
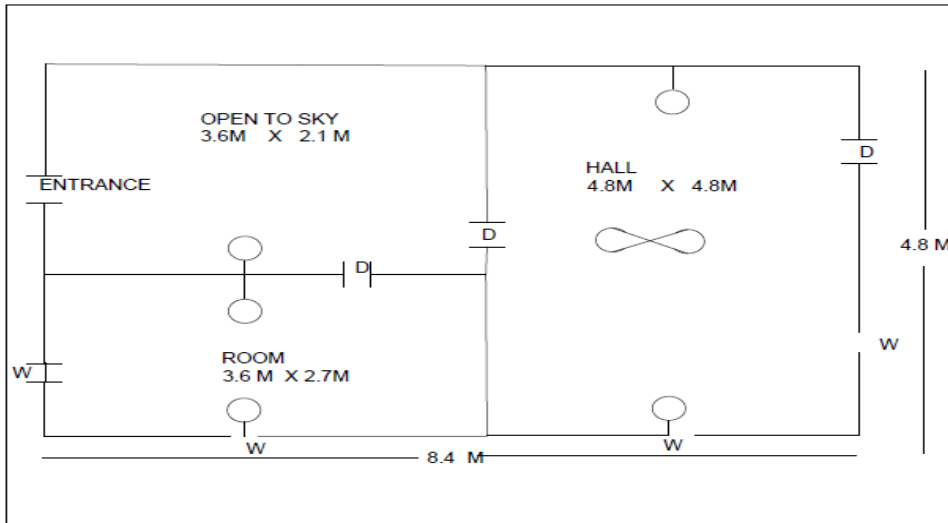


CMR INSTITUTE OF TECHNOLOGY		USN <input type="text"/>							
Internal Assessment Test - I									
Sub:	Electrical Estimation and Costing						Code:	10EE553	
Date:	20/09/2017	Duration:	90 mins	Max Marks:	50	Sem:	5	Branch:	EEE
<b>Answer any five full questions</b>									
Note: <b>Sketch figures wherever necessary.</b>							Marks	OBE	
								CO	RBT
1(a)	Define estimation and state its purpose.						2	C5053.1	L1
(b)	Define electrical schedule, catalogues, market survey & source selection.						8	C5053.1	L1
2(a)	Explain contingencies, overhead charges & profit with examples						6	C5053.1	L1
(b)	Explain different modes of tendering.						4	C5053.1	L1
3(a)	List any five rules of Indian electricity and explain.						4	C5053.2	L1
3(b)	Write short notes on the following  a. Purchase system b. Purchase enquiry c. Purchase orders						6	C5053.1	L1
4(a)	List out the general rules for wiring						6	C5053.2	L1
4(b)	List out any 8 Lighting Accessories and Fittings used in house wiring						4	C5053.3	L2
5	Explain about different types of wiring and list out the advantage and disadvantage of each						10	C5053.3	L2
6	Explain about different types of cables used in internal wiring and list out the advantage and disadvantage of each.						10	C5053.3	L2
7	Draw the electric circuit and determine the total load and estimate the quantity of materials required for PVC casing capping used in a house, the plan of which is shown in the figure. Assume the height of the ceiling as 3.6 m, height of light points 2.4 m and						10	C5053.3	L2

one plug point for each room.



## 10EE21 - Electrical Design Estimation & Costing

### Estimation

It is an art of assessment of quantities of different items & cost and hence to plan the amount required to execute the work, before actually it is carried out.

\* Helps in taking a right decision while entering a contract

Functions of Estimator:-

- \* To estimate the quantities of material required & cost.
- \* Analysis of cost
- \* Maintaining proper records
- \* Providing setting out.

### Purpose of Estimation:

As to carry out any work with ease, it is necessary to know the details of the work before starting it. To do this we need to prepare a complete project for the given programme as it will act as a guide in successful implementation of the programme. If this estimation is not prepared, then it is difficult, & it is impossible to complete work uninterrupted because a shortage of money and/or non-availability of materials may cause blockade at any stage.

### FACTS - Estimator should know

To prepare an estimation of internal wiring following details an estimator should know

- \* Complete specifications, general scheme of wiring type of wiring & quality of material used
- \* Complete schedule of points with their switches & fittings
- \* Plans and sections marked with details, alle with main switchgear & distribution board

- \* Other information about other factors affecting the cost such as distance of the job from the main place, time availability, Special Supervision or special tools, condition of weather in which job is carried out.

### ESTIMATOR

Every Organisation has a Separate department for Estimating. The person preparing the estimate is known as an Estimator.

To secure work orders and to avoid loss it is necessary that estimates should be accurate.

If any guess work is made in the cost of the job, there is a possibility of quoting high price for low price which results in heavy loss instead of profit. Estimator should have evidence for each

Statement in his Project.

He should build a library containing complete price list of all the products of his own Organisation and continuous updation of it.

He should have knowledge on production cost including labours.

### Electric Schedule:

It is the list or plan of building which provides us the information regarding the number of points [Ex: ceiling outlets, bracket outlets, single pole 3-way and 4-way rotary switches, walling and other special plugs] in each room of a building.

## CATALOGUES

catalogue is a detail information of a product with cost, quantity + specifications and it varies from Vendor to Vendor.

The estimator saves time by making judicious selection of standard catalogues, which are most useful for his work.

Further saving of time and trouble can be achieved if he prepares his own catalogue which has price list giving the net price per each product or per 100 or per 100 feet per meter.

An estimator should have special price list + schedule (or schedule of the cost of conduit / m, complete conduit accessories). These are prepared from the manufacturer net cost of each type.

Similarly other schedules, which gives cost of the cable / m or cost of main + submain or cost of power points can be obtained.

## MARKET SURVEY AND SOURCE SELECTION

Good estimating is possible only with an up-to-date knowledge of

- (i) availability of products
- (ii) sources for production, vendor selection
- (iii) new products + their quality.
- (iv) prices of products, discounts etc...

Market survey for collection of the above information + retention of the same in a library helps in a faster estimation, and decision making for selection of materials and vendors.

It gives more information about timely availability.

Non-receipt of materials in time may result in production held ups.

Receipt of materials ahead of time would be a burden on the cash flow of the organisation.

It is a healthy practice to have market survey and to obtain necessary approvals to ensure poor quality is been delivered. The estimator should maintain:

- (i) retain a list of approved suppliers/vendors both in alphabetical order and also product wise.
- (ii) Retain a list of approved standard products.

The source for the market survey can also be taken from similar surveys being conducted by the State or central PWD or MES. Std. schedules, Rates / specifications.

In order to make survey easy the following format can be used:

#### Format for Categorisation of Prices

S.No	Product	Specifications	Accepted Make	Accepted Vendors	Remarks
1	Tumbler Switches	5A, 240V, 1-way			
2	Plano Switcher	"			
3	Copper conductor cable	1mm <sup>2</sup> , Single-core Pvc insulated, 630V grade			
4	Aluminium conductor cable	1.5mm <sup>2</sup> , Single-core Pvc insulated, 630V grade			
5	Main switch	200A, 240V, Single Phase 16A			

## CONTINGENCIES

This is for Vague and unforeseen items. Most of the amount comes under contingencies.

Ex: To cover the cost on account of delays in plan, minor accidents and unforeseen variation from the plan of the estimating department.

The amount to be allowed is too Variable and depends on exactness of the specification.

If we make mistakes in specifications then the situation becomes more doubtful which gives rise to the risk & delays of work and leads to overruns.

This contingency is expressed as usually a percentage of total cost [material + labour cost].  
Say 5%.

The contingencies fully compensate additional material cost, labour cost and other allied expenses which could not be accounted for. Such expenses may be due to natural calamities such as floods, earthquakes & storms etc.

### 1.11. OVERHEAD CHARGES

The overhead charges or standing charges of the business cover all expenditure necessary to carry out the business, in addition to the special expenditure, incurred in carrying out a particular job. These can be classified under the following headings: Rent of offices and workshop; allowances for the wear and tear of buildings, plant and machinery (depreciation); wages of clerical staff; general expenses; rates and taxes; lighting and heating; advertising; insurance; postage and telephone; carriage and general travelling expenses, legal costs and bad debts etc. Since these charges cannot be charged against any one contract, however large these are, these are spread proportionately against all the jobs big and small. To arrive at the true cost of the job, a definite percentage (10 to 15%) is added to the net cost of each estimate.

### 1.12. PROFIT

This is usually added in the form of percentage to the gross or true cost of the job in order to determine the selling price of the job. This amount is purely on the discretion of the contractor, and his decision is usually governed by the following factors:

- (i) Size of the job with him.
- (ii) Degree of competition.
- (iii) The state of turnover and
- (iv) His anxiety to secure a particular job and so on.

If estimate has been prepared accurately, definite percentage has been allowed for contingencies and standing charges then, however small the percentage of profit is added, it will be a profit and never loss.



1.14.2. **Modes of Tendering.** The usual modes of tendering are:

1. Open tendering
2. Global tendering
3. Limited tender
4. Single tender.
5. Proprietary tender.
6. Spot tendering.

**Open/Public Tendering** is a system whereby even non-registered dealers are free to participate. Under this system all the known and possible sources for the supply of a particular material are made aware of the requirements and allowed to quote. To this end, one of the following methods shall be adopted.

1. Giving an advertisement in at least three leading English language newspapers of All India Circulation and, where time permits, also in the Indian Trade Journal/Indian Export Service Bulletin (IESB). Simultaneously copies of the advertisement may be sent to all the known and likely sources.

2. Addressing all the known and likely sources for a particular product.

Where items to be procured are not indigenously available, **Global tendering** shall be resorted to. Advertisements may be released in leading National Newspapers as well as in the Indian Trade Journal/Indian Export Services Bulletin. In addition, copies of the tender documents may be made available in the Indian Embassies in potential vendor countries

abroad for issuing to the tenderers besides making the documents available to the Trade Commissioners of Foreign Embassies in India.

**In limited tender**, only the most likely and suitable sources are addressed. To invite adequate competition, it is necessary that at least five sources of supply are addressed. The suppliers to be addressed shall be decided based on past experience. The selection of suppliers shall be carefully made based on vendor rating or past experience. It is preferable to include the name of last suppliers also.

When the purchase is finalised on the basis of a single offer or an offer from a single source is invited, this is called a 'Single Tender Purchase'. Common occasions of this category are given below:

- (a) When market research reveals that there is only one known reliable source of supply.
- (b) When the management in the interest of real long term economy and quality assurance and assured service standards of delivery etc. standardises on a particular brand/make.
- (c) There is a single party ready to undertake the risk of provisioning/development of item required and the value of order is such that it is not economical to develop alternative sources of supply.
- (d) The manufacturer/Government has canalised the supply only through a single source.
- (e) The item is known to be in short supply and its stocks happen to be available only with one source at the time of purchase.
- (f) Supplies from fair price shops, super-bazars, Government, Semi-Government, Co-operative undertakings.
- (g) Direct purchase from reputed manufacturers or their accredited dealers.

As far as possible offers shall be invited from the manufacturers/their authorised agent general stockist of repute.

**Proprietary tender** is a tender which is addressed only to a proprietary manufacturer his authorised agent because no equivalent or near equivalent is available from any other source and/or all possible suppliers quote only the product of one manufacturer.

**Spot tendering** is to be resorted only for emergent requirements. All the readily approachable and well-known vendors are requested to assemble and their offers are obtained after the requirement is explained/shown to them on the spot.

1.14.3. **Petty Purchases.** Items of nominal value, say up to ₹ 500, could be purchase directly from the market by the purchase assistant without issuing a formal order.

1.14.4. **Imprest Purchase System.** The purchase department arranges for each purchase of urgent production/project items as well as other items of low value. In this case also formal offers are invited. The concerned person is authorised to record rates of minimum three suppliers and approve the purchase. Under this system of purchase the value of an item may be restricted to ₹ 1,000.



### **1.13. PURCHASE SYSTEM**

Purchase system may be divided into three major heads viz objective, functions and the steps (for organisation).

**1.13.1. Purchase Objective.** The purchase procedure enlists the following objectives:

1. To purchase competitively and wisely authorised requirements as per desired specifications from approved/reliable sources at available reasonable prices within the time schedule to support the project plans.
2. To ensure that fair and open purchase practices are followed and a healthy and good relationship develops with suppliers/vendors to foster the commercial interests of the firm/organisation in the local, national and international market, if need be.
3. To ensure timely formulation and commitment of purchase budget requirements (including foreign exchange requirements, if any).
4. To serve as information centre on materials knowledge—prices, sources of supply, detailed technical specifications, catalogues etc. for all departments of the organisation.
5. To ensure that investment made on inventory is at an optimum level.
6. Training of purchase personnel in the latest-techniques of Materials Management.
7. To keep Management/Concerned Authority apprised of the likely shortfalls in purchase performance by introducing appropriate reporting systems with a view to seek management's/Concerned authority intervention at the right time.

**1.13.2. Purchase Functions.** Purchase department is responsible for the following activities:

1. Creation of a comprehensive and continuously updated lists of selected reliable vendors
2. Maintenance of vendor evaluation and rating records on the proforma (Format II given on next page).

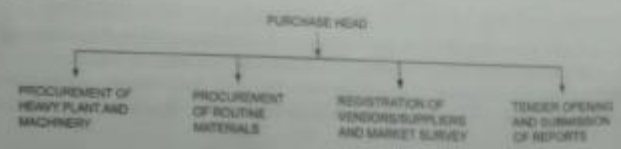
**FORMAT I— VENDOR HISTORY CARD**

Regn. No. \_\_\_\_\_ Dt. of Opening \_\_\_\_\_ Purchase Op. \_\_\_\_\_  
 Name of the firm \_\_\_\_\_  
 Postal Address \_\_\_\_\_  
 Telephone No. \_\_\_\_\_ Fax No. \_\_\_\_\_  
 E-mail ID \_\_\_\_\_  
 Contact Person Name \_\_\_\_\_ Designation \_\_\_\_\_

S.No.	Order No. & Date	Description	No. of Items	Value	Date Delivery Due	Date Delivery Made	Quality	Remarks

3. Conducting market surveys with a view to establish/develop new reliable and better sources of supply by making available information on latest products/developments.
4. Analysing bids/offers for decision-making by the competent Technical Authority.
5. Arranging negotiations with the suppliers/vendors, when necessary.
6. Issue of Purchase Order in time.
7. Obtaining Government clearances/licenses, where necessary.
8. Follow-up of Purchase Orders to ensure arrival of materials, ensure after-sales service during warranty and post-warranty periods.
9. Finalization of rate contracts for regular stock items.
10. To work out procurement lead time for various categories of items and advise to indenting departments to enable timely action in initiating purchase requests.
11. Maintaining library of product catalogues, manufacturer's/distributor's price lists etc.
12. Maintaining updated information regarding Govt laws on sales tax, excise, customs duty, service tax, income tax etc.
13. Submission of M/S reports on performance of purchase.
14. Entering into service contracts for transport, customs clearance, advertising, packing, material handling etc.
15. Entering into Transit Insurance agreements for goods in transit.

**1.13.3. Purchase Setup (or Organisation).** The purchase setup of a large organisation may be as given below:



**1.14. PURCHASE ENQUIRY AND SELECTION OF APPROPRIATE PURCHASE MODE**

The invitation to tender and instructions at enquiry stage are an important step as the vendor's offer is based upon these instructions. Any ill-conceived, indifferent and thoughtless action at this stage will result in unnecessary delays, increase in paper work and costly purchases. The enquiry shall be carefully prepared indicating requirements in clear terms.

- (a) The enquiry tender shall indicate complete description and specifications of the required materials.
- (b) Drawing, wherever available, shall be enclosed with the enquiry/tender.
- (c) Enquiry/Tender must be invited to DR/other standard specifications as far as possible. Under no circumstances, terminology such as *best quality*, *commercial quality* or *as per previous supply* etc. shall be used.
- (d) Where no drawing is available and which cannot be correctly described, a sample is to be shown to the vendors or they may be requested to submit their sample.
- (e) In cases where an option to supply materials is to be exercised the tenderers must be asked to give alternative offers with their own supply of materials and with supplied materials.
- (f) Delivery expected shall be realistic and specifically indicated.
- (g) In case quantity required is not readily marketed, Minimum Order Quantity stipulation shall be requested in the tender enquiry.

## General Rules

1. Protection for Every installation  $\rightarrow$  provide by providing linked switch + fuse cut.
2. Size of cable  $\rightarrow$  Max Load. Safety.
3. Installation of cable safe-made.
4. Every sub-circuit connected to distribution Fuse board.
5. Every phase line with fuse link.
6. A switch board lies 1.25 m above floor.
7.
  - a) Plug - Socket outlet - 3-pin type, to be earthed properly.
  - b) no. of socket outlets - To avoid long flexible cables.
  - c) 3-pin, 5A socket with fan, light socket.  
3-pin, 15A " Separately.  
5A socket @ 25cm  $\rightarrow$  switch @ 1.25m.  
 $\rightarrow$  use interlocked socket.
  - d)  $> 15A \rightarrow$  DPS  $\Rightarrow$  should not installed  $> 15A$ .
  - e) not located centrally behind appliances.
  - f)  $< 1.30m$  in bathroom.
  - g) ① or ② 3-pin - 15A in kitchen.
  - h) ① 3-pin - 15A

- 8) Incandescent lamp ht of 2.5m above floor level.  
 b) fans 2.7m above floor
- 9) a) Sub-circuit  $\rightarrow$   $> 10$  points  
 $> 800$  watts.  
 Only fans on  $\leq > 10$  points
- b) Power load  $- 3000$  watts,  $> 2$  powers used in one
- 10) No Fuse (or) Switch in earthed conductor.
- 11) Every loads are separated by a switch
- 12) Apparatus required attention is taken through separate man  
 accu
- 13) Separate light loads + heavy loads
- 14) 3- $\phi$ , 4-wire, Installation of load equally distributed.
- 15) no additional load can be added if it is not planned
- 16) Lamp holders in bathroom should have proper installat
- 17) Earth conductors  $< 7/0.915$ mm.
- 18) Each sub circuit against excessive current by fuse or CB
- 19) Light conductors insulated (or) safeguard.
- 20) Testing of installations.

## Lighting Accessories & Fittings

- Switches
- Ceiling roses
- Plugs
- Lamp holders
- Socket outlets

# Switches

•Its used for **making and breaking** the electric circuit

•Types of switches –

**Base material- porcelain or Bakelite**

**Color of the base – white, black or brown**

**Operation required -- 1 – way switch ,  
2 – way switch ,  
2 – way center off switches  
Double pole switches**

•

## CEILING ROSE

To connect the pendant lamps  
It has 2 parts – base & cover  
The number of terminal's depends on  
number of ways  
Specifications -- 240 V , 6 A



# Plugs

- 2 pin plugs
  - 3 – pin plugs
  - Screws are provided to fix it
- Power plugs – 16 A,32 A , 250V  
normal plugs - 5A ,6A , 250V

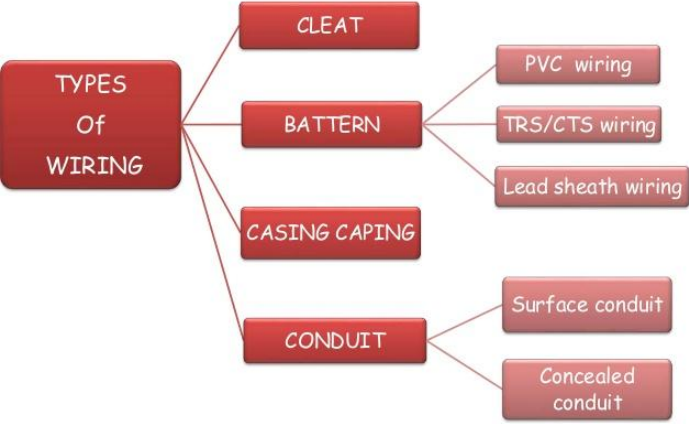


# LAMP HOLDERS

## BATTEN HOLDERS

Fitted in the roof or wall  
Bulbs res fitted by turning them  
inside and slightly left position







### Cleat Wiring (Vulcanized Indian Rubber wire known as V.I.R. wire in cleats)

In this type of wiring, insulated conductors (usually VIR, Vulcanized Indian Rubber) are supported on porcelain or wooden cleats.

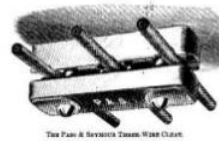
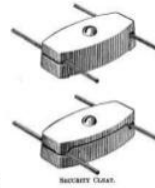
- ✓ cheapest method of wiring.
- ✓ normally used for temporary work.

#### Advantages:

- ✓ Easy installation
- ✓ Materials can be retrieved for reuse
- ✓ Flexibility provided for inspection, modifications and expansion.
- ✓ Relatively economical
- ✓ Skilled manpower not required.

#### Disadvantages:

- ✓ Appearance is not good
- ✓ Open system of wiring requiring regular cleaning
- ✓ Higher risk of mechanical injury.



### Wood Casing Capping Wiring (V.I.R. wire in wooden casings)

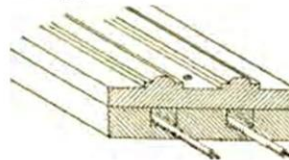
It consists of insulated conductors laid inside rectangular, teakwood boxes having grooves inside it. The system is suitable for indoor and domestic installations.

#### Advantages:

- ✓ Cheaper than lead sheathed and conduit wiring.
- ✓ Provides good isolation as the conductors are placed apart reducing the risk of short circuit.
- ✓ Easily accessible for inspection and repairs.
- ✓ Since the wires are not exposed to atmosphere, insulation is less affected by dust, dirt and climatic variations.

#### Disadvantages:

- ✓ Highly inflammable.
- ✓ Usage of unseasoned wood gets damaged by termites.
- ✓ Skilled workmanship required.



**Advantages of Casing Capping Wiring:**

- It is cheap wiring system as compared to sheathed and conduit wiring systems.
- It is strong and long-lasting wiring system.
- Customization can be easily done in this wiring system.
- If Phase and Neutral wire is installed in separate slots, then repairing is easy.
- Stay for long time in the field due to strong insulation of capping and casing..
- It stays safe from oil, Steam, smoke and rain.
- No risk of electric shock due to covered wires and cables in casing & capping.

**Disadvantages Casing Capping Wiring:**

- There is a high risk of fire in casing & capping wiring system.
  - Not suitable in the acidic, alkalies and humidity conditions
  - Costly repairing and need more material.
  - Material can't be found easily in the contemporary
- White ants may damage the casing & capping of wood.

**Metal Sheathed or Lead Sheathed wiring:**

The wiring is similar to that of CTS but the conductors (two or three) are individually insulated and covered with a common outer lead-aluminum alloy sheath. The sheath protects the cable against dampness, atmospheric extremities and mechanical damages. The sheath is earthed at every junction to provide a path to ground for the leakage current. They are fixed by means of metal clips on wooden battens. The wiring system is very expensive. It is suitable for low voltage installations.



**Precautions to be taken during installation:**

1. The clips used to fix the cables on battens should not react with the sheath.
2. Lead sheath should be properly earthed to prevent shocks due to leakage currents.
3. Cables should not be run in damp places and in areas where chemicals (may react with the lead) are used.

**Advantages of Batten Wiring**

Wiring installation is simple and easy  
cheap as compared to other electrical wiring systems  
Paraphrase is good and beautiful  
Repairing is easy  
strong and long-lasting  
Customization can be easily done in this wiring system.  
less chance of leakage current in batten wiring system

**Disadvantages of Batten Wiring**

Can't be install in the humidity, Chemical effects, open and outdoor areas.  
High risk of fires  
Not safe from external wear & tear and weather effects (because, the wires are openly visible to heat, dust, steam and smoke.  
Heavy wires can't be used in batten wiring system.  
Only suitable below then 250V.  
Need more cables and wires.

**Types of Conduit**

Following conduits are used in the conduit wiring systems (both concealed and surface conduit wiring) which are shown in the above image.

Metallic Conduit

Non-metallic conduit

**Metallic Conduit:**

Metallic conduits are made of steel which are very strong but costly as well.

There are two types of metallic conduits.

Class A Conduit: Low gauge conduit (Thin layer steel sheet conduit)

Class B Conduit: High gauge conduit (Thick sheet of steel conduit)

**Non-metallic Conduit:**

A solid PVC conduit is used as non-metallic conduit now a days, which is flexible and easy to bend.

**Size of Conduit:**

The common conduit pipes are available in different sizes genially, 13, 16.2, 18.75, 20, 25, 37, 50, and 63 mm (diameter) or 1/2, 5/8, 3/4, 1, 1.25, 1.5, and 2 inch in diameter.

#### **Disadvantages of Conduit Wiring Systems**

- It is expensive wiring system (Due to PVC and Metallic pipes, Additional earthing for metallic pipes Tee(s) and elbows etc.
- Very hard to find the defects in the wiring.
- installation is not easy and simple.
- Risk of Electric shock (In case of metallic pipes without proper earthing system)
- Very complicated to manage additional connection in the future.

#### **Advantage of Conduit Wiring Systems**

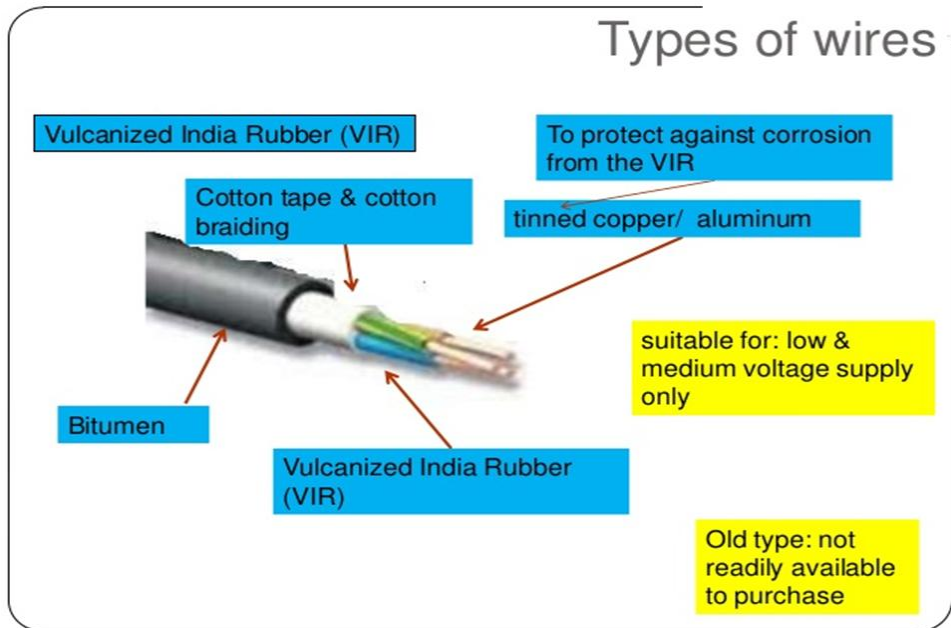
It is the safest wiring system (Concealed conduit wiring)  
Appearance is very beautiful (in case of concealed conduit wiring)  
No risk of mechanical wear & tear and fire in case of metallic pipes.  
Customization can be easily done according to the future needs.  
Repairing and maintenance is easy.  
There is no risk of damage the [cables insulation](#).  
it is safe from corrosion (in case of PVC conduit) and risk of fire.  
It can be used even in humidity , chemical effect and smoky areas.  
No risk of electric shock (In case of proper [earthing and grounding](#) of metallic pipes).  
It is reliable and popular wiring system.  
sustainable and long-lasting wiring system.

# Types of Cables

On basis of conductors	On basis of no. of voltage grading	On basis of conductor used
<ul style="list-style-type: none"> <li>• Single core cable</li> <li>• Multi core cable</li> </ul>	<ul style="list-style-type: none"> <li>• 250/440 volt cables</li> <li>• 650/1100 volt cables</li> </ul>	<ul style="list-style-type: none"> <li>• Copper conductor cables</li> <li>• Aluminium conductor cables</li> </ul>

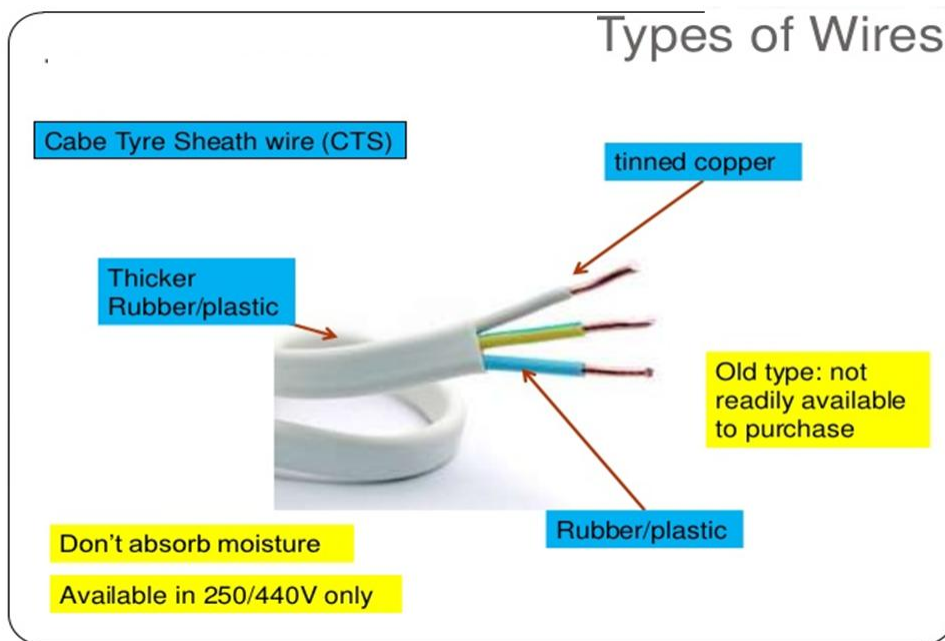
## On basis of insulation

- |                        |                         |
|------------------------|-------------------------|
| 1 VIR insulated Cables | 5 Weather proof Cables  |
| 2 TRS/CTS Cables       | 6 Flexible Chord Cables |
| 3 Lead sheathed Cables | 7 XLPE Cables           |
| 4 PVC Cables           |                         |



## V.I.R (Vulcanised Indian Rubber) wires.

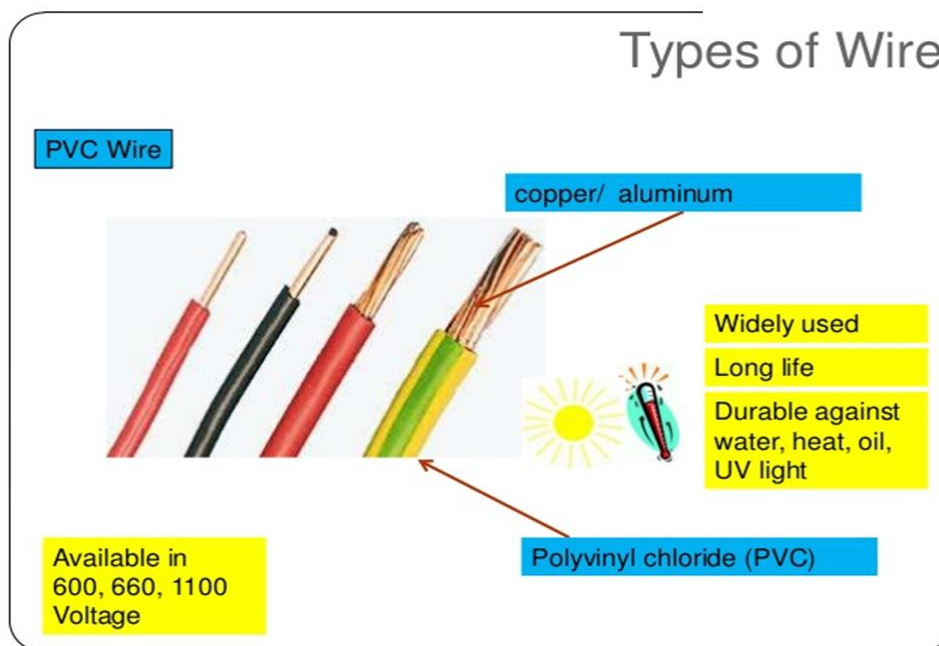
- A VIR wire mainly consists of a tinned conductor having rubber coating.
- Tinning of conductor prevents the sticking of rubber to the conductor.
- Thickness of rubber mainly depends on the operating voltage to which wire is designed.
- A cotton bradding is done over the rubber insulations to protect the conductor against the moisture.
- Finally the wire is finished with wax for cleanliness.
- Nowadays these wires are not used since a better quality wires are available at a cheaper rate.





## T.R.S. (Tough Rubber Sheathed) wires.

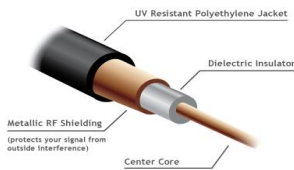
- This type of wire is a modification of V.I.R. wire. It consists of the ordinary rubber coated conductors with an additional sheath of tough rubber.
- This layer provides better protection against moisture and wear and tear. Also it provides an extra insulation.
- These wires are generally available in single conductor, two conductors or three conductors.



- Its available in 250/440v and 650/1100v
- It does not require cotton tapping and moisture protection
- It has better insulating qualities
- It provides better flexibility
- Has no chemical effect on metal wire
- It will provide thin insulation level
- It can accommodate more number of wires

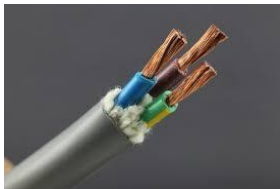
## Lead alloy sheathed wires.

- The ordinary wires can be used only at dry places but for damp places these wires are covered with continuous lead sheaths.
- The layer of lead covering is very thin like 0.12 cm thick.
- These wires provides little mechanical protections to the wires.



## Weather proof wires.

- These types of wires are used outdoor i.e. providing a service connection from overhead line to building etc.
- In this type of wire the conductor is not tinned and the conductor is covered with three braids of fibrous yarn and saturated with water proof compound.



## Flexible wires.

- These wires consists of number of strands instead of a single conductor. (Strand is a very thin conductor).
- The conductor is insulated with P.V.C. material.
- These wires are very useful for household portable appliances where flexibility of wire is more important.
- Typical specifications
- 55/.01mm(55 strands of 0.1mm diameter), maximum current 6A,used for household purposes.



Connected load =  $8 \times 60 = 480$  watts  
 Since number of points to be connected is 8 (less than 10) and load is 480 watts (less than 800 watts), one circuit is used and distribution board is not required.

Full load current,  $I = \frac{480}{240} = 2$  A.

Hence 240 V, 16A, DPIC switch fuse of any standard make may be used as a main switch and 1/1.40 mm aluminium conductor, single core, 650 V grade, PVC cable having current carrying capacity of 10 amperes may be used for phase and neutral connections.

**Assumptions :**

- Assume the height of main board and switchboard = 1.5 metres
- Height of casing-capping run = 3.0 metres
- Height of bracket light points = 2.4 metres
- The distance of meter board (MB) from the front wall (in hall) = 0.2 metre

The wiring plan is shown in Fig. 8.6.

**Length of PVC Casing-Capping**

- From meter board to main board = 0.2 m
- From meter board to switch board  $SB_1$  =  $1.5 + 2 + 1.5 = 5$  m
- Vertical run to ceiling in hall (above  $SB_1$ ) =  $3.6 - 3.0 = 0.6$  m
- Run along ceiling in hall =  $2.4 + 2.4 + 2.4 = 7.2$  metres
- Drop from ceiling to  $L_1$  =  $3.6 - 2.4 = 1.2$  metres
- Drop from ceiling to  $L_2$  =  $3.6 - 2.4 = 1.2$  metres
- From switchboard  $SB_2$  to  $L_4$  =  $1.5 + 0.3 + 1.8 + 0.6 = 4.2$  m
- Vertical run to ceiling in room = 0.6 metre
- Run along ceiling in room = 2.7 metres
- Drop from ceiling to lamp  $L_3$  =  $3.6 - 2.4 = 1.2$  metres
- Total length of casing-capping =  $0.2 + 5 + 0.6 + 7.2 + 1.2 + 1.2 + 4.2 + 0.6 + 2.7 + 1.2 = 24.1$  metres
- Wastage and length used in joints (15%) = 3.6 metres (say)
- Total = 27.7 m = 28 m (say)

**Length of Conduit of 19 mm Size**

Connections are taken from  $SB_1$  to  $SB_2$  and from light point  $L_4$  to  $L_5$  through 19 mm conduit  
 Conduit length of conduit required =  $0.25 + 0.25 = 0.5$  metre

**Length of Phase Wire [1.5 mm<sup>2</sup> aluminium conductor, single core, 650 V grade PVC cable]**

- From meter board to main board = 0.2 metre
- From main board to switchboard  $SB_1$  =  $1.5 + 2 + 1.5 = 5$  metres
- From  $SB_1$  to fan point =  $2.1 + 2.4 = 4.5$  metres
- From  $SB_1$  to light point  $L_1$  =  $2.1 + 2.4 + 2.4 + 1.2 = 8.1$  m
- From  $SB_1$  to light point  $L_2$  =  $2.1 + 2.4 + 2.4 + 1.2 = 8.1$  m
- From  $SB_1$  to  $SB_2$  = 0.25 m
- From  $SB_2$  to light point  $L_4$  =  $1.5 + 0.3 + 1.8 + 0.6 = 4.2$  m
- From  $SB_2$  to light point  $L_5$  =  $1.5 + 0.3 + 1.8 + 0.6 + 0.25 = 4.45$  m
- From  $SB_2$  to light point  $L_3$  =  $1.5 + 0.3 + 1.8 + 0.6 + 2.7 + 1.2 = 10.1$  m

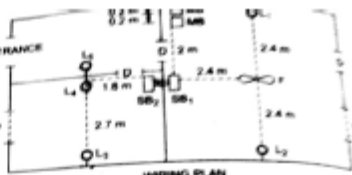


Fig. 8.6

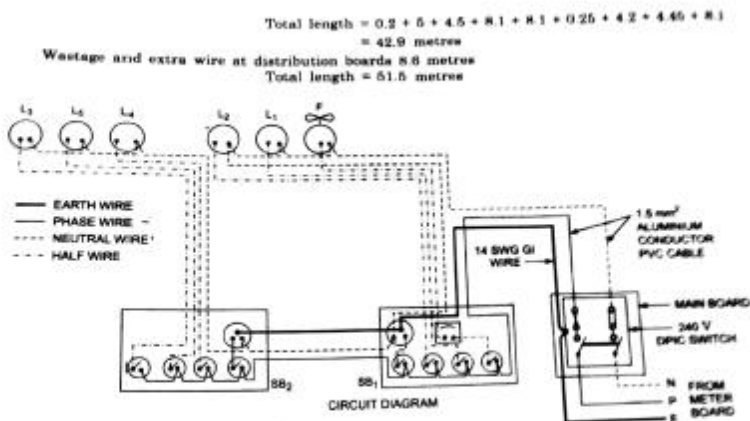


Fig. 8.7

**Length of Neutral Wire** [1.5 mm<sup>2</sup>, aluminium conductor, single core 650 V grade PVC cable]

- From meter board to main board = 0.2 m
- From main board to fan point F =  $1.5 + 2 + 0.6 + 2.4 = 6.5$  m
- From fan point F to light point L<sub>1</sub> =  $2.4 + 1.2 = 3.6$  m
- From light point L<sub>1</sub> to light point L<sub>2</sub> =  $1.2 + 4.8 + 1.2 = 7.2$  m
- From light point L<sub>2</sub> to switchboard SB<sub>1</sub> =  $1.2 + 2.4 + 2.4 + 2.1 = 8.1$  m
- From SB<sub>1</sub> to SB<sub>2</sub> = 0.25 m
- From SB<sub>2</sub> to light point L<sub>4</sub> =  $1.5 + 0.3 + 1.8 + 0.6 = 4.2$  m
- From light point L<sub>4</sub> to L<sub>5</sub> = 0.25 m
- From light point L<sub>5</sub> to L<sub>3</sub> =  $0.25 + 1.2 + 2.7 + 1.2 = 5.35$  m
- Total length of neutral wire =  $0.2 + 6.5 + 3.6 + 7.2 + 8.1 + 0.25 + 4.2 + 0.25 + 5.35$   
 = 35.65 metres

Wastage and length used in connections (10%) = 3.6 m

Total length of neutral wire required = 39.25 metres

Total length of aluminium conductor single core PVC cable of size 1.5 mm<sup>2</sup> required (Phase and neutral) =  $51.5 + 39.25 = 90.75$  metres = 90 metres (say)

**Length of Earth Wire required (14 SWG GI wire)**

- From meter board to main board = 0.2 metre
- From main board to switchboard SB<sub>1</sub> =  $1.5 + 2 + 1.5 = 5$  m
- From switch board SB<sub>1</sub> to switchboard SB<sub>2</sub> = 0.25 m
- Total length required including wastage = 6 m = 0.2 kg (say)

**Electrical Installation Estimating and Costing**

**ESTIMATE ON THE BASIS OF ITEM WISE RATES**

S. No.	Description of Material With Full Specifications	Quantity Required		Rate			Amount		Remarks
		Quantity	Unit	₹	P	Per	₹	P	
1	240 V grade, 16A, DPIC switch with fuse and neutral link	1	no	300	00	each	300	00	For earthing connections from meter board to main board and from main board to switchboard
2	PVC casing-capping 76 mm x 25 mm	28	m	30	00	m	840	00	
3	14 SWG GI wire (earth wire)	0.2	kg	270	00	kg	54	00	
4	Earthing thimbles with nuts and bolts	3	nos	15	00	each	45	00	
5	1.5 mm <sup>2</sup> single core 650 V grade aluminium conductor PVC cable	90	m	3	00	m	270	00	
6	Plano switches, one-way 5 A surface type	8	nos	12	00	each	96	00	
7	Ceiling rose, two plate PVC type	1	no	12	00	do	12	00	For fan
8	Brass brackets with holders	4	nos	52	50	do	210	00	For light points L <sub>1</sub> , L <sub>2</sub> , L <sub>3</sub> and L <sub>4</sub>
9	Watertight bracket with holder and globe	1	no	75	00	do	75	00	For light point L <sub>3</sub>
10	Plug sockets 3 pin 5 A	2	nos	22	50	do	45	00	
11	Teak wood boards (double) (i) 25 cm x 20 cm	2	do	65	00	do	130	00	For MB and SB <sub>1</sub>
	(ii) 20 cm x 15 cm	1	do	52	50	do	52	50	For SB <sub>2</sub>
12	Round wooden blocks 10 cm x 4 cm	6	do	16	50	do	99	00	
13	Teak wood gutties	100	do	75	00	100	75	00	
14	Wooden screws (i) 51 mm for boards (ii) 32 mm for casing (iii) 13 mm for capping (iv) 19 mm for switches	18 45 180 32	nos do do do	75 60 30 30	00 00 00 00	100 do do do	13 27 54 9	50 00 00 60	
15	Cement, sand, paint, varnish etc						500	00	Lump-sum provision
Total							2,907	60	
Labour cost @ ₹ 60 per point							600	00	8 points plus 2 points for MB
Contingencies 5%							175	38	
Grand Total							3,682	98	
Say ₹ 3,700.00									