

# **ELECTRICAL ESTIMATION & COSTING**

## **Unit-1**

### **Introduction**

#### **Estimation**

Before carrying out a work, it is necessary to know all the materials required and its approximate cost. Thus estimation is the calculation of all required engineering materials and the expenses likely to be incurred in carrying out the project (work) before the execution of project.

#### **Purpose of Estimating**

1. It gives the approximate budget for carrying out the work.
2. It avoids wastage of materials.
3. It helps to use correct material.
4. It helps to do the work according to the engineering principles without any confusion in adopting different methods for procedures.

#### **Factors to be considered for Estimation**

1. Full specification of material to have control over the quality of materials used.
2. To provide sufficient labour to carry out the whole work.
3. The cost of difference charges incurred such as transportation, supervision, inspection, stock incidental with allowance for variation in prices.
4. The most economical procedure for the execution of work is to be adopted with the knowledge of different available systems.
5. While selecting the material it should not be too costly or too cheap. Because costly products leads to be loss and cheap products leads to damage of electrical Installation. So always ISI approved materials should be selected.
6. While quoting the rate, the unit selected should be according to the market.
7. Provisions in the estimate must be given.

## **Qualities of a good Estimator**

1. Knowledge of full specification, giving general scheme of installation, type of wiring to be adopted and the quality of materials to be used.
2. He should have plan of installation work, nature of project and complete data of installation.
3. He must have knowledge of standard of materials and availability with current market rates.
4. He should have knowledge of electrical safety and shock treatment.
5. He should have knowledge of selection of labour.
6. He should have knowledge of distance of work & transportation.
7. He must be able to read drawings, blue prints & topo sheets.
8. He must have knowledge of tools.
9. He should know account procedures.
10. He must have knowledge about wages & rates.

## **Different type of charges**

### **1. Overhead charges**

It includes general office expenses, rent, rates of lighting and heating (electricity bill), office furniture & office equipment. It is calculated annually & that percentage is included in the estimate.

### **2. Stock incidental charges**

To cover the risk of damage during transportation of material, extra charge is to be included. Usually it is accounted by 5%.

Ex: Earthquake, floods, storm etc.

### **3. Transportation charges**

It includes Transportation charges of different electrical machine from the manufacturing place to working site area.

### **4. Inspection or Inspectorate charges**

High tension and transformer works are to be inspected by the government body called electrical Inspectorate for which charges are to be paid.

Example: Inspection of HT line Rs 200 per kilometer,  
Inspection of LT line Rs 250 per kilometer  
Inspection of 100 KVA. Rs 1500  
Crossing Rs 100

## **5. Contingencies**

It includes unexpected expenditure due to increase in the cost of material & cost of labour, loss due to floods or any other reasons.

## **6. Miscellaneous charger**

Minor items like nuts, bolt, rawl plugs, coal, salt etc which cannot be reflected in major works are clubbed together under miscellaneous charges.

## **7. Labour charges**

It is most difficult & variable charge. It is affected by so many factors such as site condition, skill, physical fitness and technical training.

## **Earthing:**

### **Definition**

Earthing means connection of an equipment to earth for immediate & safe discharge of electrical energy due to leakage, short circuit or any faults. The earth potential is taken as zero.

### **Necessity of Earthing**

- To protect equipment & buildings from lightening.
- To serve as return conductor in traction work & communication lines.
- To maintain a constant voltage in heating element.
- To provide safety to the operating persons or devices & equipments from the danger of leakage current.
- Tripping due to faults, saves wastage of energy.

### **Points to be earthed**

1. Structural steel work of indoor or outdoor substation.
2. Lightning arresters.
3. Switch gear with metallic bodies like main switch, starter & capacitors.
4. Electrical equipment, machines, operator & device with metal parts.
5. Frames of energy meters, heaters, boilers etc.
6. Frames of transformer, generators and motors.
7. 3 pin & 5pin plugs & sockets.
8. Light fittings like bracket type.

## **Factors of influencing earth resistance**

1. Material of electrode & earth wire.
2. Size of electrode & earth wire.
3. Temperature of soil.
4. Moisture of soil.
5. Depth to which electrode is embedded.
6. Quantity of charcoal & salt in the earth electrode pit.

## **Methods of reducing earth resistance**

In places where soil resistivity is high, the resistivity of the soil immediately surrounding the earth electrode should be reduced. Which can be done by the following methods:

1. By increasing cross sectional area of electrodes which can be achieved by connecting number of electrodes in parallel.
2. Some artificial agents, which is highly dissolved in water & form solutions made to dissolve in moisture of soil by digging earth pit of 1meter diameter & required depth.

Ex: Mostly commonly used artificial agents are:

- Sodium chloride NaCl (common salt)
- Calcium chloride CaCl<sub>2</sub>
- Sodium carbonate Na<sub>2</sub>CO<sub>3</sub>
- Copper sulphate CuSO<sub>4</sub>
- Common salt & coke
- Common salt & charcoal

## **Standard values of earth resistance for various Installation**

1. Generating station or traction power substation -0.5 ohm
2. Switching station or minor substation -2 ohm
3. Service connection -2ohm
4. LT lighting arrestor -4 Ohm
5. LT pole – 5 ohm
6. HT pole -10 ohm
7. Booster transformer station -10 ohm
8. Auxiliary transformer station – 10 ohm
9. Tower – 20 – 30 ohm

## **Method of selecting the size of earth conductor**

The minimum size of earth wire is determined by mechanical consideration. Because they are subjected to mechanical injuries & should therefore be strong enough to resist any pressure (strain) put on them.

All earth wire or conductor are almost of copper , galvanized iron , or steel or aluminum etc.

## **Types of Earthing**

1. Pipe earthing
2. Plate earthing

### **Pipe earthing**

The pipe is placed straight as shown in the above diagram & must be placed in permanently wet ground. The depth at which the pipe should be buried depends on the condition of the ground moisture. According to Indian standard the pipe should be place at the depth of 4.75 meter .If the soil is sufficient moisture the depth of digging can be reduced .The pipe at the bottom should be surrounded by broken pieces of coke or charcoal per distance of about 15cm around the pipe .The charcoal increases the effective area of the earth practically to the out side of the charcoal bed.

Mixing of charcoal with salt decreases the earth resistances Generally alternate layers of salt and charcoal are used for best results. In India during summer season ,the moisture in the soil will decrease to a large extent which will increases earth resistance. So to have effective earth resistance , we should pour above 3to 4 buckets of water in to funnel connected to the main GI pipe.

### **Specification of pipe earthing**

38mm GI pipe, 2.5m length, 3mm thick with alternate cross poles of 12.5mm diameter at a distance of 300mm is buried, so that top remains below the ground level.

### **Plate earthing**

The earth connection can also be provided with copper plate or GI plate .The plate is kept with its face vertical at a depth of 3 meter (10 feet) The plate should be embedded with alternate layers of coke or charcoal , salt with minimum thickness of about 15cm .The earth wire is securely bolted to earth plate with the help of bolts & nuts with washer. For the copper plate earthing

with copper bolts & nuts with washer & for GI plate earthing with iron bolts, nuts & washer.

### **Specification of plate earthing**

Copper plate – 300mm\*300mm\*32mm

Iron plate – 600mm\*600mm\*64mm

3mt depth basin or pit

15cm width alternate layer of coal & salt

19mm dia GI pipe connect ground & pit to pour water.

### **Important terms**

- **Tender or Tender notice**

Tender is to accept formal offer (BIDS) purposed by government or any financial institution for large projects which must be submitted within finite time (dead line)

- **Quotation**

Quotation is the formal statement of promise by an able supplier to supply the goods or services required by buyer at a specified rate & period.

Quotation also contains terms of sales & payments & warranties, if the quotation has been accepted by a buyer, there will be agreement between both the parties.

- **Comparative statement**

Comparative statement is a document that compares particular financial statement & unit rate for a product of different manufacturers. Comparative statement is prepared before placing purchase order to the supplier.

### **4. Purchase order**

Purchase order is the commercial document & first official offer issued by buyer to a seller indicating types, quantity, agreed prices for product & services.

Purchase order is issued for many reasons:

- It allows the buyer to clearly communicate their specification to the seller.

- It protects seller in case of buyer refuse to pay the amount for goods or services.

## **5.Work order**

Work order is usually a job or task given by customer which is assigned to some one (any company) .work order may be for products or services.

Work order may include:

- Name of a person to whom the work is assigned.
- Instruction
- Cost of estimates.
- Date and time to execute the work
- Information about location of product

## **IE act & IE rules**

It is an act to ammendment the law relating to supply & use of electrical energy which extends to entire India except the state Jammu and Kashmir.

The act deals with the following:

- Purchase of under taking & fixing of electricity rate (tariff)
- Provisions to open new street & to break up to streets, railways etc.
- Lying of electric supply lines.
- Restriction of use of energy without license.
- Power of state government.
- Control of transmission & use of energy
- Protection of railways ,airports & canals
- Protection of telegraph & electrical signal line
- Advisory boards.
- Overhead lines
- To settle the disputes regarding electrical energy ( arbitration)
- Penalties for different affiances
- Theft of electrical energy
- Supply ,transmission & use of energy by unauthorized persons should be monitored.

## **Specification**

Specification is the standardized description of materials directed to be used with respect to the different ratings, type of material corresponding to the market availability.

### **Importance of specification**

1. It helps to purchase only suitable material.
2. It helps the seller to locate & give the required material only.
3. Quality control is obtained.

### **Factors to be considered for specification**

1. Proper factor of safety must be considered while calculating the rating and then the suitable market availability ratings are to be selected.
2. Economic factor to be considered.
3. Specification must be written according to standards and market availability.

### **Standardization**

All electrical equipments and accessories available in the market are standardized to achieve quality control in mass production which reduces the cost.

In India standards have been formed by B.I.S (Bureau of Indian standards) also called I.S.I (Indian standard Institution) B.I.S or I.S.I has been with authority to give license to the manufactures to apply B.I.S/I.S.I marking so that the consumer can trust the quality control.

### **Advantages of standardisation**

1. It causes easy replacement of a material and avoids confusion of the user.
2. It also minimizes cost due to large scale production and enables us to use good quality material.

### **Step potential**

Step potential is the step voltage between the feet of a person standing near an energized grounding object. When a fault occurs at a tower or substation, the current will enter the earth. Based on the distribution of varying resistivity in the soil, corresponding voltage drop in the soil surrounding the grounding system can present hazards (danger) for a person standing in area of vicinity of grounding system.

### **Touch potential**

Touch potential is the touch voltage between the energized object and the feet of a person in contact with the object.



When a fault occurs at a tower or substation, the current will pass through any metallic object and enter the earth those persons touching an object in the vicinity of grounding system will subjected to those touch voltages which may be danger.