A business house or an organisation, small or large, whether engaged in trading or in manufacturing exists to make profit. Profit is the surplus or excess of income over expenditure or cost. Therefore, one must know costs.

The main objective of costing is to find out the cost of the products manufactured, at different stages of conversion from the raw materials to the finished state, and to quantify in monetary unit the contribution of each department in the final cost of the products and company.

To introduce the costing system, it is absolutely essential to identify and define all the cost centres with their activities and areas with their interconnections to each other, covering the whole of the organisation, after taking into account the technology of manufacturing and the specific needs of the organisation.

Costing or cost accounting system is meant for strengthening the organisation of the business and therefore, the system has to fit within the broad framework of the organisation, and for installation of costing system the product, methods of productions and technical aspects of the business are to be thoroughly studied and examined.

The manufacturing processes differ from industry to industry. Some of the industries can put themselves suitable for job nature work, or process work. In the case of job nature work,
company is manufacturing the equipment(s) or product(s) according to customers’ requirements, while in case of process work, the production or output of one activity or operation, is input for second activity, and the raw materials or product(s) pass through number of sequential operations to take the shape of finished product.

The cotton industry is one of the process industry. The cotton textile manufacturer is purchasing yarn, colour and dyes, chemicals etc. from the vendors. The purchased yarn is passing through spinning, weaving, winding, dyeing or/and printing, drying, and finishing operations. Till time, all operations are completed, textile cloth cannot be used as a finished product. Here, all necessary operations are to be performed on yarn by adding necessary inputs i.e. dyes, colours and chemicals at each activity. In this industry, costing method is used which is suitable for process industry, and is known as Process costing method.

As in engineering industry, in these sectors, job undertaken or product manufactured differs from the others, as the work is undertaken to meet the customers’ specific requirements. These are job nature industries. The referred sectors put themselves suitable for Job costing method.

Manufacturing process for electronic telecommunication equipment and computer equipment, like many electronic equipments, basically involve purchasing various parts, buying electronics components, making subassemblies, testing them, assembling equipment according to customer’s requirement and finally testing them to cater the requirement of customer. However, it should be
noted that development of utility program and application program for each equipment to suit the specific requirement of each customer forms a part and parcel of the manufacture and supply of equipment. It is only after building such a software i.e. utility program and application program in to the equipment and testing it, the equipment can be installed at the customer's end for his use.

The manufacturing facilities installed by the sample companies are normally as under:

1) 1500 square metres of air conditioned dust proof area,
2) dual static earth protection provided throughout the production floor and all work areas,
3) fully compressed air or vacuum installation for computer-controlled machineries, and
4) use of electrostatic protected material handling equipments for handling of materials.

MANUFACTURING PROCESSES

More or less the manufacturing processes for telecommunication equipment and computer equipment are same. Manufacturing processes can broadly be divided into the following stages, a brief outline of each stage is described hereunder:

Incoming Inspection

Inspection of materials received from supplier is a vital activity for control of material cost and for maintenance of quality of the equipment produced. So, inspection should be carried out cent percent by using pre-programmed automatic computerized machine for important components by competent persons.
PCBs Baking (Printed Circuit Boards Baking)

PCBs are required to be hardened so as to enable them to endure temperature. By taking into consideration, end use of equipment, technical estimates are prepared by technical people, and as per technical requirement, PCBs are baked for certain hours at certain degree of temperature in the Dry heat chamber.

PCBs Masking

As per the technical drawing, it is required to mount big components e.g. transformers, on some of the PCB’s after soldering process. So, it is required to protect the part of PCB’s; where big components are required to be mounted; from soldering process. This process is known as PCB masking process. Here, protective strips for soldering are stuck on particular place of the PCB.

Components Forming

Different types of cutting and bending operations are required to be performed on electric and electronics components, for the purpose of components to be perfectly mounted on the PCBs.

Package Assembly (PCB Assembly)

The formed components are manually or mechanically mounted or inserted into the PCBs at appropriate predetermined places to achieve a specific circuit configuration. Generally, package assembly will be manual and/or mechanical operation.

Package Inspection

At this stage, the PCB is inspected visually to verify that all
required components are mounted perfectly on the PCB, by comparing the same with drawing of the concerned PCB. The PCBs with components mounted on them are then sent for soldering.

Soldering

The pre-assembled PCBs are put on soldering frames and sent through a Wave soldering bath. Normally, Wave soldering bath is used in preference to Hand soldering to achieve uniform and faultless soldering besides achieving higher productivity. Hand soldering sets are also used to rectify small mistakes or for packages which are not possible to solder through wave soldering machines.

A visual inspection of all packages is required to verify that all parts are soldered perfectly and all components or parts are mounted on PCBs correctly.

Lead Cutting

Generally, every component has some extra lead that is required to cut down, so Lead cutter machine is used. Lead cutter machine, cuts down the extra lead from the soldering side of package.

Back Package Washing

Each soldered PCB is required to be cleaned on back side of PCB’s, because during the process of soldering some sticky material e.g. flux is stuck on soldering side of PCBs. This process is done by manual and/or with mechanical help e.g. Back plate washer machine.
Package Testing

All packages (mounted and soldered PCBs) are required to pass through function and incircuit testing. Incircuit testing is required to test whether PCB is o.k., and all electronic and electrical components mounted on it are within the tolerance limit for its functioning. Function tester is required to test whether PCB is o.k. to function according to the requirement and/or drawing for which it is meant. Generally Function tester and Incircuit tester is pre-programmed automatic computerized machines.

Mechanical Assembly

Tested mechanical parts are assembled to manufacture bays or frames, with the help of prefabricated parts in accordance with special layout or design.

Wiring

Bays or frames are wired in such a way that when the specific packages are fitted into them, they can form a specific system e.g. a modem, a personal computer, a mainframe etc.. These set of wirings are also known as harnesses.

Integration

The assembled mechanical frames are brought from mechanical assembly dept., and tested packages also are brought from package testing department.

According to the specific design and/or customer's requirement, all parts (mechanical as well as packages) are integrated in a cabinet to form an equipment. This stage is also known as
equipment integration stage.

Configuration Testing

Equipment is tested by taking into consideration, customer's all requirements and in pursuance with specific drawings drawn for catering the requirements of the customer. It is tested that customer's full requirements are fulfilled and quality of the equipment is in accordance with the technical assurance required.

Equipment Testing

At this stage insulation test, environment test, shock-absorbing test and general equipment test are carried out. All these tests are one type of quality assurance tests.

Packing

Here, the primary packing of the equipment is done.

Godown and Despatch

After equipment is packed, it is kept in godown, and on the scheduled date of despatch, equipment is finally packed and despatched to the customer or destination.

SPECIAL NOTES

1. The package assembly and mechanical assembly are parallel processes.

2. It should be noted that electronically conductive mats and runners are laid all through the working and walking area of the shop floor to provide protection, to the components, partly unfinished products, and finished products, against the static
charge which is built up while approaching the working area. Static control mat at the work station, wrist straps to dissipate static charge from the operation personnel and static shield bags or electronically conductive boxes for strong assembled packages are the items which are provided for such protection.

3. The equipments which are found acceptable after testing are packed and sent to the customer's site for installation. The cabling and installation at the customer's end is normally undertaken by the supplier or trader depending on the type of contract with him.


T.E.O. should be responsible for time and motion study of the production processes involved in the manufacturing activities.

The correct estimation and recording of time is very essential for correctly pricing and costing respectively. To find out the correct manufacturing time for a product, a time study is performed by the time study engineer. Time study is the art of observing and recording the time required to do each detailed element of an industrial operation. Industrial operation includes manual, mental and machining operation.

The group of motion engineers analyse each operation, of a given piece of work, very closely in order to eliminate unnecessary operations and to achieve the quickest and easiest method of performing each necessary operation.

The time study is required for estimating and calculating the cost of the product, whereas motion study helps the organisation to reduce the cost of the product by simplifying manufacturing
operations.

The establishment of T.E.O. is advisable in electronics industries.

RAW MATERIALS AND COMPONENTS

The materials that are used in the manufacturing of telecommunication and computer equipments are:

1. Electronic and electrical components such as ICs, digital ICs, memory ICs, microprocessor chips, transistors, transistor arrays, diodes, resistors, capacitors, switches, cables etc.

2. Mechanical items such as bays, MDFs, socket, fuse holder, rivets, screws, power supply parts etc.

3. Consumable items such as soldering iron, soldering chips, cotton-waste, antistatic wrist strips, anti-static shield bags etc.

The various important raw material items or components used in electronic equipments can be broadly categorised into the following:

Printed Circuit Boards (PCBs)

An electronic circuit, or part of a circuit, in which the conducting interconnection pattern is formed on a board. A thin board of insulating material is coated with a conducting film, usually copper.

Double-sided printed circuits are commonly used in which both sides of the board have a circuit formed on them, with a feed throughs to connect the two sides as required.
Peripherals

Devices that are connected to a system or equipment, form part of the system, and whose operation is controlled by the central processing unit of the system i.e. terminals, visual display unit, printers are examples of peripherals.

Power Supplies

Any source of electrical power in a form suitable for operating electronic circuits.

Semi Conductors or Active Devices

Semiconductors include

Transistors:

A multielectrode semiconductor device in which the current flowing between two specified electrodes is modulated by the voltage or current applied to one or more specified electrodes.

Modern transistors fall in to two main classes: bipolar devices, which depend on the flow of both minority and majority carriers through the device, and unipolar transistors, in which the current is carried by majority carriers only.

Integrated Circuits (ICs):

A complete circuit (the combination of a number of electrical devices and conductors that, when connected together to form a conducting path, fulfil a desired function such as amplification, filtering, or oscillation) that is manufactured as a single package.
A hybrid integrated circuit consists of several component parts attached to a ceramic substrate and interconnected either by wire bonds or a suitable metallization pattern. In a monolithic integrated circuit all the circuit components are manufactured into or on top of a single chip of silicon. The individual parts of the circuits are not separable from the complete circuit once formed.

Oscillators:

A circuit that converts direct-current power into alternating current power at a frequency that is usually greater than can be achieved by rotating electromechanical alternating-current generators. There are two broad categories of oscillator i.e., harmonic oscillators and feedback oscillators.

Liquid Crystal Display (LCD):

A type of passive display that uses liquid crystals (an organic liquid consisting of long-chain molecules that line up under the influence of an applied electric field to give a quasi-crystalline structure to the liquid), as in the seven-segment numerical display of digital watches and pocket calculators.

Passive Devices

Passive components include:

Diodes:

Any electronic device that has only two electrodes. There are several different types of diode, their voltage characteristics determining their application. Diodes are most commonly used as rectifiers.
Regulators:
An electronic device that is used to maintain the voltage or current constant at a given point in a circuit or to vary it in a controlled manner.

Resistors:
An electronic device that possesses resistance (the tendency of a material to resist the passage of an electric current and to convert electrical energy into heat energy) and is selected for use because of that property.

Capacitors:
A component that has an appreciable capacitance (the property of an isolated conductor or a set of conductors and insulators whereby it stores electric charge). The conductors or semiconductors are known as electrodes or plates.

Transformers:
An apparatus that has no moving parts and that transforms electrical energy at one alternating voltage into electrical energy at another usually different alternating voltage without change of frequency.

Coils:
A conductor or conductors wound in a series of turns. Coils are used to form inductors or the windings of transformers and motors.
Cables and Cable Assemblies:

An assembly of conductor that has some degree of flexibility; the conductors are insulated from each other and enclosed in a common binding or sheath.

Varistors:

Acronym from variable resistor. A resistor that has a markedly nonohmic characteristic.

Fuse:

A short length of easily fusible wire that is used to protect electric circuits or devices by melting at a specific current and thus breaking the circuit.

Circuit Breaker:

A device such as a contactor, switch or tripping device that is used to make or break a circuit under normal or fault conditions.

Delay Line:

Any circuit, device or transmission line that introduces a known delay in the transmission of a signal.

Heat Sink:

A device that is employed to dispose of unwanted heat in a circuit and prevent an excessive rise in temperature.

Switches:

1) A device that opens or closes a circuit.

ii) A device that causes the operating conditions of a
circuits to change between discrete specified levels.

iii: A device that selects from two or more components, parts or circuits the desired element for a particular mode of operation.

Relays:

An electrical device in which one electrical phenomenon (current, voltage etc.) controls the switching on or off of an independent electrical phenomenon.

CONCLUSIONS

Manufacturing processes for electronic telecommunication and computer equipments basically involve assembly of various types of purchased components or parts, making sub-assemblies, testing them and assembling of equipments, the development of utility and application programmes and building such programmes into the equipment, and finally testing them to cater the requirement of the customer.

Manufacturing processes for the manufacture or assembly of telecommunication and/or computer equipments consist of number of operations i.e. incoming inspection (inspection of materials received from supplier), PCB baking, PCB masking, components forming, package (PCB) assembly, package inspection, soldering, lead cutting, back package washing, package testing, mechanical assembly, wiring, integration, configuration testing, equipment testing and packing.

The correct estimation and recording of time is very essential for correctly pricing and costing respectively. For this purpose, a group of time and motion engineers is formed in unit, which is
known as "Technical Efficiency Organisation" (TEO).

The various types of raw material items and components are used in the manufacture of products i.e. printed circuit boards, power supplies, active devices e.g. transistors, integrated circuits, oscillators, LCD etc. and passive devices e.g. diodes, regulators, resistors, capacitors, transformers, coils, cables and cable assemblies, varistors, fuse, circuit breaker, oids, line, heat sink, switches, relays etc..

REFERENCES


2. Chowdhury, A.P.R., and Bhattacharya, A., Cost and Management Accountancy - Methods and Techniques, New Central, 1986, p.11

3. Based on -

