
DVD-32C

Introduction to Electronic Assembly

Below is a copy of the narration for DVD-32C. The contents for this script were developed by a review group of industry experts and were based on the best available knowledge at the time of development. The narration may be helpful for translation and technical reference.

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Electronics Assembly Tour

You have just entered the world of electronic assembly, one of the fastest growing industries in the world. We are the heart of a 60 billion dollar electronics industry -- responsible for more than two million direct jobs -- employing more people than the automotive, steel and aerospace industries combined.

We all know that this is an electronic assembly. But what does it do? Well, for starters all electronic products consist of two basic elements: components and interconnections. Components are devices that alter the flow of electricity such as resistors, transistors, switches and integrated circuits. Interconnections are the pathways for the flow of electricity -- such as printed wiring, discrete wires and connectors.

Basically, electronic assembly consists of attaching the electronic components to a printed wiring board, then soldering them in place to complete the electrical connection. Think about this. Without the assembly operation, there would be no functioning electronic products. That's like having a guitar with no strings. You just can't play it. But when the strings are put on and are tuned properly, beautiful sounds can be made.

Let's look at an earlier type of interconnection technique to get a better understanding of how we arrived at modern electronic assembly methods. If you've ever seen an old radio, you know they were much larger than today's radios. If you looked inside, you'd see lots of soldered wires, along with glass vacuum tubes mounted in sockets on a metal chassis. Each wire had to be soldered by hand which took lots of time, wire and space. The vacuum tubes gave off a considerable amount of heat, and to avoid overheating, the cabinet had to be large enough to allow them to cool properly.

During the late 1940s, scientists began to explore ways to put the same electronic functions into smaller packages. Through this process, the transistor was developed to replace tubes -- and the jumble of wires, in most instances, gave way to the printed wiring board, or printed circuit board.

Here's what the assembly process looked like several years later. The component leads were inserted into the holes of a printed wiring board and joined with solder to form an electrical connection. Today, adding the components to the board can be done very quickly by automatic insertion machines -- or they still can be done by hand at manual assembly stations. And the soldering of the component leads to the board can be performed by passing the entire assembly over a wave of molten solder -- or manually with a soldering iron.

These assemblies operate the electronic systems in cars, telephones, TVs, home computers, spaceships, and countless other products.

Now, let's take a tour of a typical electronic assembly facility. There are two categories of components to be assembled -- through hole and surface mount. They each require different processes and different types of machines. In through hole technology, component leads are inserted into mounting holes, then soldered to the printed wiring board. In surface mount technology, the components are placed and soldered directly to lands on the surface of the board.

Now, let's briefly look at each of these processes. In through hole assembly, automatic insertion machines make it possible to insert many components onto a circuit board in a very short time. Depending on the type of components, different types of automatic inserters may be used. The assembled boards are then passed through a wave soldering machine. The purpose of wave soldering is to complete the electrical and mechanical connection of the components to the board.

In surface mount technology, the first step is to print solder paste through a stencil or screen onto the lands of the printed wiring board. The components are then automatically placed onto the lands containing solder paste. The components are now soldered to the lands in a reflow oven which melts the solder paste to form the interconnections. Many assemblies contain both through hole and surface mount components and will undergo both wave and reflow soldering.

The assemblies are usually cleaned to remove any flux residues which can degrade the assembly if they are left on. When companies use low residue fluxes, the cleaning operation may not be necessary.

A visual and/or microscopic inspection is often done to identify areas where there is not enough solder, where there is bridging between the solder joints, and other soldering defects. These conditions can then be manually corrected at a rework station.

There are manual insertion stations for certain kinds of components that can't be attached by the automatic insertion machines. There are also special components that will require hand soldering.

The fully assembled boards are then tested for correct component installation, and that all the electronic components are functioning properly. For some applications, the assemblies that pass these tests are conformally coated to protect them from dust, dirt and moisture. The completed boards are eventually installed in the products they were designed for.

Working in Electronics Assembly

Now that you've been introduced to a typical electronic assembly facility, let's talk about the two types of companies that do electronic assembly -Original Equipment Manufacturers, or OEMs and members of the Electronics Manufacturing Services Industry, also called EMS providers.

OEMs are companies that design and manufacture their own electronic products. In the majority of cases, these companies do all or some of the electronic assembly work themselves. For a variety of reasons, there are times when OEMs send out all or some of their electronic design and assembly to EMS providers. These companies are differentiated from OEMs in that they do not produce their own assemblies. They provide services.

They purchase the components specified by the OEM, assemble the components into finished circuit boards, and perform post assembly testing. Usually any repair or rework required is also done by the EMS provider. A current trend has been for some of these companies to also assume some of the design responsibilities for the OEM.

Today, Electronic Manufacturing Services is a multi-billion dollar industry which is expected to grow at an annual rate of twenty percent for the next five years. The computer industry is by far the largest user of electronic manufacturing services. Regardless of whether you are working for an OEM or EMS provider, it is you that makes the difference between the success and failure of the company.

The electronics business is very competitive. The margin of profit on every item we manufacture continues to decrease. Just look at the way prices of computers and other electronic equipment has dropped over the past few years. In every other industry prices have generally increased. Not only that, but the performance of the products have increased significantly. For example, today's computers are faster, have higher storage capacity and are even easier to use. That's why we're always searching for ways to reduce costs and to do things better. It may seem that the emphasis is on technology, but it's people that make the technology work -- people who have the willingness to learn, to work together and to innovate. Remember, it's people who build the assemblies, not machines. We want you to understand that you are the key to our success in this business.

It's true that in many processes, once the boards and components are loaded, the machine takes over and completes the job automatically. But this is when you need to pay the closest attention. Machines don't always function the way they're supposed to. It takes an alert operator to observe, reason and correct mistakes.

Now let's take a look at some general topics regarding your employment in the assembly operations. An important part of your work involves communication with your supervisor. While you are being taught about your job there will be a lot to learn and remember. Your supervisor is there to answer questions.

Even an experienced operator never hesitates to call the supervisor or other team members for a consultation if there is any confusion about instructions or performing a particular step. Asking questions shows that you care. Asking that question may save an assembly from expensive rework, or even from becoming scrapped.

Also, whenever you have an idea about how something can be improved, you are encouraged to share that with your team members, supervisors or managers, as appropriate. They value your opinions and observations.

Almost all companies have standard operating procedures for all of the electronic assembly processes. There is documentation that tells you what you need to know for each process step. It is important to follow these instructions exactly, and to ask questions if there's something you don't understand.

Careful attention to detail can make the difference in the successful completion of each assembly process. If the equipment is not operating properly, immediately notify your team members, supervisor or the process engineer for assistance in correcting the problem. Quality is doing things right the first time -- even if it takes a little longer. Attention to detail is far less expensive than rework, or having to recall products.

Attitude is another important ingredient. Approaching your work with a positive attitude goes a long way in developing your abilities and performing your job successfully.

In our industry, technology is constantly evolving. We're always searching for ways to do things better. Having challenges is one way not only to improve the company, but to improve yourself. There's always an opportunity to learn something new. And positive attitudes are contagious. This makes coming to work more fun and promotes teamwork.

Teamwork is a very important aspect to producing quality assemblies. Everyone's job is critical to the final product. If one step is done improperly, the entire production process can be slowed down, or potential assemblies can turn to scrap. If one member of the team isn't doing the job satisfactorily, it affects all the members. That is, it affects the financial well-being of our company. Teams can do great things when people's spirits come together for a common goal. You see, a company is nothing more than individuals combining abilities to make a quality product.

Another consideration of any job you're assigned to is safety. You have the right to a safe and healthy workplace. We all are required to maintain certain health and safety standards specified by local, state and federal regulatory agencies. But rules don't prevent injury. Safety is the responsibility of everyone in the company.

Specific training and information relative to safety for all jobs is provided and available to you. It's important to be aware of any potential hazards in your area -- and the correct methods of performing each task. When the proper procedures are followed, the result should be safe performance of the job.

Depending on your job, you may be asked to wear different types of safety equipment such as safety glasses, gloves, steel toed shoes and respirators. This equipment is there for a purpose and should be worn when required.

Another aspect of safety involves alcohol and drugs. One recent study revealed that forty percent of industrial injuries are drug and alcohol related. You may be working with potentially hazardous materials and equipment. Your judgment and abilities must not be impaired for your safety and the safety of those around you. Drugs and alcohol have no place on the job.

Another concern in electronic assembly is the handling of the bare boards, components and finished assemblies. Boards and finished assemblies should only be handled by the edges. Residues of oils and salts from your hands can cause contamination in the circuit areas and ruin the solderability of a circuit board.

In terms of the components, it is important never to touch the device leads or contacts. Oils from your hands can produce poor solderability. Also, the component leads are fragile and can be easily broken or bent.

Another critical handling issue in electronic assembly is electrostatic discharge, or ESD. ESD occurs when static electricity from your body comes in contact with and is discharged into an electronic component. This electricity can degrade or destroy the functionality of some types of components. To prevent ESD, you must always wear wrist and/or heel straps when working on electronic assemblies. Also, grounded workstations and static dissipative mats and work surfaces will help to protect the assemblies.

Finally, your company will have specific methods for handling in process circuit boards, handling components and storing both in-process and finished assemblies.

The more care you take in handling these materials, the less scrap there'll be. Scrap results in the loss of both time and money, and can threaten the continued success of the company. And in most cases, improper handling is the biggest cause of scrap.

During this orientation you were introduced to electronic assembly as part of the 60 billion dollar electronics industry. You were shown the technologies that make up a typical electronic assembly facility. You were informed about the two different types of companies performing electronic assembly -- OEMs and EMS providers. And most importantly, you should now realize how vital you are to our company's continued success.

Please remember to follow all the procedures and instructions -- and ask questions when there's something you don't understand.