

Hardware Tools

General Tool Use

For every job there is the right tool. Make sure that you are familiar with the correct use of each tool and that the correct tool is used for the current task. Skilled use of tools and software makes the job less difficult and ensures that tasks are performed properly and safely.

A toolkit should contain all the tools necessary to complete hardware repairs. As you gain experience, you learn which tools to have available for different types of jobs. Hardware tools are grouped into four categories:

- ESD tools
- Hand tools
- Cleaning tools
- Diagnostic tools



ESD Tools

There are two ESD tools: the antistatic wrist strap and the antistatic mat. The antistatic wrist strap protects computer equipment when grounded to a computer chassis. The antistatic mat

protects
computer
equipment by
preventing
static
electricity
from
accumulating
on the
hardware or
on the
technician.



An antistatic wrist strap is used to prevent ESD damage to computer equipment.



An antistatic mat is used to stand on or to place hardware on to prevent static electricity from building up.

Hardware Tools

Hand Tools

Most tools used in the computer assembly process are small hand tools. They are available individually or as part of a computer repair toolkit. Toolkits range widely in size, quality, and price.



A flat head screwdriver is used to loosen or tighten slotted screws.



A Phillips head screwdriver is used to tighten or loosen cross-head screws.



A torx screwdriver is used to tighten or loosen screws that have a star-like depression on the top, a feature that is mainly found on laptops.



A hex driver, sometimes called a nut driver, is used to tighten nuts in the same way that a screwdriver tightens screws.

Cleaning Tools

Having the appropriate cleaning tools is essential when maintaining and repairing computers. Using the appropriate cleaning tools helps ensure that computer components are not damaged during cleaning.



A soft, lint-free cloth is used to clean different computer components without scratching or leaving debris.



Compressed air is used to blow away dust and debris from different computer parts without touching the components.



Cable ties are used to bundle cables neatly inside and outside of a computer.



A parts organizer is used to hold screws, jumpers, fasteners, and other small parts and prevents them from getting mixed together.

Diagnostic Tools

Digital Multimeter

A digital multimeter, as shown in Figure 1, is a device that can take many types of measurements. It tests the integrity of circuits and the quality of electricity in computer components. A digital multimeter displays the information on an LCD or LED.

A digital multimeter is used to test the integrity of circuits and the quality of electricity in computer components.



Loopback Adapter

Loopback Adapter



A loopback adapter is used to test the basic functionality of computer ports.

A loopback adapter, as shown in Figure 2, also called a loopback plug, tests the basic functionality of computer ports. The adapter is specific to the port that you want to test.

Toner Probe

The toner probe, as shown in Figure 3, is a two-part tool. The toner part is connected to a cable at one end using specific adapters, such as an RJ-45, coaxial, or metal

A toner probe is used to trace cables.

Toner Probe



clips. The toner generates a tone that travels the length of the cable. The probe part traces the cable. When the probe is in near proximity to the cable to which the toner is attached, the tone can be heard through a speaker in the probe.

External Hard Drive Enclosure

Although an external hard drive enclosure, as shown in Figure 4, is not a diagnostic tool, it is often used when diagnosing and repairing computers. The customer hard drive is placed into the external enclosure for inspection, diagnosis, and repair using a known-working computer. Backups can also be recorded to a drive in an external enclosure to prevent data corruption during a computer repair.



An external enclosure houses a hard drive that can be used to diagnose a customer hard drive or a computer that does not boot. The external enclosure can also be used to create backups of a customer's hard drive.

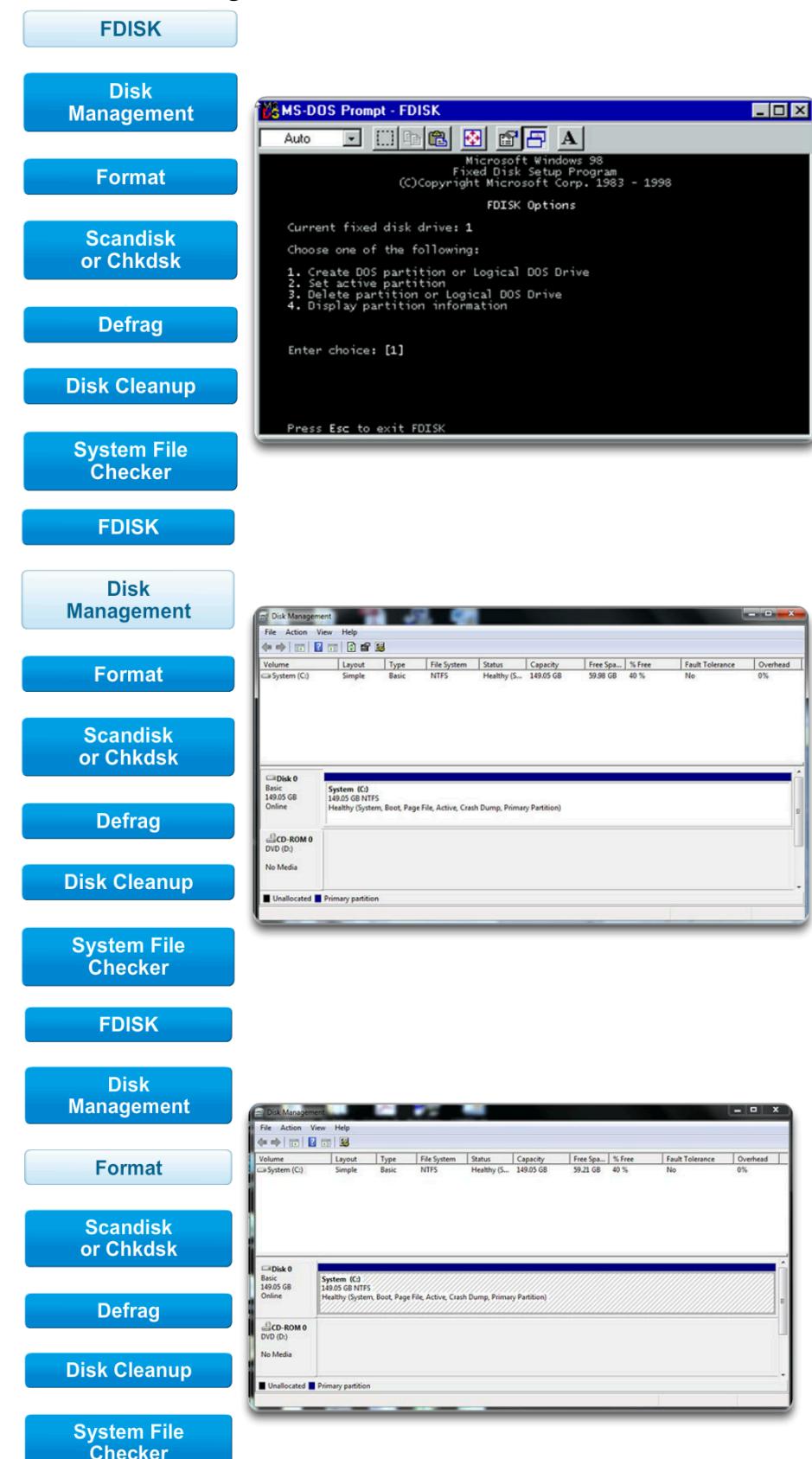
Disk Management Tools

Software tools help diagnose computer and network problems and determine which computer device is not functioning correctly. A technician must be able to use a range of software tools to diagnose problems, maintain hardware, and protect the data stored on a computer.

You must be able to identify which software to use in different situations. Disk management tools help detect and correct disk errors, prepare a disk for data storage, and remove unwanted files.

The figure gives more information on the following disk management tools:

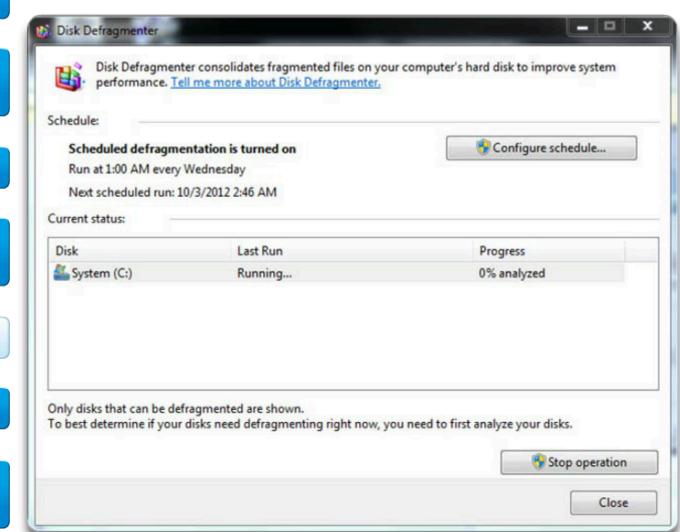
- **FDISK** - Creates and deletes partitions on a hard drive. The FDISK tool is not available in Windows XP, Vista, or 7. It has been replaced with the Disk Management tool.



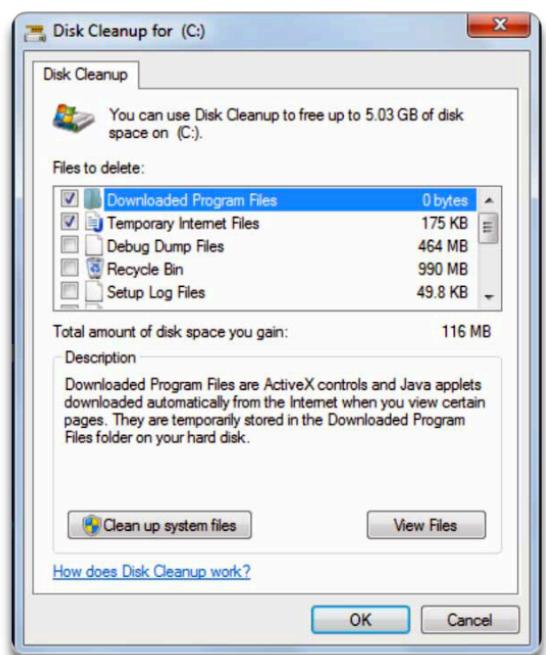
- **Scandisk or CHKDSK** - Checks the integrity of files and folders on a hard drive by scanning the file system. These tools might also check the disk surface for physical errors.



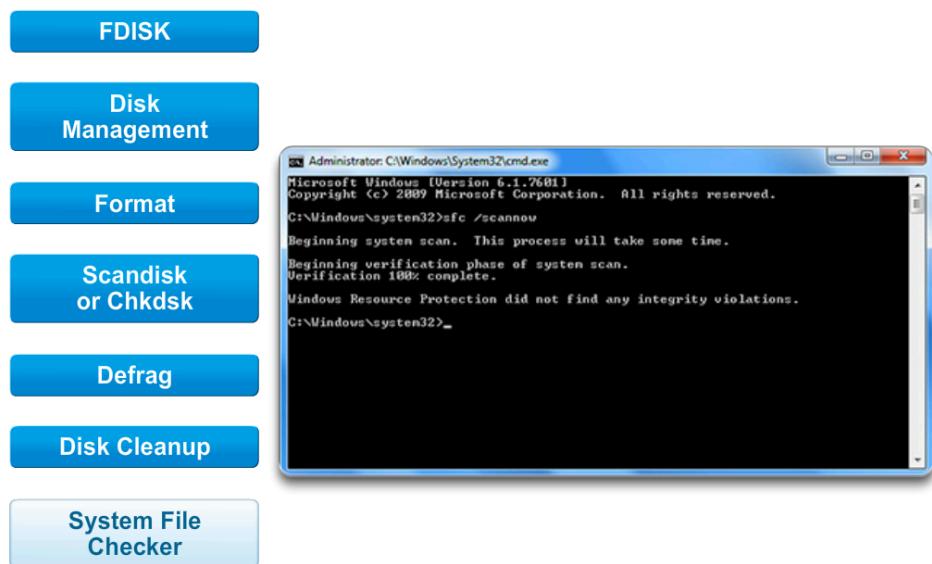
- **Defrag** - Optimizes space on a hard drive to allow faster access to programs and data.



- **Disk Cleanup** - Clears space on a hard drive by searching for files that can be safely deleted.



- System File Checker (SFC)** - Scans the operating system critical files and replaces files that are corrupted. Use the Windows 7 boot disk for troubleshooting and repairing corrupted files. The Windows 7 boot disk repairs Windows system files, restores damaged or lost files, and reinstalls the operating system. Third-party software tools are also available to assist in troubleshooting problems.



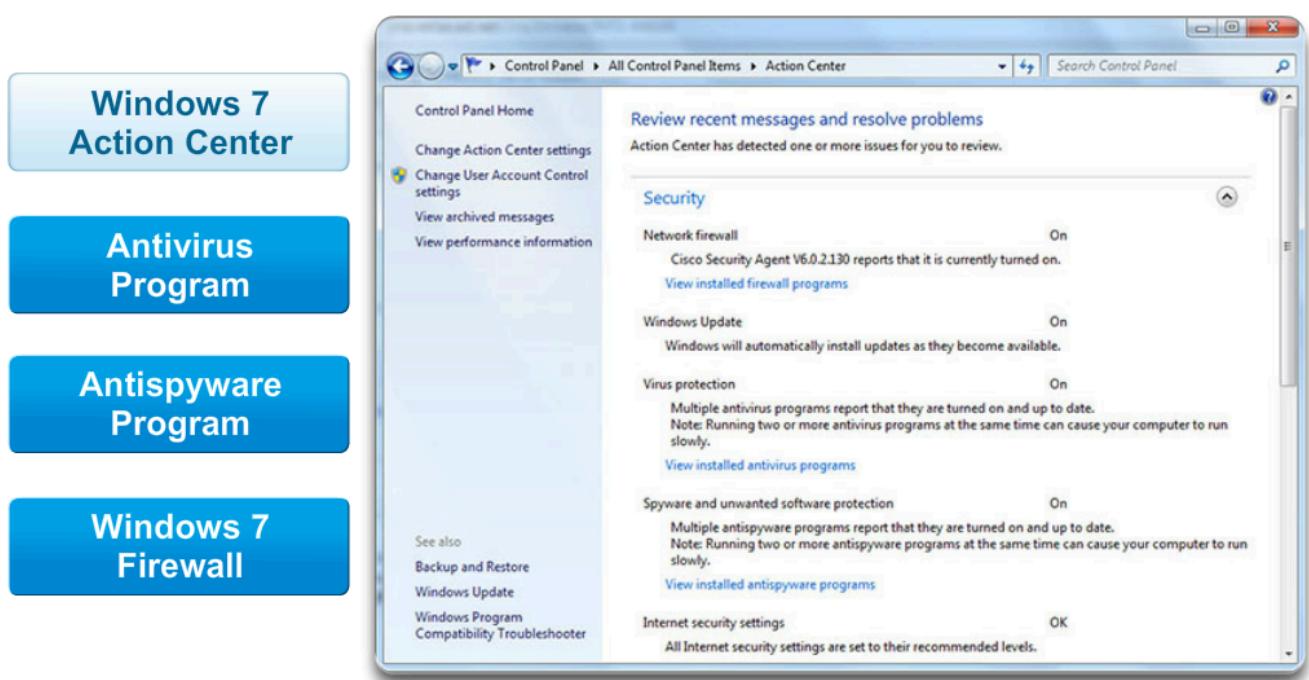
Protection Software Tools

Each year, viruses, spyware, and other types of malicious attacks infect millions of computers. These attacks can damage operating systems, applications, and data. Computers that have been infected may even have problems with hardware performance or component failure.

To protect data and the integrity of the operating system and hardware, use software designed to guard against attacks and to remove malicious programs.

Various types of software protect hardware and data. The figure gives more information on these protection software tools:

- Windows 7 Action Center** - Checks the status of essential security settings. The Action Center continuously checks to make sure that the software firewall and antivirus programs are running. It also ensures that automatic updates download and install automatically.



Organizational Tools

Reference Tools

A technician must document all repairs and computer problems. The documentation can then be used as a reference for future problems or for other technicians who may not have encountered the problem before. The documents can be paper-based, but electronic forms are preferred because they can be easily searched for specific problems.

It is important that a technician document all services and repairs. These documents need to be stored centrally and made available to all other technicians. The documentation can then be used as reference material for similar problems that are encountered in the future. Good customer service includes providing the customer with a detailed description of the problem and the solution.

The screenshot shows the Microsoft TechNet Support website. At the top, there's a navigation bar with links for TechNet, Products, Resources, Downloads, and Support. A search bar is located at the top right. Below the navigation, there's a main heading 'TechNet Support' and three numbered sections: 1. Search for a Solution, 2. Ask a Question in the Forums, and 3. Contact Microsoft for Additional Help. Each section contains sub-links and search fields. The 'Ask a Question in the Forums' section lists various Microsoft products like Exchange Server, Forefront, Office 2007 Deployment, Office 2010, SharePoint Products, SQL Server, System Center, System Center Virtual Machine Manager, Windows 7, and Windows Server.

Personal Reference Tools

Personal reference tools include troubleshooting guides, manufacturer manuals, quick reference guides, and repair journals. In addition to an invoice, a technician keeps a journal of upgrades and repairs. The documentation in the journal includes descriptions of the problem, possible solutions that have been attempted, and the steps taken to repair the problem. Note any configuration changes made to the equipment and any replacement parts used in the repair. This documentation is valuable when you encounter similar situations in the future.

- **Notes** - Make notes as you go through the troubleshooting and repair process. Refer to these notes to avoid repeating previous steps and to determine what steps to take next.
- **Journal** - Document the upgrades and repairs that you perform. Include descriptions of the problem, possible solutions that have been tried to correct the problem, and the steps taken to repair the problem. Note any configuration changes made to the equipment and any replacement parts used in the repair. Your journal, along with your notes, can be valuable when you encounter similar situations in the future.

- **History of repairs** - Make a detailed list of problems and repairs, including the date, replacement parts, and customer information. The history allows a technician to determine what work has been performed on a specific computer in the past.

Internet Reference Tools

The Internet is an excellent source of information about specific hardware problems and possible solutions:

- Internet search engines
- News groups
- Manufacturer FAQs
- Online computer manuals
- Online forums and chat
- Technical websites

The figure shows an example of a technical website.

Miscellaneous Tools

With experience, you will discover many additional items to add to the toolkit. This image shows how a roll of masking tape can be used to label parts that have been removed from a computer when a parts organizer is not available.

A working computer is also a valuable resource to take with you on computer repairs in the field. A working computer can be used to research information, download tools or drivers, and communicate with other technicians.



The image below shows the types of computer replacement parts to include in a toolkit. Make sure that the parts are in good working order before you use them. Using known good components to replace possible bad ones in computers helps you quickly determine which component is not working properly.



Case Fan



Motherboard



CPU Fan



Power Supply



RAM



Hard Drive



NIC



Sound Adapter



Video Adapter



SSD

Demonstrate Proper Tool Use

Antistatic Wrist Strap

Safety in the workplace is everyone's responsibility. You are much less likely to injure yourself or damage components when using the proper tool for the job.

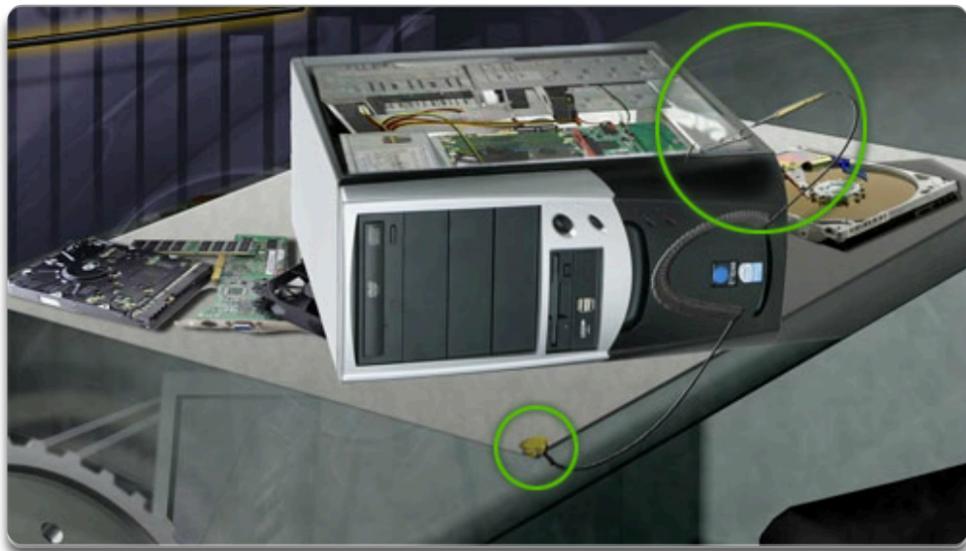
Before cleaning or repairing equipment, make sure that your tools are in good condition. Clean, repair, or replace items that are not functioning adequately.

An example of ESD is the small shock that you receive when you walk across a carpeted room and touch a doorknob. Although the small shock is harmless to you, the same electrical charge passing from you to a computer can damage its components. Self-grounding or wearing an antistatic wrist strap can prevent ESD damage to computer components.

An antistatic mat is slightly conductive. It works by drawing static electricity away from a component and transferring it safely from equipment to a grounding point, as shown in the figure:

Step 1. Lay the mat on the workspace next to or under the computer case.

Step 2. Clip the mat to the case to provide a grounded surface on which you can place parts as you remove them from the system.



When you are working at a workbench, ground the workbench and the antistatic floor mat. By standing on the mat and wearing the wrist strap, your body has the same charge as the equipment and reduces the probability of ESD.

Reducing the potential for ESD reduces the likelihood of damage to delicate circuits or components.

NOTE: Always handle components by the edges.

Hand Tools

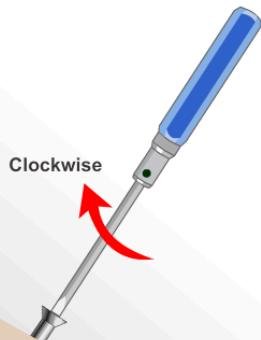
A technician needs to be able to properly use each tool in the toolkit. This page covers many of the various hand tools used when repairing computers.

Screws

Match each screw with the proper screwdriver. Place the tip of the screwdriver on the head of the

Proper Screwdriver Use

screw. Turn the screwdriver clockwise to tighten the screw and counterclockwise to loosen the screw.



Proper Screwdriver Use



Stripped Screw

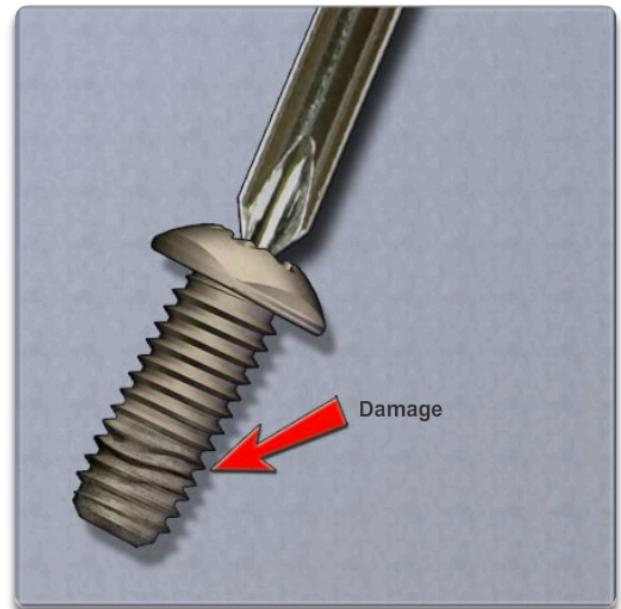
Screws can become stripped if you over-tighten them with a screwdriver. A stripped screw may get stuck in the screw hole, or it may not tighten firmly. Discard stripped screws.

Flat Head Screwdriver

As shown in below, use a flat head screwdriver when you are working with a slotted screw. Do not use a flat head screwdriver to remove a Phillips head screw. Never use a

screwdriver as a pry bar. If you cannot remove a component, check to see if there is a clip or latch that is securing the component in place.

Flat Head Screwdriver



CAUTION: If excessive force is needed to remove or add a component, something is probably wrong. Take a second look to make sure that you have not missed a screw or a locking clip that is holding the component in place. Refer to the device manual or diagram for additional information.

Phillips Head Screwdriver

As shown below, use a Phillips head screwdriver with crosshead screws. Do not use this type of screwdriver to puncture anything. This will damage the head of the screwdriver.

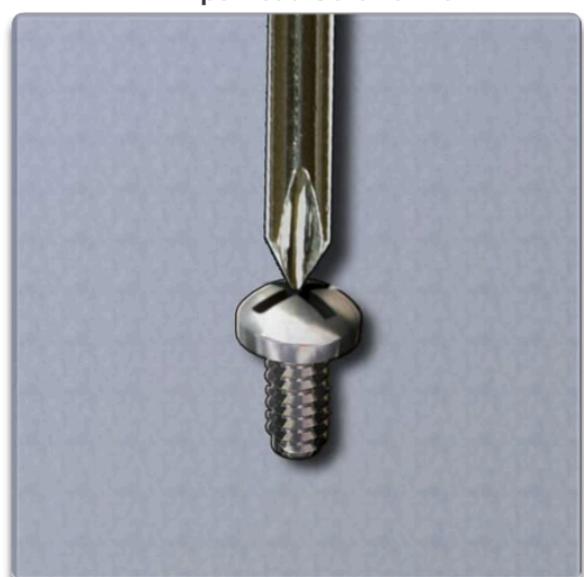
Hex Driver

Use a hex driver to loosen and tighten bolts that have a hexagonal (six-sided) head. Hex bolts should not be over-tightened because the threads of the bolts can be stripped. Do not use a hex driver that is too large for the bolt that you are using.

Hex Driver



Phillips Head Screwdriver



CAUTION: Some tools are magnetized. When working around electronic devices, be sure that the tools you are using have not been magnetized. Magnetic fields can be

harmful to data stored on magnetic media. Test your tool by touching the tool with a screw. If the screw is attracted to the tool, do not use the tool.

Component Retrieving Tools

Needle-nose pliers and tweezers can be used to place and retrieve parts that may be hard to reach with your fingers. There are also tools called part retrievers that are specifically designed for this task. Do not scratch or hit any components when using these tools.

CAUTION: Pencils should not be used inside the computer to change the setting of switches or to pry off jumpers. The pencil lead can act as a conductor and may damage the computer components.

A computer technician needs proper tools to work safely and prevent damage to the computer equipment. A technician uses many tools to diagnose and repair computer problems:

Component Retrieving Tools



- Straight-head screwdriver, large and small
- Phillips-head screwdriver, large and small
- Tweezers or part retriever
- Needle-nosed pliers
- Wire cutters
- Chip extractor
- Hex wrench set
- Torx screwdriver
- Nut driver, large and small
- Three-claw component holder
- Wire Stripper
- Crimper
- Punch Down Tool

- Digital multimeter
- Wrap plugs
- Small mirror
- Small dust brush
- Soft, lint-free cloth
- Cable ties
- Scissors
- Small flashlight
- Electrical tape
- Pencil or pen
- Compressed air

Various specialty tools, such as Torx bits, antistatic bags and gloves, and integrated circuit pullers, can be used to repair and maintain computers. Always avoid magnetized tools, such as screwdrivers with magnetic heads, or tools that use extension magnets to retrieve small metal objects that are out of reach. Using magnetic tools can cause loss of data on hard drives and floppy disks. Magnetic tools can also induce current, which can damage internal computer components. Additionally, there are specialized testing devices used to diagnose computer and cable problems:

- **Multimeter** - A device that measures AC/DC voltage, electric current, and other cable and electrical characteristics, as shown in Figure 7.
- **Power supply tester** - A device that checks whether the computer power supply is working properly. A simple power supply tester might just have indicator lights, while more advanced



To explore the different functions of the multimeter, click the buttons, the dial, and the leads.

Multimeter

Fluke Networks 110 Multimeter

The Fluke Networks 110 Multimeter is an example of equipment used to test for voltage. To explore the different functions of the multimeter, click on the buttons and switch positions.

Summary

This chapter discussed safe lab procedures, correct tool usage, and the proper disposal of computer components and supplies. You have familiarized yourself in the lab with many of the tools used to build, service, and clean computer and electronic components. You have also learned the importance of organizational tools and how these tools help you work more efficiently.



Some of the important concepts to remember from this chapter:

- Work in a safe manner to protect users and equipment.
- Follow all safety guidelines to prevent injuries to yourself and others.
- Know how to protect equipment from ESD damage.
- Know about and be able to prevent power issues that can cause equipment damage or data loss.
- Know which products and supplies require special disposal procedures.
- Familiarize yourself with the MSDS for safety issues and disposal restrictions to help protect the environment.
- Be able to use the correct tools for the task.
- Know how to clean components safely.
- Use organizational tools during computer repairs.