Technician Safety

Getting Started

Welcome to the Technician Safety course.

Technician Safety precautions include CRT discharge procedures, avoiding shock hazards on some iMacs, special take apart handling on some iMac models, and how to properly handle hazardous materials used in servicing Macintosh systems.

Please note that the topics covered in this course are the basis for the Technician Safety sections of both ACMT Certification and Recertification Exams. Those sections MUST be passed in order to pass those exams.

If you do not pass a Technician Safety section, even a perfect score on the remainder of the exam will still result in a failed exam.

Target Audience

This training module is intended for technicians who support and service Apple products.

Prerequisites

You review these courses before reviewing this one:

- Basic Computer Theory and Terms
- Underlying Technologies
- References
- Diagnostics
- Troubleshooting Theory
- ESD Precautions
- Hardware Tools

Time Required

It will take about forty minutes to complete this course.

Training Course Objectives

After reviewing this course you should be able to:

- Locate safety information via Service Source.
- State the risks of servicing CRTs.
- Identify hazardous areas inside and around a CRT display.
- List the eight CRT safety rules.
- Describe the CRT discharge procedure.
- Given a CRT, discharge the CRT using Apple-recommended ESD and CRT discharge procedures. (AASPs only).
- Describe the CRT disposal procedure.
- Describe precautions for avoiding shock hazards on iMac systems.
- Describe special tools and procedures required when opening up iMac (Early 2008) systems.
- Describe precautions for working with Krytox thermal grease.
- Identify potentially hazardous materials used in Macintosh systems.

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Next: Safety Overview

Safety Overview

Introduction

Safety issues in Macintosh systems fall into several major categories:

- Handling and servicing CRTs
- Shock hazards
- Working with and disposing of hazardous materials

Safety Resources

There are several online resources that can keep you up to date regarding safety issues for Macintosh systems.

Service News

Service News provides announcements and updates for safety procedures.

It can be accessed via the service provider version of Service Source.

Service Manuals and Technician Guides

Any special precautions for working on product will be spelled out in detail.

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Next: Course Exercise

Course Exercise

Open this page separately and keep it open while you review the course.

As you go through the course, answer each of the exercise questions.

1. You are about to work on a Mac Pro (8x) system for the first time. No one else at your site has worked on this system. Which ONE of the following resources will be your BEST means of understanding any safety issues or procedures?
   a. Discussion Boards
   b. Service manual
   c. Service News

2. What makes up most of the weight of a CRT?
   a. Electron Generator
   b. Anode
   c. CRT Grids
   d. Glass Vacuum Tube

3. Name the three major risks of working on CRTs

4. Is it recommended to carry CRTs by the neck?

5. Name one toxic material found inside of CRTs.

6. You are troubleshooting an eMac system for a no video issue. You want to open up the system to check internal cabling. What is the FIRST recommended step you take before doing this?

7. What are the eight CRT safety rules?
   1.
   2.
   3.
   4.
   5.

6.
7.
8.

8. What does this symbol represent?

9. Another technician is working on an iMac (24-inch) system and has plugged in the opened unit to check LEDs. Should he be wearing an ESD wrist strap?

10. List five of the special tools needed to open the case on an iMac (20-inch Early 2008) system.
    1.
    2.
    3.
    4.
    5.

11. You are surfing the Web on a Power Mac G5 (Early 2005) 2.7 GHz system and notice that there appears to be liquid leaking out from the bottom of the case. What is the FIRST thing you should do?

    a. Restart the system
    b. Unplug the system
    c. Shut down the system
    d. Start up system in verbose mode

12. You get some of the liquid in your eye. How long should you flush out your eye with water?

    a. One minute
    b. Five minutes
    c. Ten minutes
    d. Fifteen minutes

13. You diagnose that a high-end Mac Pro (Early 2008) requires a new heat sink. Is it okay to leave the system torn down while you order a new heat sink?

14. What do you do with the disposable materials that came with the replacement heat sink?

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Next: CRT Introduction

CRT Introduction

Overview

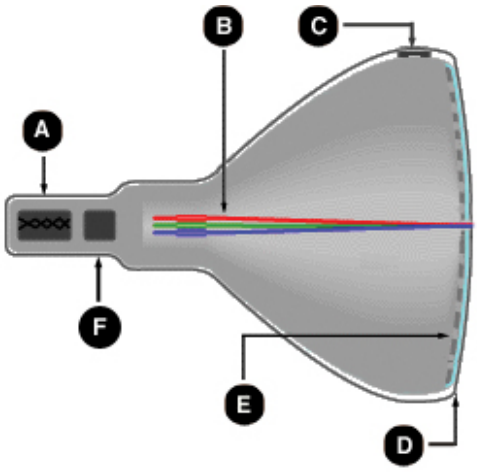
CRT (Cathode Ray Tube) displays designed for use with computers are built to high specifications because they are used for word processing and other detailed work, and must be readable.

A CRT display is composed of a vacuum tube with an electron beam generator inside.

The tube makes up most of the size and weight of a CRT display

The number of times the screen is repainted each second is the CRT's scan, or refresh rate, expressed in hertz (Hz). Higher scan rates result in images that appear stable; lower scan rates result in images that seem to flicker. Flickering images can cause eyestrain.

You can adjust the scan rate in the Displays pane in System Preferences. Select a rate that is compatible with the display for best results.



A. Cathodes (electron generator)
B. Electron beams (RGB)
C. Anode

D. Phosphor-coated screen
E. Shadow mask or aperture grill
F. CRT grids

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Next: CRT Risks

CRT Risks

Introduction

While CRT-based Macintosh systems are no longer sold, they will be a part of the supported product line for years to come.

At some point, you may have to service a CRT system and it is extremely important that you know how to troubleshoot and service these potentially dangerous Macs.

Glass and Vacuums

Cathode ray tubes are glass vessels that have the air pumped out of them. They will have very thick glass in the screen area and a thinner glass in the narrow neck area.

This makes a CRT fairly fragile when it is not encased in a computer or bezel. The neck area, in particular, is easy to break or crack.

A - Front of CRT where the glass is very thick.
B - Neck area of CRT where the glass is very fragile

Implosions

If a CRT is broken, the surrounding air will rush violently into the unsealed vacuum in the CRT. This normally results in broken glass being sprayed in every direction.

Avoiding Breakage

Avoid placing stress on the neck portion of the CRT assembly.

Since the neck has thinner glass, you should never lift a CRT by the neck and handle CRT modules carefully when lifting them or putting them down.

If you have to transport a CRT module, always make sure that it is in a shipping package or installed in the computer.

Toxic Materials

Color cathode ray tubes may contain mercury or other potentially toxic materials.

If the CRT is not broken or cracked, these materials are contained and do not pose a risk.

This is another reason to be very careful when handling CRT service modules.

It's also important to understand that there are no toxic gases, or gases of any kind, inside a CRT; it's a near-vacuum, with almost all air removed.

Shock Hazard

CRTs are potentially dangerous because charged CRT carries high voltage - about 27,000 volts.

In addition, the vacuum in a CRT can cause it to implode if broken or punctured. When handled properly, CRTs should cause no harm.

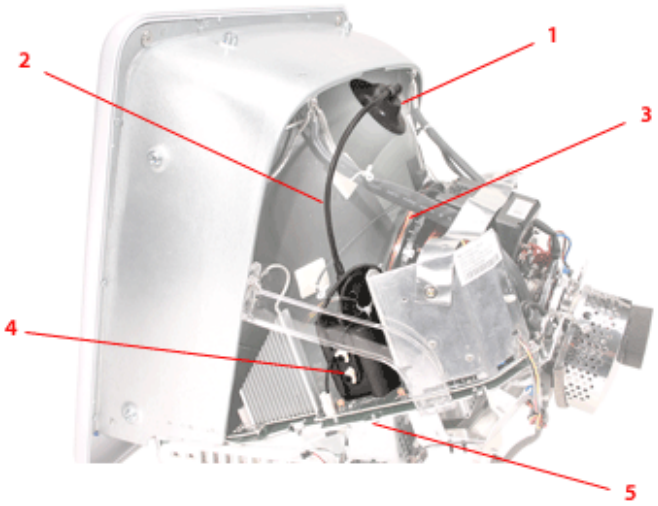
There are very few occasions when you should have to open a display and expose a CRT.

Because of changing technology and lower prices, servicing a CRT unit is rarely your first option, and untrained AASPs should not attempt CRT service.

NOTE: A CRT can carry a charge even when the display or system is turned off and can build up a secondary charge after the power is removed.

Because of dangerously high voltages it is important that you do not touch any of the following parts inside the product housing until after the display is disconnected from its power source and properly discharged.

This illustration shows the Display Analog Assembly of an eMac system:



These areas of a CRT can present a shock hazard:

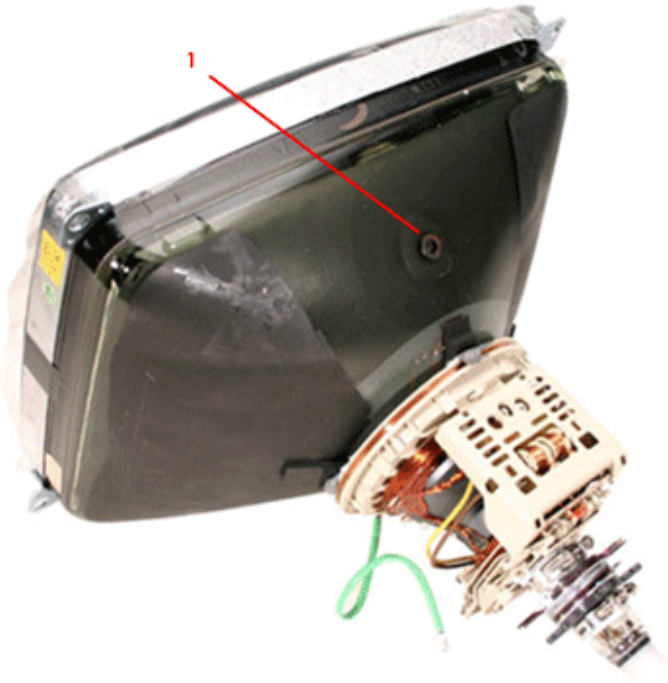
1. Anode cap and connector
2. High voltage cable
3. Yoke assembly (deflection coils)
4. Flyback transformer
5. Any exposed soldered

connections

The illustration below shows a close-up view of the anode aperture itself. The anode aperture is a metallic connector that is embedded into the glass envelope of the CRT when it's manufactured.

Since a disconnected CRT can build a charge back up on its own over time, it is important to be aware of the anode aperture because this is where such built-up charge can shock you if you touch this connector, even when power has been removed and the high voltage cable has been disconnected.

This is why it's important to always establish an ongoing ground between the anode aperture and ground after discharging the CRT.



1. CRT Anode Aperture

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Next: CRT Safety Rules

CRT Safety Rules

CRT Safety Rules

Working around a CRT inside a Mac, or working around the inside of any Mac while it's powered on, can bring parts of your body dangerously close to hazardous voltages and therefore requires an exception to the ESD rules.

Being grounded in these situations is extremely dangerous because your grounded ESD wrist or heel strap and workbench mat create a path through your body to ground.

To work safely on a CRT inside a Mac, you need to follow these safety rules every time:

1. Don't work alone. Having someone nearby in case of an accident could save your life.
2. Turn off the power and disconnect the AC power cord before you remove the CRT cover.
3. Remove any metal jewelry.
4. Remove the grounding wrist or heel strap until the CRT has been discharged.
5. Disconnect the snap fastener on the grounded workbench mat until the CRT has been discharged.

6. Wear safety goggles.

7. Discharge the CRT immediately after the case has been removed and before touching anything inside the system or display. The CRT discharge procedure is covered in the next section of this course.
8. After you have discharged the CRT, reconnect and wear a grounding wrist or heel strap.

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Next: CRT Discharge

CRT Discharge

Overview

Please exercise caution - CRTs carry a high voltage and can be dangerous. For safety, newer Apple displays are equipped with a bleeder resistor (contained in the flyback transformer) that automatically drains the charge from the CRT when the power is shut off. Even so, Apple requires all service technicians to discharge all CRTs before performing repairs. In this module you will learn how to safely discharge the high voltage from a cathode-ray tube.

Warning: The CRT discharge component of this lesson is intended for service technicians working under the direct supervision of an AASP. Do not attempt the CRT discharge part of this lesson if you are an individual studying AppleCare Technician Training.

Required Tools and Equipment

Required Tools and Equipment
When discharging a CRT, you need the following equipment:

- Safety glasses
- Ungrounded foam pad
- Needle-nose pliers
- Wire lead with alligator clips at both ends
- CRT discharge tool

CRT Discharge Procedure

To ensure your safety, you should follow Apple-recommended CRT discharge procedures. Search Service Source to obtain the latest version of the correct service manual for the display or Mac you are servicing, and read through all instructions and cautions before starting any work.

Before you do anything (including discharging a CRT), turn off and unplug the display or Mac.

1. Follow CRT Safety steps 1 through 6 to prepare to discharge the CRT.
   (These steps were covered in the previous section of this course.)

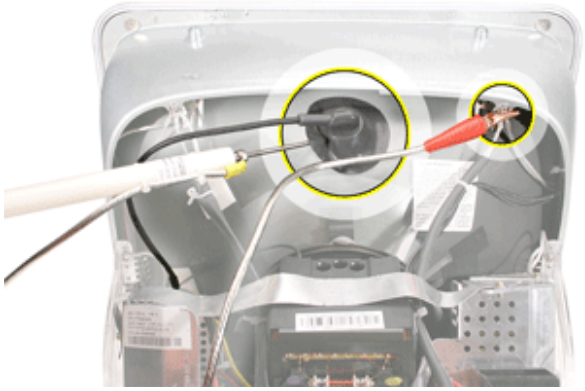
2. Remove the housing. If you have access to them, refer to the take apart instructions in the appropriate service manual for your Macintosh or display.

3. Put one hand in your pocket or behind your back to prevent current from passing through your heart if you accidentally touch a high-voltage area.

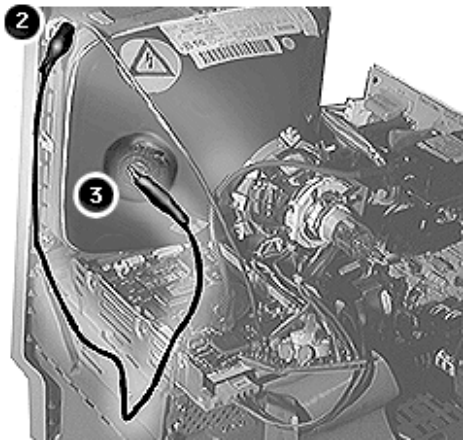
4. Using the Apple CRT discharge tool shown below, connect the alligator clip from the lead to any metal part of the chassis on standalone CRT displays or to the ground lug on a Mac with a built-in CRT display. The ground lug is usually found on a corner of the CRT where it attaches to the front bezel.

   NOTE: When discharging a CRT, use only the ground lug to make your ground connection on a Macintosh to prevent high voltage damage to the logic board. The ground lug ensures high voltage is safely discharged through appropriate circuits.

5. Carefully slide the discharge tool probe under the anode cap and into the anode aperture, until you can feel metal-to-metal contact being made between the probe and the anode aperture. Feeling for this contact is your confirmation that any voltage that may still be inside the CRT has been safely discharged through the discharge tool.



6. If a discharged CRT must remain exposed for any length of time, establish an ongoing ground lead between the ground lug (2) and the anode aperture (3). This prevents the CRT from building up a secondary charge again. A typical ground lead would have alligator clips at both ends of a short wire lead.



7. After you have discharged the CRT and established your ongoing ground lead, reconnect and wear a grounding wrist or heel strap and reconnect your ESD mat to ground to resume ESD precautions.

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Next: CRT Disposal

CRT Disposal

Overview

Remember that even electrically discharged CRT displays still present these basic dangers during disposal:

- CRT displays may implode if mishandled.
- CRT displays may contain hazardous materials.

Use the following instructions for returning color CRT's (whether in-warranty or out-of-warranty).

Color CRT assemblies must be disposed of as hazardous waste. AASPs should return dead color CRT assemblies (not physically cracked or broken) directly to Apple.

Remember:

- Do not devacuum them.
- Enclose them in the packaging in which they were originally shipped.

If you no longer have the original packaging, do NOT return color CRTs to Apple. Instead, dispose of CRT assemblies according to your local hazardous waste ordinances.

Broken CRTs (for example, monitors with cracked glass) must not be returned to Apple. Again, dispose of them according to your local hazardous waste ordinance.

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Next: Power Supply Precautions

Power Supply Precautions

Power Supply Safety

When the iMac G5 (iSight) and later models (including 17-inch, 20-inch, and 24-inch Intel-based systems) are plugged in, the power supply contains high voltages that pose a potential safety hazard.

Even without booting, a plugged in system will supply AC mains power to the power supply, and this voltage is exposed on parts of the power supply.

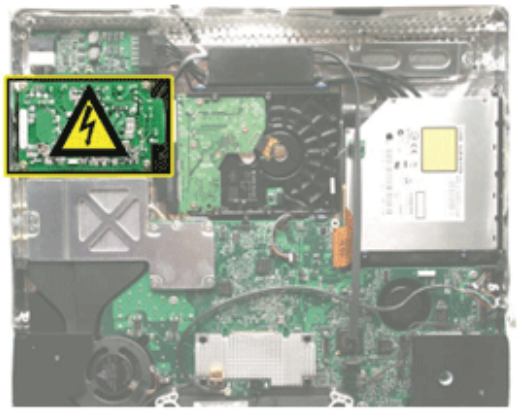
Never work on or near the power supply with the unit plugged in, and make sure the unit is unplugged when

whenever the front bezel is removed.

If the unit needs to be plugged in for LED checks or similar troubleshooting, you must NOT be wearing an ESD wrist strap. A shock could be very dangerous if you are connected to ground.

Avoid touching the exposed power supply for a few minutes after the system has been unplugged. The components inside the power supply can store an electrical charge for a few minutes before they slowly drain their stored charge.

This illustration from the iMac (24-inch) service manual shows the location of the power supply:



This symbol identifies any section of a system that presents a shock hazard:

Any time you see this symbol in Apple service manuals, Technician Guides or other Apple documentation, you need to read and fully understand the shock hazard it identifies.

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Next: Glass Handling Procedures

Glass Handling Procedures

Glass Panel Precautions

Recent iMac models have a glass panel that attaches to the outside of the front bezel.

The glass panel is not tempered and will break into sharp pieces if mishandled.

A scratched or broken glass panel is not covered under warranty. To prevent contamination, handle only by panel's edges while you are wearing lint-free gloves.

Removing the Glass Panel

Removing the glass panel requires special tools and must be done prior to replacing any module other than the SO-DIMM's.

Special tools such as lint-free gloves, rubber suction cups, a sticky silicone roller, microfoam storage bags, and the iKlear cleaning solution are required to remove, handle, and clean the glass panel. Details concerning these special tools and materials are available in the service manuals for these latest iMac models.

Things to Do

- Handle glass panel using lint free gloves.
- Use only a sticky silicone roller to clean the inside surface of the glass and the LCD panel.
- Use iKlear to clean ONLY the outside surface of the glass panel.
- Place the glass panel into a clean protective microfoam bag when it is not installed on an iMac.
- Store the glass panel in a safe area where it will not be broken or damaged.
- Store the LCD panel in an anti-static bag to prevent the buildup of static charges which may attract dust particles to the display's surface.

Things to Avoid

- Avoid fingerprints. Do NOT touch the inside of the glass with bare hands or dirty gloves.
- Do NOT clean the inside surface of the glass or the LCD with iKlear or other cleaning solutions.
- Do NOT place the glass panel on a work surface where it may collect dust and other contaminants unless it is in its protective microfoam bag.
- Do NOT use single wipe iKlear packets or other cleaning solutions to clean the glass.

Handling a Broken Glass Panel

- The glass panel is not tempered and will break into sharp pieces if mishandled.
- If the glass is broken it must be carefully removed from the iMac to prevent irreparable damage to the front surface of the LCD. If the front surface of the LCD is scratched by the broken glass the LCD may need to be replaced.
- Do not handle broken glass unless you are wearing protective cut-resistant gloves. The lint-free gloves

used to prevent contamination of the glass panel are not suitable for handling broken glass.
- Use a broom and dust pan to sweep up as much of the broken glass as possible. Glass fragments may have traveled several feet from the location of the glass panel so be sure to thoroughly clean the entire area. Use a vacuum to remove the smaller fragments not picked up by the broom.

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Next: Portable Precautions

Portable Precautions

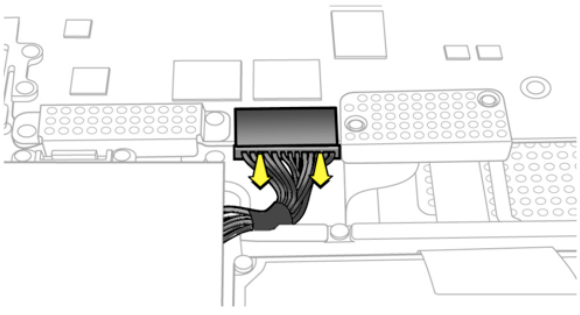
Internal Battery Must Be Disconnected

Summary: Newer Apple portable models contain an internal-only battery that is serviceable only by Apple-authorized service providers and are fitted with tamper-proof screws.

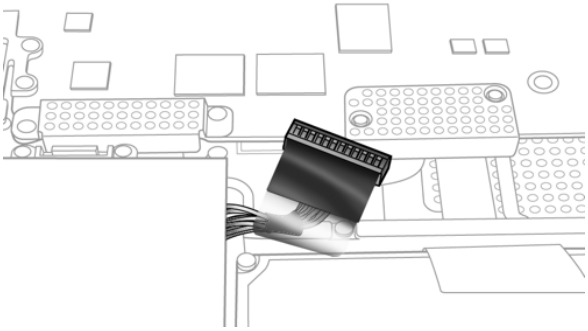
Note: Some Apple portable models have no access door on the bottom case. On such models, the entire bottom case is removed to gain access to the battery and other internal components.

WARNING: Because the battery is internal and connected to the logic board by a cable, it MUST BE DISCONNECTED before performing service procedures. If you fail to do so, live current from the battery will short circuit the components and render the logic board and/or LVDS cable unusable. **Causing the battery to short circuit is a technician safety issue because doing so can cause an electrical fire.**

Tip: Every time you remove the bottom case, disconnect the battery cable from the logic board before doing anything else inside. Please consult the latest version of the appropriate Apple Technician Guide for complete instructions.



Pull on tab to disconnect battery cable



Battery cable disconnected from logic board

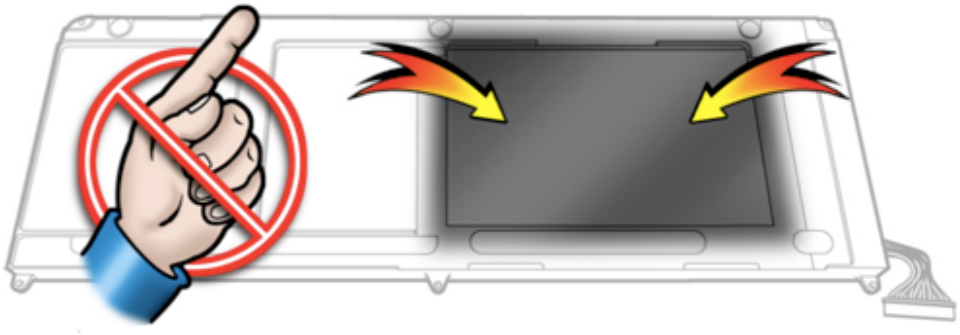
Internal Battery May Have Soft Underside

Summary: Some newer Apple portable models, such as the MacBook Air and MacBook Pro (17-inch, Early 2009), contain an internal-only battery. The underside of this battery may be soft.

The battery's mylar gel packs are partially exposed on the battery's underside.

WARNING: Puncturing or otherwise damaging the battery may cause hazardous chemicals to leak out of the battery.

Tip: Whenever you handle the battery, hold the battery carefully by its edges only. Do not puncture or press on battery. If mylar covering battery is punctured, do not re-use battery. Do not drop the battery. Do not place the battery on any surface near sharp objects like screws, metal clips, or tools, because sharp objects can easily puncture the soft battery cover.



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Next: **Liquid Cooling**

Mac Pro Thermal Materials

Introduction

In the Mac Pro (8x) and high-end Mac Pro (Early 2008) configurations a special coating is used on the heat sink and processor to manage the computers' temperature.

There are special disposal requirements for these models as detailed below.

Handling Instructions

General

- Wear disposable nitrile or latex gloves when handling the processor heat sink and processor.
- Avoid touching the silver coating on the underside of the heat sink and the top of the processor.
- Use care when removing the heat sink from the computer. As much as possible, lift the heat sink straight up off the processor.
- Use care when removing the processor from the logic board. Lift the processor out of the processor holder by inserting a finger or flat-blade screwdriver in the notch at the front of the holder. Hold the processor only by the edges.
- When installing a replacement heat sink or processor, remove the protective cover from the new heat sink or processor and transfer it to the defective heat sink or processor before packaging it for return to Apple.

Timing

- When removing or replacing the heat sink and/or processor, do not allow the heat sink to be separated from the processor for more than 30 minutes. The silver coating on the heat sink and processor degrades with exposure to air; more than 30 minutes exposure could result in damage to the computer and a repeat, multi-part repair. Reassemble the computer while waiting for any new parts to arrive.
- When installing a new logic board, use care in transferring the heat sinks and processors to the new board. Do not allow the heat sinks and processors to be separated from the board or from each other for more than 30 minutes. Reassemble the computer while waiting for a new logic board to arrive.

Krytox Thermal Grease

To ensure a proper seal between the heat sink and processor, a bead of Krytox grease rims the gasket on the underside of the heat sink. Replacement heat sinks come with the grease already applied.

Use the following guidelines for when to reapply Krytox grease to the heat sink.

- In most cases, you do not need to reapply Krytox grease when installing a new processor or when transferring processors and heat sinks to a replacement logic board.
- If you are installing a new heat sink , use a lint-free cloth to remove any residual grease from the outer edges of the processor. Do not apply new grease to the heat sink or processor, as the heat sink comes with the full capacity of grease applied.

Safety and First Aid Guidelines

For complete instructions, refer to the specific Material Safety Data Sheets (MSDS) included with the replacement parts.

Safety

- Avoid contact with eyes.
- Avoid contact with skin.
- Wash thoroughly after handling.
- Do not store or consume food, drink, or tobacco in areas where they may become contaminated with the material.

First Aid

- **Eyes**: Immediately flush with plenty of water. If wearing contact lenses, after initial flushing, remove contact lenses and continue to flush for 15 minutes. Have eyes examined by a medical professional if irritation persists.
- **Skin**: Wash skin with soap and running water. The recommended flushing is 15 minutes if pain or irritation occurs. Remove and wash contaminated clothing. Seek medical attention if irritation or redness develops.
- **Inhalation**: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
- **Ingestion**: Do not induce vomiting. Contaminated individual should immediately be given two glasses of water. Never give anything by mouth to someone who is unconscious, having convulsions, or unable to swallow. Call a physician.

Disposal Instructions

Place all disposable materials used in removing or replacing a processor heat sink or processor inside the re-sealable plastic bag included with the replacement module.

(Disposable materials include such items as protective gloves, alcohol wipes, lint-free cleaning cloths, Krytox grease and syringe, and heat sink gasket.)

Dispose of this material per local and federal disposal regulations, and/or your site's disposal procedures.

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Next: Summary

Liquid Cooling

Introduction

The following Power Mac systems:

- Power Mac G5 (Late 2004) 2.5 GHz
- Power Mac G5 (Early 2005) 2.7 GHz
- Power Mac G5 (Late 2005 Quad) 2.5 GHz

use a liquid cooling system (LCS) to manage the temperature in the computer. The liquid cooling system is sealed and is designed to be opened only by an Apple Authorized Service Provider (AASP).

To ensure proper safety and handling of the LCS system, please read the following information.

General Safety Information

The LCS cooling system fluid is predominantly water (80% or greater) with a mixture of corrosion inhibitors and bacterial growth preventatives. In normal use in a non-leaking LCS there are no special handling considerations.

However, if a leak in the system is suspected or discovered and the computer is plugged in, remove power to the computer by pulling the power plug.

Nitrile or rubber gloves should be worn when handling an LCS module that is leaking or suspected to be leaking. Evidence of leaks would include corrosion around fittings in the LCS coolant system, a liquid present, or a slick or slimy feel when handling the part.

For leaks or spills, wipe up the fluid using rags, paper towels, or other suitable materials. Dispose of all cleaning materials according to local laws and regulations. Do not combine used coolant with any other chemical.

When returning a failed LCS module to Apple, place the module (leaking or not) in the packaging that the replacement module came in. Follow the packaging instructions included with the replacement module. Failure to follow the instructions could damage the equipment and void warranty coverage.

Safety Guidelines

Below is a summary of first aid measures for exposure to the liquid.

- Eyes: Immediately flush with plenty of water. If wearing contact lenses, after initial flushing, remove contact lenses and continue to flush for 15 minutes. Have eyes examined by a medical professional if irritation persists.

- Skin: Wash skin with running water. Remove contaminated clothing. The recommended flushing is 15 minutes if pain or irritation occurs. Seek medical attention if irritation or redness develops.

- Ingestion: Ingestion of this product, while unlikely to occur in its containment, may cause irritation of the mouth and throat, gastric upset, stomach ache, cramps, nausea and vomiting.

If the product is swallowed,

CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION.

If professional advice is not available, do not induce vomiting. Contaminated individuals should drink milk, egg whites, or large quantities of water. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow.

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Next: Mac Pro Thermal Materials

Summary

- In Conclusion

In Conclusion

To summarize what you have learned:

- You now know how to locate safety information about Apple products in Service News, service manuals, and technician guides.
- CRTs are hazardous from implosion, hazardous materials such as mercury, and electrical shocks.
- CRT necks are very fragile.
- The eight CRT safety rules are as follows:
    1. Don't work alone.
    2. Turn off the power and disconnect the AC power cord before you remove the CRT cover.
    3. Remove any metal jewelry.
    4. Remove the grounding wrist or heel strap until the CRT has been discharged.
    5. Disconnect the snap fastener on the grounded workbench mat until the CRT has been discharged.
    6. Wear safety goggles.
    7. Discharge the CRT immediately after the case has been removed and before touching anything inside the system or display.
    8. After you have discharged the CRT and turned off the CRT power, reconnect and wear a grounding wrist or heel strap.
- You now know about power supply shock hazards when later model iMac systems are plugged in but not booted.
- You can name the special tools required to open up later iMac systems.
    - Lint-free gloves
    - Rubber suction cups
    - Sticky silicon roller
    - Microfoam storage bags
    - iKlear cleaning solution
- You know to immediately unplug any liquid cooled Macintosh system that appears to be leaking.
- You know that Mac Pro (8x) and some Mac Pro (Early 2008) systems require special handling whenever you remove or replace the heat sinks or processors.

Next: Exercise Answer Key

Course Exercise Answer Key

Review your answers against those shown here. Correct answers are in **bold.**

1. You are about to work on a Mac Pro (8x) system for the first time. No one else at your site has worked on this system. Which ONE of the following resources will be your BEST means of understanding any safety issues or procedures?
   a. Discussion Boards
   b. **Service manual**
   c. Service News

2. What makes up most of the weight of a CRT?
   a. Electron Generator
   b. Anode
   c. CRT Grids
   d. **Glass Vacuum Tube**

3. Name the three major risks of working on CRTs
   a. **Implosion - flying glass**
   b. **Hazardous materials if CRT is cracked or broken**
   c. **Lethal shock hazard**

4. Is it recommended to carry CRTs by the neck?
   No, it is not. The neck has the thinnest glass and is the most fragile area of the CRT.

5. Name one toxic material found inside of CRTs.
   Mercury

6. You are troubleshooting an eMac system for a no video issue. You want to open up the system to check internal cabling. What is the FIRST recommended step you take before doing this?
   Make sure someone is in the room with you. Do not work alone when servicing CRTs.

7. What are the eight CRT safety rules?
   1. **Don't work alone.**
   2. **Turn off the power and disconnect the AC power cord before you remove the CRT cover.**
   3. **Remove any metal jewelry.**
   4. **Remove the grounding wrist or heel strap until the CRT has been discharged.**
   5. **Disconnect the snap fastener on the grounded workbench mat until the CRT has been discharged.**
   6. **Wear safety goggles.**
   7. **Discharge the CRT immediately after the case has been removed and before touching anything inside the system or display.**
   8. **After you have discharged the CRT and turned off the CRT power, reconnect and wear a grounding wrist or heel strap.**

8. What does this symbol represent?

It identifies a shock hazard in Apple service manuals.

9. Another technician is working on an iMac (24-inch) system and has plugged in the opened unit to check LEDs. Should he be wearing an ESD wrist strap?

No. There is a serious shock hazard.

10. List five of the special tools needed to open the case on an iMac (20-inch Early 2008) system.
    1. **Lint-free gloves**
    2. **Rubber suction cups**
    3. **Sticky silicone roller**
    4. **Microfoam storage bags**
    5. **iKlear cleaning solution**

11. You are surfing the Web on a Power Mac G5 (Early 2005) 2.7 GHz system and notice that there appears to be liquid leaking out from the bottom of the case. What is the FIRST thing you should do?

    a. Restart the system
    b. **Unplug the system**
    c. Shut down the system
    d. Start up system in verbose mode

12. You get some of the liquid in your eye. How long should you flush out your eye with water?

    a. One minute
    b. Five minutes
    c. Ten minutes
    d. **Fifteen minutes**

13. You diagnose that a high-end Mac Pro (Early 2008) requires a new heat sink. Is it okay to leave the system torn down while you order a new heat sink?

No, it is not. You need to reassemble the system while waiting for the part to arrive.

14. What do you do with the disposable materials that came with the replacement heat sink?

You package them up in sealable plastic bags and dispose of them in accordance with local and federal regulations.

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Next: This concludes the Technician Safety course.