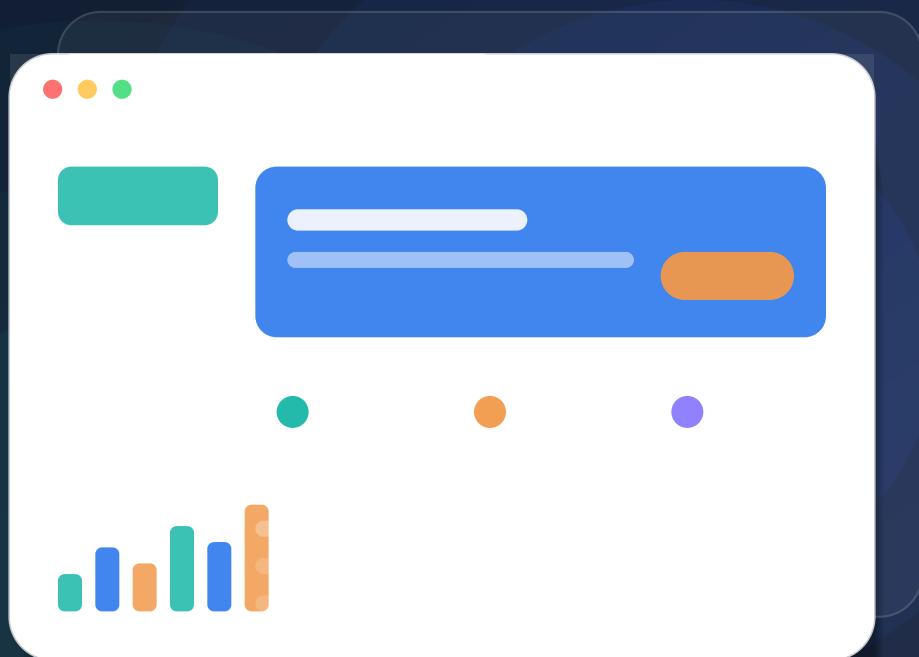


FIX YOUR LAPTOP

A PRACTICAL REPAIR MANUAL



**A Practical Guide to
Internal Laptop Repair**

DIAGNOSE • OPEN • UPGRADE • REPAIR

Fix Your Laptop

A Practical Guide to Internal Laptop Hardware Repair

This guide is provided for general information. Laptop designs differ widely, so always follow your model's service manual. Repairs can void warranties, damage devices and cause injury, particularly where lithium-ion batteries are involved. Work carefully and use a professional if you are unsure.

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Introduction

Laptops are far more repairable than most people think. A laptop that is slow, hot, noisy, low on storage or running out of battery is often one inexpensive part away from working like new. A new drive, a stick of memory, a fresh battery or a clean fan can add years to a machine that would otherwise be thrown away.

This book shows you how to look inside a laptop, work out what is wrong, and carry out the most common internal repairs and upgrades safely. It is written for beginners and assumes no electronics background. It is equally candid about the jobs that are best left to professionals.

Laptops differ a great deal between makers and models, so this book teaches the **general method and principles** that apply to almost all of them. For exact screw positions and part numbers, pair it with the **service manual or maintenance guide** for your model, which most manufacturers publish free online.

How to use this book

- **New to opening laptops?** Read Chapters 1 to 4 first. They cover the decision to repair, tools, safety and a tour of the inside.
- **Something is wrong but you are not sure what?** Start with Chapter 5, which matches symptoms to causes.
- **Know what you need to do?** Jump to Chapters 6 to 10: opening the case, memory and storage, cooling, power, and screens and keyboards.
- **About to finish?** Chapter 11 and Appendix A cover reassembly and testing.

WARNING

Opening a laptop can void its warranty, damage components with static electricity, and expose you to a lithium-ion battery that can overheat or ignite if damaged. Read Chapter 3 before you begin, take your time, and stop if you are unsure.

Should You Open It Up?

Before you reach for a screwdriver, take a few minutes to decide whether a repair is the right choice. The best repairs are the ones you plan.

Step 1: Rule out software

Many problems that look like hardware faults are software: slowness, freezing, overheating from a runaway program, a battery that drains fast or a Wi-Fi card that seems dead. Chapter 5 shows how to tell the difference. Always check software first, because it is free.

Step 2: Check your warranty and options

- **Manufacturer warranty.** Opening the case may void it. If the laptop is still covered, use the warranty.
- **Extended or accidental-damage cover.** Many business laptops and credit-card protections cover repairs. Check before spending.
- **Official parts and guides.** Many manufacturers publish service manuals and sell genuine parts. This is the safest start.
- **Independent repair shops** can be cheaper and faster, but check reviews and ask for a warranty on parts and labour.

Step 3: Find out whether your laptop is repairable

Laptop designs fall on a spectrum:

- **Easily upgradeable.** Many business and gaming laptops have a bottom panel that opens with a few screws, socketed memory, a replaceable drive and a battery that is easy to swap.
- **Partly upgradeable.** The drive and battery are replaceable, but the memory is soldered to the board.

- **Sealed and glued.** Many thin laptops have soldered memory, glued batteries and parts that are hard to reach. Repairs are possible but more difficult.

Search for your model number plus "service manual" or "upgrade guide" to see what you can change, how many screws there are and what the inside looks like. Knowing this before you buy parts avoids a lot of waste.

Step 4: Gauge the difficulty honestly

Job	Typical difficulty	Main risk
Cleaning vents and keyboard	Easy	Static, loosening debris into fans
Adding or replacing RAM	Easy to moderate	Wrong memory type, static
Replacing an SSD or hard drive	Easy to moderate	Data loss, wrong drive type
Replacing the battery	Moderate	Damaging the battery, adhesive
Cleaning fans, new thermal paste	Moderate	Bad contact, overheating
Replacing Wi-Fi card or keyboard	Moderate	Antenna cables, ribbon cables
Replacing a screen	Moderate to hard	Cracked panel, delicate cable
Replacing a DC jack or USB-C port	Hard	May need soldering
Motherboard or chip-level repair	Expert only	Needs specialist equipment

Step 5: Protect your data, and watch out for encryption

1. **Back up** your files to an external drive or cloud storage before you open the laptop, if it still works.
2. **Check for disk encryption.** Many modern laptops use **BitLocker** (Windows) or **FileVault** (Mac). Changing hardware or BIOS settings can trigger a request for your recovery key.
3. **Find your recovery key now.** For Windows, it is usually saved to your Microsoft account. Without it, an encrypted drive cannot be unlocked and the data is gone.
4. **Note your passwords** and licence keys, and sign out of any software that limits installs.

TIP

Make your first repair a simple one, such as adding memory or swapping a drive. You will learn how your laptop opens and how it is put together, and gain confidence for bigger jobs.

Tools and Workspace

A laptop is not hard to open if you have the right tools, but kitchen knives and mismatched screwdrivers cause scratched cases, stripped screws and broken clips. A small, inexpensive kit does the job.

The basic toolkit

Tool	What it is for
Precision screwdriver set	Most laptops use small Phillips screws (often #0 or #1). Some use Torx (T5 or T6) or other heads
Plastic opening tools and spudgers	Releasing the clips that hold the case together without leaving marks
Fine-tipped tweezers	Picking up small screws and handling tiny connectors
Anti-static wrist strap	Prevents static electricity from damaging chips and memory
Magnetic mat or sorted tray	Keeping screws organised by position and length
Compressed air	Blowing dust out of vents, fans and heatsinks
Isopropyl alcohol, 90 percent or higher	Cleaning old thermal paste and contacts
Lint-free cloths and swabs	Cleaning without leaving fibres
Thermal paste	Restoring heat transfer between processor and heatsink
Good light and a magnifier	Reading tiny markings and seeing connectors
Smartphone camera	Photographing every step as you go

Useful extras

- A **bootable USB drive** with a diagnostic tool or a Windows installer, ready before you start.
- A **USB enclosure or adapter** for reading an old drive from a new laptop.
- A **multimeter**, to check whether a charger delivers the voltage printed on it.
- **Thermal pads**, if your cooler uses them, in the right thickness.
- A **spare, known-good charger** for testing power problems.

Choosing replacement parts

- Find your exact **model number**, usually printed on the bottom of the laptop or listed in system information, and the **part number** in the service manual.
- For **memory**, buy the type your laptop supports (see Chapter 7). For **drives**, check the form factor and interface.
- Prefer **genuine or reputable parts**. Very cheap batteries, chargers and screens often have shorter life or are unsafe.
- Check the **return policy** in case a part turns out to be incompatible.

Setting up your workspace

- Use a **clean, well-lit, flat table**. A light-coloured surface makes dropped screws easy to see.
- Work on a **soft mat or towel** to protect the lid and case.
- Avoid **carpet and synthetic clothing**, which build static. Wearing cotton helps.
- Keep **drinks, food and pets** away.
- Allow **plenty of time**. Most damage comes from rushing.

Keeping track of screws

Laptops use screws of many lengths, and putting a long screw in the wrong place can crack the case or pierce a circuit board. As you remove screws, place them on a sheet of paper on which you have drawn an outline of the laptop, or use a magnetic mat divided into sections. Take photos at each stage. Your photos become the reassembly guide.

TIP

Tape the screws for each section to a card, labelled "bottom cover", "battery", "fan" and so on. It takes a few minutes and prevents most mix-ups.

Safety and Static

Opening a laptop is safe when you respect two things: electricity stored inside it, and static electricity carried by you. Take both seriously.

Power down completely

1. **Shut the laptop down** fully. Do not just close the lid or use sleep or hibernate.
2. **Unplug the charger** and all accessories, including USB devices, memory cards and external screens.
3. **Remove the battery** if it is removable. If it is internal, **disconnect its cable** as soon as you open the case.
4. **Drain residual power.** With the battery disconnected and the charger unplugged, press and hold the power button for about 15 to 30 seconds. This discharges stored electricity.

Static electricity

Static electricity can silently damage memory, drives and processors. A discharge too small for you to feel can still harm components.

- Wear an **anti-static wrist strap** attached to bare metal, or touch an unpainted metal object frequently to discharge yourself.
- Handle memory, drives and cards by the **edges**, never by the gold contacts or chips.
- Keep parts in **anti-static bags** until you are ready to fit them.
- Avoid working on carpet, and avoid synthetic or woollen clothing.

The battery

Laptop batteries are lithium-ion packs that store a lot of energy. If a pack is punctured, crushed, bent or short-circuited, it can vent smoke or flame.

- **Disconnect the battery first** before touching anything else inside.
- **Never puncture or bend** a battery, and never use metal tools to pry under it.
- **Do not use a swollen battery.** Swelling can show as a bulging case, a trackpad pushed up, or a base that no longer sits flat. Stop using and charging the laptop.
- **Keep metal objects away** from battery contacts.
- **Recycle old batteries** at a proper collection point; never put them in household waste.

WARNING

If a battery is swollen, hot, smoking or smells of chemicals, move the laptop onto a non-flammable surface outdoors if it is safe to do so, keep your distance, and call the emergency services if it ignites. Do not try to puncture, flatten or fight a lithium fire yourself.

The charger and power supply

Never open a charger or power adapter. Capacitors inside can hold a dangerous charge even when it is unplugged. Replace a charger that is damaged, frayed, very hot or smells burnt.

Handling and heat

- Heatsinks and processors can remain **hot** for several minutes after shutdown. Let the laptop cool before opening.
- Take care with **sharp edges** on metal frames and cracked screens.

- Do not use a **vacuum cleaner** on electronics, as it generates static. Use compressed air instead.
- When using compressed air, **hold the fan blades still** with a swab or toothpick. Letting them spin freely can damage the fan.
- Never force a connector, clip or screw. If something resists, look for a hidden screw or latch.

Ribbon cables and connectors

Laptops use thin, flat ribbon cables that slide into small sockets. Many sockets, called **ZIF connectors**, have a tiny latch that must be opened first. Flip the latch up (or slide it out), slide the cable out, and reverse the process to reconnect. Pulling a cable out while its latch is closed tears the cable or breaks the socket.

TIP

Before disconnecting anything, take a clear photo showing its position and orientation. Many connectors fit more than one way, and only one is right.

CHAPTER 4

A Tour Inside Your Laptop

Understanding what is inside makes diagnosis and repair far less mysterious. A laptop is simply a handful of parts connected to one main circuit board.

The main components

Part	What it does	Usually user-replaceable?
Motherboard	The main circuit board that connects everything	Rarely (expert job)
Processor (CPU)	The brain that runs your programs	Usually soldered
Graphics (GPU)	Draws the picture. Integrated in the CPU or separate	Usually soldered
Memory (RAM)	Short-term workspace for running programs	Often yes; sometimes soldered
Storage (SSD or hard drive)	Long-term storage for the system and your files	Usually yes
Battery	Powers the laptop away from a socket	Usually yes
Cooling system	Fan, heat pipes and heatsink that remove heat	Yes (fan and paste)
Wi-Fi and Bluetooth card	Wireless networking	Usually yes
Display and cable	Screen panel and its connection	Yes
Keyboard and trackpad	Typing and pointing	Usually yes

Part	What it does	Usually user-replaceable?
CMOS battery	Small coin cell keeping clock and BIOS settings	Yes
DC jack or USB-C power port	Where the charger plugs in	Sometimes; may be soldered

Memory (RAM)

Laptop memory comes as small sticks called **SODIMMs**, which sit in sockets and are held by two metal clips. Types such as DDR4 and DDR5 are not interchangeable. Some laptops have soldered memory that cannot be changed.

Storage

- **2.5-inch drives** are the older, rectangular drives held in a caddy. They may be solid-state (SATA SSD) or spinning hard drives.
- **M.2 drives** are small, flat sticks that screw down on the board. They may be fast NVMe drives or SATA drives. Most new laptops use M.2.

Cooling

The processor and graphics chip generate heat. Copper **heat pipes** carry it to a **heatsink**, and a **fan** blows air through it and out of the vents. A thin layer of **thermal paste** (or a thermal pad) between the chip and the heatsink makes heat transfer efficient. Dust, dried paste and failing fans are common causes of overheating.

The wireless card

A small card, usually in an M.2 slot, provides Wi-Fi and Bluetooth. It connects to two thin antenna wires that run up to the screen. On many laptops it can be replaced easily.

The CMOS battery

A coin cell, often a CR2032 or similar, keeps the clock and BIOS settings alive when the laptop is off and unplugged. If the date and time keep resetting, this small cell is probably flat.

Connections and cables

- **Display cable:** a thin, delicate cable that runs through the hinge to the screen.
- **Keyboard and trackpad cables:** flat ribbon cables that lift off with a small latch.
- **Speaker, fan and battery cables:** small plugs that pull straight out.
- **Antenna wires:** tiny coaxial leads that snap onto the wireless card.

BIOS and UEFI

The **BIOS** (or modern **UEFI**) is the basic firmware that starts the laptop. It shows hardware information, lets you change boot order and settings, and can often run built-in hardware tests. You usually enter it by pressing a key such as F2, F10, F12 or Delete as the laptop starts.

TIP

Check your model's service manual for a diagram of the inside. Seeing where the memory, drive, battery and fan sit before you open the case makes the whole job calmer.

Diagnosing the Problem

Good diagnosis saves money. Replacing the wrong part wastes time and cash, and can leave the original fault in place.

Step 1: Try the software fixes first

- 1. **Restart** the laptop. A full restart clears many glitches.
- 2. **Update** Windows, drivers and the BIOS (carefully, with the charger plugged in).
- 3. **Start in Safe Mode** to see whether a program or driver is causing the problem.
- 4. **Scan for malware** with built-in security tools.
- 5. **Free up storage.** A nearly full drive makes a laptop slow and unreliable.
- 6. **Run the system repair tools.** In an administrator command prompt, run the commands shown below.

Command	What it does
<code>sfc /scannow</code>	Checks and repairs protected Windows system files
<code>DISM /Online /Cleanup-Image /RestoreHealth</code>	Repairs the Windows component store
<code>chkdsk C: /f</code>	Checks the drive for file system errors (needs a restart)
<code>powercfg /batteryreport</code>	Creates a battery health report as an HTML file
<code>mdsched</code>	Opens the Windows Memory Diagnostic tool

Step 2: Use built-in hardware diagnostics

- Most makers include a **pre-boot diagnostic** that tests memory, drive, processor and battery. It is usually reached by pressing a key such as F2 or F12 at startup. Search for your brand's diagnostics key.
- The **BIOS or UEFI** screen shows detected memory, drive and temperature information. If memory or a drive is missing there, it is a hardware problem.
- **LED and beep codes** are signals from the laptop. Patterns vary by brand, so check the service manual.

Step 3: Match the symptom to the likely cause

Symptom	Likely cause
Laptop is very slow, drive light stays on	Failing or full hard drive; software; low memory
Freezes or crashes randomly	Overheating, faulty memory, failing drive
Blue screens with memory errors	Faulty RAM or poorly seated memory
Hot to touch, loud fan, shuts down	Dust in vents, dried thermal paste, failing fan
Battery drains in under an hour	Worn battery, or a software drain
Will not charge or says "plugged in, not charging"	Bad charger, worn jack or cable, battery, or software
No power, no lights	Charger, battery, power button board or motherboard
Power on but black screen	Display, display cable, memory or motherboard
Image visible only in torchlight	Backlight failure
Lines, flicker or colour patches	Damaged display or loose cable

Symptom	Likely cause
Wi-Fi missing or very weak	Disconnected antenna wires, failed card or driver
Keys do not work or type wrong keys	Spill, dirt or a loose keyboard cable
Date and time reset, BIOS errors	Flat CMOS battery
Clicking or grinding noise	Failing hard drive (back up at once) or fan
Boot loop or "no boot device"	Failing drive, corrupted system, loose connection

Step 4: Use free tools to look deeper

- **Drive health tools** such as CrystalDiskInfo report a drive's SMART status. A warning means back up and replace the drive.
- **MemTest86** (run from a USB drive) thoroughly tests memory. Any error means a faulty stick or slot.
- **Temperature monitors** such as HWMonitor show processor temperatures. Idle should be fairly low; sustained temperatures in the high 90s Celsius under light load suggest a cooling problem.
- **The battery report** compares the battery's design capacity with its actual full-charge capacity.

Step 5: Narrow it down by swapping

If you have a spare charger, memory stick or drive, try it. Boot the laptop from a USB stick to see whether the problem is the drive or the installed system. Connect an external monitor to see whether the graphics work when the built-in screen is black. Each simple test removes a suspect.

TIP

Write down the symptoms, when they began and what changed just beforehand, such as a drop, spill, update or new software. These notes often point straight to the cause.

Opening the Case Safely

The general method is the same for almost every laptop. The details, such as which screws and where the clips are, come from your model's service manual.

Preparation

1. Back up your data, and confirm you have your encryption recovery key.
2. If your laptop uses **BitLocker**, consider suspending it from the control panel before hardware or BIOS changes.
3. Shut down fully, unplug everything and let the laptop cool.
4. Clear a clean, well-lit workspace and prepare your screw tray.
5. Open the service manual to the page for the part you are changing.

Removing the bottom cover

1. **Place the laptop upside down** on a soft mat.
2. **Remove the removable battery** if there is one.
3. **Look for every screw.** Some hide under rubber feet, stickers or a hinge cover. Peel gently, and keep the feet so you can reuse them.
4. **Remove the screws** and sort them by length. Photograph their positions.
5. **Release the clips.** Starting at a corner, slide a plastic pick into the seam and work slowly around the edge. Clips make small clicks as they release.
6. **Lift the cover** away gently. If it resists, stop and look for a missed screw rather than forcing it.

Inside: first disconnect the battery

As soon as the cover is off, **disconnect the battery cable** from the motherboard before you touch anything else. Grip the plastic connector, not the wires, and ease it straight out or lift it with a plastic tool. Then press the power button for several seconds to drain remaining power.

Working with ribbon cable connectors

1. Identify the type of connector. A **ZIF connector** has a small hinged or sliding latch; a **plug connector** pulls straight out.
2. For a ZIF connector, use a fingernail or plastic tool to flip the latch up (or slide it out) before moving the cable.
3. Slide the cable gently out of the socket.
4. To reconnect, slide the cable fully in, keeping it straight and square, then close the latch.

WARNING

Never pull a ribbon cable out while its latch is still closed. This tears the cable and can break the socket, which can turn a simple job into a motherboard repair.

Dealing with stuck or hidden parts

- If a part will not move, **look for another screw** before applying more force.
- Some laptops need the **keyboard** or **palm rest** removed to reach the internals.
- Some designs open from the **top** rather than the bottom.
- Warranty stickers over screws may be required for support. Check your terms before breaking them.

Reassembly

- Work in **reverse order**, using your photos and screw map.
- Make sure every ribbon cable is **fully seated and latched**.
- Check that no wire or cable is **trapped** between the cover and the frame.
- **Reconnect the battery** last among internal parts.
- Clip the cover down carefully before fitting the screws, which should **go in all the way without forcing**.
- Count the screws. If there are any left over, find where they belong.

TIP

Do a first power-on test before you close the case if the design allows it. With the battery connected and the cover just resting in place, check that the laptop boots, and then power down completely before sealing it.

Memory and Storage Upgrades

Adding memory or fitting a solid-state drive is the single best upgrade for an older laptop, and both are among the easiest jobs. A laptop with 4 GB of memory and a spinning hard drive can feel dramatically faster with 8 or 16 GB and an SSD.

Upgrading memory (RAM)

First, find out what your laptop supports. Check the service manual or the maker's specification page for the memory **type** (such as DDR4 or DDR5), the number of **slots**, the **maximum capacity** and whether any memory is **soldered**.

Check	Why it matters
Memory type (DDR3, DDR4, DDR5)	They are not interchangeable and the slots differ
SODIMM form factor	Laptops use SODIMMs, not desktop-size sticks
Maximum supported capacity	Memory beyond the limit may not be recognised
Number of slots	Two slots allow dual-channel for better speed
Speed (MHz)	Mixed speeds run at the slowest stick's speed
Soldered memory	Some laptops have part soldered, part socketed

Fitting a memory stick

1. Power down, unplug, open the cover and **disconnect the battery**. Discharge static.
2. Find the memory slots. If an old stick is there, **spread the two metal clips** outward. The stick pops up at an angle.
3. Slide the old stick out, holding it by the edges.
4. Hold the new stick by its edges, line up the **notch** with the key in the slot, and push it in **at about 30 to 45 degrees** until the gold contacts almost disappear.
5. **Press it down flat** until the clips click into place on both sides.
6. Reconnect the battery, boot and check the installed memory in system settings or the BIOS.

If the laptop does not start, beeps, or shows less memory than expected, switch off and **reseat** the stick. Try each stick in each slot separately to find a faulty one. Run MemTest86 to confirm the memory is healthy.

Upgrading storage

Check which drive type your laptop uses:

Drive type	Notes
2.5-inch SATA SSD or hard drive	Held in a caddy, with a SATA connector. Easy to swap
M.2 SATA SSD	Small stick, slower than NVMe, key B+M
M.2 NVMe SSD	Small stick, much faster, key M. Check your laptop supports NVMe

- M.2 drives come in different lengths. **2280** (22 mm wide, 80 mm long) is the most common, but check which lengths your laptop fits.
- Some laptops support only SATA or only NVMe. Check before buying.

- A **heat spreader or sticker** may need to be moved from the old drive to the new one.
- Buy from reputable makers, with a good warranty and a reasonable endurance rating.

Moving to the new drive

You have two options:

1. **Clone the old drive** to the new one with cloning software, so that your system, programs and files carry over. Connect the new drive through a USB adapter, clone, then swap them. Cloning tools such as Macrium Reflect and Clonezilla are free or have free versions.
2. **Install fresh.** Create a Windows installer on a USB stick, fit the new drive, and install Windows from scratch, then reinstall programs and restore files from your backup. This is cleaner and often fixes long-standing software problems.

Fitting an M.2 drive

1. Power down, unplug, open the cover and disconnect the battery.
2. Unscrew the single small screw holding the old drive. The drive pops up at a slight angle.
3. Slide it out gently and note the notch position.
4. Insert the new drive at about 30 degrees, then press it flat and fix it with the screw. Do not overtighten.
5. Reconnect the battery, close the case and boot.

If the new drive is not detected

- Reseat it, and make sure it is fully pushed in before the screw is fitted.
- Check the BIOS to see whether it appears. If not, it may be the wrong type for your laptop.

- In Windows, a new empty drive needs initialising in **Disk Management** before it can be used.
- On some laptops, the storage mode (such as **AHCI** or **Intel RST**) in the BIOS affects whether Windows can see the drive or boot from it.

Rescuing data from a failing drive

If your drive is clicking, very slow or reports SMART errors, **stop using it as soon as possible**. Every extra hour of use risks more loss. Connect it to another computer, or boot from a USB system, and copy your most important files first. If the data is critical, consult a data recovery professional rather than experimenting.

TIP

Keep the old drive until you are sure everything has been copied across. Before you throw it away, wipe it or physically destroy it, since it still holds your private data.

Cooling and Overheating

Heat is the enemy of every laptop. Overheating slows the machine down, makes the fan roar, shortens component life, and can cause crashes and shutdowns. The good news is that cooling problems are among the most fixable.

Signs of a cooling problem

- The fan runs loudly and constantly, even during light use.
- The case is uncomfortably hot, especially near the vents.
- The laptop slows down when working hard (this is **thermal throttling**).
- It freezes, crashes or shuts itself off without warning.
- Temperature software shows very high processor or graphics temperatures.

Quick checks and habits

- Use the laptop on a **hard, flat surface**. Beds, sofas and laps block the intake vents.
- Make sure **vents are not blocked** and that there is room around the laptop.
- Check for a **runaway program** in Task Manager that is using the processor constantly.
- Update the BIOS and drivers. Updates sometimes improve fan control.
- Check the **power plan** setting: a high-performance mode produces more heat.
- A **cooling pad** can help on some laptops.

Cleaning the fan and vents

Dust builds up in the fan and between the heatsink fins, blocking airflow like lint in a tumble dryer.

1. Power down fully, unplug, open the case and **disconnect the battery**.
2. **Hold the fan blades still** with a cotton swab or plastic pick so they cannot spin freely.
3. Use short bursts of **compressed air**, keeping the can upright, to blow dust out through the vents and fins. Blow from the inside outwards where you can.
4. Pick out any packed lint with tweezers or a soft brush.
5. Check that the fan turns freely and quietly by hand. A gritty or wobbly fan should be replaced.

WARNING

Do not let the fan spin from compressed air, and never use a vacuum cleaner on the circuit board. A free-spinning fan can generate a voltage and be damaged, and vacuum cleaners produce static electricity.

Replacing the thermal paste

Between the processor (and graphics chip) and the heatsink is a thin layer of thermal paste, or sometimes a thermal pad. Over several years it can dry out and lose effectiveness. If temperatures are high even after cleaning, replacing the paste often brings them down noticeably.

1. With the battery disconnected, locate the heatsink. Screws are often **numbered** on it.
2. Unscrew in **reverse numerical order**, loosening each a little at a time, then lift the heatsink off gently. If it sticks, wiggle it slightly. Do not pry hard.

3. Disconnect the fan cable if it is attached.
 4. **Clean the old paste** from the chip and the heatsink with isopropyl alcohol and a lint-free cloth. Let it dry.
 5. Apply a **small, pea-sized dot** of new thermal paste to the centre of the processor chip (follow your model's guide if it shows a different pattern).
 6. Place the heatsink straight down without sliding it, then tighten the screws in **numerical order**, a little at a time, until snug.
 7. Reconnect the fan, check connections, and reassemble.
- Do **not** use too much paste. A thin layer is better than a thick one, and excess can spill onto the board.
 - If the laptop uses **thermal pads** on other chips, replace them with pads of the same thickness.
 - Avoid **liquid metal** compounds as a beginner. They conduct electricity and can short the board if they spread.

Replacing a fan

If the fan is noisy, wobbly, or does not spin, replace it. Disconnect the battery, unplug the fan cable, remove the screws, lift out the old fan and fit a new one that is the exact part for your model. Reconnect, and test that it spins on startup.

Check the result

After reassembly, use a temperature monitor at idle and under load, and confirm that the fan runs quietly at idle and that temperatures are lower than before.

TIP

Clean the vents with compressed air every six to twelve months, even if you do not open the case. It is the cheapest cooling upgrade there is.

Batteries, Charging and Power Faults

A laptop that will not charge or power on can cause real panic, but the cause is often an inexpensive and easily replaced part. Work through the checks from simplest to most complex.

The battery report

Windows can produce a report on your battery. Open a command prompt and type:

```
powercfg /batteryreport
```

It saves an HTML file (the location is shown on screen) that you can open in a browser. Compare the **design capacity** with the **full charge capacity**. If the second is well under about 60 to 70 percent of the first, the battery is worn out.

Signs the battery needs replacing

- Battery life is a fraction of what it was.
- The laptop shuts down at 20 to 30 percent, or when unplugged.
- It says "consider replacing your battery" or similar.
- The case, trackpad or keyboard is **lifting or bulging** (a swollen battery; see Chapter 3).

Replacing a laptop battery

- **Removable batteries** slide or clip out from the outside. Replace them with an exact-model battery.

- **Internal batteries** are inside the case, held by screws, and sometimes by adhesive. Disconnect the connector, remove the screws, and lift the old battery out.
 - If the battery is **glued**, use isopropyl alcohol to loosen the adhesive and slide a plastic card underneath. Never use metal tools or bend the pack.
1. Power down, unplug and open the case. Disconnect the battery connector.
 2. Remove the battery screws and any cables in the way.
 3. Lift the battery out gently.
 4. Place the new battery, line up the screw holes and plug in the connector.
 5. Reassemble, charge it fully and check the battery report.

WARNING

Buy batteries from reputable suppliers, and match the exact part number. Very cheap, unbranded batteries often have low capacity and poor safety protection, and are a fire risk.

Charging problems

1. **Check the charger.** Look at the light on the charger (if there is one), the cable for damage, and the plug for bent pins. Try another socket.
2. **Try a known-good charger** with the same voltage and connector.
3. **Match the rating.** The label on the charger must match the laptop's required voltage and have equal or higher wattage.
4. **Test the output** with a multimeter, if you have one. The voltage should be close to the number printed on the charger.
5. **Inspect the charging port** for dirt, bent pins or looseness. A wobbly port needs replacing.

6. **Remove the battery and try the charger alone** (if removable). If it runs, the battery is faulty.
7. **Check the software.** Update the BIOS and battery drivers, and in Device Manager, uninstall and reinstall the battery driver.

When it will not turn on at all

1. Plug in the charger and wait 15 minutes.
2. Look for lights on the laptop or charger.
3. Disconnect everything: charger, USB, cards, dock.
4. Do a **hard reset**: remove the battery if possible, hold the power button for 30 seconds, then reconnect the charger and try again.
5. Listen for fans, drive noises or beeps, and watch for blinking lights. These codes are described in your model's service manual.
6. Check the memory by reseating it (Chapter 7), since poorly seated memory can stop a laptop from starting.
7. Connect an external monitor, in case only the screen has failed.

The charging port (DC jack)

On many laptops, the round charger socket is a separate small part that can be unscrewed and replaced, which is a moderate repair. On others, the jack is soldered directly to the motherboard and needs soldering skills. Newer laptops with USB-C charging usually have a USB-C board that may be separate or soldered.

Replacing the CMOS battery

If the laptop forgets the date and time, or shows BIOS checksum errors, the small coin cell battery is probably flat. Open the laptop, disconnect the main battery, find the coin cell (often a CR2032, in a holder or on a short cable) and replace it with the same type. You may need to reset BIOS settings afterwards.

TIP

If a laptop shows a charging light but will not run on the charger alone, and works only with the battery in place, the charger or jack is the likely culprit. If it runs only on the charger, suspect the battery.

Screens, Keyboards, Wi-Fi and Other Parts

These parts fail from knocks, spills and wear, and most can be replaced with basic tools. The key is to identify the exact part and to be patient with delicate cables.

Screen problems

Symptom	Likely cause and test
Cracked glass, spreading patches	Broken panel. Replace the screen
Black screen but laptop sounds on	Connect an external monitor. If it works, the panel, cable or backlight is at fault
Very dim image visible with a torch	Failed backlight (inverter or LED strip). Replace the panel
Flickering or lines	Loose or damaged display cable, or a failing panel
Screen flickers when the lid moves	Display cable damaged at the hinge
Black screen even on external monitor	Graphics or motherboard fault. See a professional

Replacing a laptop screen

1. Find the exact **panel part number** on a label on the back of the current screen, or in the service manual. Size, resolution and connector must match.
2. Power down, disconnect the battery and open the case as the manual directs.

3. Remove the **screen bezel** by releasing the clips around the edge with a plastic pick, working slowly.
4. Unscrew the panel from the lid, and tilt it forward carefully. Peel back any tape covering the connector.
5. Disconnect the **display cable** by lifting any latch, and slide it out.
6. Connect the new panel's cable, and test the screen before reassembly.
7. Fix the panel in, press the bezel back on, and refit any screws or rubber covers.

Hinges

Loose, stiff or cracked hinges can damage the display cable and the lid. If a hinge is cracking the plastic around it, stop opening and closing the laptop and replace the hinge or the damaged frame parts. Do not just tighten screws, as it can make the damage worse.

Keyboard problems

- **A few sticky or dead keys** are often dirt. Turn the laptop upside down, tap gently, and blow compressed air between keys.
- **A spill** demands quick action: power off immediately, unplug, remove the battery if you can, and turn the laptop upside down to drain. Do not turn it on until it is fully dry, and have it cleaned if the spill was sugary or salty.
- **Whole keyboard not working** may be a loose ribbon cable, a failed keyboard or a software problem.
- **Replacing the keyboard** varies widely. On some laptops it is held by screws from underneath and lifts out. On others, it is riveted to the top case and the whole assembly must be replaced.

Trackpad problems

- Check that it has not been **disabled** by a function key or a setting.
- Update or reinstall the **trackpad driver**.
- A trackpad that **clicks poorly or is lifting** may be pushed up by a swollen battery. Check the battery immediately.
- A faulty trackpad is usually replaced as a module held by screws and a ribbon cable.

Wi-Fi and Bluetooth cards

1. If Wi-Fi is missing or weak, first check the **airplane mode**, driver and BIOS settings.
2. Open the laptop, disconnect the battery and find the small wireless card.
3. Carefully pull the **two antenna wires** off with tweezers or fingertips by lifting straight up. Note which wire goes to which terminal (often labelled main and aux, or marked with colours).
4. Unscrew the card and slide it out.
5. Fit the new card of the same type, press the antenna wires on firmly, and screw it down.
6. Install the card's drivers if Windows does not do so itself.

A weak signal often means an antenna wire has come off the card. Reseating it can instantly fix the problem. Some older laptops restrict which cards they accept, so check compatibility before buying.

Speakers, webcam and microphone

- **Crackly or silent speakers** may be a software or driver fault, or a disconnected or damaged speaker cable.
- **A webcam that does not appear** may be turned off by a privacy switch, a key or software. Check these first before suspecting the cable running through the hinge.

- Speakers and webcams are generally easy to replace once the case is open, as they connect by small plugs.

USB and other ports

If one port stops working, try a different device and a different cable. If a port is loose or damaged, it usually needs a replacement of the small board it sits on, or soldering. That is a job for a specialist unless the port is on a separate module.

TIP

Photograph the antenna wires and display cable positions before you disconnect anything. Cables that look interchangeable usually are not.

Testing, Reassembly and Knowing When to Stop

A repair is only complete when the laptop works properly and is closed up safely. A systematic test finds problems while the case is still easy to reopen.

Reassembly checks

- Every cable is **fully seated and latched**.
- No wires or cables are **pinched** under the cover or heatsink.
- The **battery** is connected, and fixed down if it has screws.
- All **screws** are in their correct holes and none are left over.
- The case **closes evenly**, without gaps or bulges.
- The laptop **sits flat** and the feet are in place.

Testing checklist

- Power on, and shut down and restart normally.
- Check that the **BIOS** sees the correct memory and drive.
- Run a **memory test** if you changed or reseated RAM.
- Run a **drive health check**, and confirm it is fast and error-free.
- Check **temperatures** at idle and under load, and that the fan sounds right.
- Test **charging** and battery level, and run the battery report.
- Check the **screen** for dead pixels, flicker and brightness across the whole display.
- Test every **key** and the **trackpad**, including clicks and gestures.

- Check **Wi-Fi, Bluetooth** and the **webcam, microphone** and speakers.
- Test all **USB, HDMI, card reader** and audio ports.

Put things right afterwards

- Re-enable **BitLocker** or other encryption if you suspended it.
- Install **BIOS and driver updates**, with the charger connected.
- Restore your files from backup if you installed a fresh drive.
- Keep a **note of what you changed** and the part numbers, for next time.

Watch it for a few days

After a repair, keep an eye on the laptop. Watch for unusual heat, smells, swelling, unexpected shutdowns or odd noises. If anything seems wrong, stop using it and reopen the case to check.

Signs you need a professional

- **No power at all** after you have tried a known-good charger and battery, and a hard reset.
- **Motherboard faults**: random shutdowns that remain after replacing the battery and memory, no display on an external screen, or a laptop that runs only briefly.
- **Liquid damage** that has reached the motherboard, especially sugary, salty or dirty liquids. Corrosion keeps spreading, so act fast.
- **Soldered parts**, such as a jack or port soldered to the board, that need re-soldering.
- **Graphics chip or processor faults**. These are rarely worth repairing and are not beginner jobs.
- A **swollen battery** you are not comfortable removing.
- A laptop still under **warranty**, or covered by insurance.

- Situations where **important data** is at risk and you have no backup.

Choosing a repair shop

- Check **reviews** and ask for a **warranty** on parts and labour.
- Ask for a **written quote** and whether there is a diagnostic fee.
- Ask what **parts** they use, and whether they are genuine or aftermarket.
- Back up your data first, or ask the shop how it protects your data.
- Be wary of quotes that seem far too cheap or shops that pressure you.

Repair or replace?

A useful rule of thumb: if the repair costs more than about half the price of a comparable new laptop, or the laptop is more than six to eight years old and no longer receives security updates, replacement may be wiser. A cheap upgrade such as an SSD or more memory is almost always worth it, even on an older machine, provided the processor is reasonably recent.

Recycling and e-waste

Laptops, batteries and screens contain valuable materials and hazardous substances. Do not put them in household waste. Take them to an electronics recycling point, a retailer take-back scheme or a manufacturer's recycling programme. Wipe or destroy the drive first, and sign out of your accounts.

TIP

Repairing and upgrading a laptop saves money and cuts electronic waste. Every year you keep a good laptop running is a year of manufacturing, transport and disposal you have avoided.

Appendix A: Repair Checklists

Before the repair

1. **Rule out software** with restart, updates, Safe Mode and repair commands.
2. **Back up** your files, and find your BitLocker or other encryption recovery key.
3. **Check your warranty** and insurance.
4. **Identify the exact model and part number** and download the service manual.
5. **Buy compatible parts** from reputable sellers.
6. **Gather tools:** screwdrivers, plastic picks, tweezers, anti-static strap, screw tray, compressed air, isopropyl alcohol and thermal paste.
7. **Prepare the workspace:** clean, bright, flat, with a soft mat.
8. **Shut down fully**, unplug everything and let the laptop cool.

During the repair

1. **Photograph** each step and note screw positions.
2. **Disconnect the battery first** and hold the power button to drain power.
3. **Wear a wrist strap** or touch bare metal often.
4. **Open ribbon cable latches** before moving the cable.
5. **Use plastic tools** to release clips and pry.
6. **Handle memory and drives by the edges.**
7. **Never force** a part. Look for another screw or latch.

After the repair

1. **Check all cables** are seated and nothing is trapped.
2. **Reconnect the battery last** and test before closing the case.
3. **Run memory, drive and temperature tests** where relevant.
4. **Test charging, screen, keyboard, trackpad, Wi-Fi, ports and audio.**
5. **Update the BIOS and drivers.**
6. **Re-enable encryption** and restore files if needed.
7. **Monitor the laptop** for several days, then recycle old parts responsibly.

Appendix B: Glossary

AHCI. A standard mode that lets the operating system talk to SATA drives.

BIOS / UEFI. The firmware that starts the laptop and holds hardware settings.

BitLocker. Windows disk encryption that protects data and may ask for a recovery key after hardware changes.

CMOS battery. A small coin cell that keeps the clock and BIOS settings when the laptop is off.

CPU. The processor, the main chip that runs programs.

DC jack. The socket where the charger plugs into the laptop.

DDR4 / DDR5. Generations of memory type; they are not interchangeable.

ESD. Electrostatic discharge: static electricity that can damage electronics.

GPU. The graphics processor that draws the image.

Heatsink. A metal block that draws heat from a chip and passes it to the airflow.

Heat pipe. A copper tube that carries heat from the chips to the heatsink.

Hard disk drive (HDD). A storage drive with spinning platters; slower and more fragile than an SSD.

Lithium-ion battery. The rechargeable battery type used in laptops; it must be handled carefully.

M.2. A small, flat connector standard used for SSDs and wireless cards.

Motherboard. The main circuit board that connects every component.

NVMe. A fast type of SSD that uses the PCIe interface.

RAM. Random access memory: the laptop's short-term workspace.

SATA. A common interface for connecting drives.

SMART. A drive's built-in health monitoring system.

SODIMM. A small memory module used in laptops.

SSD. Solid-state drive: fast storage with no moving parts.

Thermal paste. A compound spread between a chip and a heatsink to improve heat transfer.

Thermal pad. A soft pad that transfers heat from a chip to a heatsink or case.

Thermal throttling. A laptop slowing itself down to avoid overheating.

ZIF connector. A zero insertion force socket with a small latch, used for ribbon cables.