



**MacBook Pro (13-inch, 2016, Two Thunderbolt 3 ports)**

**MacBook Pro (13-inch, 2017, Two Thunderbolt 3 ports)**

**MacBook Pro (13-inch, 2019, Two Thunderbolt 3 ports)**

**MacBook Pro (13-inch, 2020, Two Thunderbolt 3 ports)**

**MacBook Pro (13-inch, M1, 2020)**

## **Apple Recycler Guide**

July 2023

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# About This Guide

Apple Recycler Guides provide guidance for electronics recyclers on how to disassemble products to maximize recovery of resources. The guides provide step-by-step disassembly instructions and information on the material composition to help recyclers direct fractions to the appropriate material recycler.

To conserve important resources, we work to reduce the materials we use and aim to one day source only recycled or renewable materials in our products. A key path to reaching that goal is resource recovery from end-of-life electronics.

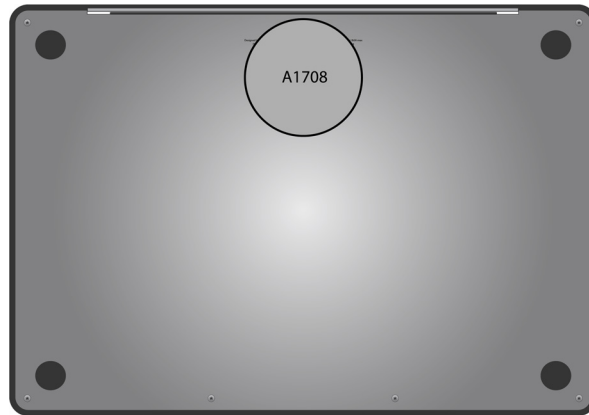
Disassembly procedures are intended to be performed only by trained electronics recycling professionals. The recycler is responsible for independently evaluating and ensuring compliance with all applicable environmental, health, and safety laws related to the work. These include but are not limited to laws relating to the management, handling, shipping, and disposal of the outputs of this work as waste and laws in place to ensure the health and safety of all employees who support this work.

For questions or feedback about this guide, email [contactesci@apple.com](mailto:contactesci@apple.com).

**Note:** This guide may show images from other similar models, but the procedures are the same.

# Identification

You can find the model number printed on the underside of the MacBook Pro, near the regulatory markings.



*Model numbers:*  
A1708, A2159, A2289, A2338

# Directive 2012/19/EU Annex VII Components

Directive 2012/19/EU Annex VII requirements apply to the following substances and components.

<b>Substance/Component</b>	<b>Apple Part Name</b>	<b>Removal Instructions</b>
Printed circuit board if the surface is greater than 10 square centimeters	Main logic board, trackpad, keyboard, data board assembly, light-emitting diode (LED) logic board	Follow steps 1–21
External electric cables	Power adapter, charge cable	Follow step 1
Battery	Lithium-ion polymer batteries	Follow steps 1–3
Cover glass and liquid crystal display (LCD) cell if the surface is greater than 100 square centimeters	LCD cell	Follow steps 1–15
No further substances or components as listed in Annex VII		

# Safety Considerations

The recycler is responsible for independently evaluating all activities undertaken by its employees to perform or support the work and ensuring compliance with all applicable health and safety laws related to the work. These include but are not limited to laws relating to the health and safety of all employees who perform or support this work. The recycler is also responsible for evaluating the workspace and ensuring that the area in which the work is to be undertaken is designed using ergonomic best practices and meets all ergonomic requirements to ensure the protection of its employees.

## Personal Protective Equipment

Personal protective equipment should be worn during the entire recycling process.



Wear hand protection



Wear a mask



Wear eye protection



Wear foot protection



Wear protective clothing

## Battery Safety

This product uses a lithium-ion polymer battery. Before beginning any disassembly work, ensure that a safe working procedure for handling lithium-ion batteries has been established, which could include discharging the batteries so that they can be more safely managed. The following considerations may also be included:

- Remove anything from your person that could conduct energy, such as jewelry and watches, to avoid electric shock to yourself or the logic board.
- To avoid the potential for thermal runaway and the release of potentially noxious fumes, don't puncture, strike, or crush lithium-ion polymer batteries or devices powered by them.
- Don't throw, drop, or bend the battery.
- Don't expose the battery to excessive heat or sunlight.
- Don't use tools that are sharp or conduct electricity.
- Keep your workspace clear of foreign objects and sharp materials.
- Dispose of batteries according to local environmental laws and guidelines.

## Workspace safety guidelines

- Use heat-resistant gloves and safety glasses.
- Keep a sand dispenser within arm's reach (2 feet or 0.6 m) on one side of the workstation, not above the workstation. The dispenser should be a wide-mouthed, quick-pour metal container with a flip-top lid or tray that contains 8–10 cups (1.9–2.4 L) of clean, dry, untreated sand.
- Keep the battery at least 2 feet (0.6 m) from paper and other combustible materials.
- Work in an area with adequate ventilation.

## Handling a thermal runaway

If you notice any of the following signs, a thermal runaway is likely underway, and you should act immediately:

- The lithium-ion polymer battery or a device containing one begins to smoke or emit sparks or soot.
- The battery pouch suddenly and quickly puffs out.
- You hear hissing or popping sounds.

**Don't** use water or an ABC/CO<sub>2</sub> fire extinguisher on a thermal runaway battery or a device containing one. Water and ABC/CO<sub>2</sub> fire extinguishers will not stop the reaction.

**Do** smother the battery or device immediately with plenty of clean, dry sand, dumped all at once. Timing is critical; the faster you pour all the sand, the faster the thermal runaway will stop.

**Do** leave the room for 30 minutes if the thermal runaway causes any irritation.

**Do** wait 30 minutes before touching the battery. Wear heat-resistant gloves and safety glasses to remove the battery from the sand, or use a touchless thermometer to measure the battery temperature. Only touch the battery when the event has finished.

**Do** dispose of the damaged battery or device (including any debris removed from the sand) according to local environmental laws and guidelines.

## LED Safety

Broken light-emitting diodes (LEDs) must be handled properly to ensure the safety of your employees and mitigate any hazards. Package broken LEDs in an appropriate container to properly manage the hazards associated with the materials and store only with compatible materials. All waste must be properly classified, packaged, and labeled in accordance with all relevant laws and regulations.

## Hazard Warnings



Rechargeable battery hazard



Chemical exposure hazard



Broken glass hazard



Chemical inhalation hazard

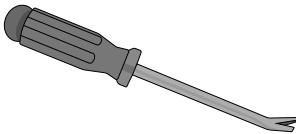


# Recommended Tools

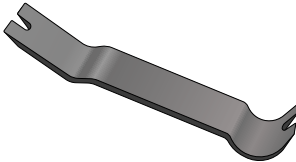
Miniature pry bar



Nail-pulling screwdriver



Plastic pry bar



Screwdriver-handle pry bar



Torx T2 screwdriver



Torx T5 screwdriver



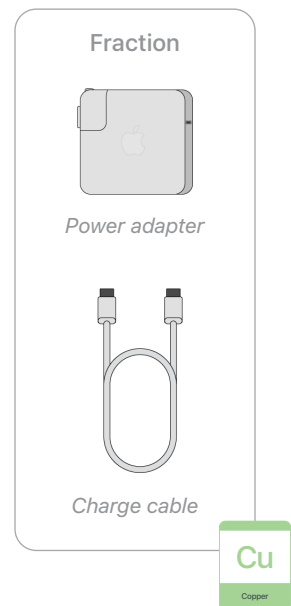
# Disassembly Instructions

## 1. Remove the power adapter and the charge cable.

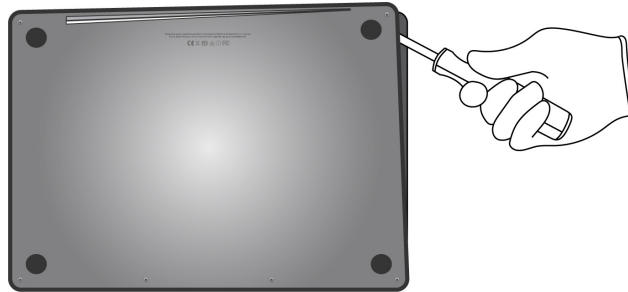
» *Ensure that the MacBook Pro is turned off.*



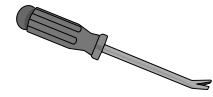
» *Unplug and remove the power adapter and the charge cable.*



2. Carefully pry off the bottom case near the fasteners to avoid damage to the batteries.



Tools Used



Fraction



Bottom case

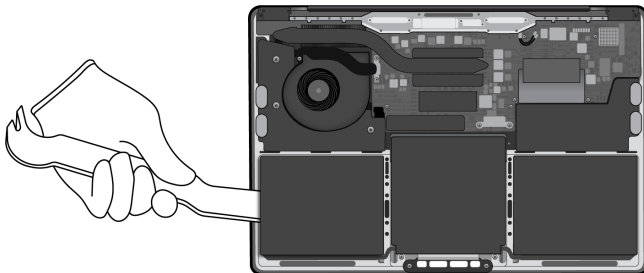
AI

Aluminum

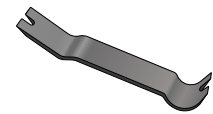
3. Carefully remove the three lithium-ion polymer batteries.



Rechargeable battery hazard



Tools Used



Fraction

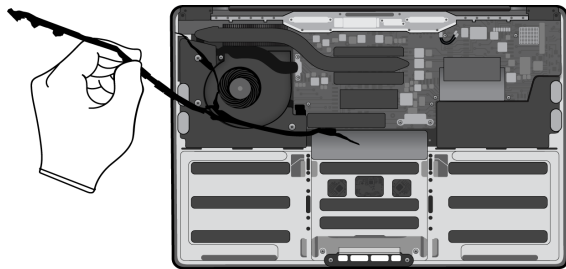
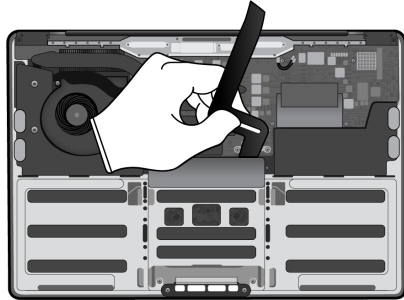


Lithium-ion polymer batteries

BT

Battery

4. Pull off the ribbon cable and the battery cable.



Fraction



Ribbon cable

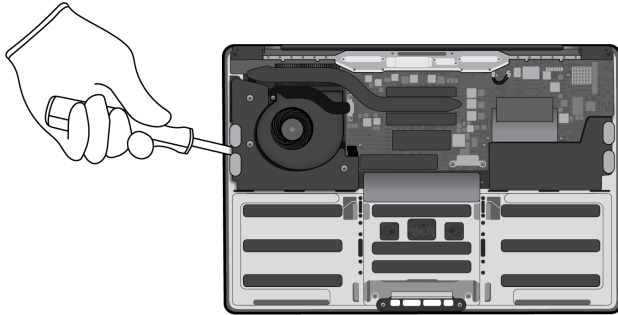


Battery cable

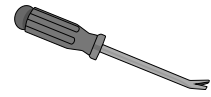
Cu

Copper

**5.** Pry off both speakers.



Tools Used



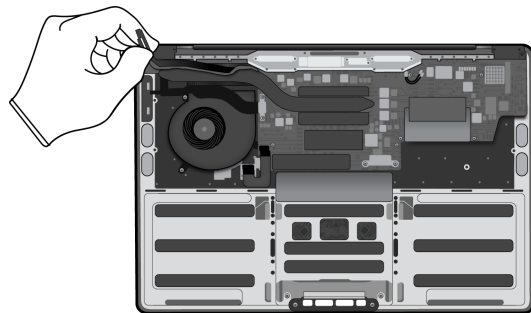
Fraction



Speakers

**REE**  
Rare Earth Elements

**6.** Pull off the thermal duct on top of the fan.



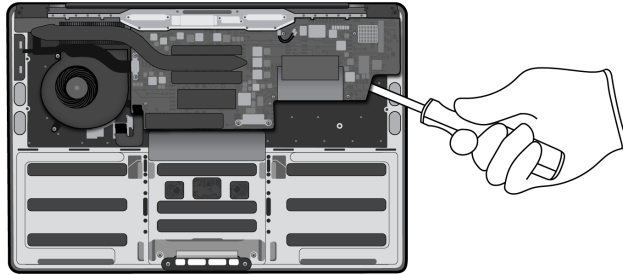
Fraction



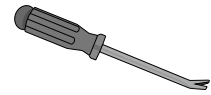
Thermal duct

**PL**  
Plastics

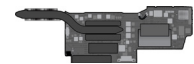
## 7. Pry off the main logic board.



### Tools Used



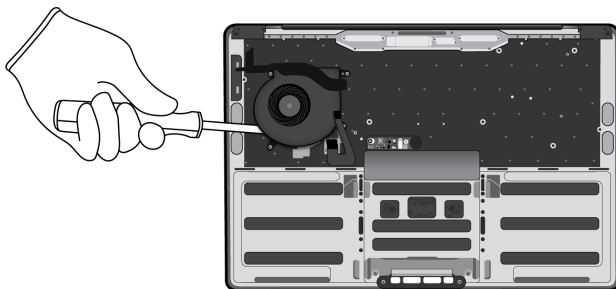
### Fraction



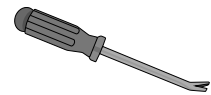
Main logic board

**PMs**  
Precious  
Metals

## 8. Pry off the fan.



### Tools Used



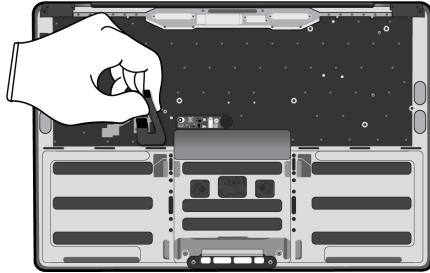
### Fraction




Fan

**Cu**  
Copper

9. Pull off the remaining ribbon cable.



Fraction

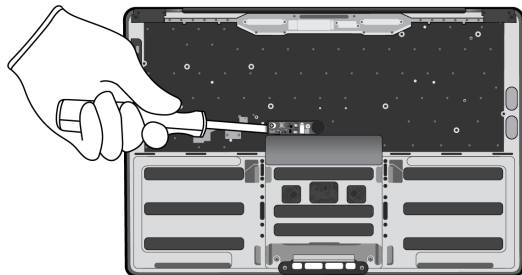


Ribbon cable

Cu  
Copper

A diagram showing a J-shaped ribbon cable. Below it is a green box with the chemical symbol 'Cu' and the word 'Copper' underneath.


10. Pry off the battery logic board.



Tools Used

A diagram of a screwdriver with a black handle and a metal shaft.

Fraction

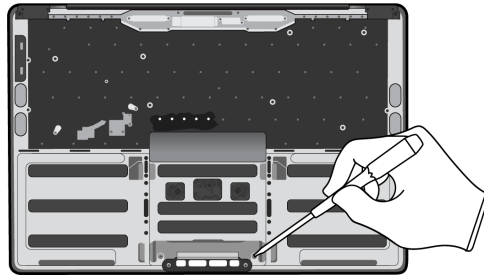


Battery logic board

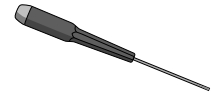
PMs  
Precious Metals

A diagram showing a battery logic board. Below it is a green box with the chemical symbol 'PMs' and the words 'Precious Metals' underneath.

- 11.** Remove the trackpad by unscrewing the 10 Torx T5 fasteners.



Tools Used



Fraction

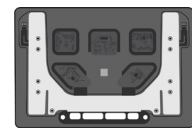


Fasteners (x10)

Fe

Ferrous

Fraction

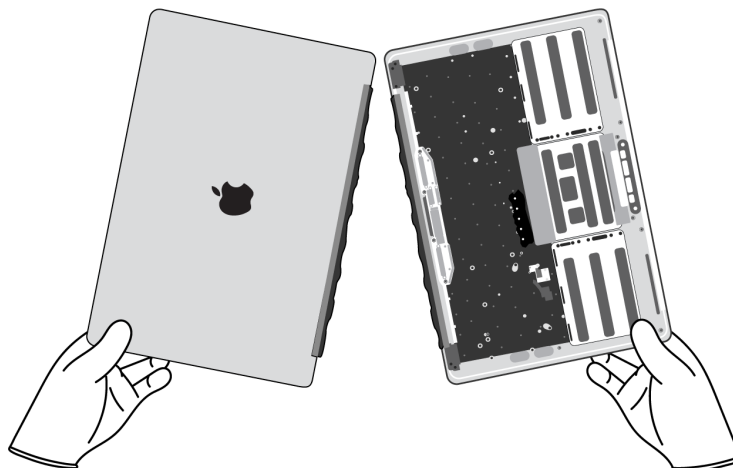


Trackpad

PMs

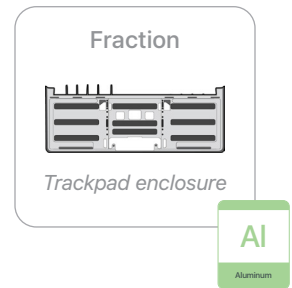
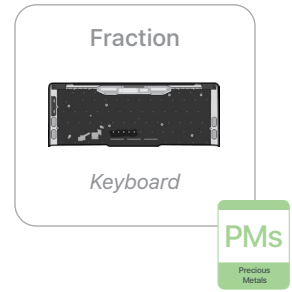
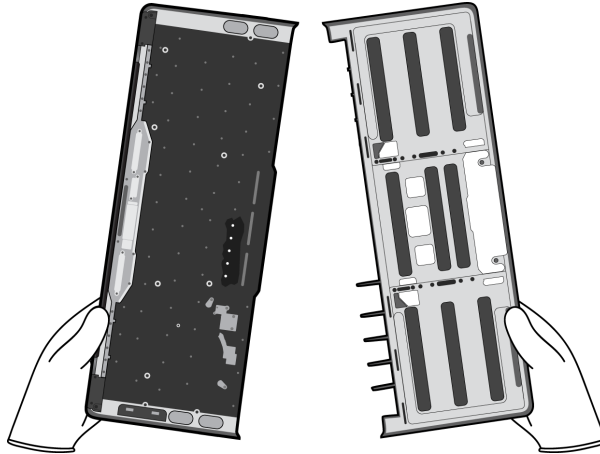
Precious Metals

- 12.** Separate the top case from the display by bending them back and forth until the hinges break.

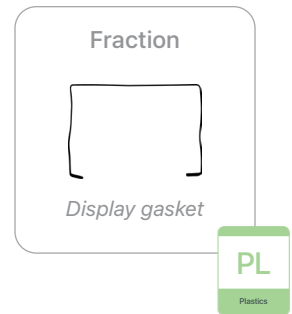
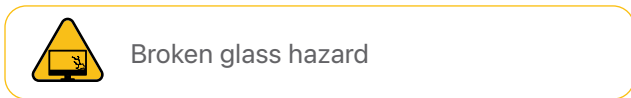





**13.** Separate the keyboard and the trackpad enclosure by breaking the top case in half.




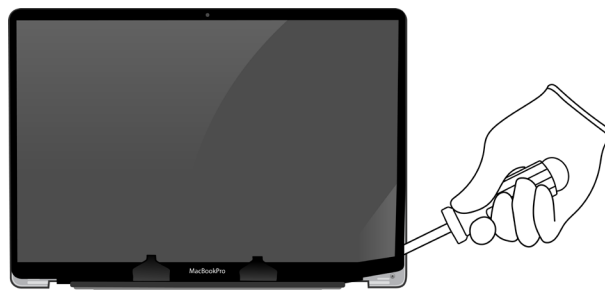
**14.** Pull off the display gasket.



# 15. Pry the LCD cell and display films away from the display housing.

 Broken glass hazard

 Chemical exposure hazard



Tools Used



Fraction



LCD cell



Fraction

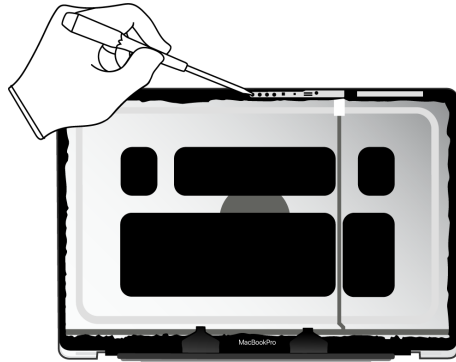


Display films

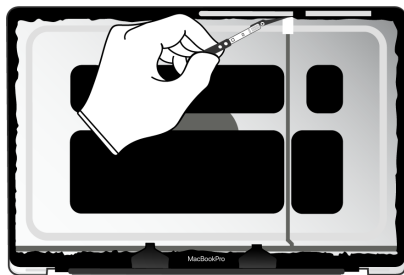


## 16. Remove the camera with logic board.

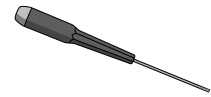
- » *Unscrew the three Torx T2 fasteners that hold the camera with logic board to the display housing.*



- » *Disconnect the camera with logic board from the LED cable.*



### Tools Used



### Fraction



Fasteners (x3)

Fe

Ferrous

### Fraction

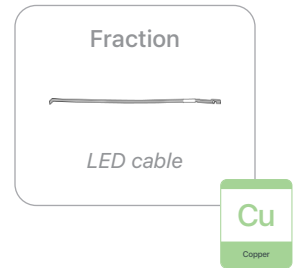
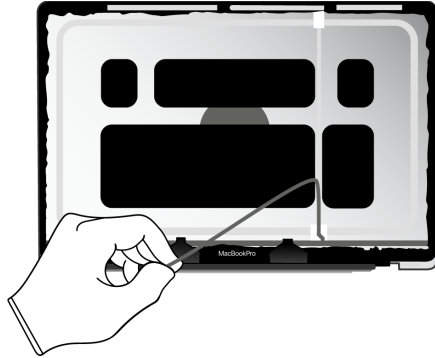


Camera with  
logic board

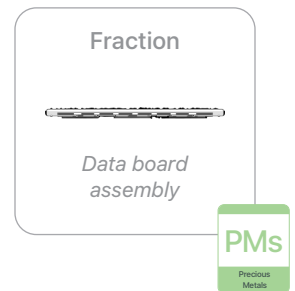
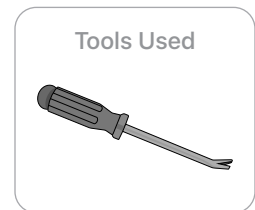
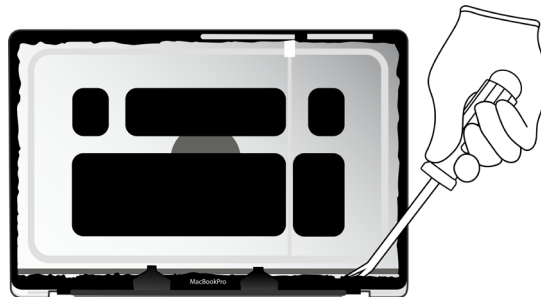
PMs

Precious  
Metals

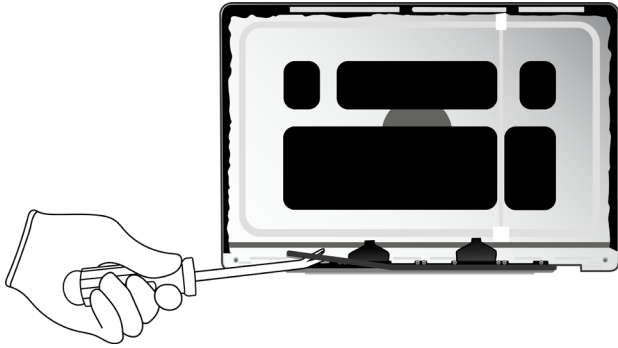
**17.** Pull off the LED cable that leads to the logic board.



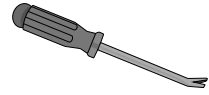
**18.** Pry off the data board assembly.



19. Pry off the plastic bracket.



Tools Used



Fraction

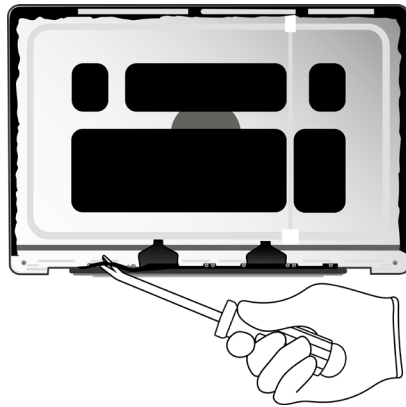


Plastic bracket

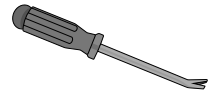
PL

Plastics

20. Pry off the cable bracket. Then pull off the ribbon cables.



Tools Used



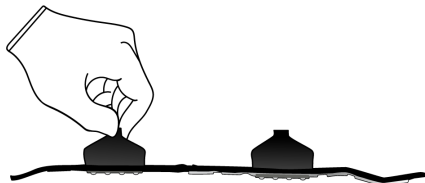
Fraction



Cable bracket

Fe

Ferrous



Fraction



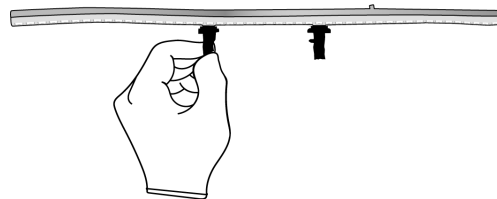
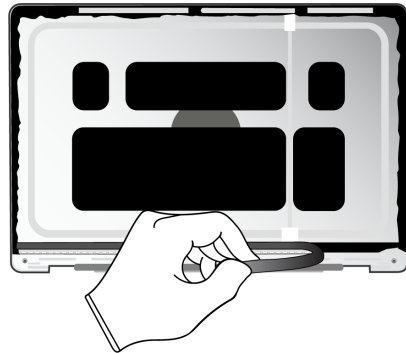
Ribbon cables

Cu


Copper

21. Pull off the LED logic board. Then pull off the ribbon cables.

 Chemical inhalation hazard




Fraction



LED logic board

PMs  
Precious Metals

Fraction



Ribbon cables

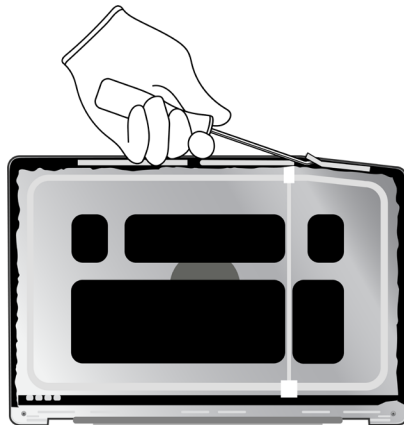
Cu  
Copper

## 22. Remove the magnets.

» *Bend the display housing to pop up the four magnets.*



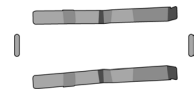
» *Pry off the magnets.*



### Tools Used



### Fraction



Magnets

REE  
Rare Earth  
Elements

### Fraction


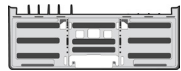










Display housing

Al  
Aluminum

# Material Categorization of Output Fractions

All outputs from this process must be managed, handled, and disposed of in accordance with applicable waste laws and regulations, including but not limited to the Waste Framework Directive and its national enactments in Europe.

Fraction	Downstream Processing
<p data-bbox="435 594 565 621"><b>Aluminum</b></p>  <p data-bbox="440 810 560 831"><i>Bottom case</i></p>  <p data-bbox="407 968 592 989"><i>Trackpad enclosure</i></p>  <p data-bbox="423 1182 576 1203"><i>Display housing</i></p>	<p data-bbox="964 594 1273 621"><b>Primary Target Material</b></p>  <p data-bbox="932 793 1305 821"><b>Potential Additional Material</b></p> 
<p data-bbox="440 1302 560 1329"><b>Batteries</b></p>  <p data-bbox="358 1455 641 1476"><i>Lithium-ion polymer batteries</i></p>	<p data-bbox="964 1302 1273 1329"><b>Primary Target Material</b></p> 
<p data-bbox="448 1575 552 1602"><b>Ferrous</b></p>  <p data-bbox="423 1734 576 1755"><i>Fasteners (x13)</i></p>  <p data-bbox="431 1843 571 1864"><i>Cable bracket</i></p>	<p data-bbox="964 1575 1273 1602"><b>Primary Target Material</b></p> 



## Fraction

## Downstream Processing

### Glass



*LCD cell*

### Primary Target Material



### Potential Additional Materials



### Logic Boards



*Main logic board*



*Battery logic board*



*Trackpad*



*Keyboard*



*Camera with logic board*

### Primary Target Material



### Potential Additional Materials



**Fraction**

**Downstream Processing**

**Logic Boards (cont.)**



*Data board assembly*

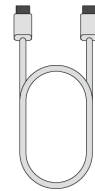


*LED logic board*

**Mixed Electronics**



*Power adapter*



*Charge cable*



*Battery cable*



*Fan*



*LED cable*

**Primary Target Material**



**Potential Additional Materials**



**Fraction**

**Downstream Processing**

**Mixed Electronics (cont.)**

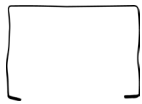


*Ribbon cables*

**Mixed Plastics**



*Thermal duct*



*Display gasket*



*Display films*



*Plastic bracket*

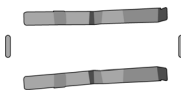
**Primary Target Material**



**Rare Earth Magnets**



*Speakers*



*Magnets*

**Primary Target Material**



**Potential Additional Materials**

