



HP Jet Fusion 540 3D Printer

Product Documentation
User Guide

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Company, L.P.

Edition 4

Legal notices

The information contained herein is subject to change without notice.

The only warranties for HP products and services are set forth in the express warranty statement accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.

Safety notice

Read and follow the operating and safety instructions before turning on the printer.

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1 Welcome to your MJF system

- [Documentation](#)
- [Product usage requirements](#)
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Documentation

The following documents are available:

- Site preparation guide
- Introductory information
- User guide (this document)
- Videos supplementing the user guide
- Legal information
- Limited warranty

Product usage requirements

The products, services, and consumables are subject to the following additional terms:

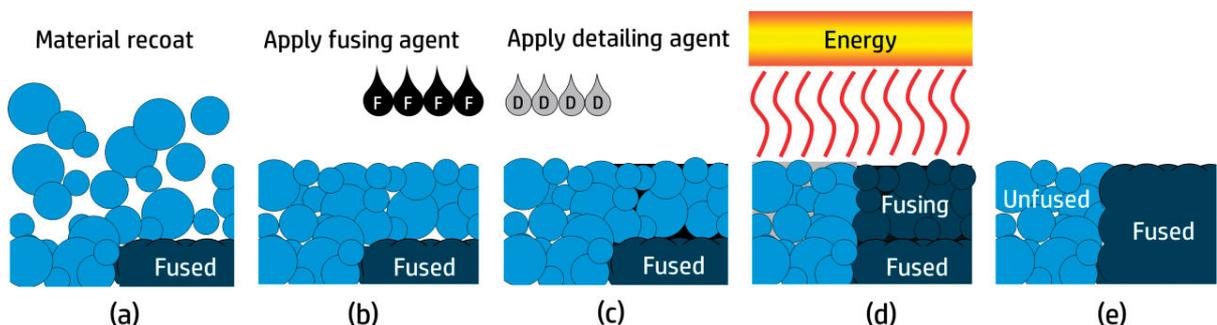
- The customer agrees to use only HP Branded Consumables and HP Certified Materials in the 3D HP printer product, and understands that use of any consumables other than HP consumables may cause serious product functionality and/or safety issues, including, but not limited to those outlined in the user guide. The customer agrees not to use the product and/or consumables for uses not permitted by US, EU, and/or other applicable law.
- The customer agrees not to use the product and/or consumables for the development, design, manufacture, or production of nuclear weapons, missiles, chemical or biological weapons, and/or explosives of any kind.
- The customer agrees to comply with the connectivity requirement outlined below.
- The customer may use firmware embedded in the product only to enable the product to function in accordance with its published specifications.
- The customer agrees to comply with the user guide.

Products, services, and/or technical data provided under these terms are for the customer's internal use and not intended for further resale.

MJF technology

HP Multi Jet Fusion technology offers control over part and material properties and speed advantages beyond those found in other 3D printing technologies.

The HP MJF printing process begins by depositing a thin layer of material in the printer's work area. Next, the carriage containing an HP Thermal Inkjet array passes over the full work area, printing chemical fusing and detailing agents. During another pass of the carriage, the work area is exposed to fusing energy, which bonds part layers together. The process continues, layer-by-layer, until a complete part is formed.



- a. The material is recoated across the work area.
- b. A fusing agent (F) is selectively applied where the particles are to fuse together.
- c. A detailing agent (D) is selectively applied where the fusing action needs to be reduced or amplified. In this example, the detailing agent reduces fusing at the boundary to produce a part with sharp and smooth edges.
- d. The work area is exposed to fusing energy.
- e. The part now consists of fused and unfused areas.

The process is repeated until the complete part has been formed.

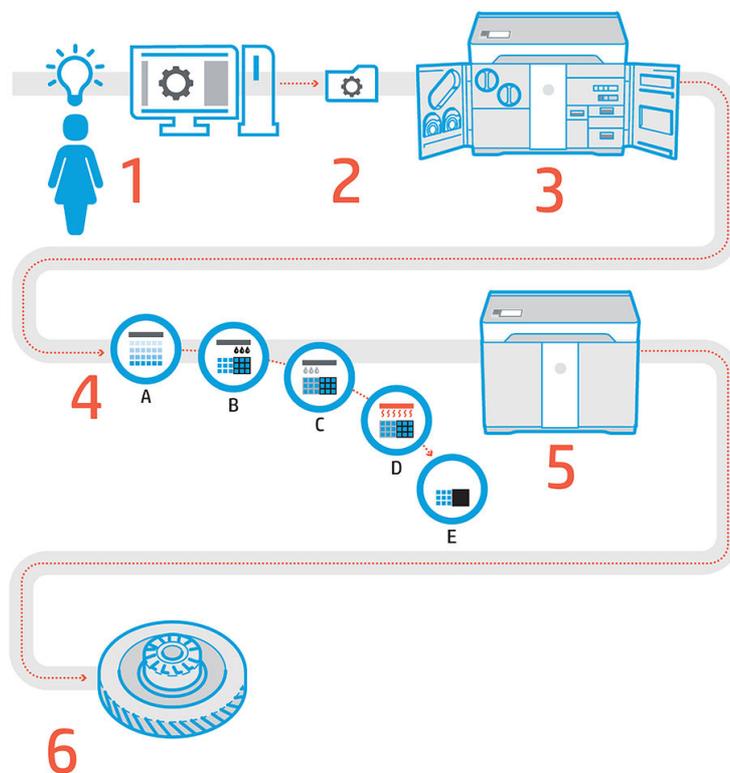
 **NOTE:** The sequence of steps above is typical, but may be changed in specific hardware implementations.

By leveraging proven HP Thermal Inkjet technology and HP's in-depth technical knowledge of rapidly and accurately placing precise, minute quantities of multiple types of fluids, MJF enables customers to produce highly detailed parts and prototypes.

As agents are deposited point-by-point across each cross-section of each part, MJF technology can transform part properties at each voxel, or volumetric pixel.

With MJF technology, HP will enable customers to realize the full potential of 3D printing.

Usage recommendations



1. **Prepare design:** Open your 3D model(s) and check for errors in the easy-to-use HP SmartStream 3D Build Manager software.
2. **Pack models and send to printer:** Arrange your 3D models in the HP SmartStream 3D Build Manager and submit the job to the printer.
3. **Prepare printer:** Clean your printer, check your long-term consumables, automatically check mechanical systems.

4. **Printing with voxel-level control:** Just tap **Start** to start building parts with extreme dimensional accuracy and fine detail, thanks to HP's unique multi-agent printing process.
5. **Automated material management:** Unused material is automatically reclaimed and stored to be reused in the next print job.
6. **Retrieve and clean parts:** The beacon indicates when parts are ready for retrieval. Retrieve your parts from the build chamber and remove excess material with a bead and air blast system.

2 Safety precautions

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Introduction

Before using the printer, read the following safety precautions and operating instructions to make sure you can use it safely.

You are expected to have the appropriate technical training and experience necessary to be aware of hazards to which you may be exposed in performing a task, and to take appropriate measures to minimize the risks to yourself and to others.

Perform the recommended maintenance and cleaning tasks to ensure the correct and safe operation of the printer.

The printer is stationary, and should be located in a restricted-access area, for authorized personnel only.

General safety guidelines

Turn off the printer, using the branch circuit breakers located in the building's Power Distribution Unit (PDU), and call your support representative (see [When you need help on page 132](#)) in any of the following cases:

- The power cord is damaged.
- The heating and fusing lamp enclosures are damaged, the glass is missing or broken, or the sealing is defective.
- The printer has been damaged by an impact.
- Condensation has entered the printer.
- There is smoke or an unusual smell coming from the printer.
- Fuses have blown.
- The printer is not operating normally.
- There is any mechanical or enclosure damage.

Turn off the printer using the branch circuit breakers in either of the following cases:

- During a thunderstorm
- During a power failure

Take special care with zones marked with warning labels.

Use HP-certified and HP-branded material and agents only. Do not use unauthorized third-party material or agents.

In case of unexpected malfunction, anomaly, ESD (ElectroStatic Discharges), or electromagnetic interference, press the emergency stop button and disconnect the printer. If the problem persists, contact your support representative.

The print-production area in which the printer is installed should be free from liquid spillage and environmental condensation. The operating climatic conditions should be maintained within the specified ranges for both product and material (see the site preparation guide for the specified ranges).

The printer should always be kept within rated environmental conditions.

Ensure that there is no condensation inside the printer before turning it on.

To repair or reinstall the printer, contact your nearest authorized service provider. Do not repair, disassemble, or replace any part of the printer or attempt any servicing yourself, unless specifically recommended in the user-maintenance instructions or in published user-repair instructions that you understand and have the skills to carry

out. Do not use any part other than original HP spare parts. Unauthorized attempts at repair may result in electric shock, fire, printer malfunction, or injury.

Final parts/builds

The customer assumes all risk relating to or arising from the 3D printed parts.

The customer is solely responsible for the evaluation of and determination of the suitability and compliance with applicable regulations of the products and/or 3D printed parts for any use, especially for uses (including but not limited to medical/dental, food contact, automotive, heavy industry, and consumer products) that are regulated by US, EU, and other applicable governments.

Explosion hazard

⚠ WARNING! Dust clouds can form explosive mixtures with air. Take precautionary measures against static charges, and keep away from sources of ignition.

NOTICE: The printer is not intended for hazardous locations or ATEX classified zones: ordinary locations only.

To avoid the risk of explosion, take the following precautions:

- Smoking, candles, welding, and open flames should be forbidden close to the printer or material storage area.
- Inside and outside the printer should be cleaned regularly with an explosion-protected vacuum cleaner to avoid dust accumulation. Do not sweep the dust or try to remove it with a compressed-air gun.
- An explosion-protected vacuum cleaner certified for collection of combustible dust is required for cleaning. Take measures to mitigate material spillage and avoid potential ignition sources such as ESD (ElectroStatic Discharges), flames, and sparks. Do not smoke nearby.
- The printer and accessories must be properly grounded at mains outlets only; do not manipulate internal bonding. If static discharges or electrical sparks are noticed, stop operation, disconnect the printer, and contact your support representative.
- Check the air filters and the sealing of the heating lamps regularly.
- Use HP-certified and HP-branded material and agents only. Do not use unauthorized third-party material or third-party agents.
- HP recommends the use of HP accessories for retrieving 3D parts and refilling the build chamber. If other methods are used, read the following notes:
 - Dust clouds generated during handling and/or storage can form explosive mixtures with air. Dust explosion characteristics vary with the particle size, particle shape, moisture content, contaminants, and other variables.
 - Check that the printer is properly grounded and installed to satisfy electrical classification requirements. As with any dry material, pouring this material or allowing it to fall freely or be conveyed through chutes or pipes can accumulate and generate electrostatic sparks, potentially causing ignition of the material itself, or of any flammable materials which may come into contact with the material or its container.
- Material storage, handling, and disposal as per local laws. See the Safety Data Sheets at <http://www.hp.com/go/msds> for adequate handling and storage. Follow your Environmental, Health, and Safety processes and procedures.
- Do not place the printer in a hazardous location area, and keep it separated from other equipment that could create a combustible dust cloud during its operation.
- Auxiliary post-processing equipment, such as for bead blasting, must be suitable for combustible dust.

- Stop operation immediately if sparks or material spillages are seen, and call your support representative before continuing.
- All personnel, when handling combustible dust, should be freed from static electricity by using conductive or dissipative footwear and clothing, and a conductive floor.

Electrical shock hazard

 **WARNING!** The internal circuits inside the e-cabinet, and the heating and fusing lamps, operate at hazardous voltages capable of causing death or serious personal injury.

Turn off the printer using the branch circuit breakers located in the building's Power Distribution Unit (PDU) before servicing. The printer must be connected to earth at mains outlets only.

To avoid the risk of electric shock:

- Do not attempt to dismantle the internal circuit enclosures, heating or fusing lamps, or e-cabinet except during hardware maintenance tasks. In that case, follow the instructions strictly.
- Do not remove or open any other closed system covers or plugs.
- Do not insert objects through slots in the printer.

 **NOTE:** A blown fuse may indicate malfunctioning electrical circuits within the system. Call your support representative (see [When you need help on page 132](#)), and do not attempt to replace the fuse yourself.

Heat hazard

The heating, fusing, and build chamber subsystems of the printer operate at high temperatures. To avoid personal injury, take the following precautions:

- Take special care when accessing the printing area. Let the printer cool down before you open the covers.
- Take special care with zones marked with warning labels.
- Do not place objects inside the printer while operating.
- Do not cover enclosures while operating.
- Remember to let the printer cool down before performing some maintenance operations.
- Wait for at least the minimum cooling time before retrieving parts from the printer. HP recommends wearing safety gloves to retrieve parts after printing, as the parts may be hot.

Fire hazard

The heating, fusing, and build chamber subsystems of the printer operate at high temperatures. Call your support representative if the fuses are repeatedly blowing.

To avoid the risk of fire, take the following precautions:

- Use the power supply voltage specified on the nameplate.
- Connect the power cord to a dedicated line, protected by a branch circuit breaker according to the information detailed in the site preparation guide.
- Do not insert objects through slots in the printer.
- Take care not to spill liquid on the printer. After cleaning, make sure all components are dry before using the printer again.

- Do not use aerosol products that contain flammable gases inside or around the printer. Do not operate the printer in an explosive atmosphere.
- Do not block or cover the openings of the printer.
- Do not attempt to modify the heating, fusing, build chamber, e-cabinet, or enclosures.
- Proper maintenance and genuine HP consumables are required to ensure that the printer operates safely as designed. The use of non-HP consumables may present a risk of fire.
- Take special care with zones marked with warning labels.
- Do not place objects covering top cover, enclosures, or air ventilation.
- Do not leave tools or other materials inside the printer after maintenance or servicing.

Suitable materials for fire-fighting include carbon dioxide, water spray, dry chemicals, or foam.

⚠ CAUTION: Do not use a jet of water, as it could scatter and spread the fire.

⚠ WARNING! Depending on the material used, some unhealthy substances can be released into the air in case of incidental fire. Wear self-contained pressure-demand breathing apparatus and full protective gear. Your EHS specialist should consult the Safety Data Sheet (SDS) about each material, available at <http://www.hp.com/go/msds>, and advice on the appropriate measures for your location.

Mechanical hazard

The printer has moving parts that could cause injury. To avoid personal injury, take the following precautions when working close to the printer.

- Keep your clothing and all parts of your body away from moving parts.
- Avoid wearing necklaces, bracelets, and other hanging objects.
- If your hair is long, try to secure it so that it will not fall into the printer.
- Take care that sleeves or gloves do not get caught in moving parts.
- Avoid standing close to the fans, which could cause injury and could also affect print quality (by obstructing the air flow).
- Do not operate the printer with covers bypassed.

Light radiation hazard

Infrared (IR) radiation is emitted from the heating and fusing lamps. The enclosures limit radiation in compliance with the requirements of the exempt group of IEC 62471:2006, *Photobiological safety of lamps and lamp systems*. Do not modify the top cover enclosure, nor the glasses or windows.

Chemical hazard

See the Safety Data Sheets available at <http://www.hp.com/go/msds> to identify the chemical ingredients of your consumables (material and agents). Sufficient ventilation needs to be provided to ensure that potential airborne exposure to these substances is adequately controlled. Consult your usual air conditioning or EHS specialist for advice on the appropriate measures for your location.

Use HP-certified material and agents only. Do not use unauthorized third-party material or third-party agents.

Ventilation

Fresh air ventilation is needed to maintain comfort levels. For a more prescriptive approach to adequate ventilation, you could refer to the latest edition of the ANSI/ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) document *Ventilation for Acceptable Indoor Air Quality*.

Adequate ventilation needs to be provided to ensure that potential airborne exposure to materials and agents is adequately controlled according to their Safety Data Sheets.

Ventilation should meet local environmental, health, and safety (EHS) guidelines and regulations.

Follow the ventilation recommendations in the site preparation guide.

 **NOTE:** The ventilation units should not blow air directly onto the printer.

Air conditioning

As with all printer installations, to maintain ambient comfort levels, air conditioning in the work area should take into account that the printer produces heat. Typically, the printer's power dissipation is in the range of 4–6 kW (13.6–20.5 kBTU/h).

Air conditioning should meet local environmental, health, and safety (EHS) guidelines and regulations.

 **NOTE:** The air conditioning units should not blow air directly onto the printer.

An HVAC unit is required which can consistently maintain the recommended operating temperature in order to achieve optimal printing performance. More specific technical information can be found in the site preparation guide.

Sound pressure level

The HP VCVRA-1804 maximum A-weighted sound pressure level over bystander positions while printing is 80 dB(A). Hearing protection may be required as per local laws; consult your EHS specialist.

Printer transport hazard

Special care must be taken to avoid personal injury when moving the printer.

- Move the printer over smooth, flat surfaces without steps.
- Move with care and avoid shocks during transport, which could spill the material.
- Lock the front casters when not moving the printer. Remember to unlock them before moving it.

If you move the printer between different rooms, bear in mind that it should be kept in constant environmental conditions, and recalibrated when it reaches its new location: recalibrate the load cells, check the spacing between the spreader roller and the preheat plate, and check printhead alignment, realigning if necessary.

3D part retrieval

Wear heat-resistant gloves when retrieving 3D printed parts manually. Safety gloves are also recommended when retrieving 3D printed parts after auto-extraction, as the parts may still be hot.

Personal protective equipment

HP recommends safety gloves, masks, goggles, and hearing protection for certain printing and maintenance tasks.

Use of tools

No tools are required for daily operations including printer settings, printing, retrieving and refilling, replacement of agent intermediate tanks, and daily checks.

 **NOTE:** During installation, the designated personnel receive training for the safe operation and maintenance of the printer. The printer should not be used without this training.

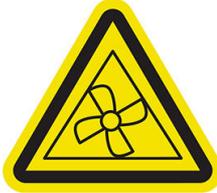
Warnings and cautions

The following symbols are used in this manual to ensure the proper use of the printer and to prevent it from being damaged. Follow the instructions marked with these symbols.

-  **WARNING!** Failure to follow the guidelines marked with this symbol could result in serious personal injury or death.
-  **CAUTION:** Failure to follow the guidelines marked with this symbol could result in minor personal injury or damage to the product.

Warning labels

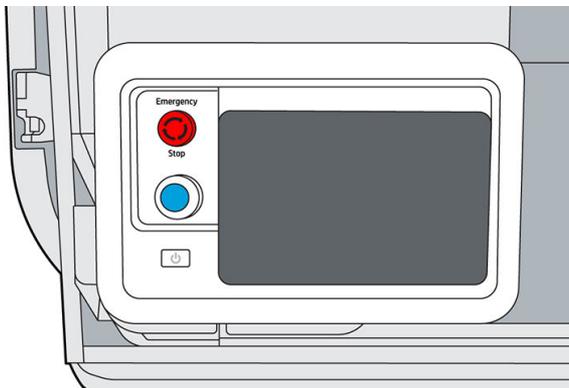
Label	Explanation
 <p>ELECTRIC SHOCK HAZARD Heating modules operate at hazardous voltages. Disconnect all power sources before servicing. Caution! Double pole. Neutral fusing.</p> <p>WARNING High leakage current. Earth connection essential before connecting supply. Before connecting Power Supply cord to the unit, refer to the Installation Instructions to determine proper input voltage configuration.</p> <p>Before starting, read and follow the operating and safety instructions. Avant de commencer, lisez et suivez les instructions de fonctionnement et de sécurité. Lesen und befolgen Sie bitte die Bedienungs- und Sicherheitsanweisungen, bevor Sie starten. Antes de empezar, lea y siga las instrucciones sobre funcionamiento y seguridad. 开始之前，请阅读并遵循以下操作和安全说明。 在開始之前，請先閱讀並依照操作與安全指引進行。</p>	<p>Electric shock hazard</p> <p>Heating modules operate at hazardous voltage. Disconnect power source before servicing.</p> <p>CAUTION: Refer servicing to qualified service personnel.</p> <p>In case of operation of the fuse, parts of the printer that remain energized may represent a hazard during servicing. Before servicing, turn off the printer using the Branch Circuit Breakers located in the building's Power Distribution Unit (PDU).</p> <p>WARNING! High leakage current. Current leakage may exceed 3.5 mA. Earth connection essential before connecting supply. Equipment to be connected to earthed mains only.</p> <p>See installation instructions before connecting to the supply. Ensure that the input voltage is within the printer's rated voltage range.</p> <p>Before starting</p> <p>Read and follow the operating and safety instructions before starting the printer.</p>
<p>For service personnel only</p> 	<p>Risk of burns. Let the printer cool down before accessing internal parts.</p>
	<p>HP recommends that you wear gloves when performing certain maintenance and cleaning tasks. Wear heat-resistant gloves when retrieving parts, either through manual extraction or after material reclamation. The parts may be very hot.</p>

Label	Explanation
	<p>Crush hazard. Keep your hands clear of the edge of the top cover. Open and close the top cover using the handle (highlighted in blue) only.</p>
	<p>WARNING! Dust clouds can form explosive mixtures with air. Take precautionary measures against static charges, and keep away from sources of ignition.</p> <p>No smoking, matches, or open flames close to printer or material storage area.</p>
	<p>An explosion-protected vacuum cleaner certified for collection of combustible dust is required for cleaning.</p> <p>Take measures to mitigate material spillage and avoid potential ignition sources such as ESD (ElectroStatic Discharges), flames, and sparks. Do not smoke nearby.</p> <p>Disposal as per local laws.</p>
	<p>Electric shock hazard. Disconnect power before servicing. Heating modules and electrical cabinets operate at hazardous voltage.</p>
<p>For maintenance and service personnel only</p>	
	<p>Hazardous moving parts. Keep away from moving fan blades.</p>
<p>For maintenance and service personnel only</p>	
	<p>Risk of trapped fingers. Do not touch gears while moving: your hands may be trapped between the gearwheels.</p>
<p>For maintenance and service personnel only</p>	
	<p>Hazardous moving parts. Keep away from the moving printhead, lamp, and heater carriages. When printing, the print carriage travels back and forth.</p>
<p>For service personnel only</p>	

Label	Explanation
	<p>Identifies the Protective Earth (PE) terminal for qualified electricians, and bonding terminals for maintenance/service personnel only. An earth connection is essential before connecting to the supply.</p>
	<p>Do not disconnect the hoses during the purging process.</p>

Emergency stop button

There is a red emergency stop button on top of the printer, beside the front panel. If an emergency occurs, simply push the emergency stop button to stop all processes.



The printer carriages, the fans, and the lamp module are halted; the top cover is locked until the internal temperature decreases. A system error message is displayed.

Ensure that the emergency stop button is released before restarting the printer.

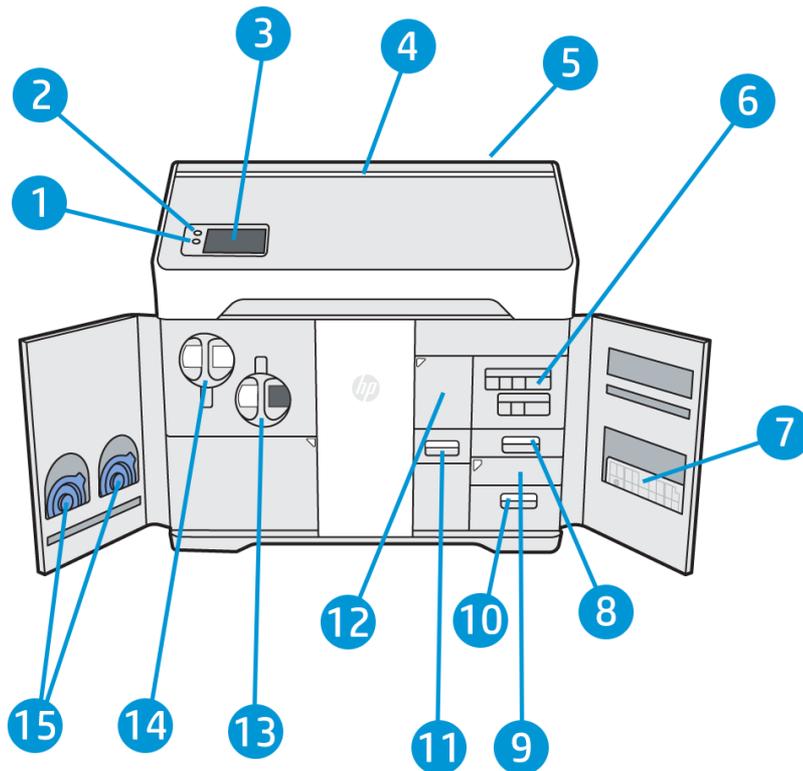
For safety reasons, access to the print zone is not permitted while printing is in progress. Let the printer cool down before touching anything inside it.

To stop the printer completely, turn it off.

3 Main components

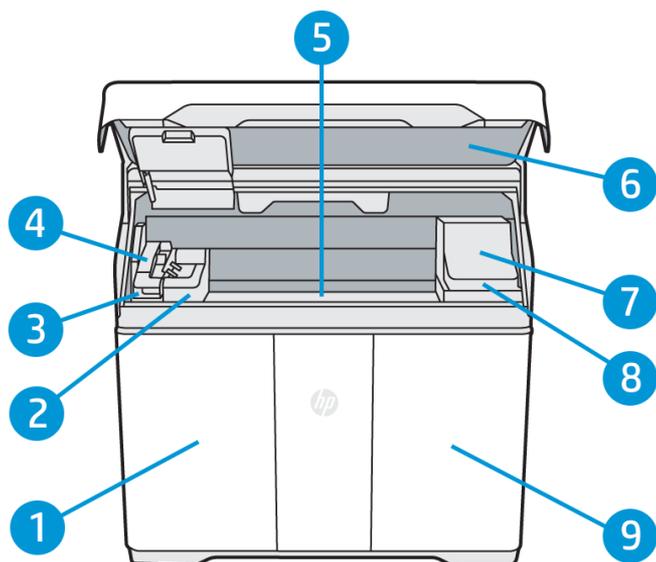
- [Printer](#)
- [Front panel](#)
- [Set the administrator password](#)
- [Software](#)

Printer



1. Rearm button
2. Emergency stop button
3. Front panel
4. Status beacon
5. Air intake filter (behind the printer)
6. Agent cartridges
7. Alignment plate
8. Distilled water tank (B3)
9. Scanner (B4)
10. Air exhaust compartment and filter (B5)
11. Reclamation sieve (B2)
12. Reclamation filter (B1), and access to the reclamation intermediate tank
13. Reused material cartridge
14. Fresh material cartridge
15. Cartridge covers

The power button  is beside the front panel, just below the rearm button.



1. Material door
2. Fusing lamp
3. Recoating roller and cover
4. Fusing carriage (C1)
5. Print platform and build chamber
6. Top cover and viewing window
7. Print carriage (C2)
8. Printhead cleaning roll (under the print carriage)
9. Agent door

Front panel

The front panel is a touch-sensitive screen with a graphical user interface, situated on the front left of the printer.

The front panel gives you complete control of your printer: from the front panel, you can view information about the device, change device settings, monitor device status, and perform tasks such as supplies replacement and printhead alignment. The front panel displays alerts (warning and error messages) when necessary.



It includes the following components:

1. A Hi-Speed USB 2.0 host port, intended for connecting a USB flash drive, which can provide firmware update files to the printer; it is located behind the front panel, accessible when the front panel is tilted up.
2. The front panel itself: an 8 inch, full-color, touch-sensitive screen with a graphical user interface
3. The loudspeaker

The front panel has a large central area to display dynamic information and icons. On the left side you can see one or two fixed icons.

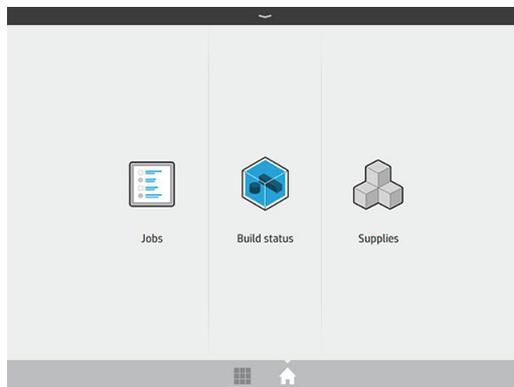
Left fixed icons

- Tap  to return to the home screen.
- Tap  to go back to the previous screen. This does not discard any changes made in the current screen.

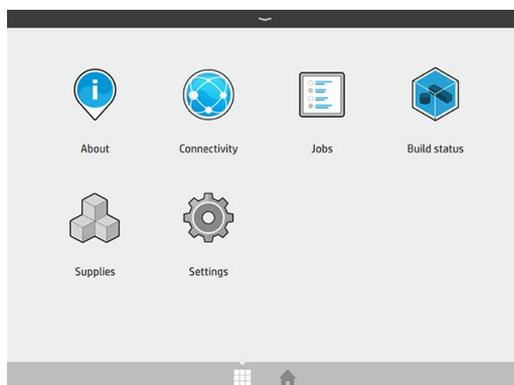
Home screens

There are two top-level screens that you can move between by swiping your finger across the screen, or tapping the appropriate icon at the bottom of the screen:

- The first main screen provides direct access to the most important functions. It can be displayed by tapping  at the bottom of the screen.



- The all-app screen displays a list of all available apps. It can be displayed by tapping  at the bottom of the screen.



Status center

At the top of the front panel is the status center, which can be expanded by swiping down from the top. This is visible on almost all screens, except when an action is taking place. In the status center, you can see the status of the printer, and access various controls and alerts.

Status beacon

The printer has a beacon strip across the top cover; it gives a summary of the printer and job status, which can be seen from a distance.



 **IMPORTANT:** The information provided in the beacon is for functional information purposes only, and is not relevant to your safety. Warning labels on the printer should always be heeded, regardless of the status indicated by the beacon lights.

Beacon off	The printer is ready for the next job.
White moving light	The printer is in the middle of a process.
White light	The printer has completed a process and is waiting for you.
Blue moving light	The printer is printing a job.
Blue light	A job is complete and the parts are ready to be retrieved.
Red light	The printer is unable to print because of a system error; a job may have been canceled.

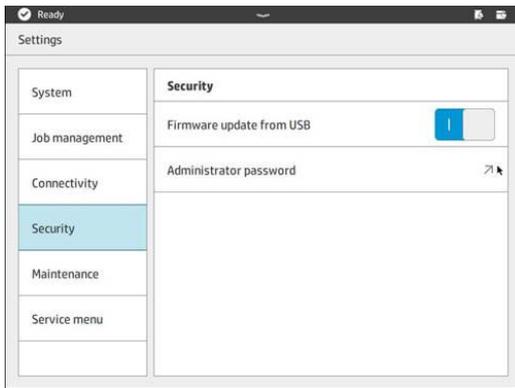
Change system options

You can change various printer system options from the front panel. Tap , then **System**.

- **Language** to change the language in which the printer operates.
- **Select altitude** to tell the printer its height above sea level.
- **Display brightness** to change the brightness of the front-panel display. The default brightness is 50.
- **Speaker volume** to change the volume of the printer's loudspeaker. Select **Off**, **Low**, or **High**.
- **Time zone** to view or set the printer's time zone.
- **Printer logs** to request detailed troubleshooting information about system errors, system warnings, printheads, or agents.
- **Restore factory settings** to restore the printer settings to their original values as set in the factory. This option restores all of the printer settings except the Gigabit Ethernet settings and paper presets.

Set the administrator password

You can set the administrator password from the front panel. Tap , then **Security > Manage password**, and enter the password. If a password has already been set, you will need to give the old password in order to set a new one.



The administrator password must be given in order to change printer settings.

Software

HP SmartStream 3D Command Center

HP Smartstream 3D Command Center is a client application that fully monitors your HP 3D printers, and all other complementary devices such as processing stations and build units, to fully utilize the power of the HP 3D ecosystem. Command Center must be installed with your 3D devices. It helps you to make all of your 3D printing builds successful: review print jobs and be ahead of the printer's needs by remotely viewing firmware updates, warnings, and errors.

HP Smartstream 3D Command Center software, manuals, and support for your 3D printing solution can be downloaded from:

- <http://www.hp.com/go/SmartStream3DCommandCenter/software>
- <http://www.hp.com/go/SmartStream3DCommandCenter/manuals>
- <http://www.hp.com/go/SmartStream3DCommandCenter/support>

For more information about the Command Center, see the *HP SmartStream 3D Command Center User Guide*.

HP SmartStream 3D Build Manager

Use the powerful 3D print-preparation capabilities of HP SmartStream 3D Build Manager to help make all of your 3D printing jobs successful:

1. Add parts to begin preparing the print job.
2. Rotate, size, and position the part on the bed.
3. Automatically locate and fix 3D geometry errors.
4. Send a printer-ready file to a connected 3D printer or save the printable file.

HP Smartstream 3D Build Manager software, manuals, and support for your 3D printing solution can be downloaded from:

- <http://www.hp.com/go/SmartStream3DBuildManager/software>
- <http://www.hp.com/go/SmartStream3DBuildManager/manuals>
- <http://www.hp.com/go/SmartStream3DBuildManager/support>

For more information about the Build Manager, see the *HP SmartStream 3D Build Manager User Guide*.

4 Power on and off

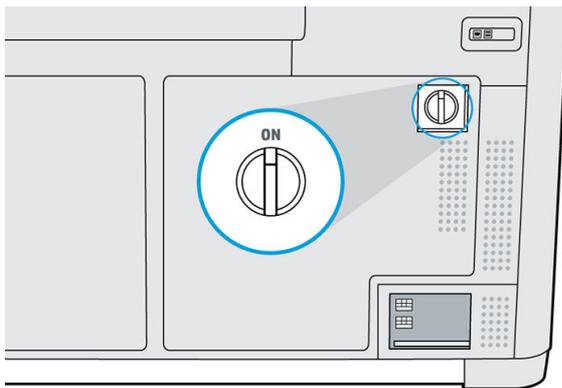
NOTICE: Operate the printer only within the specified ranges of operating temperature and humidity (see the site preparation guide). If the printer or supplies are exposed to conditions outside the environmental operating range, wait at least 12 hours for everything to reach environmental operating conditions before turning on the printer or using the supplies.

- [Turn the printer on and off](#)
- [Main power switch](#)
- [Away mode](#)

Turn the printer on and off

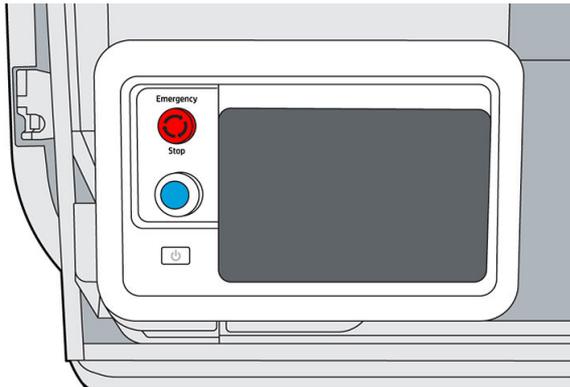
Turn on the printer for the first time

1. Ensure that the printer's doors are all closed.
2. Turn the main switch at the rear of the printer to the on position.



3. Wait for the front panel to tell you that the printer is waiting for rearm.
4. Perform a visual check of the printer.

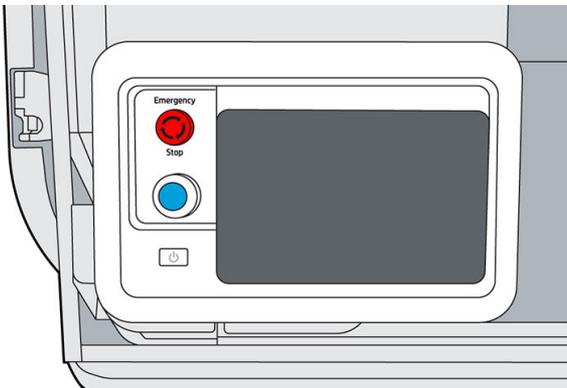
5. When requested, press the blue rear button beside the front panel, at the front left of the printer. This enables all of the printer's high-power subsystems.



6. Wait for the front panel to indicate that the printer is ready. This can take several minutes. When initialization is complete, the front panel displays a ready message. If a system error message is displayed, see [System errors on page 131](#).

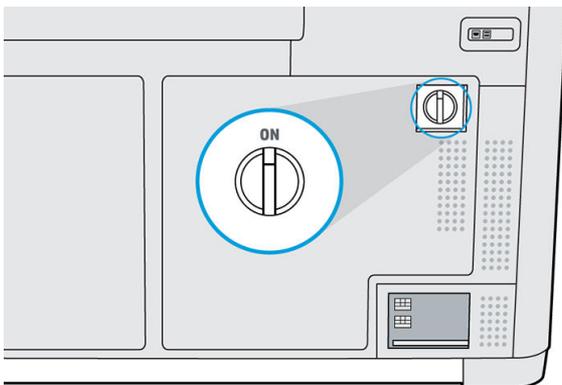
Turn the printer on and off

Use the  button beside the front panel to turn the printer on and off.



To turn off the printer for an extended period of time, first turn it off with the  button; wait for it to shut down completely; then turn off the main switch at the rear of the printer.

Main power switch



Leave the main power switch on at all times, unless you intend to move the printer.

If you plan to leave the printer unattended for more than a week, set it to away mode.

Away mode

If you plan to leave the printer unattended for more than a week, select **Away mode** from the maintenance menu. The printer will perform a series of minor maintenance tasks in order to maintain the health of your printheads.

Entering away mode is preferable to shutting the printer down completely. It will minimize the frequency of printhead replacement, as well as help maintain steady operating procedures with predictable costs based on usage. The printer will remain locked throughout away mode; it can be powered back up from the front panel.

 **CAUTION:** If you turn off the printer for an extended amount of time, it cannot maintain printhead nozzle health, and you may find that you need to replace the printheads when you eventually turn it back on.

5 Printer networking

Introduction

The printer provides a single RJ-45 port for a network connection. For optimal performance, HP recommends using Cat 5/5e or Cat 6 cabling and gigabit-capable local network equipment.

A correct network setup is required to operate the printer, as all communication with printing and management software goes through the network.

 **IMPORTANT:** In order to print, the printer must be connected to the Command Center, and the Command Center must be connected to the cloud.

Connectivity requirement and remote monitoring

The customer will allow HP to install the HP Command Center software (or other applicable HP software that controls the HP product and enables remote monitoring) on the customer's computer.

The customer will keep that computer connected to the HP product, and the customer will keep the HP Command Center software running on that computer and connected to the HP product at all times.

The customer will provide, at the customer's sole expense, permanent HP Command Center software connectivity to the HP secure cloud via permanent Internet connection through an HP-approved communications channel and ensure such connectivity at all times as further specified in the site preparation guide. The customer is responsible for restoring connectivity in a timely manner in the event of interruptions.

THE CUSTOMER AGREES THAT FAILURE TO MAINTAIN THE PRODUCT'S CONNECTION TO THE HP CLOUD AS SPECIFIED IN THE SITE PREPARATION GUIDE WILL RESULT IN LIMITED OR NO PRODUCT FUNCTIONALITY AND LIMITED SERVICE LEVEL.

HP products may collect the customer machine data. The customer grants HP and/or an HP authorized agent permission to access remotely, via the HP Command Center software, the customer machine data from HP products.

The customer machine data will be used by HP and/or an HP authorized agent for the purpose of providing remote support, enabling enhanced diagnostics, preventive maintenance, software updating, calculating supplies and consumables usage and statistics, and evaluating improvements to HP's products and offerings in the future. In addition, the customer machine data will help HP to determine how HP products are being used, which product features are used the most, and to calculate various aggregate HP product usage statistics.

HP and/or HP authorized agents respect your privacy, are committed to protecting your machine data, and will take reasonable precautions to prevent unauthorized access or disclosure and ensure the appropriate use of your machine data. In the event that some data may be categorized as individual level data, HP and/or an HP authorized agents will maintain the privacy of any such data, as well as all data collected, in accordance with the HP Privacy Statement (<http://www.hp.com/go/privacy>) and the Personal Data Rights Notice (<http://welcome.hp.com/country/privacy/privacynotice>) where applicable.

"Customer machine data" means data from the customer's HP product that may include but is not limited to the following: HP product usage data; HP product production data; HP product system events; HP product

maintenance and calibration history; HP product model number; HP product serial number; HP product firmware version; HP product IP address; consumable status and history; sensor activity; quantity and type of printheads used; build ID; build duration; and/or print mode. Customer machine data does not include: design files, parts files, job names, job contents, part geometries, thermal maps, user names, or part names.

Configuration

To access the network settings, tap  and then  on the front panel.

Hostname

You can assign a customized hostname to the printer. If the network infrastructure supports it, the printer will attempt to register the hostname to the DNS service, making it possible to address the printer using the hostname rather than the IP address.

Similarly, you can assign the domain suffix, to define the printer's fully qualified domain name.

IPv4 configuration

You can select whether the printer should try to discover automatically the IPv4 network settings using the DHCP protocol, or whether you want to configure them manually. These settings include:

- **IP address:** The unique Internet Protocol address assigned to the printer.
- **Subnet mask:** The mask corresponding to the printer's IP address.
- **Default gateway:** The IP address of the network gateway.
- **DNS configuration method:** Whether DNS servers should be assigned by DHCP service or manually.
- **Primary and secondary DNS servers:** The IP addresses of the DNS servers.

Link speed

The embedded network controller supports connection to IEEE 802.3 10Base-T Ethernet, IEEE 802.3u 100Base-TX Fast Ethernet, and 802.3ab 1000Base-T Gigabit Ethernet compliant networks. When connected and powered on, the printer auto-negotiates with your network to operate with a link speed of 10, 100, or 1000 Mbps, and to communicate using full- or half-duplex mode. However, you can manually configure the link using the printer's front panel, or through other configuration tools once network communication is established.

6 Design and printing guidelines

- [Introduction](#)
- [File preparation](#)
 - [File usage in the end-to-end workflow](#)
 - [Minimum specification for parts](#)
 - [Saving and exporting files](#)
 - [Tessellation problems](#)
 - [Repairing files](#)
 - [HP SmartStream 3D Build Manager](#)
- [Other design considerations before printing](#)
 - [Contraction coefficient](#)
 - [Orientation](#)
 - [Surface capillarity](#)
 - [Positioning of parts in the build chamber](#)
 - [Repeatability](#)
 - [Distance between parts in the build chamber](#)
 - [Printing a part for final production](#)
 - [Orientation flowcharts](#)
 - [Generating a sinter box](#)
 - [Printer capacity](#)

Introduction

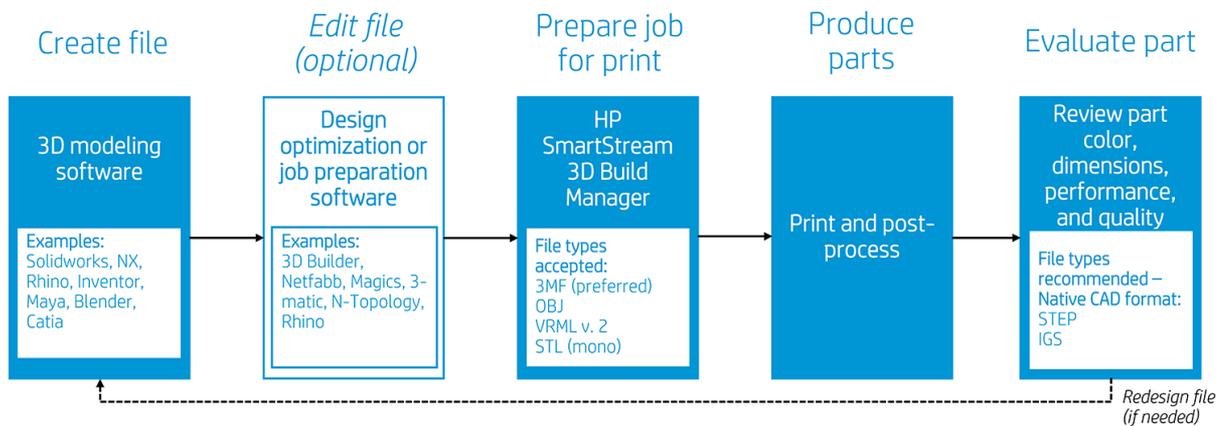
3D printing offers a much higher level of freedom in terms of design than any other traditional manufacturing technology. Designers and engineers can benefit from this, and use new geometries and concepts that were not feasible before. However, in order to optimize the design to be printed with MJF, you should be aware of some characteristics of the printing process and its capabilities, as this could help to get the best of the technology.

The design and printing guidelines offer an overview of the steps to follow before sending a job to print, from file preparation to the considerations that should be taken into account in the design of the parts and the orientation of them on the print bed to optimize the final part quality and printing performance.

File preparation

File usage in the end-to-end workflow

In the end-to-end workflow of the printing process, the files pass through different software applications. For example, the first design may be done in a CAD program, while the job preparation will be handled in HP SmartStream 3D Build Manager. If required, the printed part can be scanned in 3D and compared with the original design.

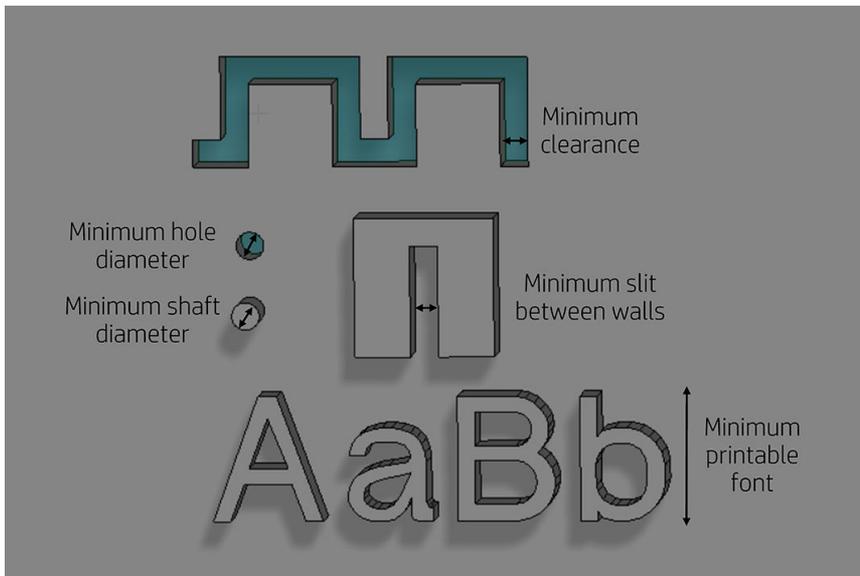


Minimum specification for parts

When designing parts in your 3D modeling software, HP recommends keeping this minimum specification in mind to avoid issues with parts and to achieve the best quality.

The minimum printable features in planes X, Y, and Z are as follows:

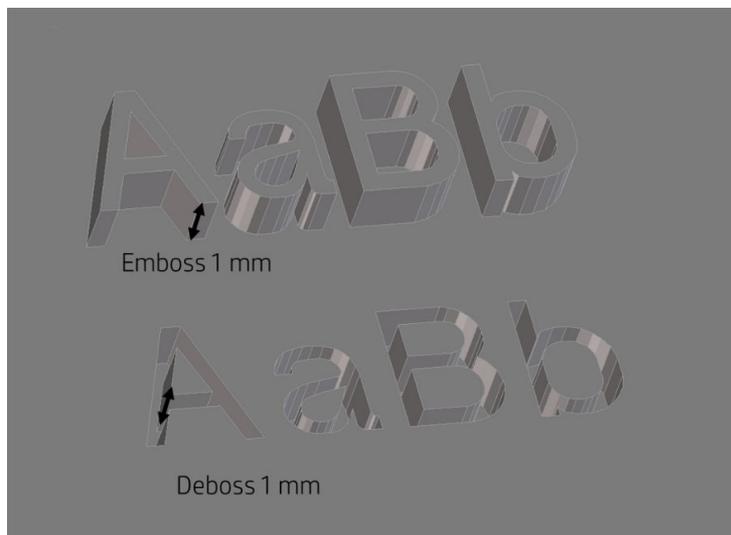
Minimum hole diameter at 1 mm thickness	0.5 mm
Minimum shaft diameter at 10 mm height	0.5 mm
Minimum printable font size for embossed or debossed letters or numbers	6 pt
Minimum clearance at 1 mm thickness	0.5 mm
Minimum slit between walls	0.5 mm



- **Engraving.** Multi Jet Fusion technology allows you to print letters and drawings with a very high resolution and definition.

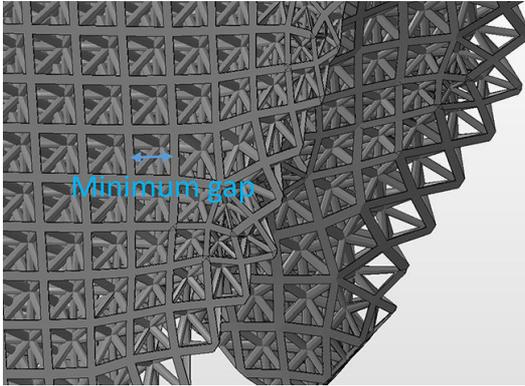
For the best possible output, any text, number, or drawing included in a part should have at least 1 mm of depth or height.

The best orientation for embossing and debossing letters is to place them upside down in the build chamber.

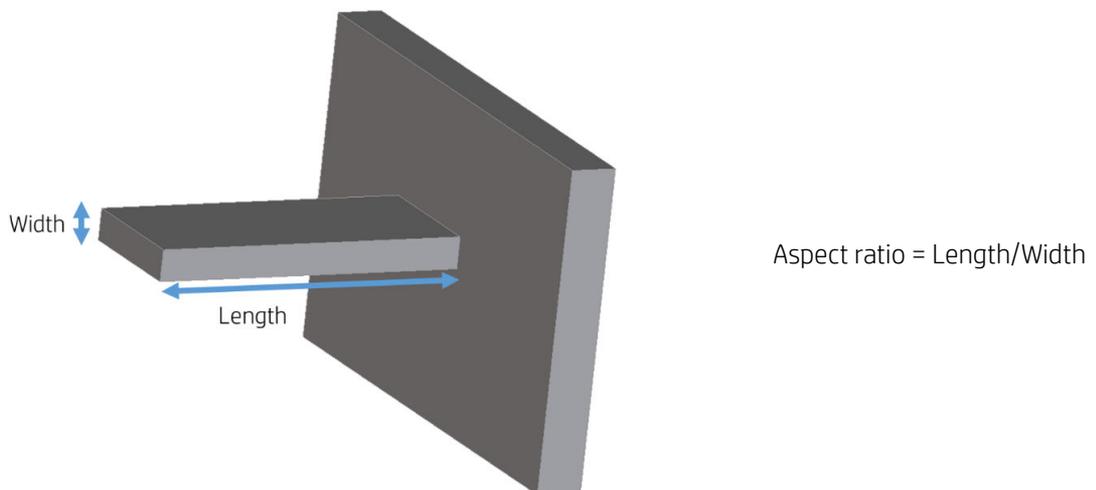


- **Solid part or structural fill.** Multi Jet Fusion allows you to print topology-optimized, generative designs or even small lattice structures. This kind of design helps to reduce the weight of the part and the quantity of material used, which not only reduces the cost of the part but also helps to reduce the operating cost in applications that are very weight-sensitive.

The minimum gap recommended in a lattice structure to ensure that all the material inside the part can be removed is 5 mm.

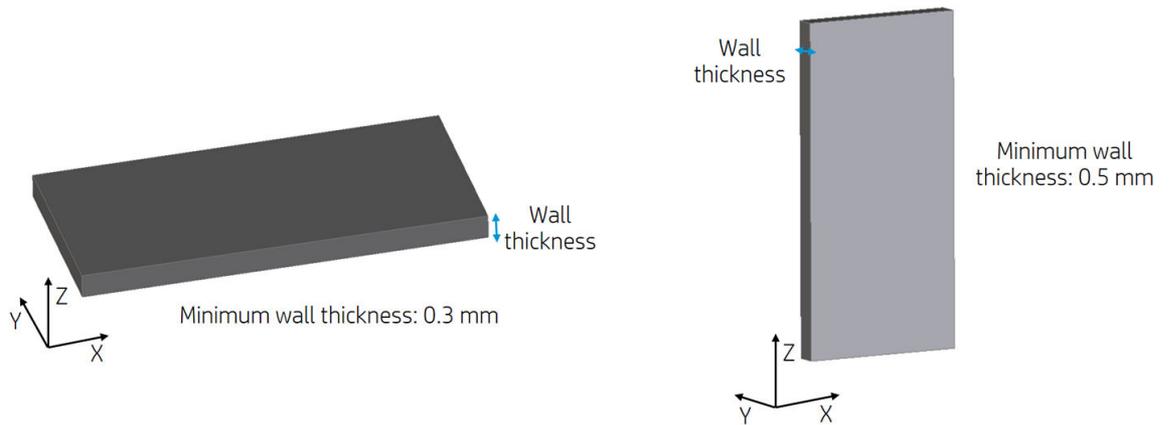


- When printing a **cantilever**, the minimum wall thickness depends on the aspect ratio, which is the length divided by the width.



For a cantilever with a width less than 1 mm, the aspect ratio should be less than 1. There are no specific recommendations for widths greater than 1 mm.

- In general, the minimum recommended **wall thickness** is 0.3 mm for short walls oriented in the XY plane, and 0.5 mm for short walls oriented in the Z plane.

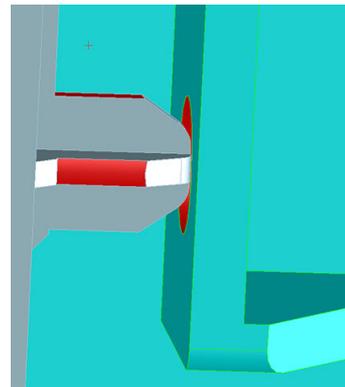
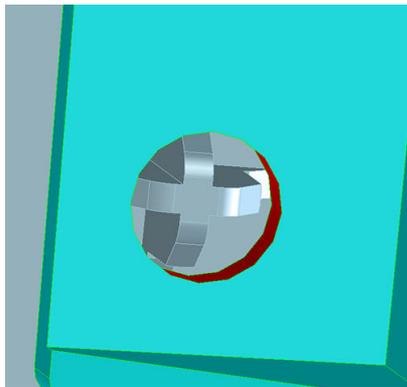


For parts with a high aspect ratio (>10:1), HP recommends increasing the wall thickness, or adding ribs or fillets to reinforce the part.

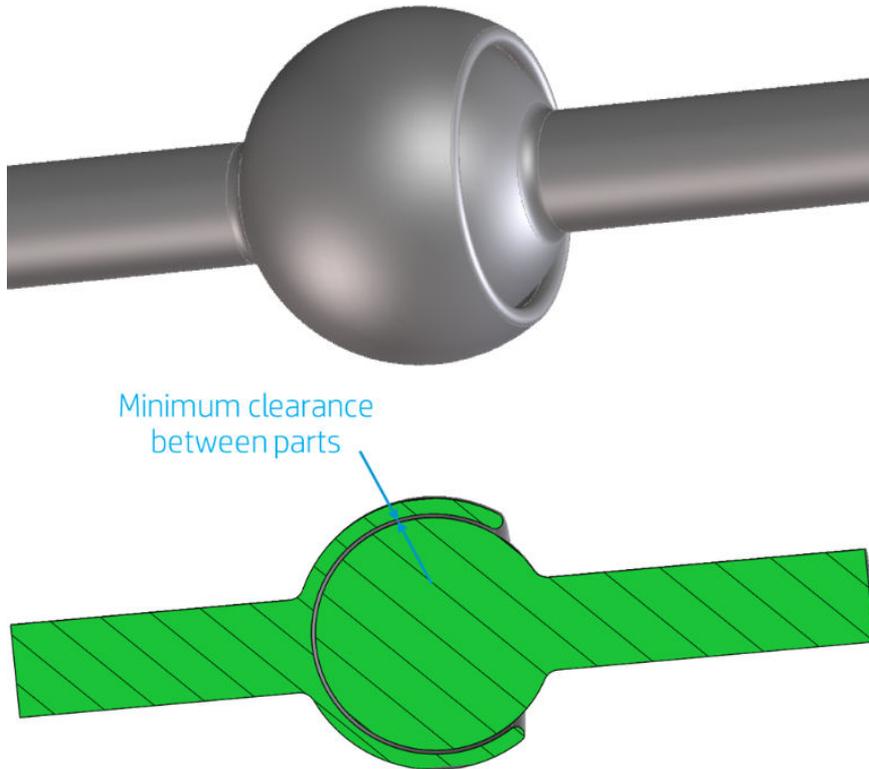
Very thick walls can accumulate heat and cause spot shrinkage in dense areas with an accumulation of material.

TIP: Hollow out the part as much as possible, saving agent and material, and reducing sink marks.

- **Minimum gap** between parts to be assembled after printing. Sometimes a pair of printed parts need to fit together for the final application. In these cases, HP recommends gaps of at least 0.5 mm (± 0.2 mm of tolerance of each part) between the interface areas that should fit together, in order to ensure correct assembly.

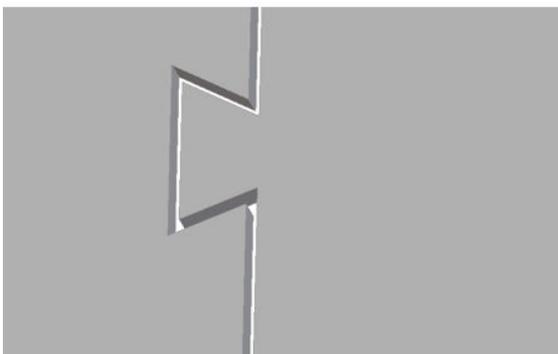


- **Minimum spacing and clearance** between parts printed as assemblies. Assembly parts that are printed together should have a minimum clearance of 0.7 mm. Parts with very thick walls above 50 mm should have a larger gap in order to ensure proper performance.



- **Hollow closed geometries.** Multi Jet Fusion is a process in which the parts are built by selectively fusing the desired areas of a material-based layer. If the parts printed are hollow, drain holes need to be added to the design to remove the material. The minimum recommended diameter of the holes is 5 mm. HP recommends including at least two holes.
- **Glue lines.** Parts larger than the maximum build size can be printed with Multi Jet Fusion by splitting them into different parts. They can then be joined together by glueing, welding, or by pin inserts.

If you plan to glue parts together, HP recommends including interlocking features such as those shown in the pictures below: as a guide to position the parts, to help them to bond together, and to facilitate the glueing process. Remember to leave an additional space of 0.2 mm between parts for the glue, in addition to the minimum spacing between parts printed as assemblies (see above).



- **Ducts.** To remove material from narrow ducts, consider designing and printing a strip or a chain through the duct. When the parts have been printed, you can pull out the chain to dislodge most of the material. Any remaining material can be removed by the normal cleaning process.



Saving and exporting files

After your files are designed and colored, your model needs to be tessellated, or converted into triangles, which are used by the printer to create layers. Tessellation occurs when you save or export your model file into specific file formats. The HP SmartStream 3D Build Manager accepts four different file formats:

- 3MF



NOTE: 3MF is the preferred file format for HP SmartStream 3D Build Manager.

- VRML 2 (.wrl)
- OBJ
- STL



NOTE: STL files do not carry color information. Use 3MF, VRML 2, or OBJ file formats for color models.

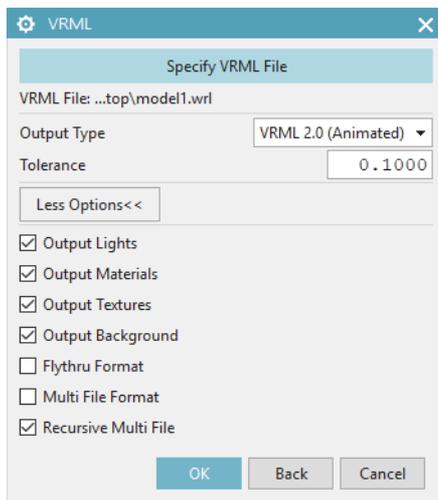
When saving or exporting your file, note that a normal file size for a model is about 1–200 MB, but the size depends on the type of software that created it, the number of triangles, the number and level of details, and so on. HP does not recommend working with files of more than 4 GB—beyond that size, the extra resolution in the file may have no effect on the printed part.

When exporting to STL, OBJ, or VRML 2 from a CAD package, you are often required to introduce some parameters such as angle tolerance and deviation chord height. These parameters define the resolution and file size of the part. The recommended parameters when exporting parts are an angle tolerance in the range 1–5 and a deviation chord height in the range 0.05–0.2. The angle tolerance should be reduced for parts with cylindrical or spherical shapes, and the chord height should be minimized for parts with fine details and small features.

Below, you will find some recommended export parameters/settings for common 3D modeling programs.

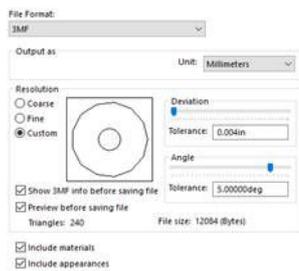
Siemens NX recommended export settings

Recommended export format: VRML (.wrl)



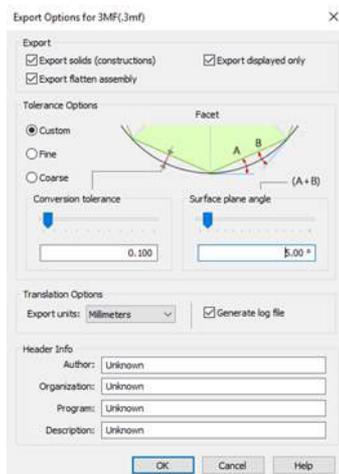
SolidWorks recommended export settings

Recommended export format: 3MF (.3mf)



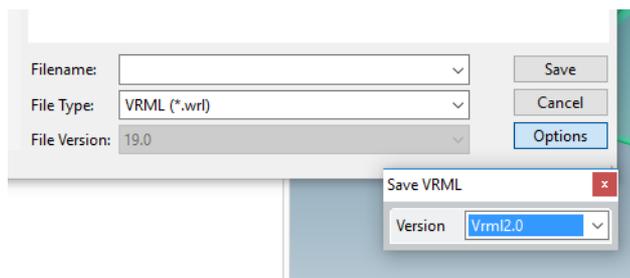
Solid Edge recommended export settings

Recommended export format: 3MF (.3mf)



Creo Elements recommended export settings

Recommended export format: VRML (.wrl)



Tessellation problems

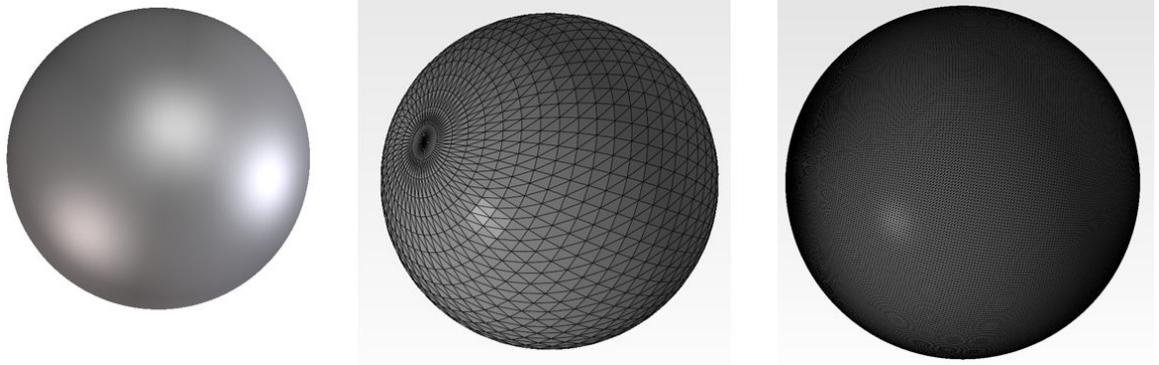
These are some common problems that you could experience during tessellation/exporting your files:

- Too many or too few triangles

Too many triangles are difficult to process and, when a certain size is reached, the extra triangles do not provide any further accuracy. For this reason, an excess of triangles could increase processing time for no benefit.

Triangulation of a surface causes faceting of the 3D model. The parameters used to output an STL model affect how much faceting occurs.

Example of tessellation



- Holes in triangles

STL models commonly suffer from surfaces that are not joined to their neighbors, and missing surfaces.

Repairing files

File-repairing software

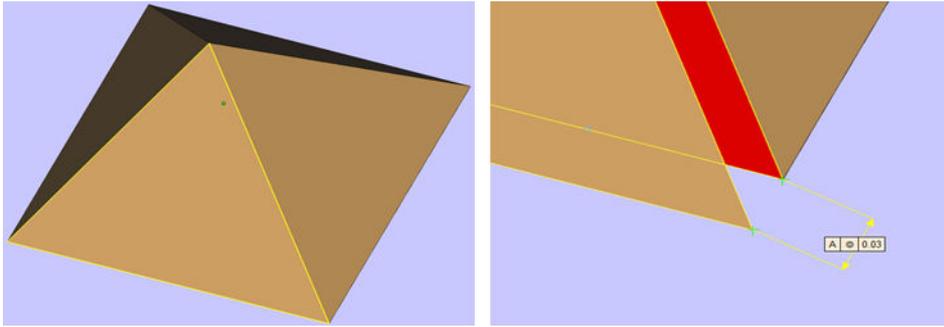
- Magics – Materialise
- Netfabb
- HP SmartStream 3D Build Manager

Common errors

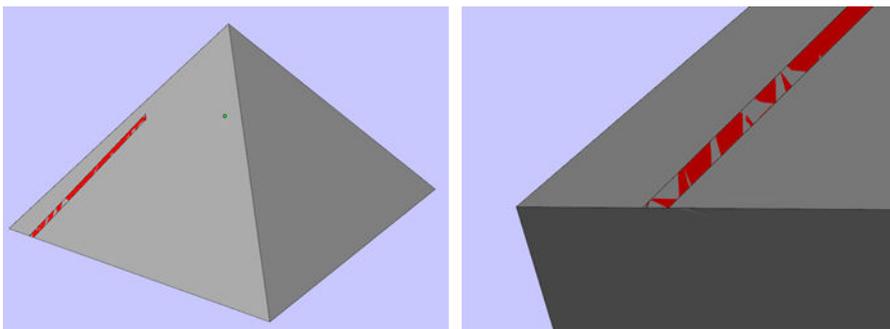
Some common errors that cause part-quality-related issues are illustrated below. They can be fixed in the native CAD software; or, if that is not available, in Magics, Netfabb, or HP Smartstream 3D Build Manager. If these files are not fixed before attempting to build the design, either the software will not allow you to proceed due to poor

file quality, or your part will not have good quality. Therefore, it is prudent to spend time at this stage to check that the CAD file designer produced a high-quality and printable design.

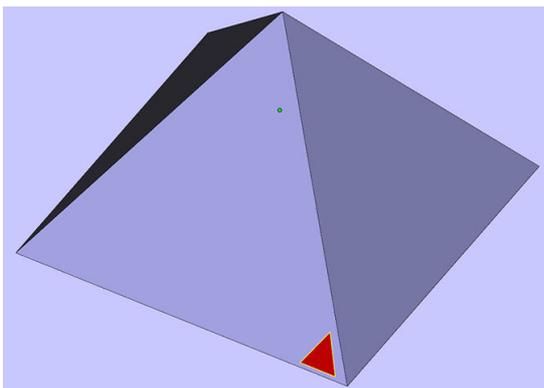
- Triangles not joined



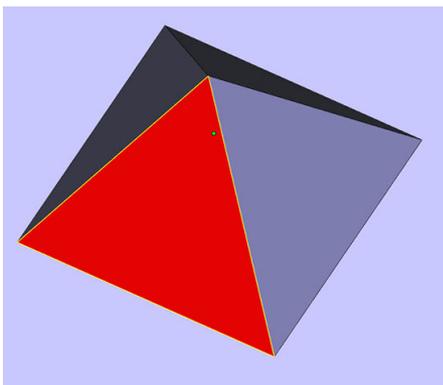
- Overlapping triangles



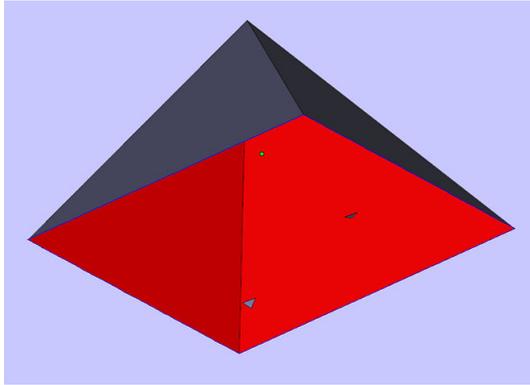
- Holes in parts



- Flipped-direction triangles



- Tiny shells



HP SmartStream 3D Build Manager

The HP SmartStream 3D Build Manager must be used to send jobs to print. Therefore, after files are exported, either from your CAD, graphic arts, or separate 3D build manager software, they must be brought into SmartStream 3D Build Manager.

 **NOTE:** For optimal dimensional accuracy, export parts separately instead of grouping them within one file.

The software preparation process may take from 15 minutes to 2 hours depending on the complexity of the job. It can be done while printing other jobs. Once ready, you can select the job to be printed from the job queue on the printer's front panel. If an error occurs while processing, a message appears on the front panel, and the printer cancels the job. To retry, you have to resubmit the job.

Other design considerations before printing

Contraction coefficient

The technology of the process produces a small contraction of the fused area in each layer. HP SmartStream 3D Build Manager already compensates for this contraction to ensure the best possible accuracy.

Orientation

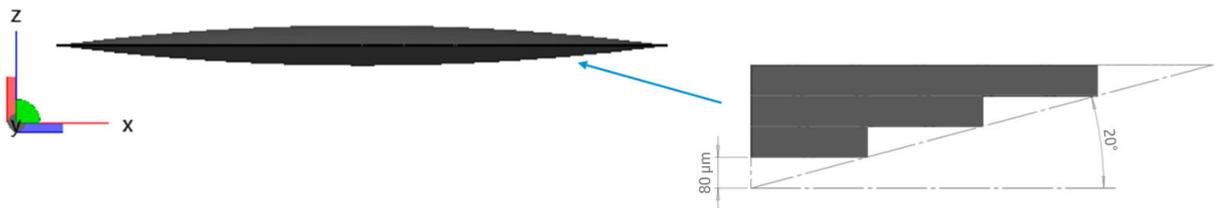
There are several considerations to be taken into account when the orientation of the part is defined:

- Aesthetics
- Accuracy
- Warp minimization
- Part strength

Aesthetics

Stepping is a phenomenon that appears when printing in any layer-based technology. Multi Jet Fusion is a layer-by-layer process and, in some cases, the layers that form the part can be detected in the finished part.

In order to avoid stepping with curved or sloped surfaces, avoid whenever possible positioning those surfaces with angles less than 20 degrees with the horizontal (XY plane).

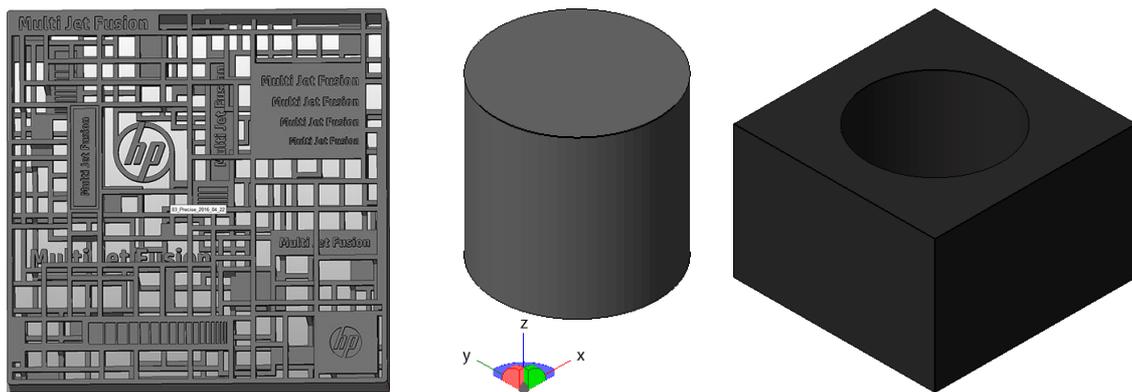


Smoothness is best achieved with surfaces that are upside down in the build chamber. If a part needs a particularly smooth surface (an exterior case, for example), it should be positioned upside down.

Accuracy of the part

The accuracy of the parts is better in the XY plane than in the Z direction. Features that require the highest resolution should be placed in the XY plane, and near the bottom center of the build chamber.

For example, cylindrical parts whose diameter is an important dimension should be oriented vertically whenever feasible.



Warp minimization

For best print quality and to minimize warping, long flat surfaces should be placed diagonally to the XY plane.

For critical parts, HP recommends placing them in the center of the bed to get the most uniform cooling.

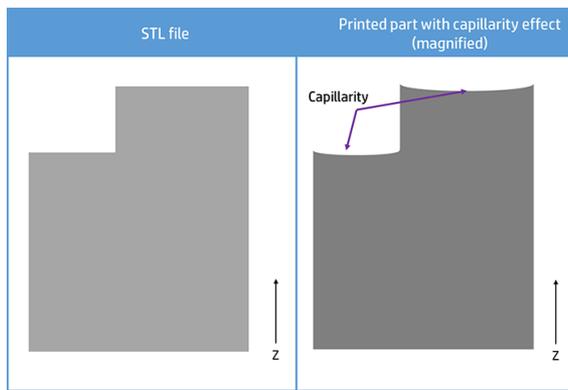
There are other design considerations that can be used to reduce warping, such as increasing the thickness of the part, or adding ribs in the areas that may be affected.

Part strength

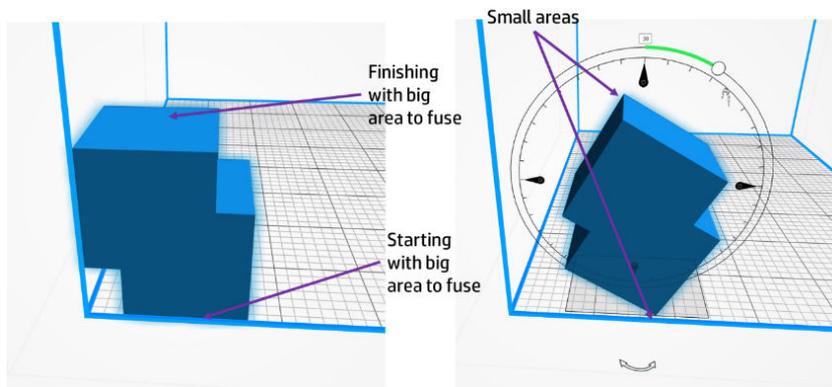
Because the printer uses a layer-based process, the highest fusing strength is achieved across a layer. For parts or features that require high strength, place them in the XY plane when possible.

Surface capillarity

This effect is intrinsic to technologies that rely on melting material to consolidate objects layer by layer. When an area is fused, it behaves as a fluid and tends to rise up along its borders (as does water inside a glass).



Thus, larger areas parallel to the XY plane are more prone to capillarity, and for them, HP recommends rotating the part to mitigate it.



Positioning of parts in the build chamber

If the part needs to be as accurate as possible, avoid positioning it near the sides of the chamber.

Solid and massive parts are best placed close to the center of the print bed.

 **TIP:** Hollow out the part as much as possible, saving agent and material.

The extraction process utilizes the series of holes in the platform surface; if these are covered during the extraction process, extraction is impeded.

Therefore, to optimize for extraction performance, avoid placing large, flat objects (such as a lunch tray) at the bottom of the print job. When this happens, the large flat part will come to rest on the platform and block most or all of the extraction holes. This will result in material being left in the build chamber after the end of extraction, and reduce material reclamation performance.

In addition, be careful not to position very delicate parts below large, dense parts. This could result in damage during the extraction process.

Repeatability

For maximum repeatability, try to keep the same printing conditions.

HP recommends maintaining the same software and machine-related settings until the end of your production run. This means printing the same .ssp pack of parts, using the same machine firmware, same print build mode, material, and so on. Once completed, perform the necessary maintenance and apply any new firmware upgrades that have become available.

Distance between parts in the build chamber

The distance between parts should be at least 5 mm for the best printer stability.

A good rule of thumb is to begin spacing your parts about 5 mm apart, with a 10 mm border from the walls. If you have a relatively large and heavy part, allow about 15 mm of space around it, to permit better heat dissipation.

Printing a part for final production

If a part is being made for final production, first try a small job with the part printed in different orientations, so that you can select the best one(s) to use for volume production.

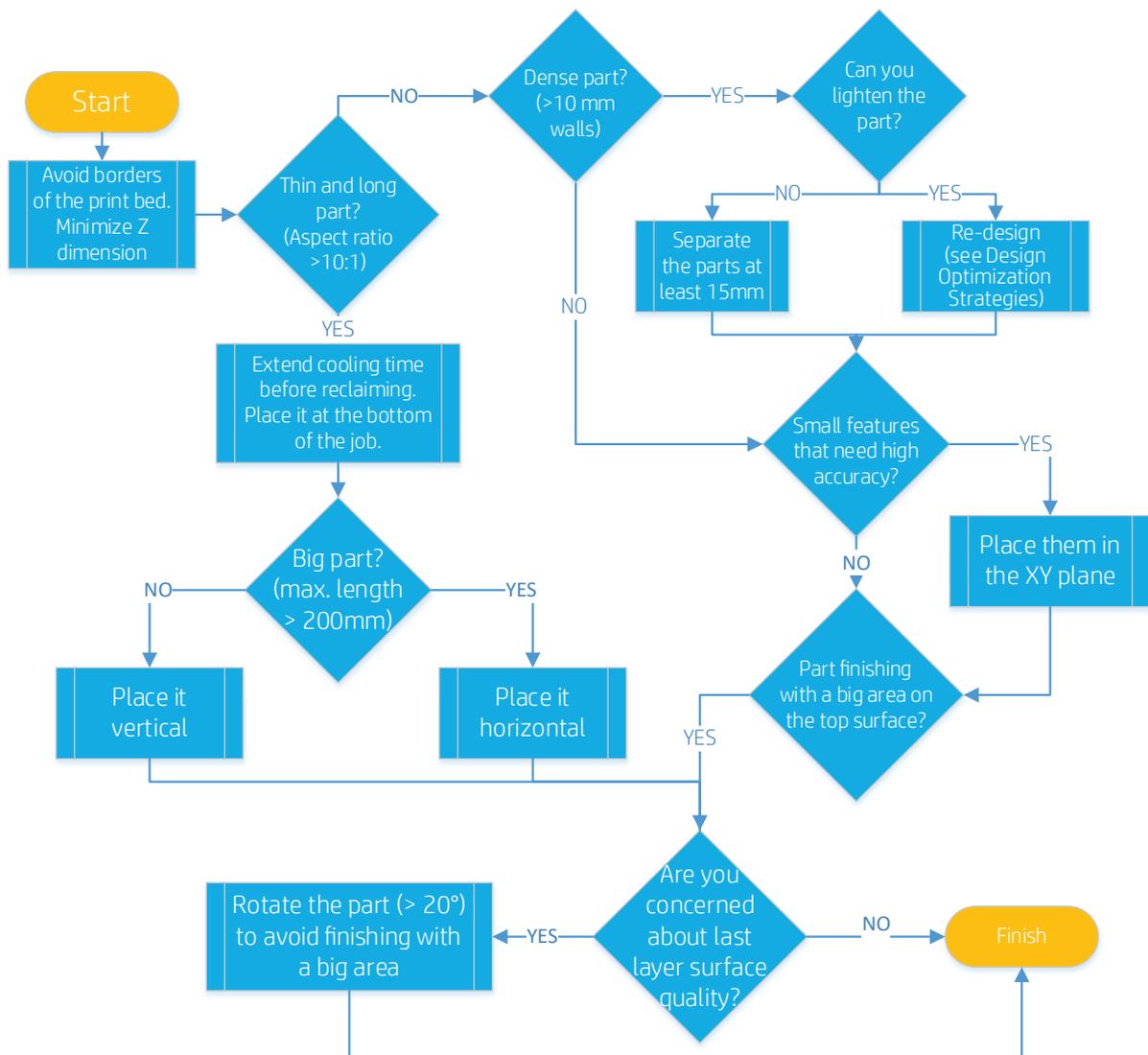
For the highest consistency, ensure that the packing density of the final job is similar to that of the test job.

Orientation flowcharts

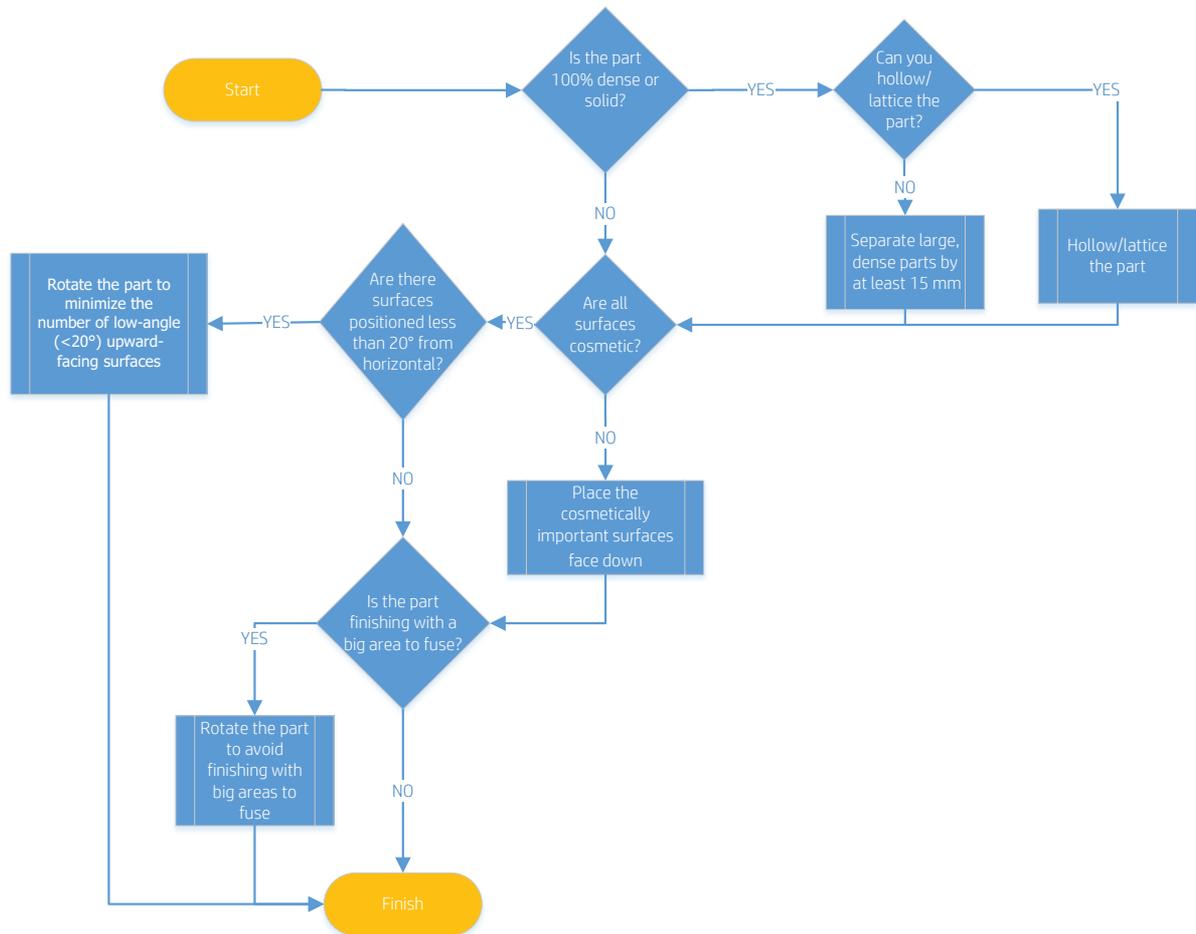
The best orientation of a part in the build chamber depends to a great extent on the final use of the part and the properties that you want to optimize. The main attributes that can be optimized are mechanical properties of certain areas, dimensional accuracy of specific features, and the look and feel of the part.

Depending on your objectives, HP recommends the following workflows.

Optimize accuracy

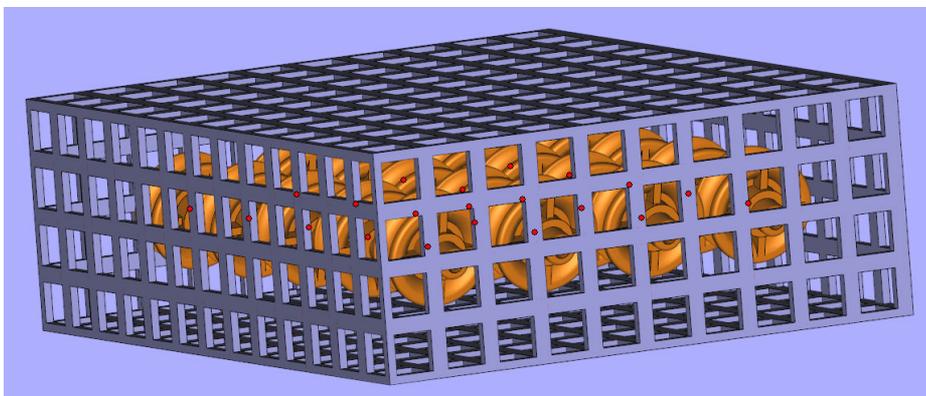


Optimize look and feel



Generating a sinter box

Small or delicate parts can be protected by generating a sinter box or cage. Some software, including HP SmartStream 3D Build Manager, can automatically generate one. It also helps in tracking, as names or QR codes can be added with all the information about the parts.



When generating a sinter box, the recommended parameters are:

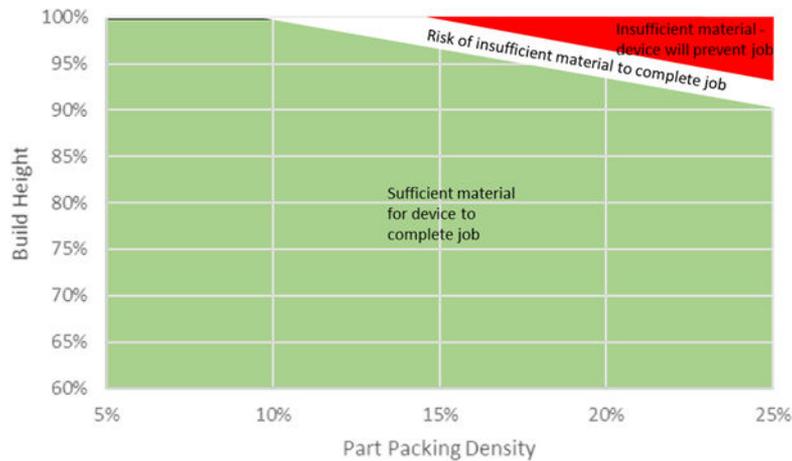
- Bar thickness: 0.8 mm
- Bar width: 1.2 mm

- Grid size: 10 mm (this should be at least double the bar width)
- Cage padding: 1.2 mm (this is the space between parts and the cage, and should be at least as much as the bar width)

 **NOTE:** The smaller the grid size or larger the bar size, the harder it will be to extract material from it.

Printer capacity

The front panel will prompt you to add material during printer preparation when additional material is needed to ensure job completion. However, the system has limitations even at maximum material availability. The chart below provides guidance to help you design jobs that will have a high chance of success. In most cases, the printer will refuse to print a job if it may be at risk of insufficient material.



7 Send a job

Use appropriate software to send the job to the printer, such as the HP SmartStream 3D Build Manager (see the *HP SmartStream 3D Build Manager User Guide*).

Before printing any job, the printer performs various checks. See [Job preparation list on page 44](#).

8 Select a job

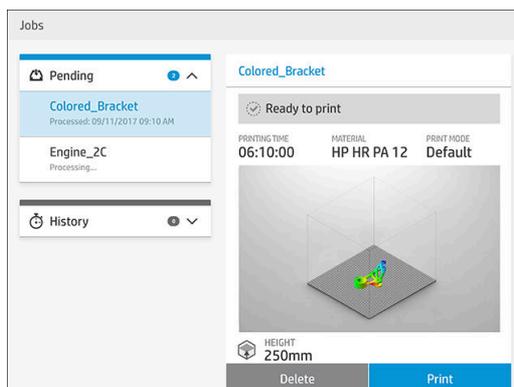
Job list app

The job list app in the printer's front panel displays the status of all jobs. Possible statuses are:

- **Waiting to process**
- **Processing**
- **Processed:** The job is ready to be sent for printing. Either it has never been printed, or it is ready for reprinting.
- **Sent to print:** The job has started printing.

Select a job to be printed

1. Tap **Jobs** on the home screen.



2. Select the processed job and tap **Print**.
3. The printer checks that all subsystems and supplies are ready to complete the build (see [Job preparation list on page 44](#)). If your attention is needed, the printer notifies and advises you: a notification appears in the job details with an accessible summary of any issues. To print the job, address any issues on the list by following the front-panel instructions. Once you have completed all the tasks on the list, the printer will run a second check to ensure it is ready to print the job. If there are any additional issues, the front panel will again provide instructions.
4. The printer starts the printing process. Wait until the printer tells you that the process is complete.

9 Printer preparation

- [Job preparation list](#)
- [Agents](#)
- [Material](#)
 - [Material cartridges](#)
 - [Replace a material cartridge](#)
 - [Maintain the cartridges](#)
 - [Store the cartridges](#)
- [Distilled or deionized water](#)
- [How to recycle consumables and printed parts](#)

Job preparation list

Before printing, the printer performs some checks to ensure that it is ready to print the whole build. These include the following checks:

- Printer clean (see [Clean the print area on page 71](#))
- Job compatible with device
- Printhead ready (see [Align the printheads on page 110](#))
- Cloud connected (see [Printer networking on page 23](#))
- Enough agent (see [Agents on page 44](#))
- Enough material (see [Material on page 47](#))
- Enough water in the distilled water tank (see [Distilled or deionized water on page 50](#))
- Printhead cleaning roll ready (see [Replace the cleaning roll on page 88](#))
- Filters ready (see [Maintenance on page 65](#))
- Lamp clean
- Doors closed

If the printer finds any problem, it may ask you to contact your support representative for assistance.

Agents

The printer uses three types of agents: detailing, fusing, and bright fusing agents.

Please note:

- This is a dynamic security-enabled printer. Cartridges using a non-HP chip will not work. For more information, see <http://www.hp.com/go/learnaboutsupplies>.
- This printer is not designed to use continuous agent systems. To print successfully, remove any continuous agent system and install genuine HP cartridges.
- This printer is designed for agent cartridges to be used until they are empty. Refilling cartridges prior to depletion could cause your printer to fail. If this happens, insert a new cartridge to continue printing.

Status

At the printer's front panel, tap , then **Agents**, then tap any agent to see its status:

- **Check pending:** The cartridge is present, but has not yet been checked. The agent door must be closed before the cartridge can be checked.
- **Checking:** The cartridge is being checked.
- **Not present:** The cartridge is not present (this is not an error status).
- **Missing cartridge:** The cartridge is not present while you are trying to perform an action or workflow that requires a cartridge, such as a build (this is an error status).
- **Out of agent:** The agent should be replaced.
- **Incompatible cartridge:** The cartridge is incompatible with the slot it was inserted into (for example, yellow cartridge in black slot).

- **Incompatible cartridge region:** Cartridges work only in specific regions of the world, for world trade and regulation reasons. This status appears if the agent and the printer are registered for different regions.
- **Reseat required:** The agent is not seated properly; try removing and reinserting it.
- **Replacement required:** The agent is faulty and should be replaced.
- **Very low agent:** The agent intermediate tank is very low and the cartridge is empty.
- **Low agent:** The agent intermediate tank is low and the cartridge is empty.
- **Expired agent:** The agent has reached its expiration date. Using expired agents may affect the warranty on your printheads.
- **Ready:** The cartridge is ready.
- **Altered cartridge:** The cartridge is unknown or altered.
- **Non-HP agent detected:** The cartridge contains non-HP agent.

 **NOTE:** The level of each agent shown on the front panel is an estimate.

LEDs

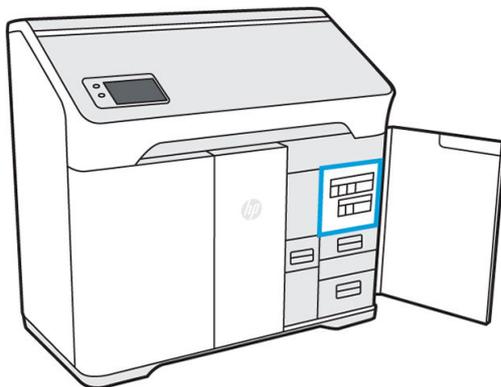
- **White:** If the light is on, the cartridge is empty and needs to be replaced.

Replace an agent

 **NOTE:** Printer processes may be stopped while any doors are open.

 **NOTE:** If you remove a cartridge from the printer for any reason, try to replace it again as soon as possible. Do not open or unpackage cartridges until you are ready to install them.

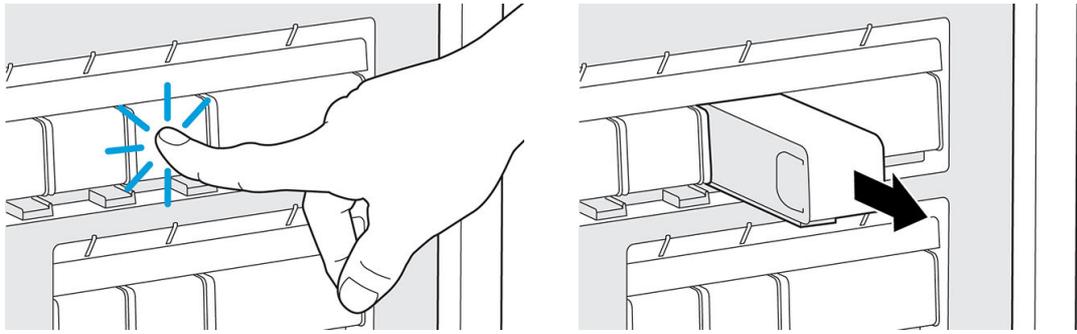
1. At the printer's front panel, tap , then **Agents > Replace**.
2. Open the agent door.



3. Locate the agent to be replaced. You can see which agent needs to be replaced on the front panel; it is also indicated by a white LED above the cartridge.

 **NOTE:** More than one cartridge can be replaced at a time.

4. Press the agent to release and remove it; you should hear a click as you remove it.

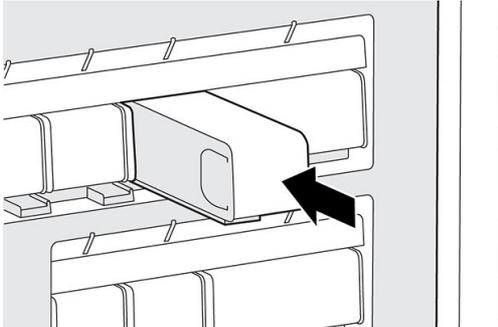


5. Old agent cartridges can be recycled through HP's Planet Partners Program, where available. Visit <http://www.hp.com/recycle/> for more information. Where the program is not available, dispose of the cartridges according to local regulations.
6. Follow the instructions on the new agent cartridge to prepare it for installation.

 **CAUTION:** Do not touch the metal contacts on the cartridge. Fingerprints on the contacts can cause connection errors.



7. Insert the new agent cartridge until you hear a click.



8. Close the agent door.
9. Tap **Finish** and **Check** on the front panel.

 **TIP:** If the new agent fails to work, see [Agent troubleshooting on page 62](#).

Material

The printer uses a mixture of fresh and reusable material—the configuration for PA12 material is 20% fresh, 80% reusable. The reusable material slot serves two functions:

- Adding reusable material. You may be prompted to put more reusable material into the machine if there is not enough to maintain the mix ratio and meet the requirements of the job; the front panel will walk you through installing a reused material supply.
- Removing excess reusable material. You may be prompted to remove reusable material if there is not enough space to hold all reusable material that the job will generate; the front panel will walk you through installing an empty or partial supply to accommodate the excess material.

Material states

- **Fresh:** New, unused material.
- **Reusable:** Material that the printer has reclaimed from previous jobs, which may be reused for future jobs.
- **Waste material:** Used material that will not be reused.
- **Mix ratio:** A mixture of fresh and reclaimed material.
- **Empty:** Empty cartridges should be stored and used to reclaim material.

Material cartridges

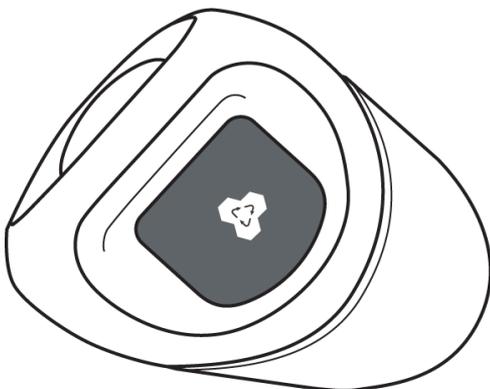
The material cartridges dispense the material in the printer. Each material cartridge has a capacity of 10 liters. The printer will not accept cartridges that have been modified or tampered with. See the material list for ordering information.

There are two material cartridge slots, one for fresh material (on the left) and the other for reusable material (on the right).

Any time you remove an empty cartridge from the fresh slot, be sure to peel off the fresh material label to reveal the reusable material label underneath. This cartridge can now be filled with reusable material and used in the reusable material slot.

Both fresh and reusable cartridges must be installed in order to print.

 **NOTE:** Waste material that has not been automatically reclaimed should not be reintroduced into the system: it could cause print-quality issues.



You can store empty, partially full, or full reusable cartridges for later use.

Do not throw away the blue material cartridge cap. Storage for the caps is provided on the interior of the material door. Any time you remove a material cartridge from the printer, be sure to put the cap back on.

Special care must be taken to avoid personal injury when handling heavy cartridges.

10 liter cartridges

Material	Total cartridge weight (kg)	Net weight of material (kg)
HP 3D HR CB PA 12 10L	5	4

Replace a material cartridge

A cartridge should be removed and replaced when indicated in the front panel, and by the wayfinding LED above or below the cartridge.

CAUTION: Cartridge removal must be initiated from the front panel. The cartridges are physically latched to the printer; do not try to pull them out without using the front panel.

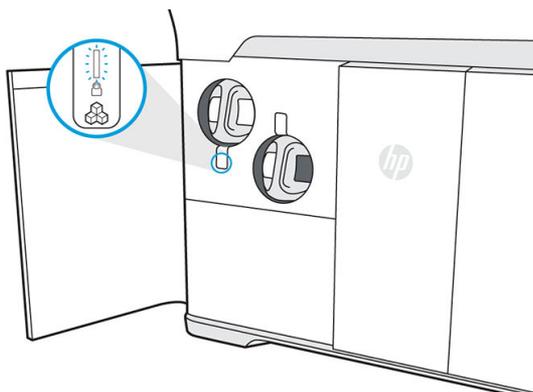
CAUTION: Depending on the material, a cartridge may be sensitive to temperature, humidity, or other factors. Using cartridges under uncontrolled conditions can affect the functionality of the printer or severely damage it.

LEDs

- **Wayfinding:** The wayfinding LED is in the form of a vertical line; it is located below the fresh material slot and above the reusable material slot. If the LED is on, the cartridge needs to be replaced.
- **Lock icon:** The lock icon LED is located beside the wayfinding LED for each material slot. If the LED is on, the cartridge is locked in place. To remove a cartridge, you must first unlock it, using the **Supplies** tab.

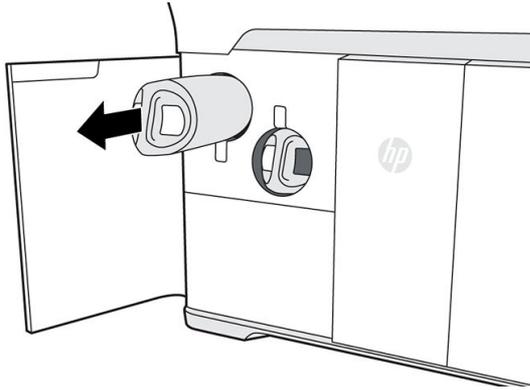
Cartridge replacement

1. At the front panel, tap , then **Material** > **Fresh material** or **Reused material** > **Replace**.
2. Open the material door. You will see a white LED in the form of a vertical line above or below the cartridge that needs to be replaced.

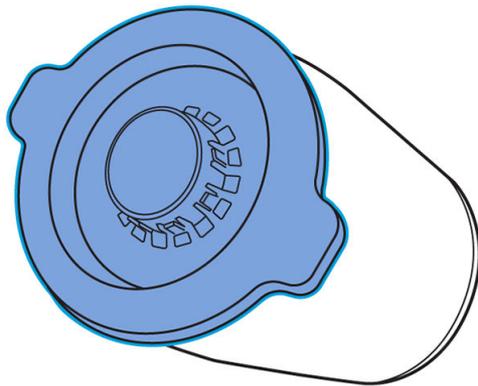


3. Pull the handle straight out to remove the cartridge from the slot.

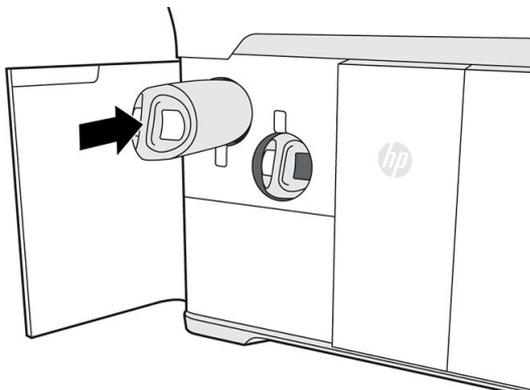
 **NOTE:** Each cartridge weighs 1 kg (2.2 lb) empty and 5 kg (11 lb) full.



4. Reattach the cap before storing the cartridge.
5. Remove the cap from the packaging of the new cartridge.



6. Insert the new cartridge into the slot until the lock icon turns on. There is no need to rotate it: just push it straight in.



7. Close the material door.
8. Tap **Finish and check** on the front panel.

Maintain the cartridges

Before use, the material must acclimatize to the environmental conditions of the room for at least two days.

During the normal lifetime of a cartridge, no specific maintenance is required. However, to maintain the highest quality, replace a cartridge when it reaches its expiration date. An alert on the front panel notifies you when any cartridge reaches its expiration date.

Store the cartridges

Cartridges should be stored according to cartridge specifications. Before use, a cartridge should be kept at the printer's environmental conditions for at least 2 days.

⚠ CAUTION: HP recommends storing only capped cartridges. Storing an opened cartridge containing material can render the material unusable and cause safety hazards, such as a cloud of material if dropped. Depending on the material, it can be sensitive to temperature, humidity, or other factors. Using cartridges under uncontrolled conditions can affect the functionality of the printer or severely damage it. Placing the cap back on the cartridge is necessary for storage to prevent material from spilling; if excess material is lost, the cartridge may not be recognized by the printer because it is considered to have been tampered with.

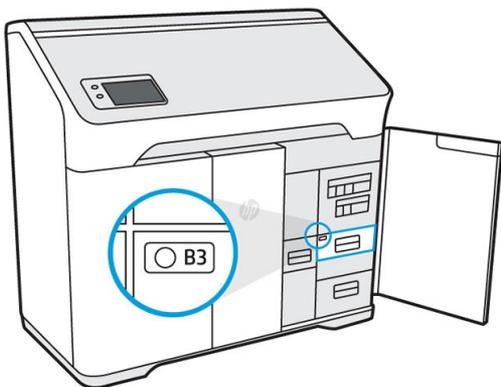
Distilled or deionized water

Refill the water tank

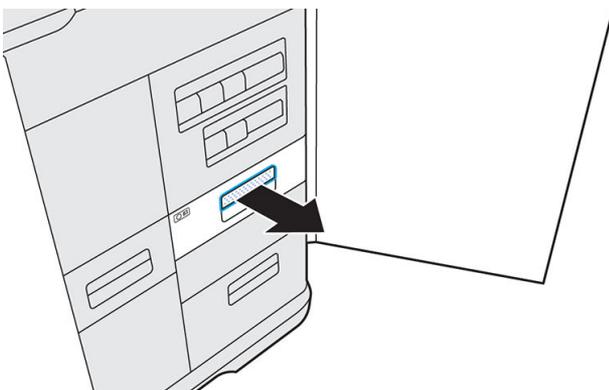
Refill the water tank when prompted by the front panel. Printing cannot start until there is sufficient water to complete the job.

⚠ CAUTION: Never use tap water.

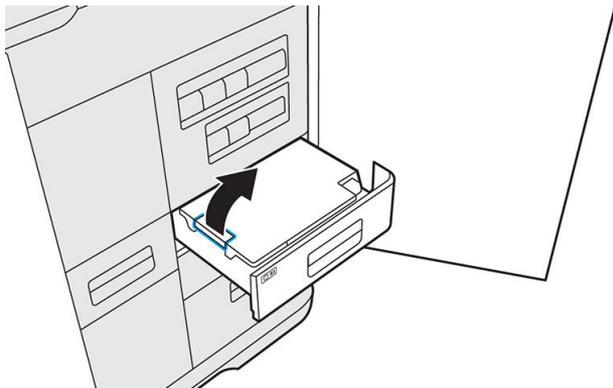
1. Open the agent door.



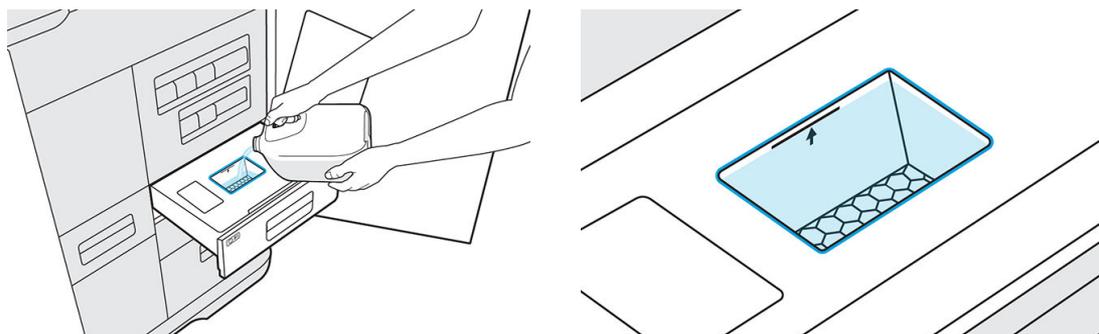
2. Open the water tank drawer.



3. Open the tank cover.

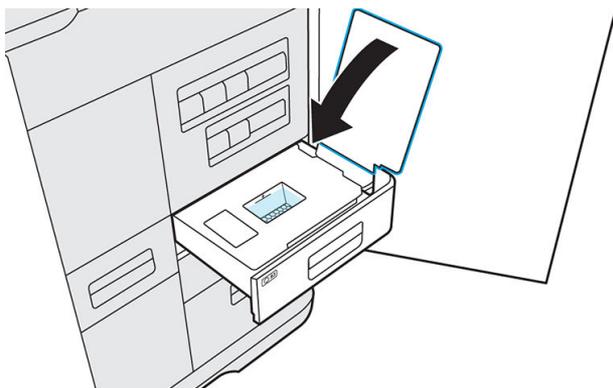


4. Add distilled or deionized water to the tank until it reaches the full line.

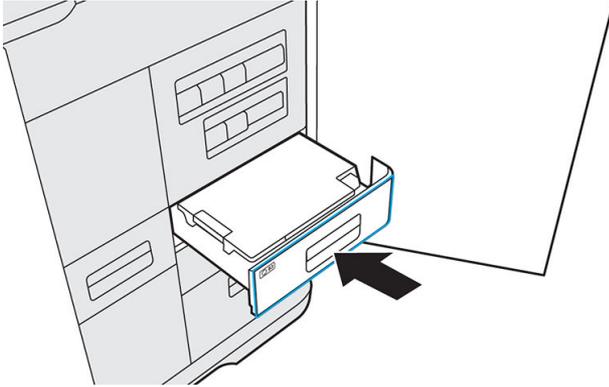


5. Wipe up any excess water or splashes with a clean cloth or towel before closing the cover.

6. Close the tank cover.



7. Close the water tank drawer.



8. Close the agent door to clear the low water message and continue printing.

How to recycle consumables and printed parts

NOTICE: Parts and waste generated during the printing process should be disposed of in compliance with federal, state, and local regulations. Consult your local authorities to determine the correct manner in which to dispose of waste. Also check with your local plastics recycler, as some printed parts may be appropriate for municipal recycling streams. Where appropriate, HP recommends that the parts be marked with the applicable plastic marking code according to ISO 11469 to encourage recycling.

HP provides many free and convenient ways to recycle your used HP hardware, cartridges, and other consumables. For information about these HP programs, see <http://www.hp.com/recycle/>.

The following consumables for your printer can be recycled through HP's Planet Partners Program, where available:

- Agent cartridges
- Lamps

Empty material cartridges can be recycled through commonly available recycling programs.

Dispose of the following supplies in compliance with federal, state, and local regulations:

- Full or partially full material cartridges
- Printhead cleaning roll
- Filters
- Printheads

HP recommends that you wear gloves while handling printer supplies.

10 Print

- [Indemnity to HP for 3D parts printed by the printer](#)
- [Cancel a job](#)
- [Check status on the front panel](#)
- [Check status remotely](#)
- [Possible errors while printing](#)

Indemnity to HP for 3D parts printed by the printer

The customer assumes all risk relating to or arising from the 3D printed parts. HP shall have no responsibility for any loss or damage caused by the 3D printed parts.

The customer shall defend, indemnify, and hold harmless HP from all third-party claims, losses, liabilities, costs, damages, judgments, awards, expenses (including but not limited to attorney's fees, expert witness fees, and bonds) arising out of the customer's or its customers and/or partners or end user's use, operation, distribution, sale, marketing, or possession of the 3D printed parts. HP shall provide prompt notification of the claim and cooperation with the defense.

Notwithstanding anything to the contrary contained herein or otherwise communicated to the customer, the customer is solely responsible for the evaluation of and determination of the suitability and compliance with applicable regulations of the products and/or 3D printed parts for any use, especially for uses (including but not limited to medical, dental, food contact, automotive, aerospace, heavy industry, and consumer products) that are regulated by US, EU, and other applicable governments. "3D printed parts" means any output or parts created, developed, and/or produced by the customer or its customers, partners, and/or other end-users from use of the products.

Cancel a job

If you need to cancel the job while printing, tap **Cancel print** and confirm it in the build status app on the printer's home screen. The printer will cancel the job immediately.

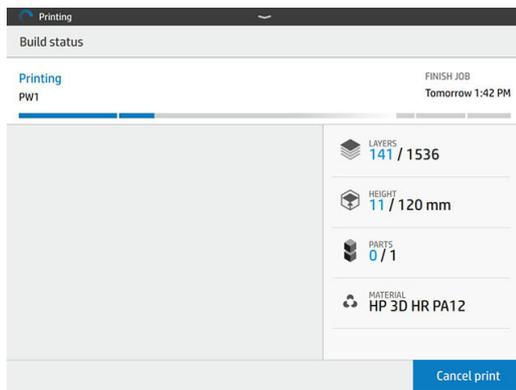
Depending on the state the job is in when it is canceled, the printer may need to cool to a safe temperature before unlocking the top lid and allowing access to the print area.

Proceed with cooling, retrieval, and material conditioning if relevant.

Check status on the front panel

At the printer's front panel, the build status app on the home screen shows you the status of the build currently being printed.

- Status of the job: A progress bar shows the whole printing process. The phases are warming up, printing, annealing, cooling, and reclaiming material.
- Estimated finishing time
- Job name
- Layers printed and layers in total
- Parts printed and parts in total
- Height printed and total height
- Material type



You can select an isometric, section, or temperature view of the current layer, and you can navigate through layers.

Check status remotely

You can check the job status from the Command Center. See [HP SmartStream 3D Command Center on page 19](#).

Select the view area to show the tabs, swipe in the view area to move between views.

Possible errors while printing

- Print failed
- Cooling failed
- Annealing failed

 **IMPORTANT:** If the air intake filter door is open while printing, the process will be cut automatically.

In the event of an error, the printer cancels the job immediately.

Proceed with retrieval if relevant.

 **NOTE:** The printer needs to cool down before unlocking.

11 Cooling and part retrieval

Parts are ready for retrieval after the cooling and reclamation process; although part retrieval is possible as soon as safe cooling is complete.

After cooling, reclamation starts automatically, unless you have previously turned it off for that job, or chosen to skip it. If you skip it, you will have to wait until the end of the cooling process to open the top cover.

During reclamation, material is sent to the bottom by platform vibration and vacuuming, so that the material can be reclaimed for reuse.

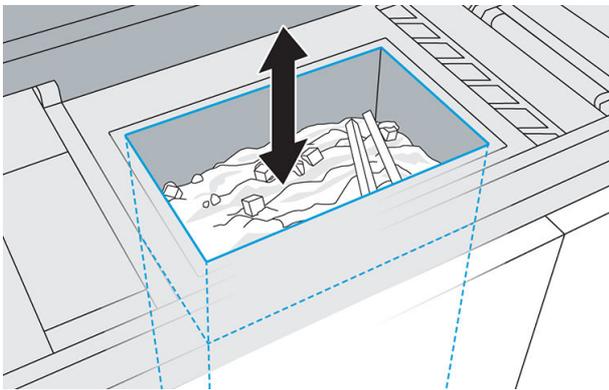
When reclamation has finished, the front panel tells you that parts are ready for retrieval.

However, the printer automatically starts conditioning the reusable material, during which the top cover remains locked. You can cancel material conditioning if you are in a hurry to retrieve parts, but then it will happen at the beginning of the next job.

 **NOTE:** All doors, and the top cover, must be closed before material conditioning starts.

Part retrieval

1. Tap **Retrieve parts** or **Finish build** in the build status app.
2. Open the top cover.
3. Use the up and down buttons to raise or lower the platform to make the part retrieval process more convenient.



 **CAUTION:** Tall, vertically-oriented parts could fall over and become wedged while the platform is being raised. If this happens, stop and rearrange parts before continuing to raise the platform.

CAUTION: Wear safety gloves. The parts may be hot.

4. For optimal part quality, remove each part with all attached material. Do not allow any excess material to fall back into the build chamber.

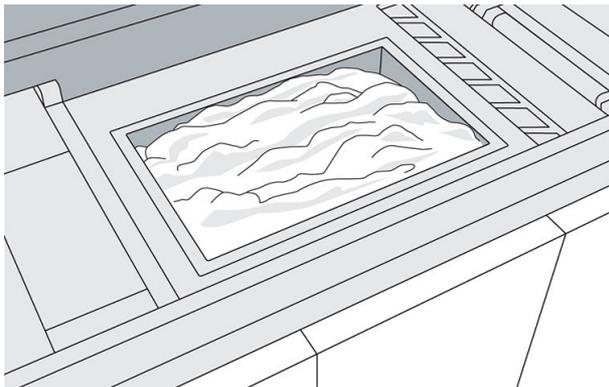
The examples below show a part with attached material when removed from the build chamber, and the same part after bead blasting.



⚠ CAUTION: Do not brush or forcibly scrape loose material attached to the parts back into the build chamber.

5. Continue until all parts are retrieved from the build chamber. Use the buttons to lift the platform to reach all parts.
6. Once the parts are outside the build chamber, HP recommends removing excess material remaining on parts with your hands or a brush before bead blasting. This will preserve the color of the final parts as well as the lifespan of bead-blaster filters and glass beads. After cleaning the part, dispose of the excess material.
7. As material may remain on the platform, you can start the optional reclamation by tapping the **Reclaim material** button and closing the top cover.

📝 NOTE: All doors, and the top cover, must be closed before starting to reclaim material.



You can choose the 5 minute or 15 minute reclamation mode depending on the remaining material.

⚠ CAUTION: Do not reclaim material that has been fused.

Once the front panel tells you that the process has finished, you may want to check whether all material has been reclaimed. To remove any remaining material, you can reclaim material as many times as needed or use an external explosion-protected vacuum cleaner.

📝 NOTE: Some material may remain at the edges or frame of the platform.

8. With all parts clean and excess material reclaimed, resume normal printing.

Fall of material from the top cover

If you find that a significant amount of material falls from the top cover when you open it after a build, try the following procedure:

1. Tap along the front of the top cover before opening it.
2. Slowly open the top cover about 25 cm (10 in), and use an explosion-protected vacuum cleaner with a soft-brush nozzle to remove material from the edge of the cover.
3. Continue opening the cover slowly, without releasing it, until it is fully open.
4. Vacuum the interior surface of the cover to remove any remaining material.

12 Post-processing

Once parts have been retrieved from the printer, they should be cleaned of excess material. HP recommends removing loose excess material and large clumps of material from each part before bead blasting. This will preserve the color of the final parts as well as the lifespan of bead-blaster filters and glass beads. After this loose material is removed, the remaining material will have to be removed in a bead- and air-blast machine. All parts should be bead blasted (first) and air blasted (second).

- Bead blasting consists of applying compressed air mixed with an abrasive material (HP recommends glass beads) to the part in order to remove the attached material.
- Air blasting consists of applying compressed air to the part in order to remove any material remaining after bead blasting.

The following options are available to improve surface finishing:

- Tumbling: The part is immersed in a vibro-tumbler full of abrasives, to smooth any surface roughness.
- Hand sanding: The surfaces of the part are smoothed by abrasion with sandpaper.

The following options are available for color-related finishing:

- Dyeing: The part is immersed in a controlled dyeing bath. All details and cavities of the part can be reached.
- Painting: The part is painted with a spray can, spray gun, or brush. For specific color finishing, HP recommends applying a primer before painting the part. Repeat the process several times for optimal results.

Other industry-standard postprocessing methods may be used:

- Coatings for wear resistance, conductivity, temperature resistance, strength, watertightness, resistance to chemicals, gloss properties, and so on
- Gluing, bonding, sealing
- Drilling, tapping
- Plating

Contact your service representative to discuss solutions for your specific needs.

Consult your usual EHS specialist for advice on the appropriate measures for your location depending on the post-processing method you use. Consult your local authorities to determine the correct manner in which to dispose of wastes.

13 Troubleshooting

- [Network troubleshooting](#)
- [Start-up issues](#)
- [Power-on issues](#)
- [Agent troubleshooting](#)
- [Material cartridge troubleshooting](#)
- [Printhead health troubleshooting](#)
- [How to get the diagnostic package](#)

Network troubleshooting

Link issues

The printer has status lights (LEDs) beside the network connector that indicate the link status and network activity.

- When the green light is on, the printer has successfully linked to the network.
- When the yellow light is blinking, there is transmission activity over the network.

If the printer fails to connect to the network, both LEDs will be off. In this situation, try the following steps:

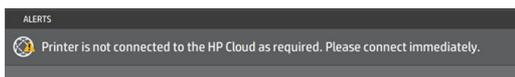
1. Check the cable connections at both ends.
2. Consider replacing the cables with ones that are known to work.
3. Consider switching to another network connector in the network switch, hub, or device to which the printer is connected.
4. Manually configure the link setting to match the port configuration of the network hub or switch.
5. In case of doubt or misconfiguration of link settings, reset the network parameters to their factory settings.

Restore factory settings

In the case of accidental misconfiguration, you can reset the network settings to the factory defaults by tapping **Restore factory settings** in the Network Settings configuration menu.

Network connectivity

If your printer detects that it is not connected to the HP Cloud via HP SmartStream 3D Command Center, a warning will appear on the front panel.



If this problem persists, you may be unable to send new jobs to print. Please run the diagnostics explained in the network troubleshooting guide. If you cannot find this guide, contact your support representative.

For more guidance about checking your network connection, see the site preparation guide.

Start-up issues

The printer has three status lights (LEDs) beside the network connector that indicate the start-up status.

These LEDs can help the remote support agent to understand potential root causes in case the printer fails to start up.

The LEDs are arranged vertically.



If the printer fails to start up and announce itself as Ready, and the front panel is unresponsive, call your support representative and describe the status of these three LEDs.

Power-on issues

The printer has three status lights (LEDs) beside the power-cord panel that indicate the start-up status.

These LEDs can help the remote support agent to understand potential root causes in case the printer fails to power on.

The LEDs are arranged vertically.



If the printer fails to power on, and the front panel is blank, call your support representative and describe the status of these three LEDs.

Agent troubleshooting

1. Check that the agent is designed for your printer.
2. Use the correct procedure to change agents, through the front panel.
3. Check that there is no obstruction in the agent slot.
4. Check that the agent is of the correct type.
5. Check that the agent is correctly oriented (compare with another agent).
6. Ensure that you have inserted the agent correctly and fully, and that it is latched. You should hear a click.
7. If the problem still remains, call your support representative.

Material cartridge troubleshooting

1. Check that the cartridge is designed for your printer.
2. Check that the cartridge contains the correct type of material and that it matches the slot type (fresh or reusable material).
3. Use the correct procedure to change cartridges, through the front panel.
4. Check that you have removed the cartridge cap.
5. Check that there is no obstruction in the cartridge connector in the slot.
6. Check that the cartridge is correctly oriented (compare with another cartridge). The flat side should be facing down when inserting the cartridge into the printer.
7. Ensure that you have inserted the cartridge correctly and fully. You should hear a click.
8. If the problem still remains, call your support representative.

Printhead health troubleshooting

Recover (clean) the printheads

The printer can try to recover the use of a malfunctioning printhead by cleaning it.

1. At the front panel, tap , then **Part quality troubleshooting** > **Printhead recovery 1**.
2. Tap **Print quality diagnostic** to check the printhead.
3. If the recovery is not completely successful, you can try **Printhead recovery 2**.

Printhead alignment issues

- Alignment issues. If you notice alignment issues, you can print the quality diagnostic plot under **Maintenance** menu > **Part troubleshooting** > **Print quality diagnostic** to check the status of the printhead alignment. See [Align the printheads on page 110](#).
- The front panel may display a system error while aligning the printheads. See [System errors on page 131](#).

How to get the diagnostic package

If you need the help of HP support, you may need to send the diagnostic package by email or through the Expert Now application. There are two ways to get the diagnostic package.

 **NOTE:** Try to avoid downloading the diagnostic package while the printer is working, which could cause printing failures.

With a USB flash drive

1. Restart or rearm the printer to confirm the problem.
2. Collect the printer logs and escalate the problem for troubleshooting assistance. Also collect general information about what the printer was doing at the time when the problem occurred.
3. Prepare a USB flash drive with a file named **pdipu_enable.log** in the root folder. Ensure that the flash drive has at least 20 MB of free storage capacity.
4. Plug the flash drive into the USB port behind the front panel. The printer logs should then be automatically stored on the flash drive.

 **NOTE:** These files are encrypted; they may be needed for problem analysis.

5. Escalate this problem to Level 2 for advanced troubleshooting assistance.

Through the Command Center

1. Open Command Center.
2. Click **Save diagnostic package**.

hp SmartStream 3D Command Center

Finish all
14:25
Today

Qual 411
Printhead alignment required

Build status Builds Supplies **About**



Qual 411

HP Jet Fusion 580 Color 3D Printer

SERIAL NUMBER: SG81852411
PRODUCT NUMBER: M2K85A

Firmware information

VERSION: 15_18_27.9
PUBLISHED DATE: 13 Jul 18 21:58:00

[Save service info](#)

[Save diagnostic package](#)

[Certificate of Installation](#)

To be filled in after installation.

Help and support

[User guides](#)

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14 Maintenance

⚠ WARNING! Hardware maintenance may be performed by trained personnel only. During printer installation, the designated personnel receive training for safe operation and maintenance of the printer. No-one should use the printer without this training.

- [Safety precautions](#)
- [Maintenance resources](#)
 - [Maintenance kits](#)
 - [Kit contents](#)
- [Maintenance tools recommended but not provided](#)
- [Printer maintenance schedule](#)
 - [Fixed-interval cleaning operations](#)
 - [Usage-based maintenance operations](#)
- [Clean the print area](#)
- [Wipe the recoating roller](#)
- [Scrape and wipe the fusing lamp](#)
- [Vacuum the air exhaust filter compartment](#)
- [Vacuum the reclamation sieve drawer](#)
- [Clean the inside of the viewing window](#)
- [Clean the build-chamber front rail](#)
- [Clean the scanner](#)
- [Replace a fusing lamp](#)
- [Replace the cleaning roll](#)
- [Replace the reclamation filter](#)
- [Replace the air exhaust filter](#)
- [Replace a printhead](#)
- [Replace the print-area filter](#)
- [Replace the air intake filter](#)
- [Replace the printhead cap](#)

- [Align the printheads](#)

Safety precautions

Read and follow the safety precautions in this guide to make sure you use the printer safely: see [Safety precautions on page 5](#).

You are expected to have the appropriate technical training and experience necessary to be aware of hazards to which you may be exposed in performing a task, and to take appropriate measures to minimize the risks to yourself and to others.

Maintenance resources

Maintenance kits

Name	Purpose	How to order
Printer initial maintenance kit	For periodic maintenance operations that require the replacement of printer parts	Contact your HP-authorized reseller
Other maintenance kits	For periodic maintenance operations of various kinds	Contact your HP-authorized reseller

Kit contents

 **NOTE:** The contents of each kit may vary.

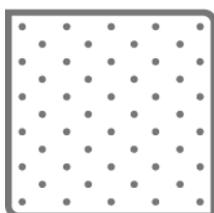
Printer initial maintenance kit contents

HP recommends purchasing this kit with your printer.

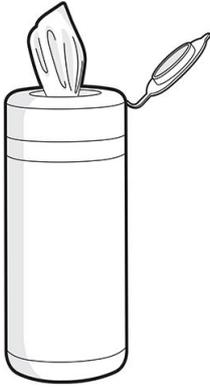
Part	Part number	Quantity	Purpose
Air intake filter	U9ZR1E	1	Replace the air intake filter on page 107
Print-area filter	U9ZR2E	1	Replace the print-area filter on page 104
Air exhaust filter	U9ZR3E	2	Vacuum the air exhaust filter compartment on page 78
Printhead cleaning roll	U9ZR5E	2	Replace the cleaning roll on page 88
Lamp module	U9ZR6E	1	Replace a fusing lamp on page 85

Maintenance tools recommended but not provided

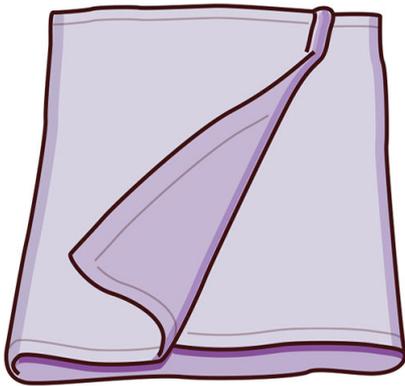
- Disposable antistatic alcohol wipes



- Disposable lint-free wipes



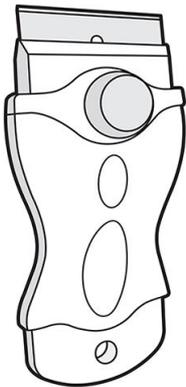
- Lint-free cloth



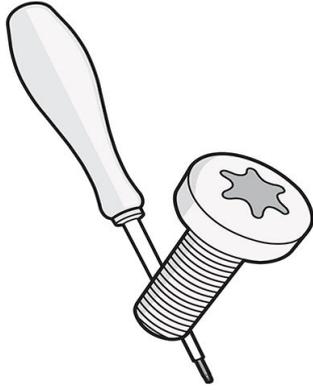
- Distilled water



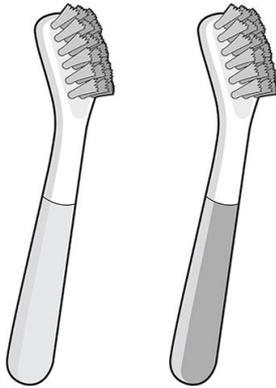
- Razor scraper



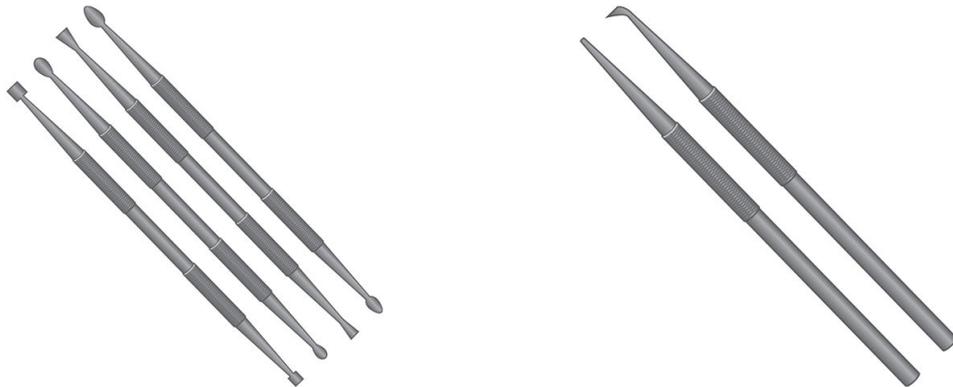
- T20 screwdriver



- Soft brushes



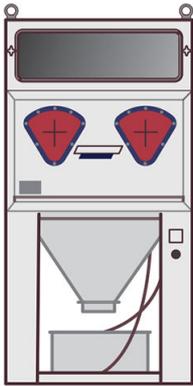
- Metal picks for cleaning detailed parts



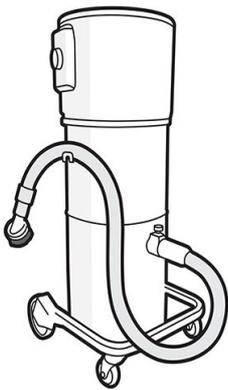
- Part cleaning basket for bead and air blasting small parts



- Bead and air blaster



- Explosion-protected vacuum cleaner, with nozzle accessories for general cleaning (large and small soft-brush nozzles highly recommended)



 **NOTE:** Inside and outside the equipment should be cleaned regularly with an explosion-protected vacuum cleaner to prevent dust from accumulating. Do not sweep the dust or try to remove it with a compressed-air gun.

An explosion-protected vacuum cleaner certified for collection of combustible dust is required for cleaning. Take measures to mitigate material spillage and avoid potential ignition sources such as ESD (ElectroStatic Discharges), flames, and sparks. Do not smoke nearby.

Printer maintenance schedule

Fixed-interval cleaning operations

Frequency	Maintenance operation	Part description	Part number	Time
After every job	Vacuum the supply station			
	Clean the print area on page 71			
	Wipe the recoating roller on page 74			
	Scrape and wipe the fusing lamp on page 76			
	Vacuum the air exhaust filter compartment on page 78			
After every ten jobs	Vacuum the reclamation sieve drawer on page 81			
When needed	Clean the inside of the viewing window on page 82			
	Clean the build-chamber front rail on page 83			
	Clean the scanner on page 83			
	Replace a fusing lamp on page 85	HP 3D400 Lamp Module	U9ZR6E	15 min
	Add or remove material (see Material on page 47)			
	Replace agents (see Replace an agent on page 45)			
	Refill water tank (see Distilled or deionized water on page 50)			
	Clean the printing cap			

Usage-based maintenance operations

Frequency	Maintenance operation	Part description	Part number	Time
Once every 2 months	Replace the cleaning roll on page 88	Printhead cleaning roll	U9ZR5E	5 min
Once every 3–5 months	Replace the reclamation filter on page 92	Air-exhaust filter	U9ZR3E	5 min
Once every 3–7 months	Replace the air exhaust filter on page 94	Air-exhaust filter	U9ZR3E	5 min
	Replace a printhead on page 97	HP 3D400 Printhead Kit	V1Q67A	90 min
	Replace the print-area filter on page 104	Print-area filter	U9ZR2E	5 min
Once every year	Replace the air intake filter on page 107	Air-intake filter	U9ZR1E	5 min
Once every 5 years	Replace the printhead cap on page 108	Printhead cap		2 min

Clean the print area

Tools needed

- Explosion-protected vacuum cleaner with a soft brush nozzle
- Nitrile gloves (recommended)

- Mask (recommended)
- Protective eyewear (recommended)

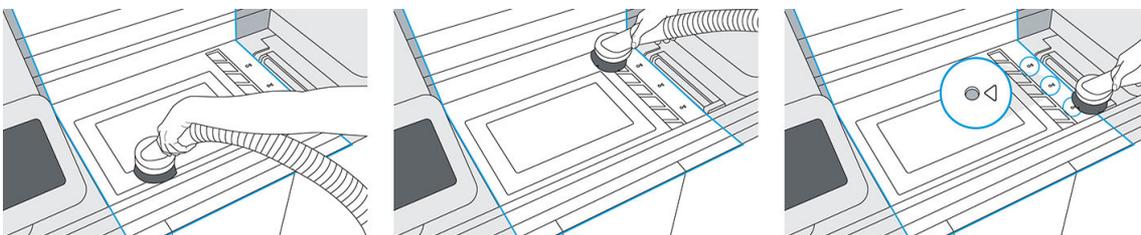
Procedure

1. Open the top cover.

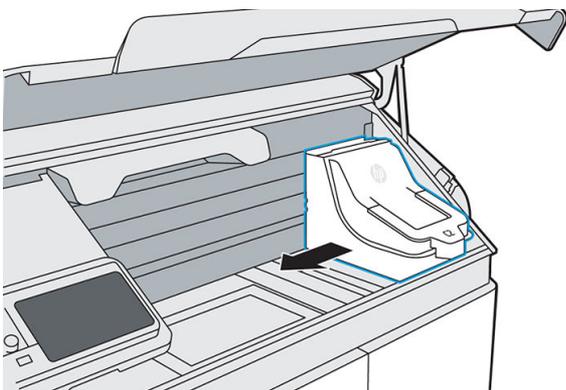


2. Use the explosion-protected vacuum cleaner with the soft brush nozzle to clean all exposed areas of the print area, build chamber, curtain, and optical sensors to the right of the build chamber.

⚠ CAUTION: Do not vacuum or touch the printhead cleaning roll.

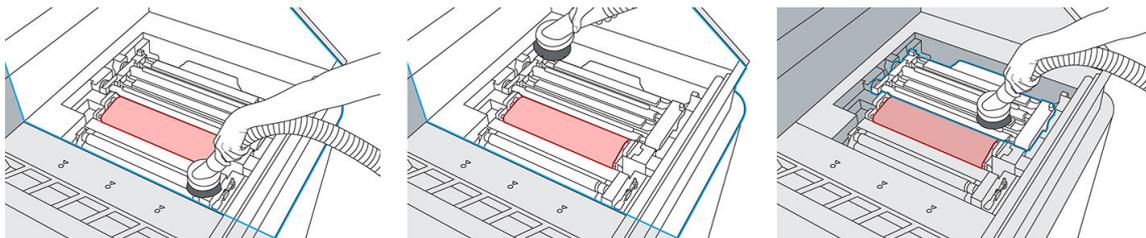


3. Move the print carriage over the center of the build chamber.

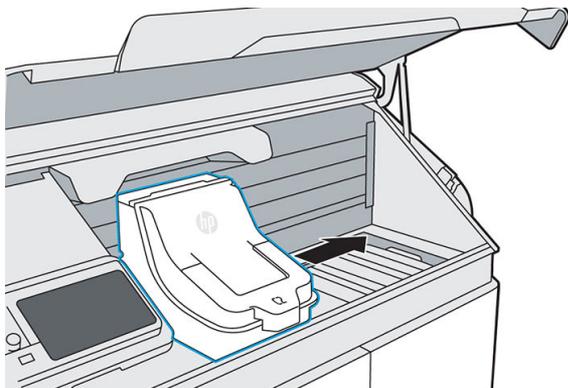


4. Vacuum all exposed surfaces in the print carriage area and the printhead cap.

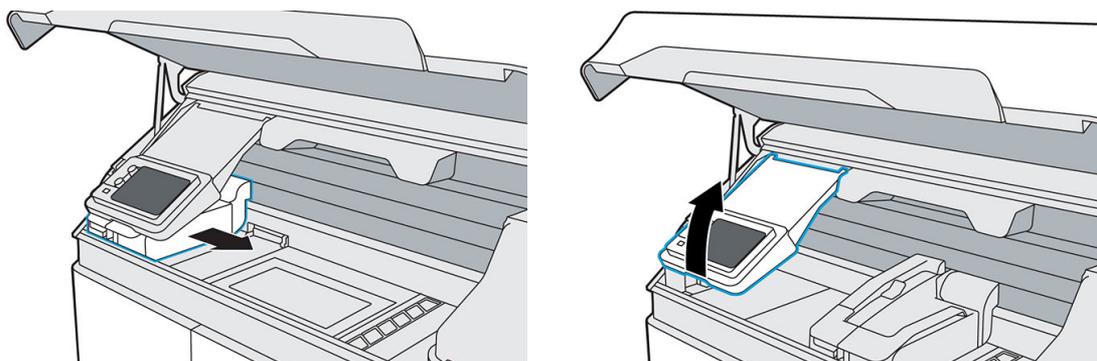
⚠ CAUTION: Do not vacuum or touch the printhead cleaning roll.



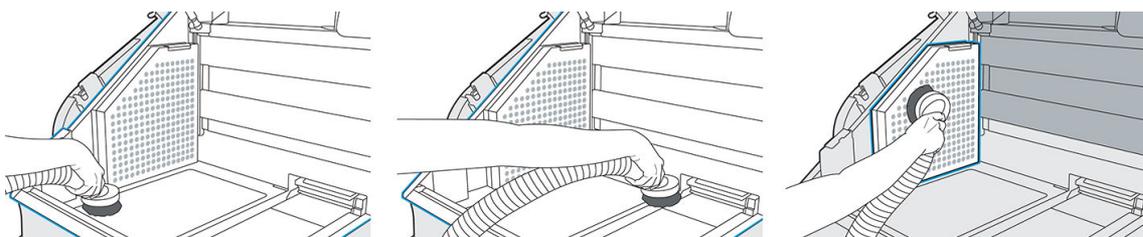
5. Move the print carriage back to its home position.



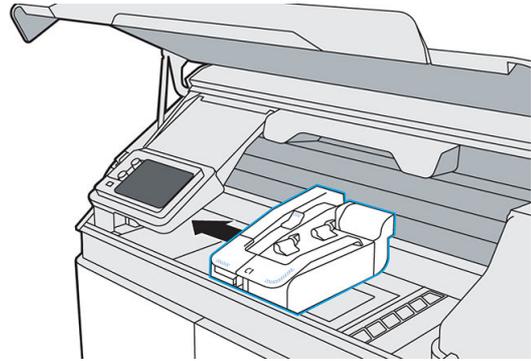
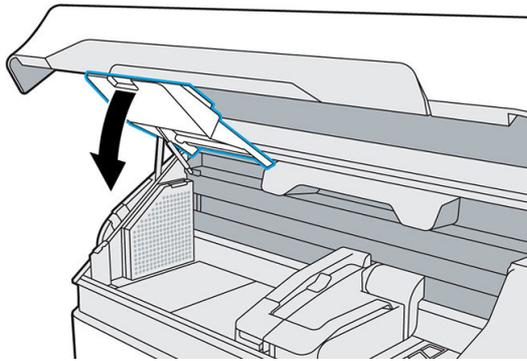
6. Move the fusing carriage to the right and lift up the front panel.



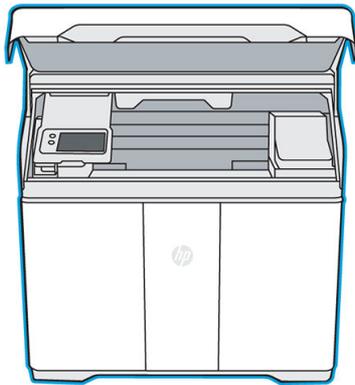
7. Vacuum all exposed surfaces, including the left wall and build-chamber filter cover.



8. Lower the front panel, and move the fusing carriage back to its original position.



9. Vacuum the underside of the top cover.



10. If the window is not clean, wipe inside the window with an antistatic alcohol wipe.
11. Close the top cover.
12. Vacuum the exterior of the printer, including the areas around the front panel.



13. Dispose of the contents of the vacuum cleaner according to local regulations.

Wipe the recoating roller

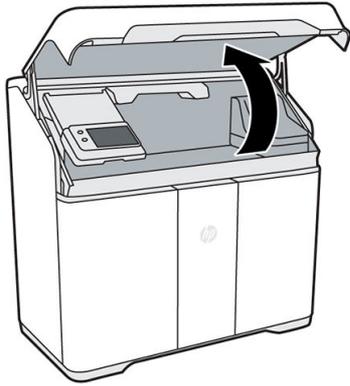
Tools needed

- Gloves
- Clean lint-free cloth
- Antistatic alcohol wipe

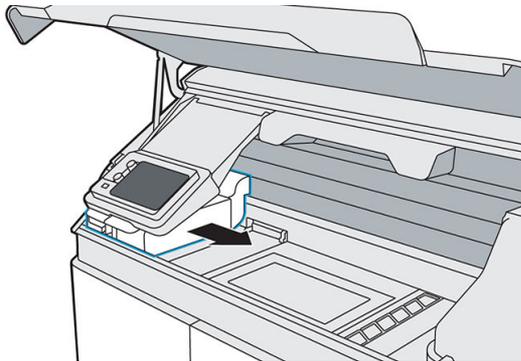
Procedure

You should wear gloves throughout this procedure to avoid contaminating the roller.

1. When prompted by the front panel, tap **Start**.
2. Open the top cover.



3. Move the fusing carriage to the center of the print area.



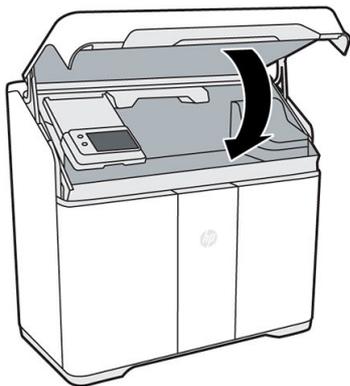
4. Locate the metal roller underneath the left side of the fusing carriage.
5. Clean the roller with a lint-free cloth.

 **NOTE:** If the roller is contaminated with grease or oil, you may need to use an antistatic alcohol wipe.

6. Rotate the roller as you finish cleaning a section, to clean the entire roller.

 **CAUTION:** Use gloves; do not touch the roller with your bare hands.

7. Close the top cover.



8. On the front panel, tap **Continue**, then **OK** to complete the process.

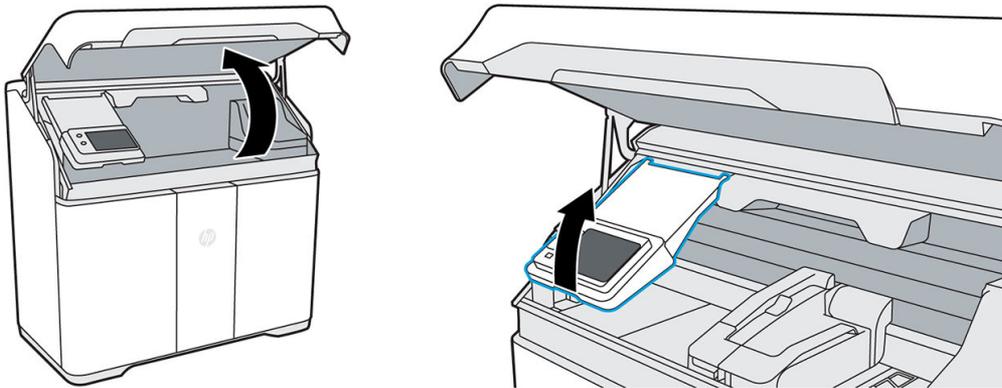
Scrape and wipe the fusing lamp

Tools needed

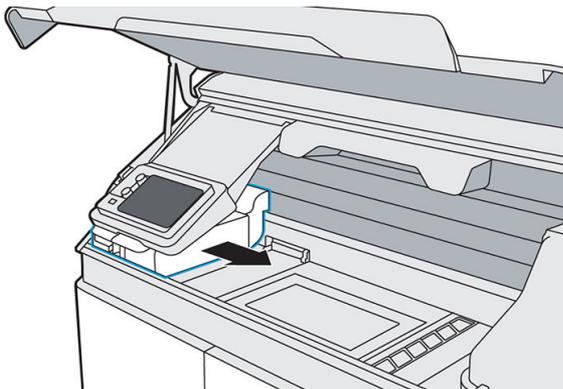
- Razor scraper
- Antistatic alcohol wipe
- Explosion-protected vacuum cleaner

Procedure

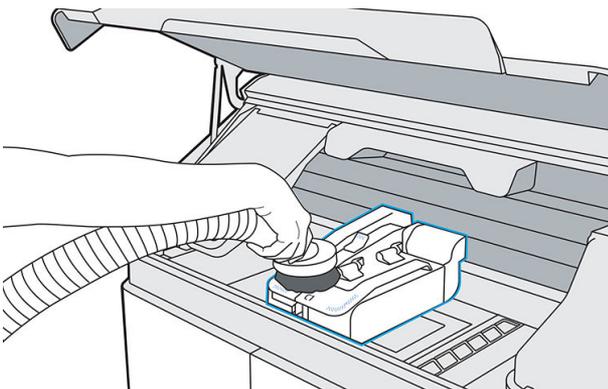
1. When prompted by the front panel, open the top cover. For better access, you can move the front-panel arm.



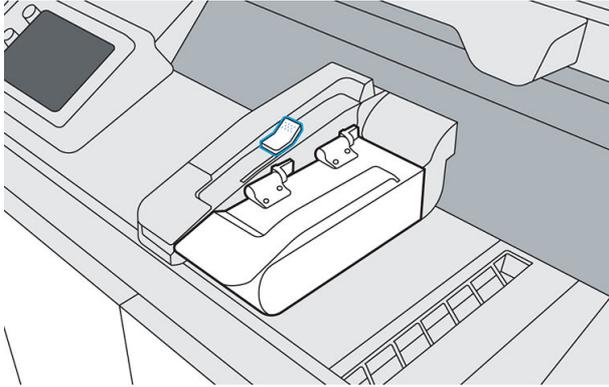
2. Pull the fusing carriage from the left of the build chamber to the center.



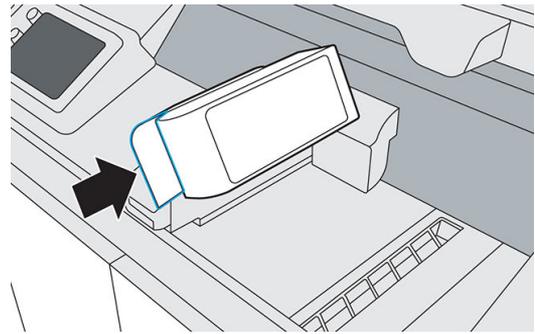
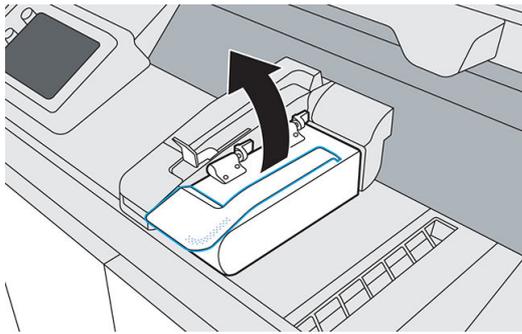
3. Inspect the top and sides of the fusing carriage. If you see any material there, use an explosion-protected vacuum cleaner to remove it.



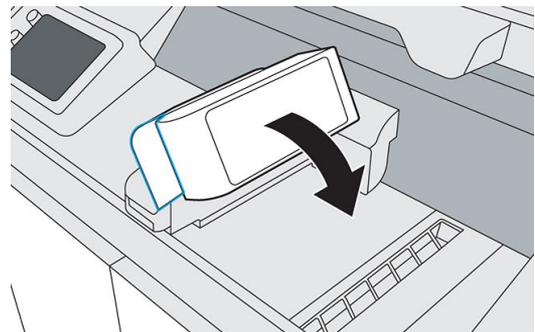
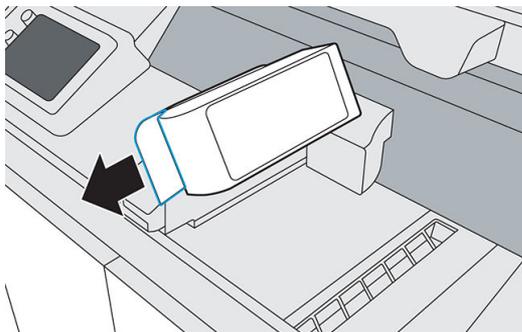
4. Pull the lamp release handle to disengage the lamp module from the printer.



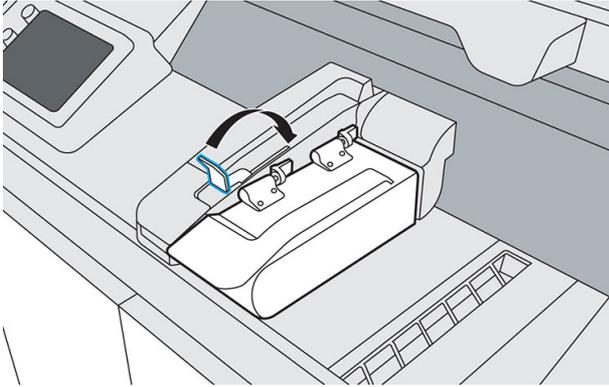
5. Lift the lamp handle and rotate the lamp to the left, then push to lock it into the cleaning position.



6. Use a glass scraper with a metal razor to scrape any fused material from the fusing lamp glass.
7. Use an antistatic alcohol wipe to finish cleaning the fusing lamp.
8. Pull the lamp to release it from its locked cleaning position, then rotate the lamp back to the right.



9. Push the lamp release handle back into place to connect the lamp module to the printer.



10. Close the top cover.



11. On the front panel, tap **Finish** to complete the process.

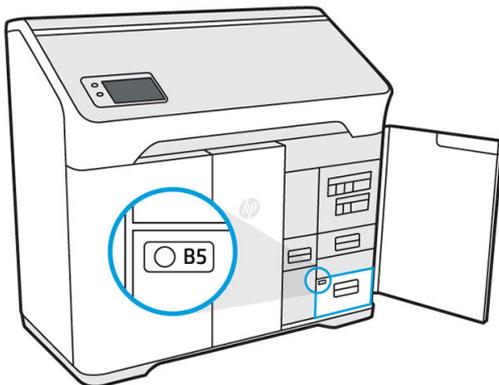
Vacuum the air exhaust filter compartment

Tools needed

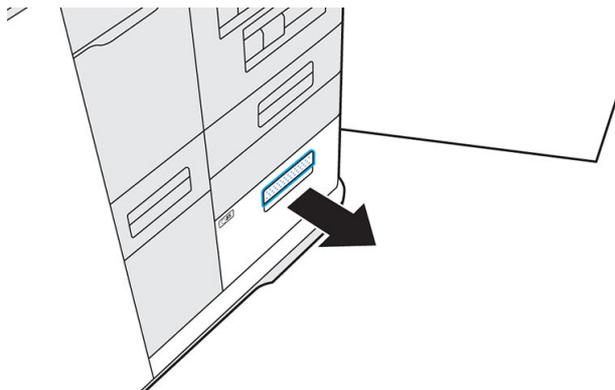
- Explosion-protected vacuum cleaner with a soft brush nozzle
- Nitrile gloves and mask (recommended)

Procedure

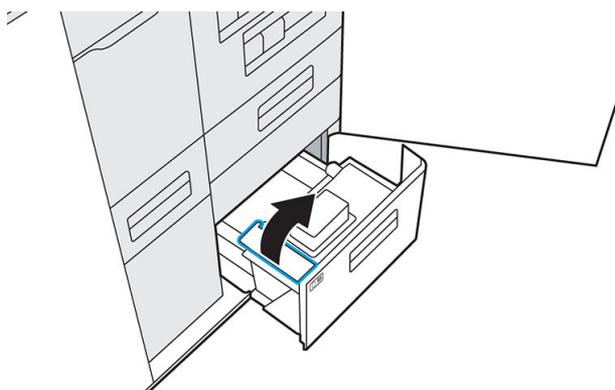
1. Open the agent door.



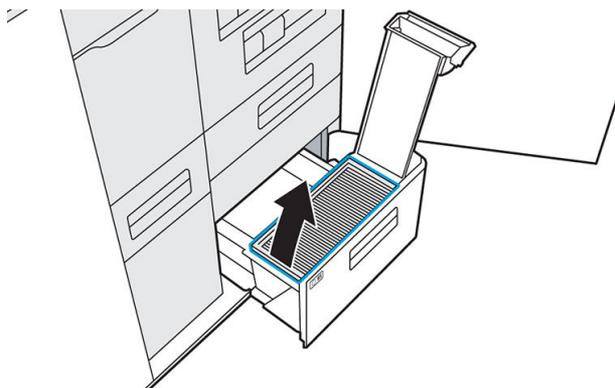
2. Open drawer B5 by pulling the handle.



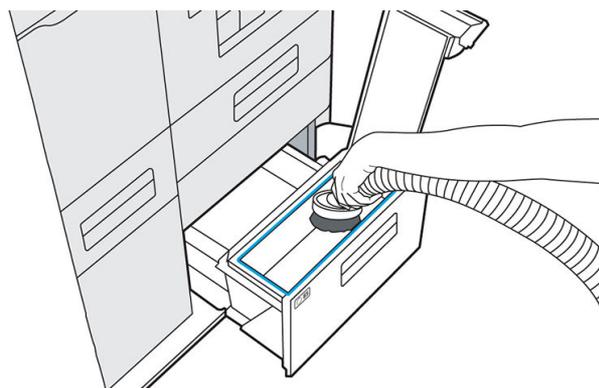
3. Unlatch and lift the lid to access the filter.



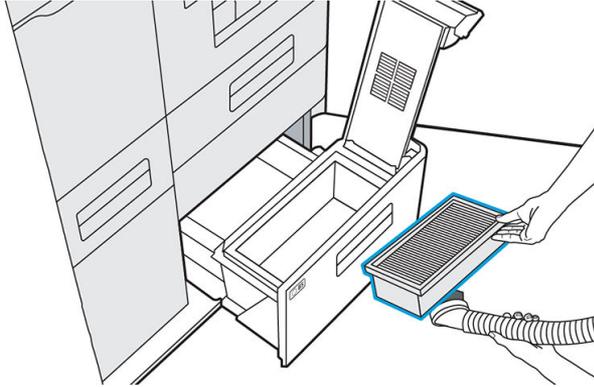
4. Remove the filter.



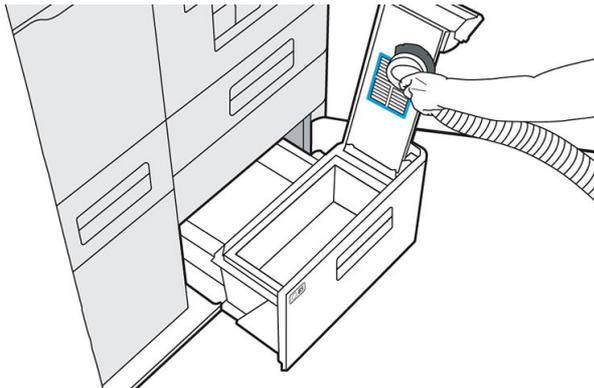
5. Vacuum any material in the compartment.



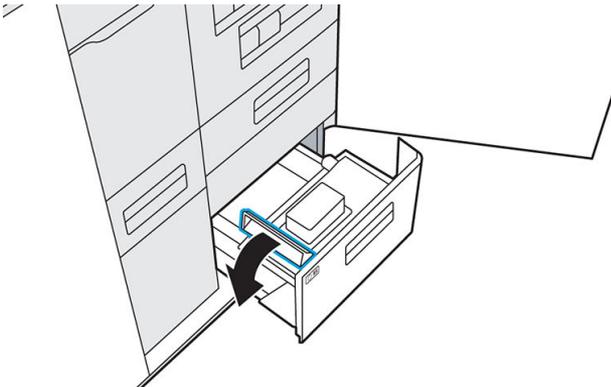
6. Vacuum any material from the bottom of the air exhaust filter.



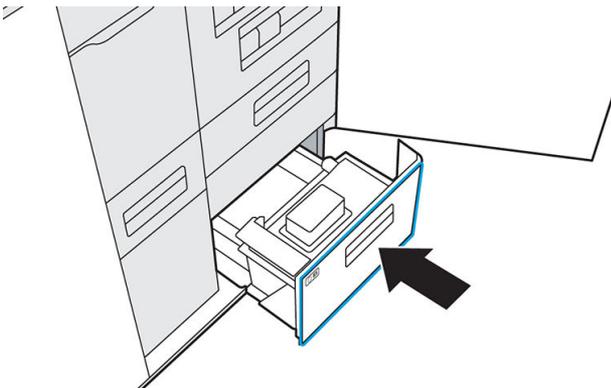
7. Vacuum the interior of the lid.



8. Push the handle down and make sure that the latch engages.



9. Push drawer B5 back in, and close the agent door.



10. Check that the LED has turned off.
11. Dispose of the contents of the vacuum cleaner according to local regulations.

Vacuum the reclamation sieve drawer

Tools needed

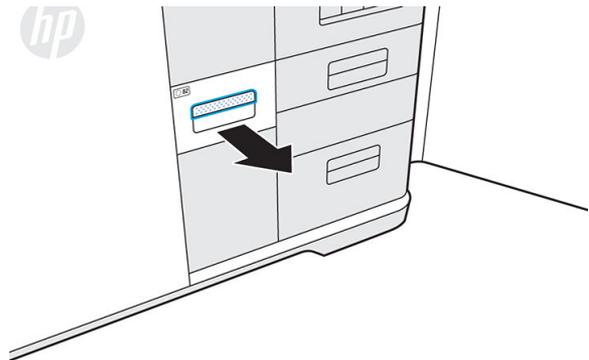
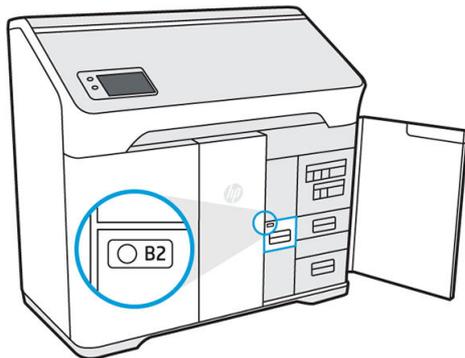
- Explosion-protected vacuum cleaner with a soft brush nozzle
- Nitrile gloves and mask (recommended)

Procedure

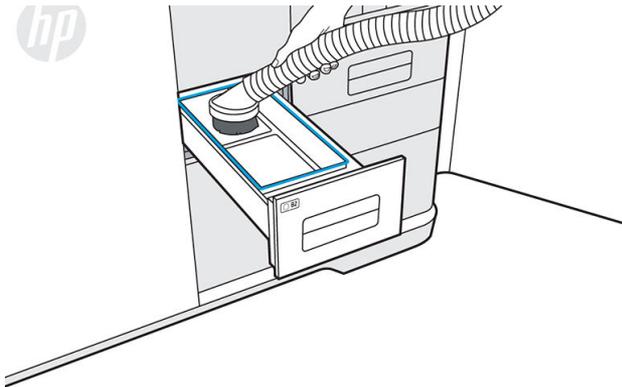
1. When prompted by the front panel, tap **Start**.
2. Open the agent door.



3. Open drawer B2 by pulling the handle.



4. Turn on the explosion-protected vacuum cleaner, attach the soft brush nozzle, and vacuum the interior of the drawer.



5. When the drawer is clean, turn off the vacuum cleaner.
6. Close drawer B2 firmly (ensure that the light on the drawer turns on), then close the agent door.



7. Tap **Finish** and **OK** to complete the process.
8. Dispose of the contents of the vacuum cleaner according to local regulations.

Clean the inside of the viewing window

Tools needed

- Antistatic alcohol wipe or cloth dampened with alcohol
- Nitrile gloves (recommended)

Procedure

- ▲ Wipe the inside of the window with an antistatic alcohol wipe, or with a cloth dampened with alcohol.

CAUTION: Do not use any spray alcohol or solvent in the build chamber.

CAUTION: Take care not to spill liquid on the equipment.

CAUTION: Ensure that the window is dry before using the printer.

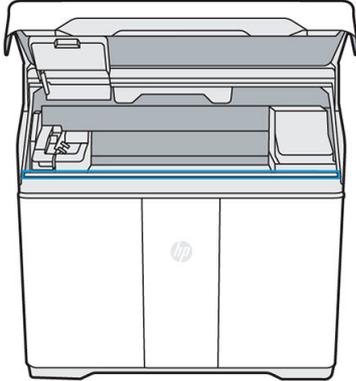
Clean the build-chamber front rail

Tools needed

- Cloth dampened with water or alcohol

Procedure

- ▲ Wipe the rail at the front of the build chamber with a dampened cloth to dislodge and clean any stains that have developed.



⚠ CAUTION: Ensure that the rail is completely dry before using the printer.

CAUTION: Do not use any spray alcohol or solvent in the build chamber.

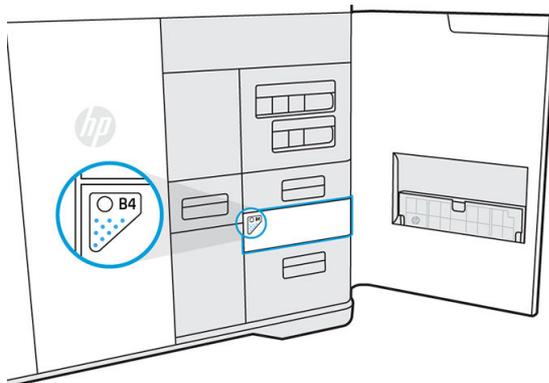
Clean the scanner

Tools needed

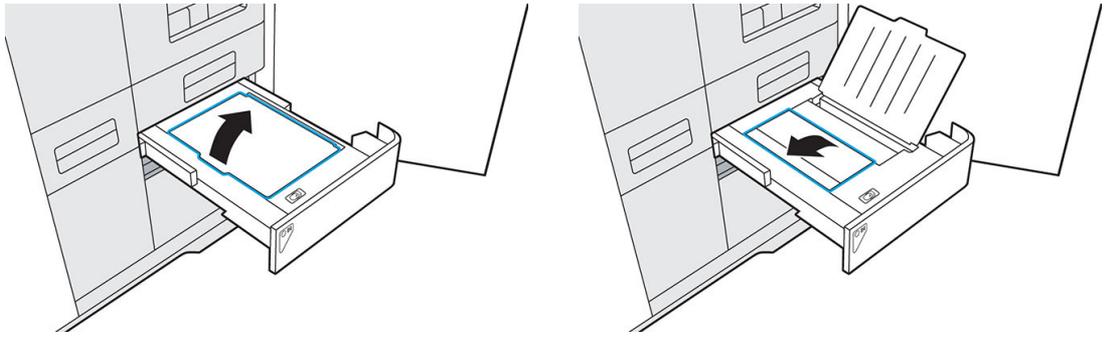
- Clean lint-free cloth
- Nitrile gloves (recommended)

Procedure

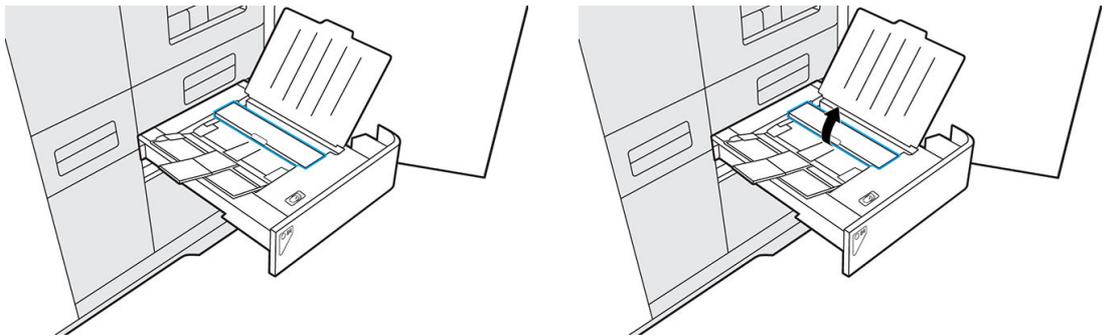
1. Open the agent door.
2. Push the scanner drawer (B4) to release and open it.



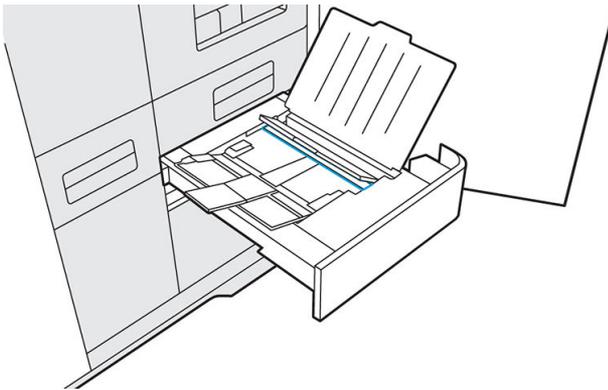
3. Open the scanner paper input and paper output trays.



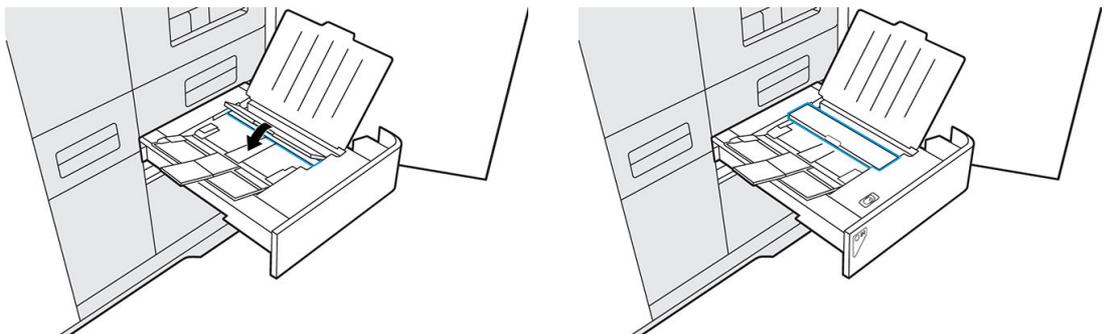
4. Rotate open the scanner access bar by reaching under the center tab and pulling up on the textured surface underneath.



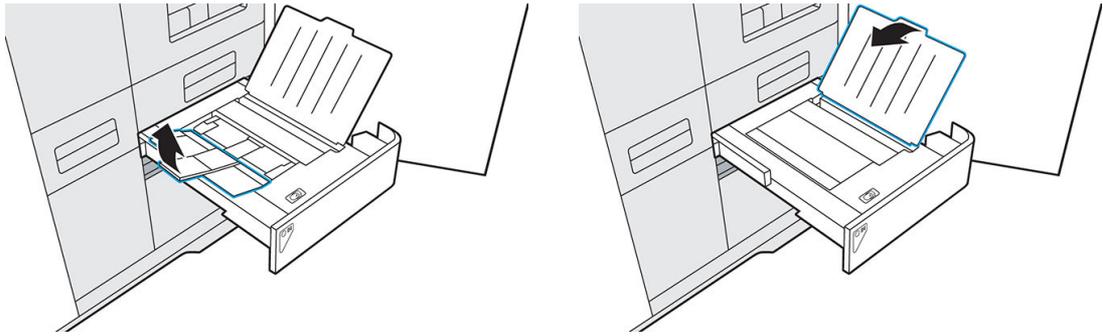
5. Locate the white plastic strip and the scanner glass strip. The glass strip is located underneath the scanner access bar on the base of the scanner, between the rollers and the white plastic strip.



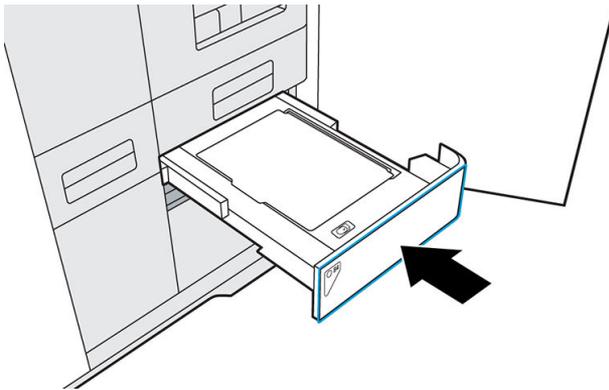
6. While holding the scanner access bar open, use a clean, lint-free cloth to press down firmly and wipe both the white plastic strip and the scanner glass strip. Make sure to break up any residue.
7. Lower and push the scanner access bar to close it.



8. Close both paper trays.



9. Push the scanner drawer to close it.



10. Close the agent door.

Replace a fusing lamp

Tools needed

- HP 3D400 Lamp Module
- T20 screwdriver
- Nitrile gloves (recommended)

Procedure

The front panel will tell you when a lamp needs to be replaced.

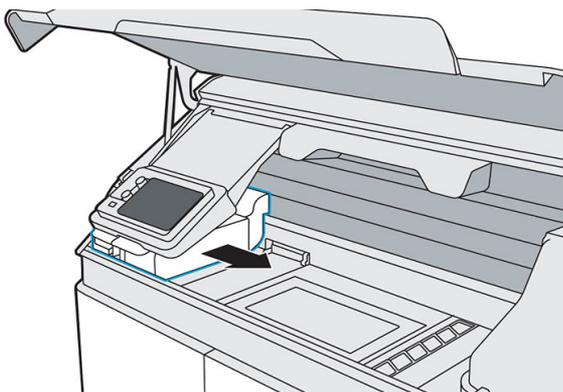
 **NOTE:** If you receive an **Incompatible lamp error**, contact your service representative to order the latest version.

1. At the front panel, go to the **Supplies** tab, select the lamp, and tap **Replace**. The front panel displays a guide to the replacement process.

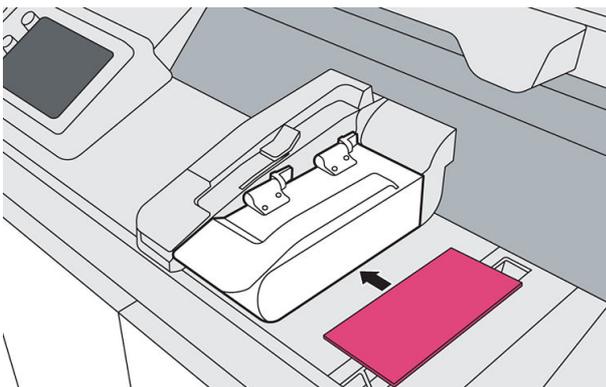
2. Open the top cover.



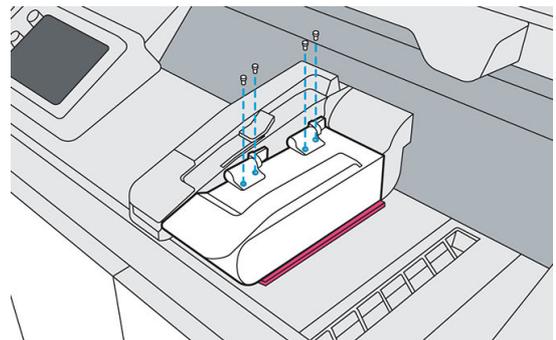
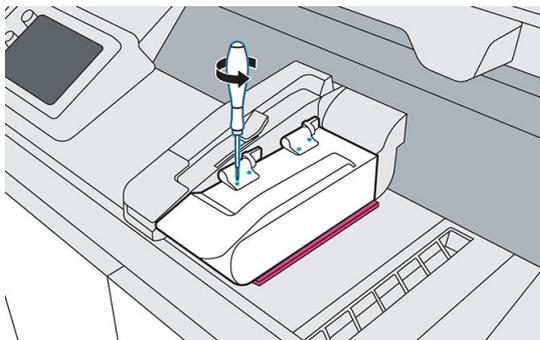
3. Move the fusing carriage (C1) to the center of the print area. If any material is present on the fusing carriage, vacuum it before proceeding.



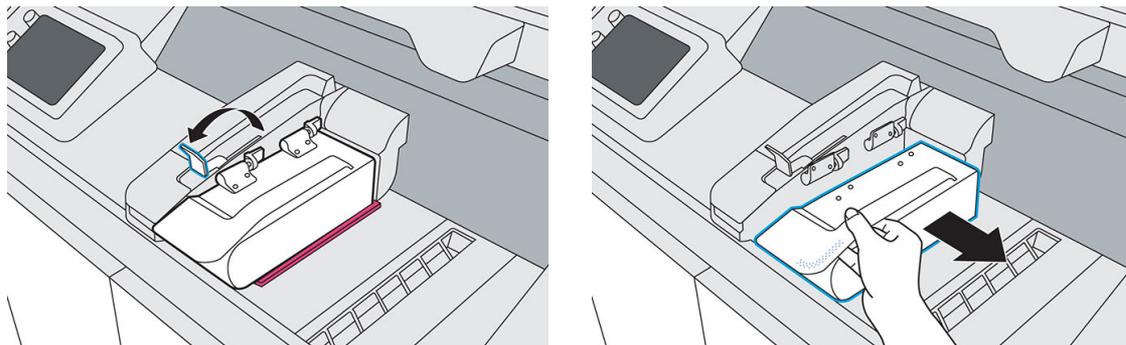
4. Remove the foam from the box and place it under the lamp.



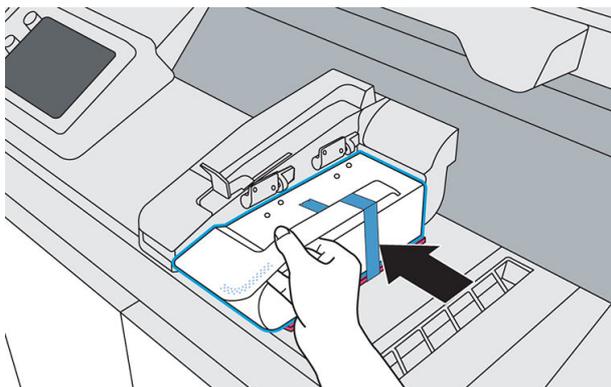
5. Use a T20 screwdriver to remove the four screws securing the lamp hinge to the lamp module.



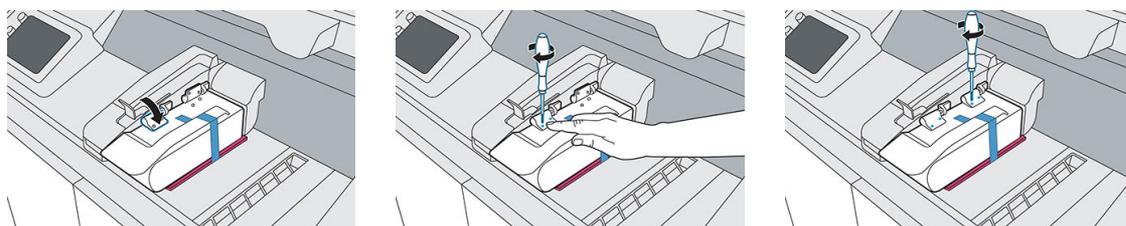
6. Pull the lamp release handle, lift the module, then remove it from the printer. Used lamps can be recycled through HP's Planet Partners Program, where available. Visit <http://www.hp.com/recycle/> for more information. Where the program is not available, dispose of the lamp according to local regulations.



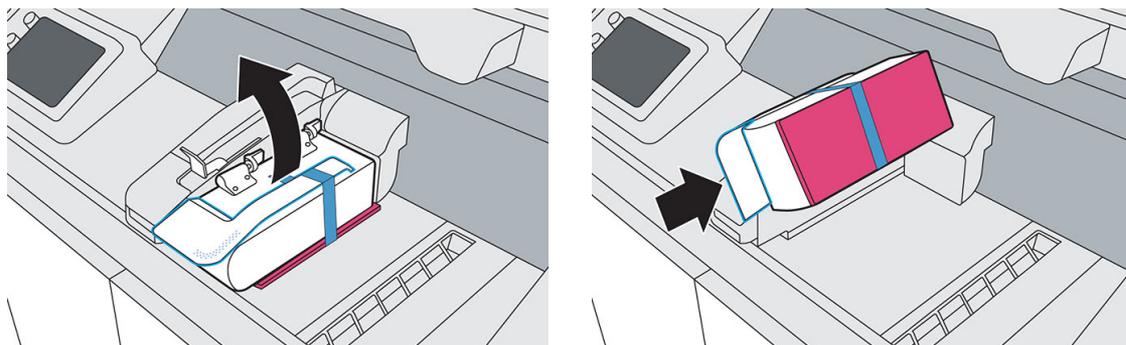
7. Take the new lamp from its packaging. Do not remove the tape and foam yet.
8. Holding the new lamp module, align it with the hinges on the fusing carriage.



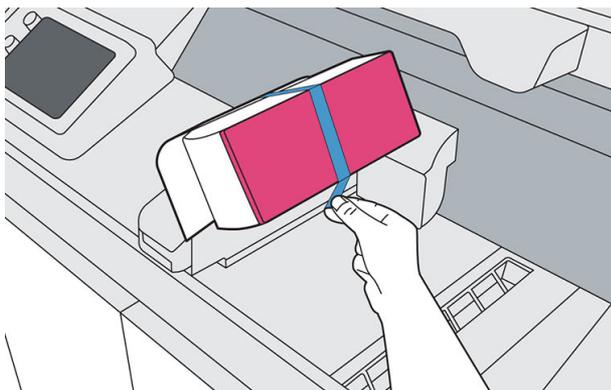
9. Holding each hinge in place, use a T20 screwdriver to replace all four screws.



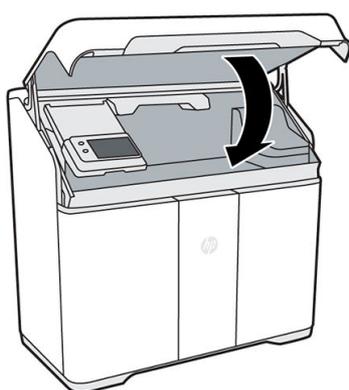
10. Pull the handle to unlock and rotate the lamp clockwise.



11. Remove the tape and foam from the lamp and wipe any fingerprints off the glass.



12. Push the lever to secure the lamp.
13. Close the top cover.



14. The printer automatically locks the top cover, moves the fusing carriage to its original location, checks the new lamp status, and calibrates the lamp.

Replace the cleaning roll

The cleaning roll is a roll of absorbent fabric used in the normal operation of the printer to wipe the printheads periodically: at the beginning and end of printing, while printing, on printhead check and clean, and so on. This helps the printheads to deliver agents continuously and maintain print quality.

The frequency of replacement depends on your use of the printer. The printer will not print when the cleaning roll needs to be replaced.

At the printer's front panel, tap , then **Other supplies** > **Cleaning roll** to see the status of the roll.

CAUTION: Do not touch or vacuum the fabric of the printhead cleaning roll. Any interference with the roll may prevent the printer from keeping track of roll usage, in which case you may see incorrect error messages, and a printing job may be canceled unnecessarily.

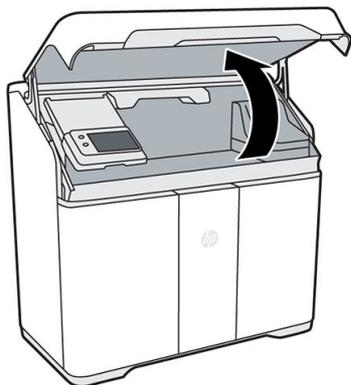
Tools needed

- Explosion-protected vacuum cleaner with a soft brush nozzle
- Nitrile gloves (recommended)

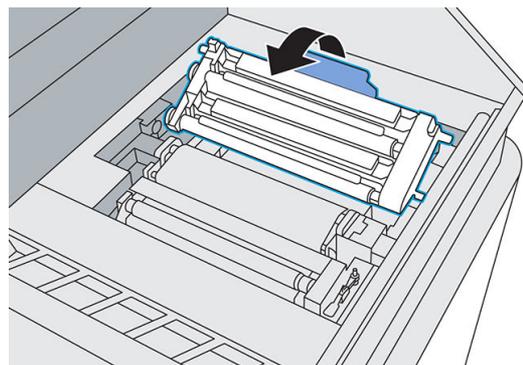
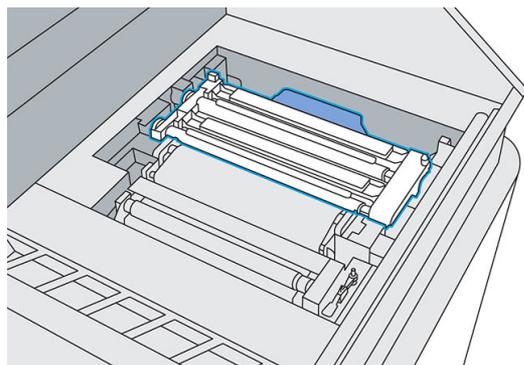
Procedure

Replace the printhead cleaning roll immediately following the front panel message, to continue printing without damaging the printhead.

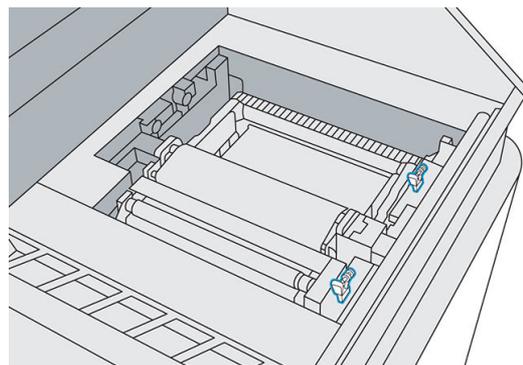
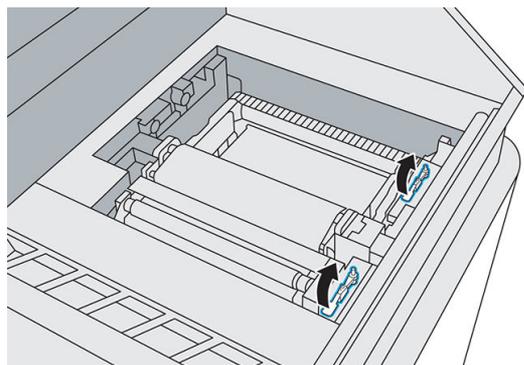
1. Ensure that you have a new cleaning roll ready.
2. Tap **Replace cleaning roll** on the front panel.
3. Open the top cover.



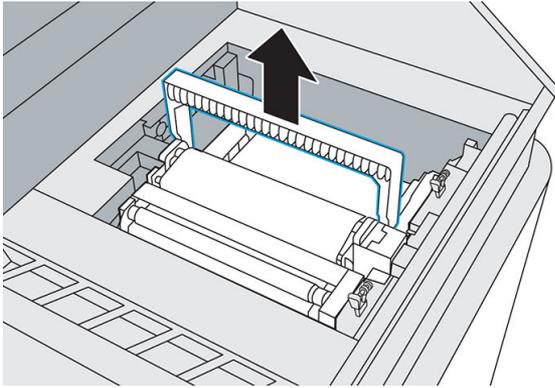
4. Put on gloves.
5. Ensure that no parts are left in the build chamber and that the print area is clean. See [Clean the print area on page 71](#) if necessary.
6. Move the print carriage over the platform.
7. Remove the printhead cap by rotating it 20° and pulling it out.



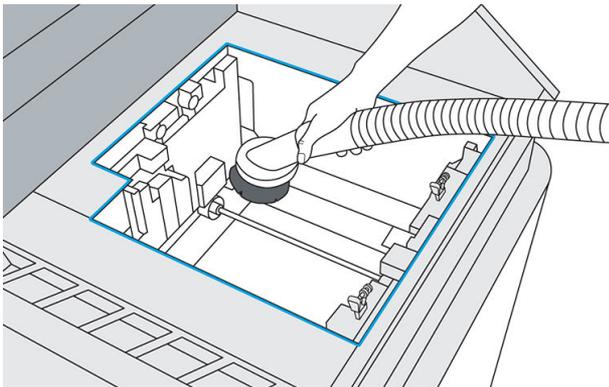
8. Disengage the two latches to release the cleaning roll module.



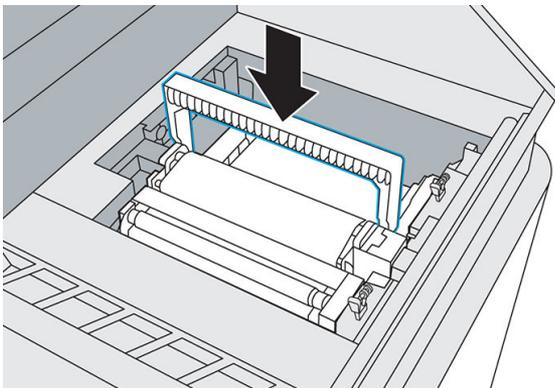
9. Rotate the handle until it is vertical, then pull it upwards to remove the cleaning roll module from the printer.



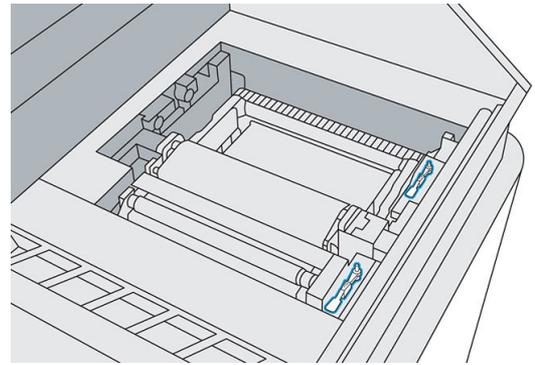
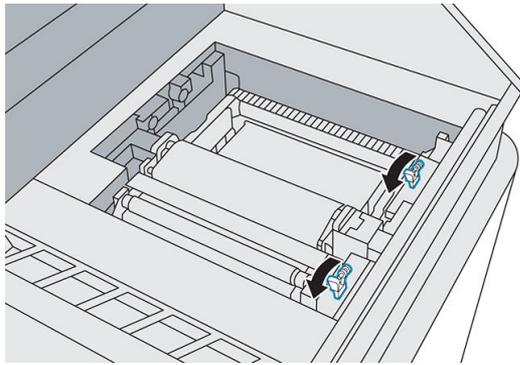
10. Transfer the used roll module to a container or bag and dispose of it according to local regulations.
11. Vacuum the cavity with the explosion-protected vacuum cleaner, using a soft brush nozzle.



12. Remove the packaging from the new module, then orient and insert it into the cavity.
13. Push down, and rotate the handle to close it.

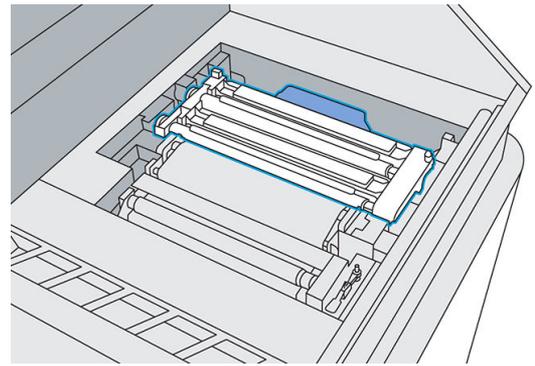
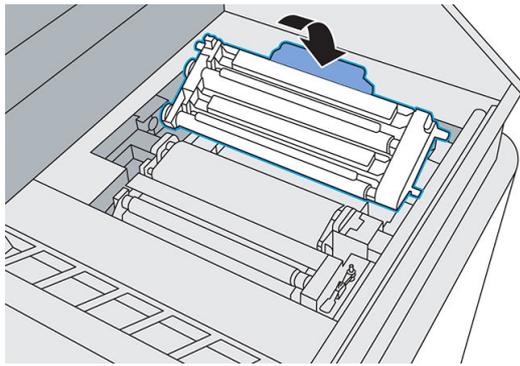


14. Engage the two latches to secure the cleaning roll module.



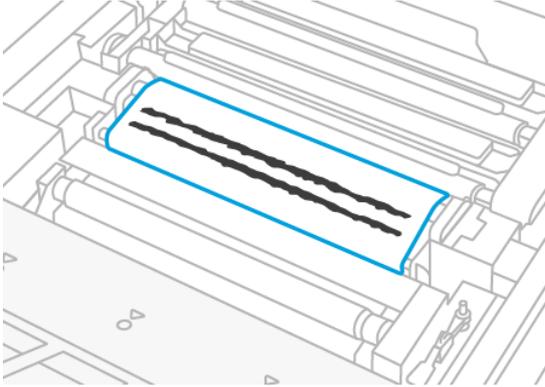
⚠ CAUTION: Ensure that the latches are pushed down as far as they will go.

15. Reinsert the printhead cap. See [Replace the printhead cap on page 108](#).

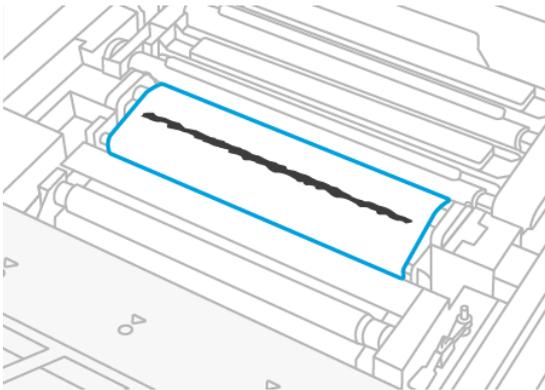


16. Move the print carriage back to its original position.
17. Close the top cover.
18. Tap **Finish and check** on the front panel.
The roll rotates, then the print carriage returns to its home position.

19. Open the top cover to check that two marks appear on the roll. Tap **Two marks** on the front panel.



If there is only one mark, tap **One mark** on the front panel; the cleaning roll may have been inserted incorrectly. Try reinserting the cleaning roll module, and ensure that the latches are fully engaged.



20. When you are sure that the cleaning roll module is working correctly, close the top cover.
21. Dispose of the contents of the vacuum cleaner according to local regulations.

Replace the reclamation filter

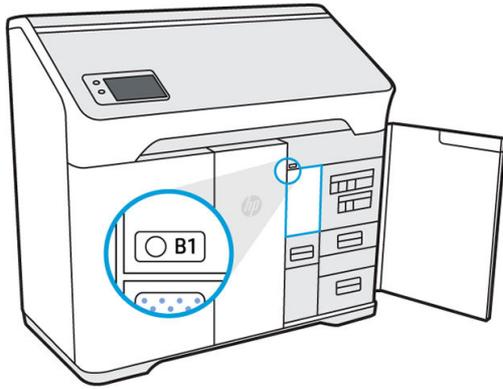
The front panel notifies you when the reclamation filter needs to be replaced. Follow the steps on the front panel.

Tools needed

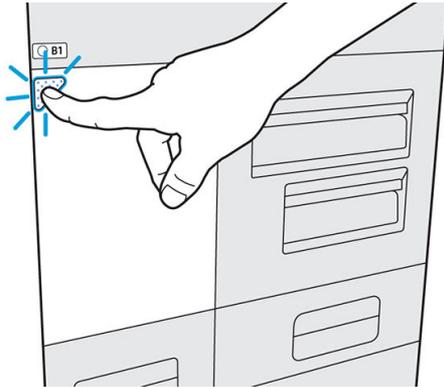
- HP 3D400 Air Exhaust Filter
- Nitrile gloves and mask (recommended)

Procedure

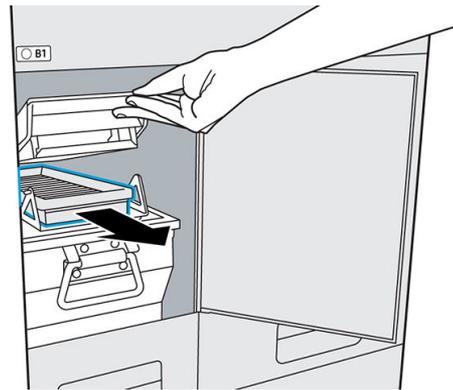
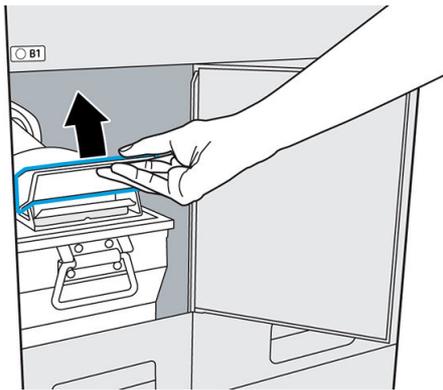
1. Open the agent door.



2. Check that the wayfinding LED is on, next to the access door to the reclamation filter. Open the reclamation filter by pushing the top left corner.

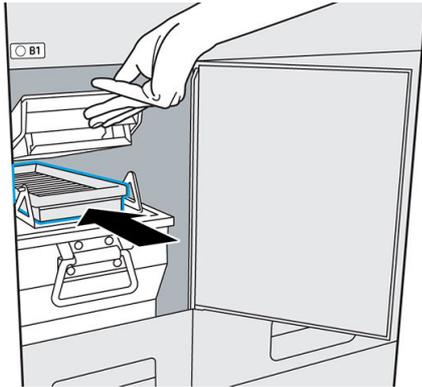


3. Unlock the latch, pull it up, then pull out the old filter.

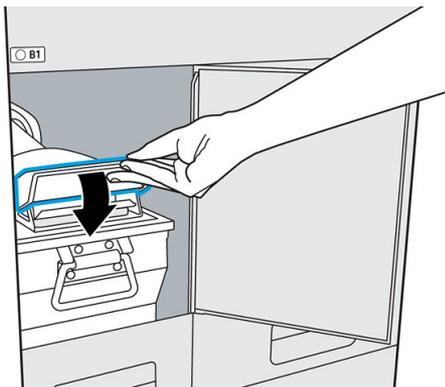


4. Remove the new filter from its packaging.

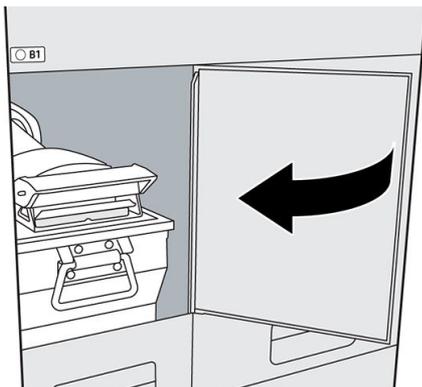
5. Insert the new filter into the slot.



6. Close the lid and latch it into place.



7. Close the access door.



8. Check that the wayfinding LED beside the filter is now off.
9. Close the agent door.
10. Tap **Finish and check** and then **OK** on the front panel.
11. Dispose of the old filter according to local regulations.

Replace the air exhaust filter

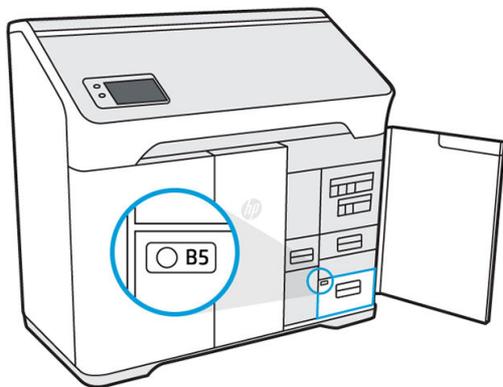
The front panel notifies you when the air exhaust filter needs to be replaced. Follow the steps on the front panel.

Tools needed

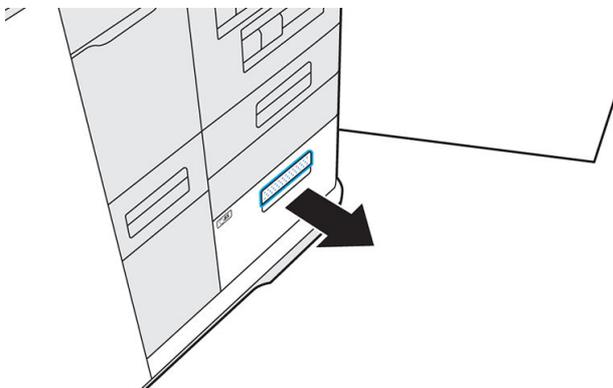
- HP 3D400 Air Exhaust Filter
- Nitrile gloves and mask (recommended)

Procedure

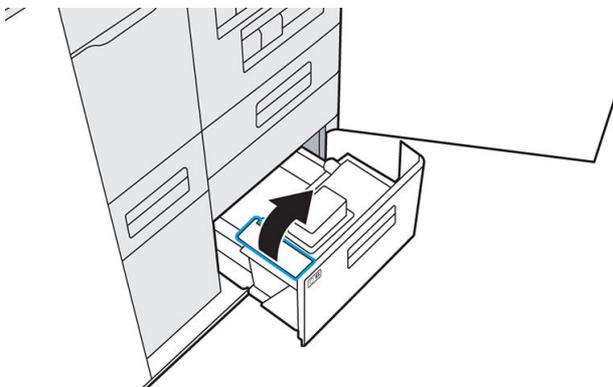
1. Tap **Replace air exhaust filter** on the front panel.
2. Open the agent door.



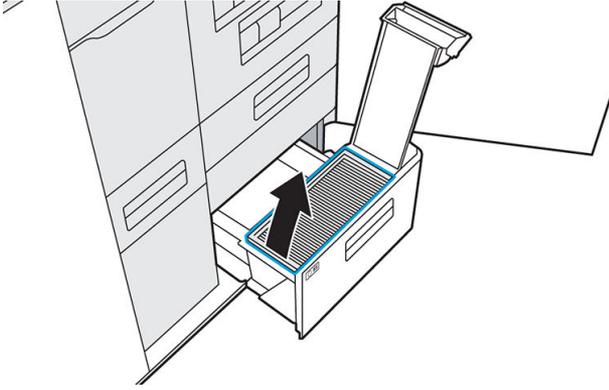
3. Open the B5 drawer by pulling the handle.



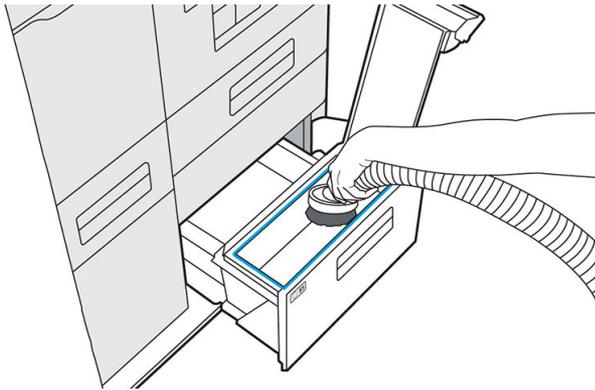
4. Unlatch the lid and open the compartment.



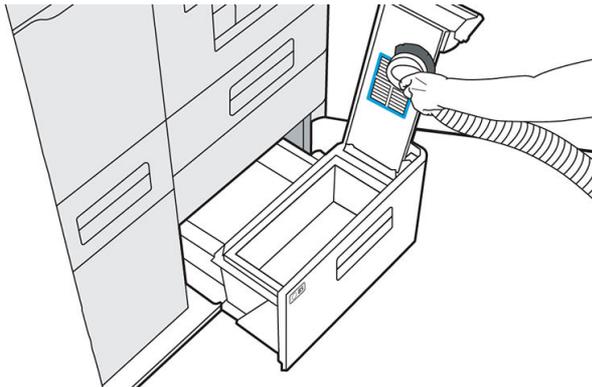
5. Remove the old filter.



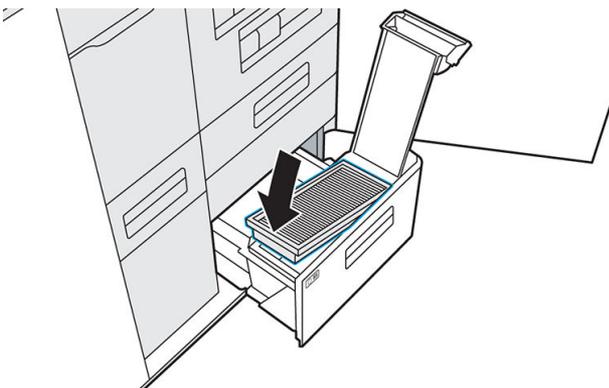
6. Vacuum any material in the compartment.



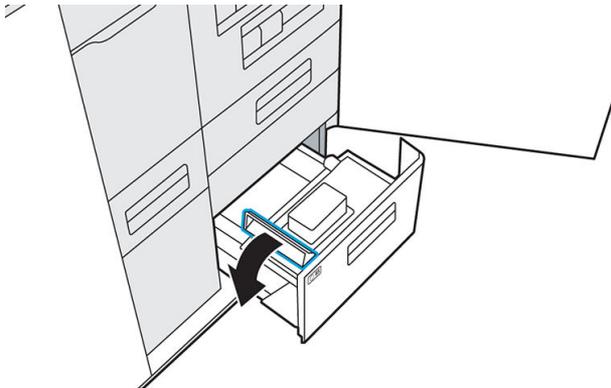
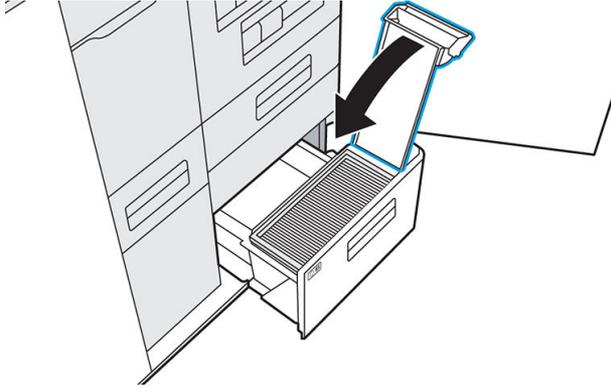
7. Vacuum the interior of the lid.



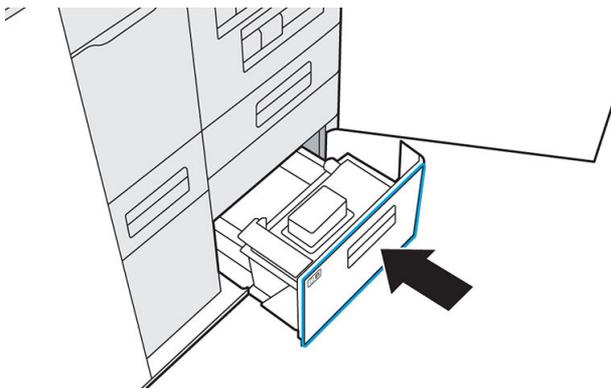
8. Insert the new filter.



9. Close and latch the lid.



10. Push the drawer back in.



11. Check that the air exhaust compartment LED is now off.
12. Close the agent door.
13. Tap **Finish and check** on the front panel.
14. Dispose of the old filter according to local regulations.

Replace a printhead

A printhead delivers agents and prints them onto the material in the build chamber.

⚠ CAUTION: Observe precautions when handling printheads because they are ESD-sensitive devices (sensitive to ElectroStatic Discharges). After removing the orange shipping caps, avoid touching components on the bottom of the printhead, and avoid putting the printhead down on the exposed nozzles.

This printer has only one printhead.

Status

At the printer's front panel, tap , then **Printheads**, then tap any printhead to see its status:

- **Not present:** The printer cannot detect the printhead.
- **Check pending:** The printhead needs to be checked.
- **Missing printhead:** The printhead is missing.
- **Reseat required:** The printhead needs to be removed and reinserted.
- **Remove:** The printhead needs to be removed.
- **Incompatible printhead:** The printhead is not compatible with the printer.
- **Printhead replacement incomplete; start again:** The printhead replacement process needs to be restarted.
- **Replacement required:** The printhead needs to be replaced.
- **Non-HP agent detected:** The printer has detected a non-HP agent among its consumables.
- **Ready:** The printhead is working normally.

Tools needed

- HP 3D400 Printhead Kit
- Gloves (recommended)
- T20 screwdriver
- Lint-free cloth



NOTE: Printhead replacement is guided by the front panel, which will show you how to replace the printhead. The steps described below are meant to be done as prompted by the front panel. The procedure may be started by responding to an alert, or from the **Printhead detailed information** screen (accessed from the Supplies menu).

Procedure

1. A new printhead must be acclimated to a normal operating temperature. If it has been shipped or stored in a cold environment, it may need up to 24 hours to reach operating temperature.
2. HP recommends wearing a mask.

You will need a new priming tray (included in the printhead kit), and the alignment plate included with the printer. Ensure that the AP numbers on the printer and the plate match. Contact HP if they do not match.

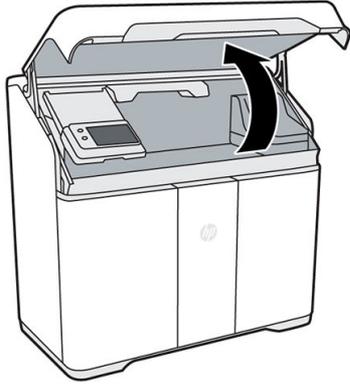
3. From the **Printhead detailed information** screen, tap **Replace** to be guided through the procedure.



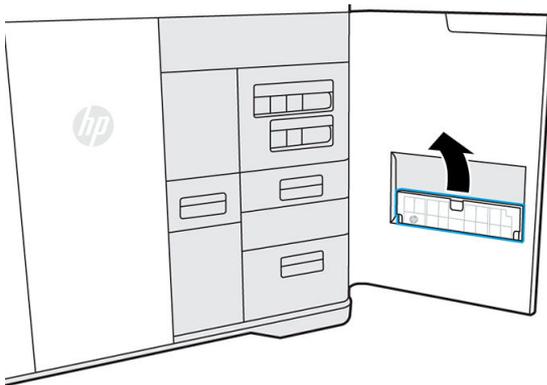
NOTE: You may be prompted to replace agents before proceeding.

4. Close the top cover to permits checks to be done.

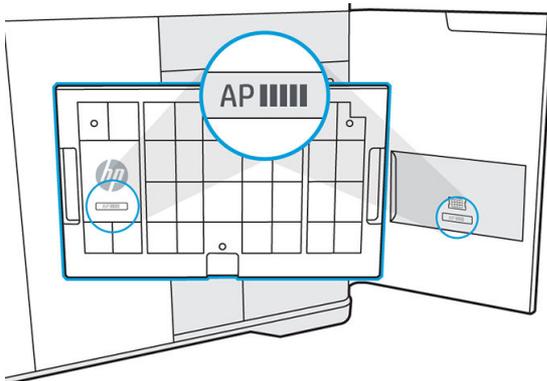
- When the checks are completed, open the top cover.



- Ensure that you have cleaned the print area since the last build. See [Clean the print area on page 71](#).
- Open the agent door and take the alignment plate from inside the door.



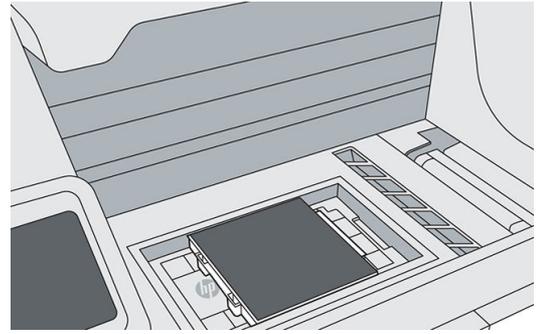
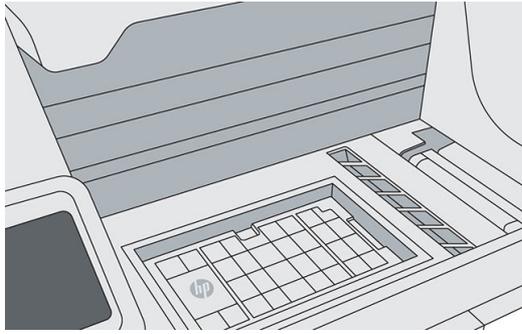
- Ensure that the alignment plate AP number matches the number on the inside of the agent door. Close the door.



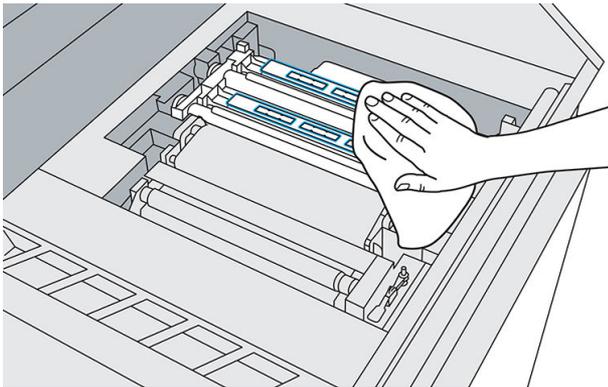
- Tap **Continue** on the front panel.
- Place the alignment plate on the build platform and then the priming tray on top of the alignment plate. Make sure the priming tray nests into place on the alignment plate by matching the feet on the bottom of the tray to the cutouts on the alignment plate.

CAUTION: Do not place the alignment plate and the priming tray on the bed outside this procedure, because the chamber may not be adjusted to the correct height, and could contact the printbars. The priming tray should be installed only as a part of the workflow process, when the chamber is moved to the appropriate height.

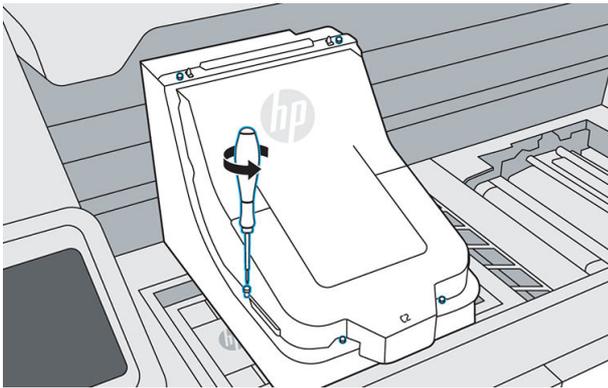
CAUTION: The black foam top is an essential part of the priming tray assembly. Do not remove it.



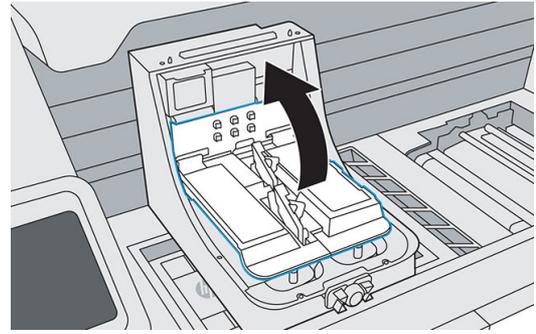
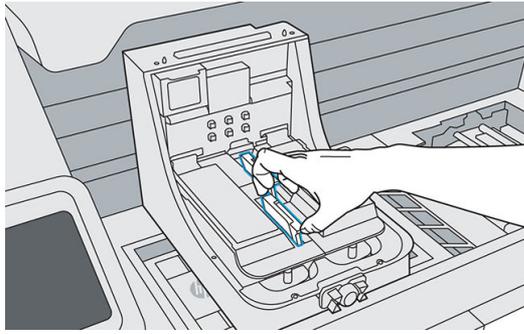
11. Close the top cover and tap **Continue** on the front panel. The print carriage will move to the left, then you can open the top cover again.
12. Inspect the printhead cap(s). If you see any liquid in the cap(s), remove it by blotting with a dry, lint-free cloth.



13. Use a screwdriver to loosen the six screws to remove the cover from the carriage, and carefully set aside the carriage cover.

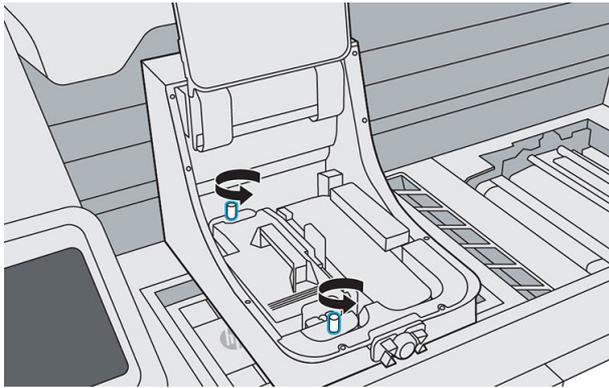


14. Release both clips, and lift the print-bar cover over the carriage. It will magnetically stay in place.

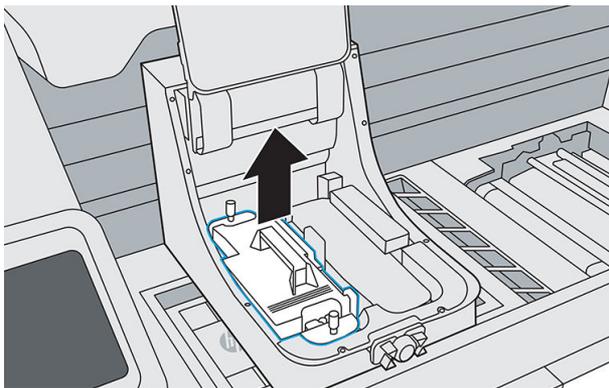


15. Loosen the two thumb screws at each end of the printhead until the printhead is released.

 **NOTE:** Loosen only the screws of the printhead you intend to remove.

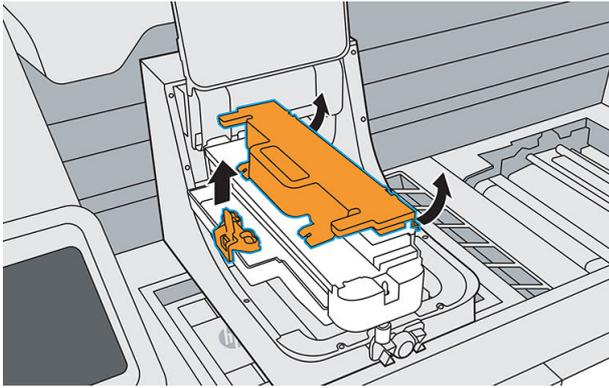


16. Carefully pull up the handle to remove the printhead, and place it on a flat surface with the nozzles facing up or to the side.

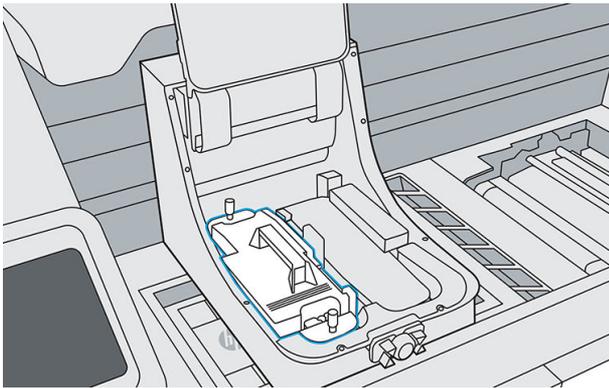


17. Make sure there are no obstacles and no material in the way of installing the new printhead. Vacuum the inside of the carriage if necessary.
18. Remove the packaging from the new printhead.
19. Check that the new printhead matches the slot.

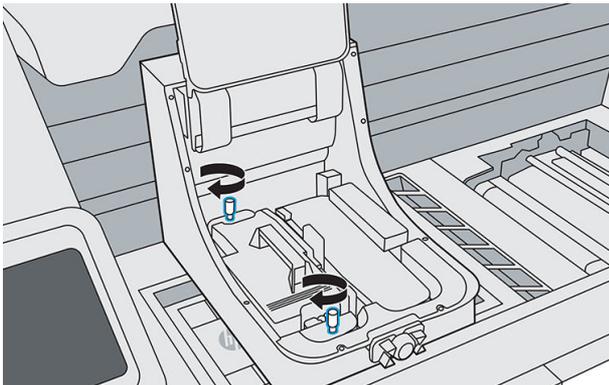
20. Remove the two orange caps. Later, put them onto the old printhead, before disposing of it according to local regulations.



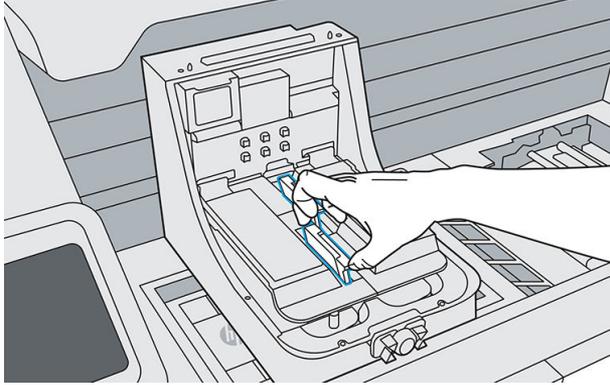
21. Orient and align the new printhead, then insert it into place, using the center post to guide the printhead. Ensure that all edges of the printhead lie flush with the carriage housing.



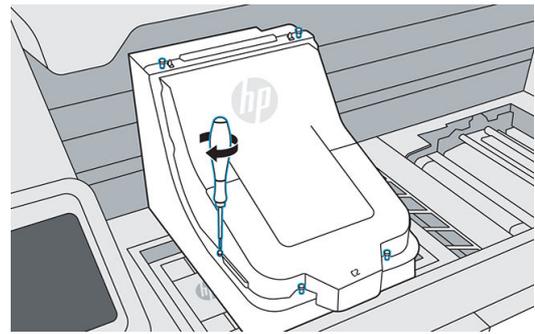
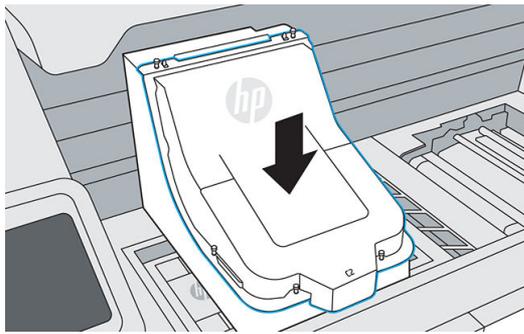
22. Push down and firmly tighten both thumb screws.



23. Pull down the printhead cover over the printhead, and secure both clips.



24. Put back the print carriage cover. Tighten the six screws.

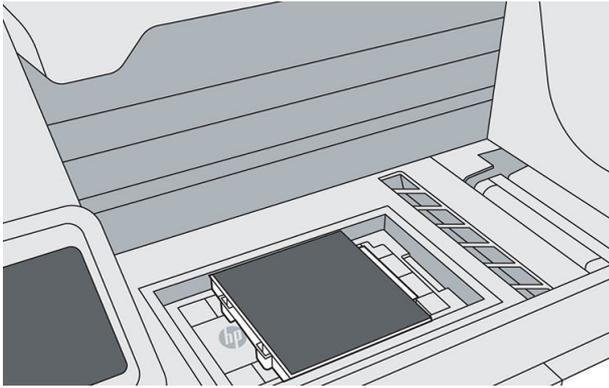


25. Tap **Finish & Check**. Leave the print carriage centered. Close the top cover and tap **Continue** on the front panel; when the priming tray is detected, tap **Prime**. Priming will take about 20 minutes.



26. If you have replaced two printheads, follow the instructions on the front panel to prime the second printhead. You do not need to replace the priming tray with a new one in order to do this.

27. When priming is complete, open the top cover, carefully remove the used priming tray, and leave the alignment plate in the build chamber, for use during the printhead alignment process.



28. Place the used priming tray in the bag in which it came, and dispose of it according to local regulations.
29. Launch the printhead alignment from the front panel by tapping **Calibrate printheads**.

 **NOTE:** The printer cannot print until alignment has been completed.

Replace the print-area filter

The front panel notifies you when the print-area filter needs to be replaced. Follow the steps on the front panel.

Tools needed

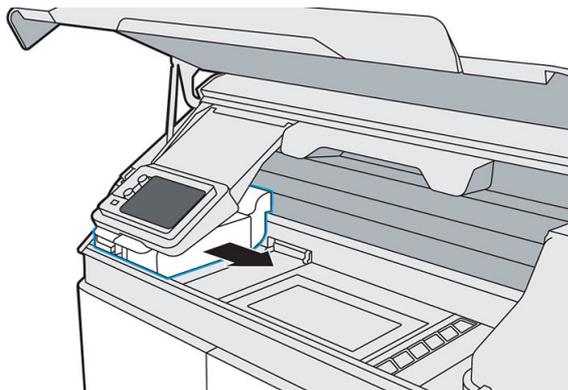
- HP 3D400 Print Area Filter
- Nitrile gloves and mask (recommended)

Procedure

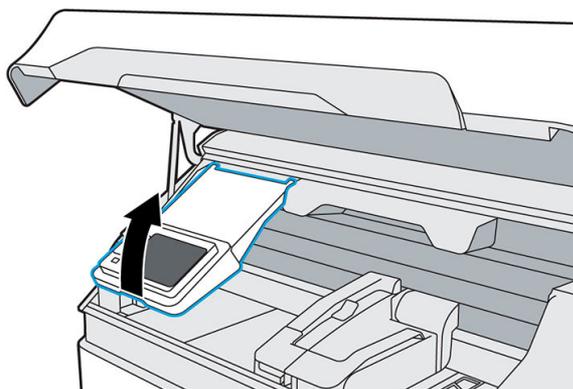
1. Tap **Replace print area filter** on the front panel.
2. Open the top cover.



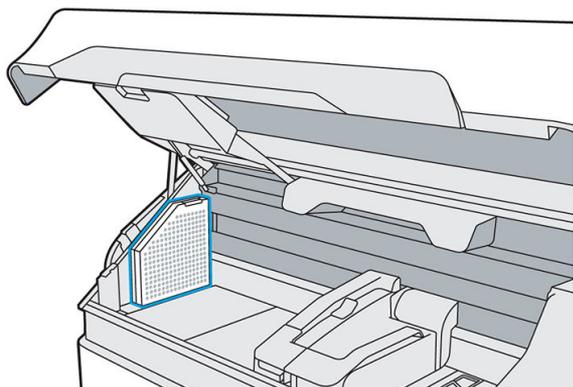
3. Pull the fusing carriage over the build chamber.



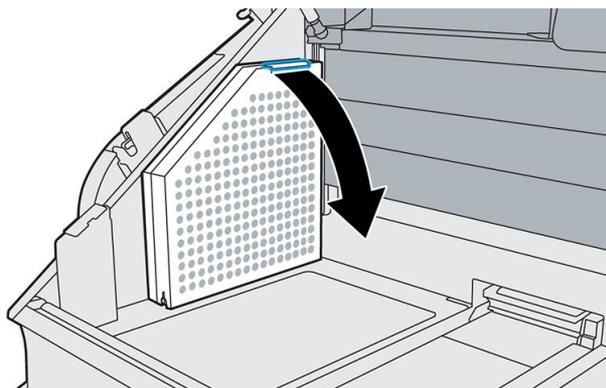
4. Lift up the front panel.



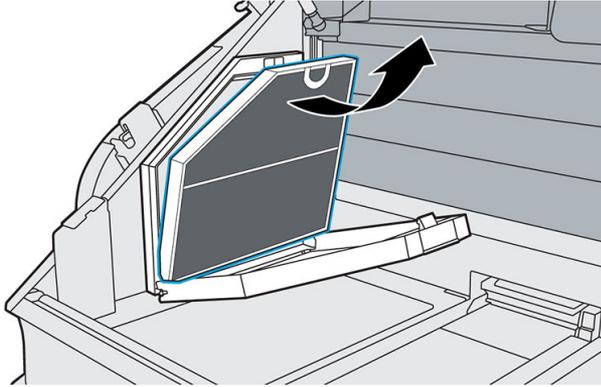
5. Locate the print-area filter on the left.



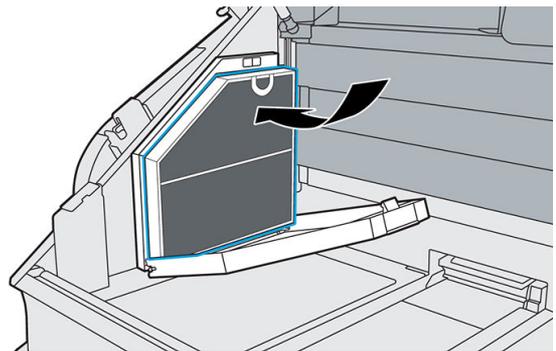
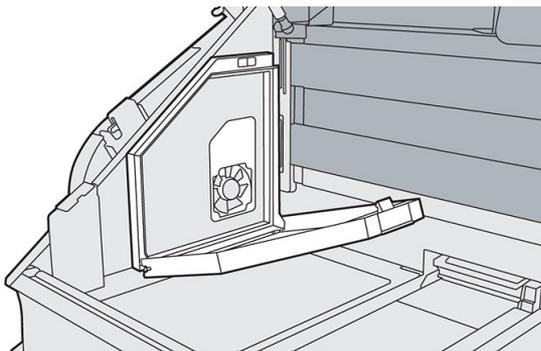
6. Disengage the latch on top of the filter.



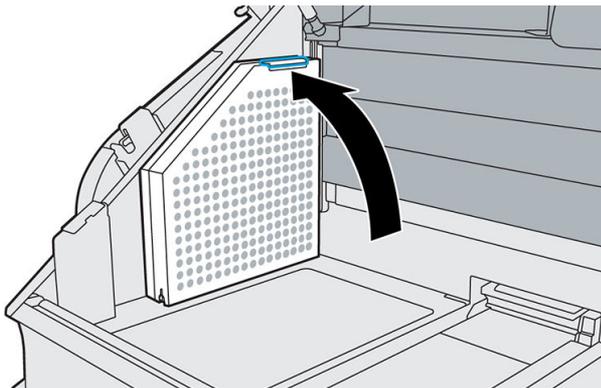
7. Remove the old filter.



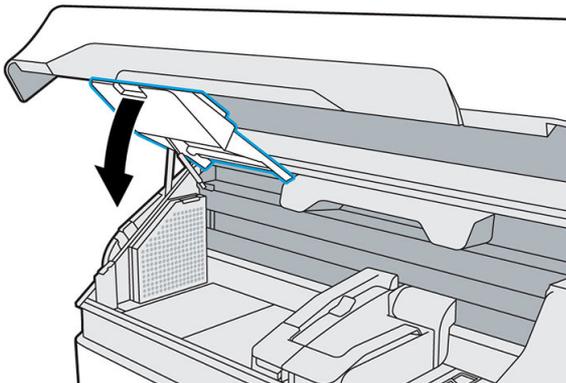
8. Insert the new filter, ensuring that the blue line on the filter is facing the interior of the print area.



9. Close the cover and reengage the latch.



10. Lower the front panel.



11. Optionally, move the fusing carriage back to its home position.
12. Close the top cover.



The carriage automatically returns to its home position, if it is not already there.

13. Tap **Finish and check** on the front panel.
14. Dispose of the old filter according to local regulations.

Replace the air intake filter

The front panel notifies you when the air intake filter needs to be replaced. Follow the steps on the front panel.

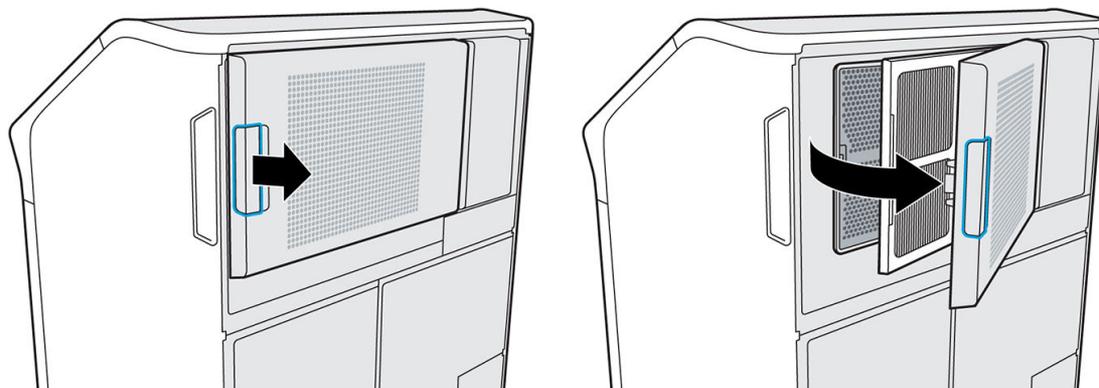
⚠ CAUTION: Do not open the air intake filter door while printing.

Tools needed

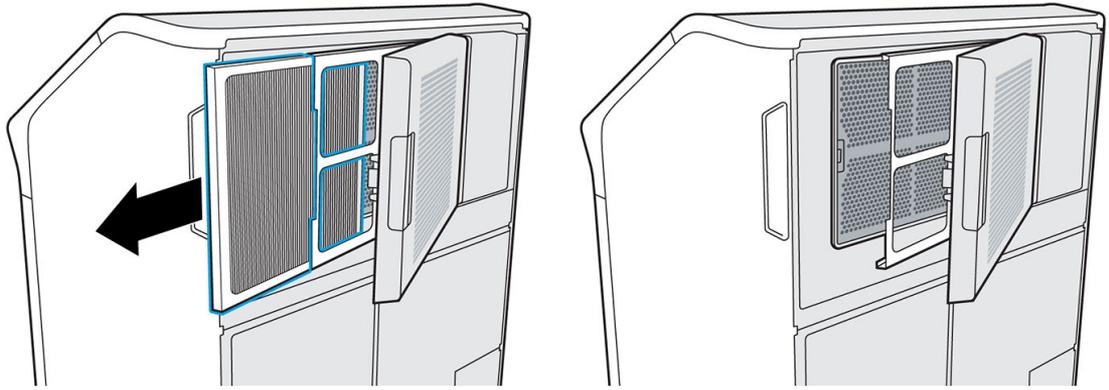
- HP 3D400 Air Intake Filter
- Nitrile gloves (recommended)

Procedure

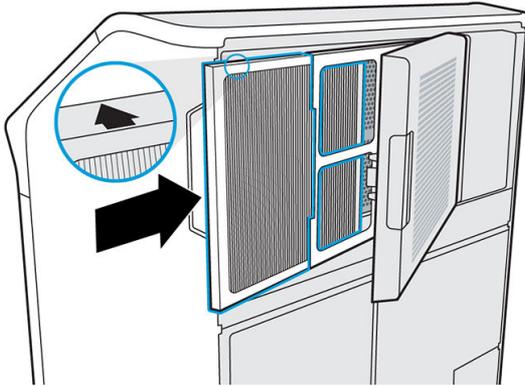
1. Tap **Replace air intake filter** on the front panel.
2. Release the latch at the rear right of the printer to open the access door.



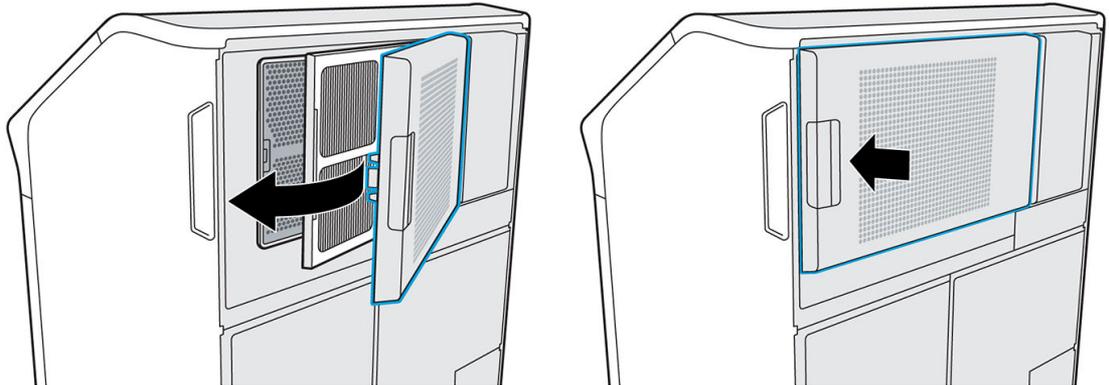
3. Slide out the used filter.



4. Insert the new filter. The arrows on it should be pointing towards the printer.



5. Close the filter cover and the access door (which clicks into place).



6. Tap **Finish and check** on the front panel.
7. Dispose of the used filter according to local regulations.

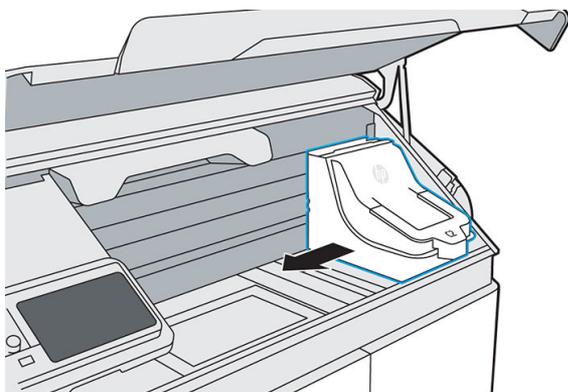
Replace the printhead cap

Tools needed

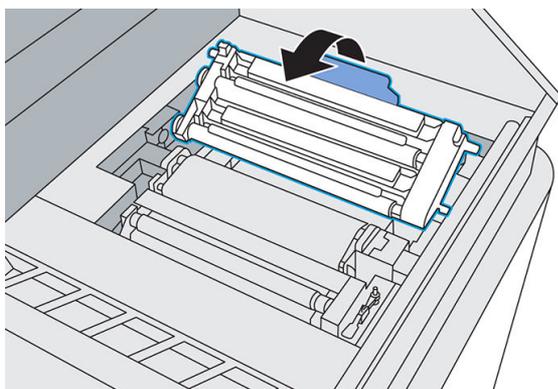
- Nitrile gloves (recommended)

Procedure

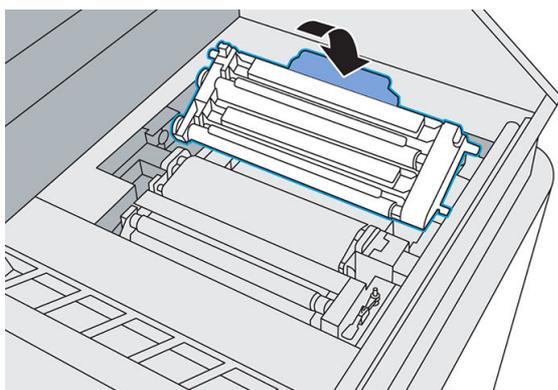
1. Move the print carriage over the build chamber.



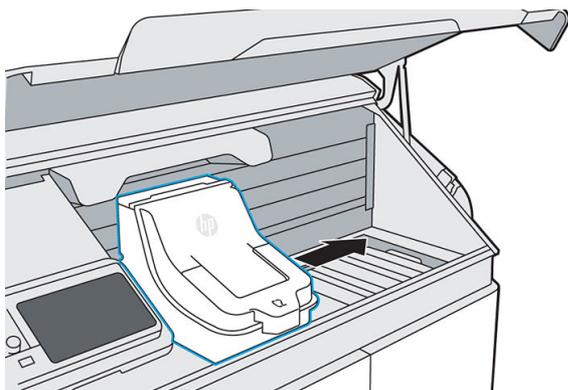
2. Remove the printhead cap.



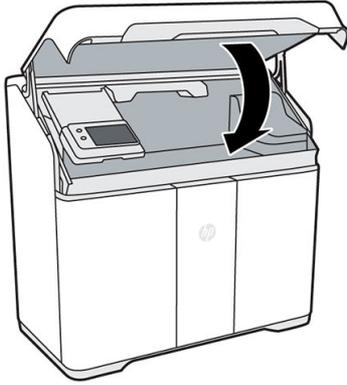
3. Insert the new printhead cap.



4. Move the print carriage back to the right.



5. Close the top cover.



6. Dispose of the old printhead cap according to local regulations.

Align the printheads

HP recommends printhead alignment in these situations:

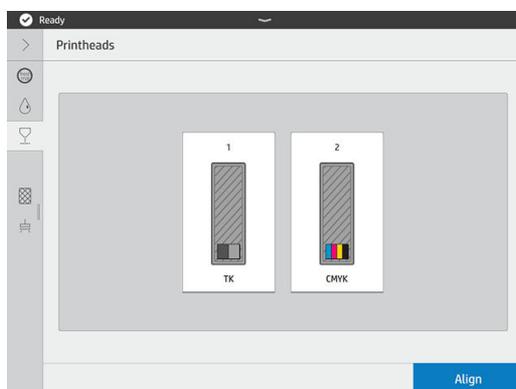
- After replacing or reseating a printhead
- After a printhead crash
- When there are print-quality problems that could be caused by printhead misalignment

Tools needed

- Nitrile gloves (recommended)
- Eight sheets of plain white, A4- or US-Letter-sized paper

Procedure

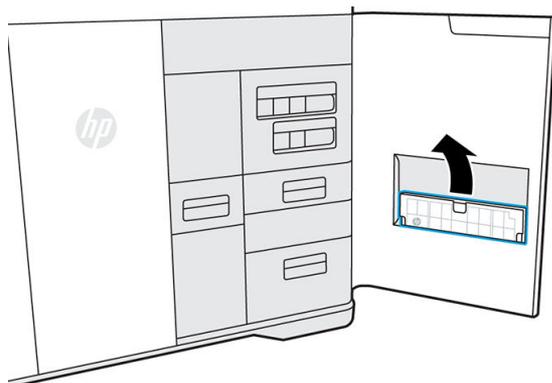
1. If you have just replaced the printhead(s), skip to step 6.
2. Go to the front panel and tap , then the **Printheads** tab, then **Align**.



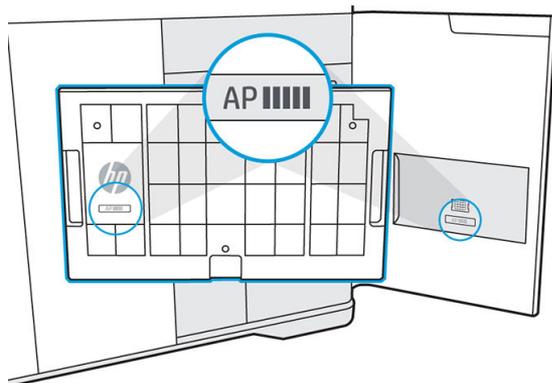
3. Open the top cover.



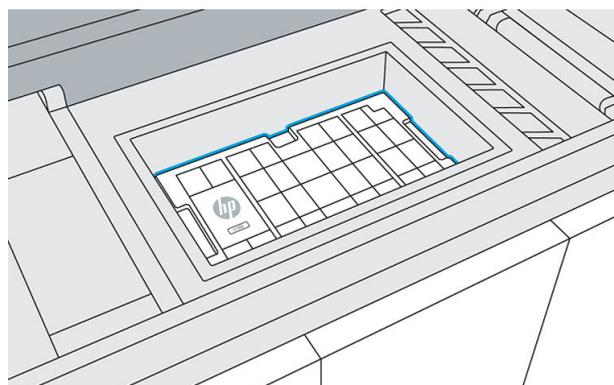
4. Open the agent door, and take the alignment plate from inside the door.



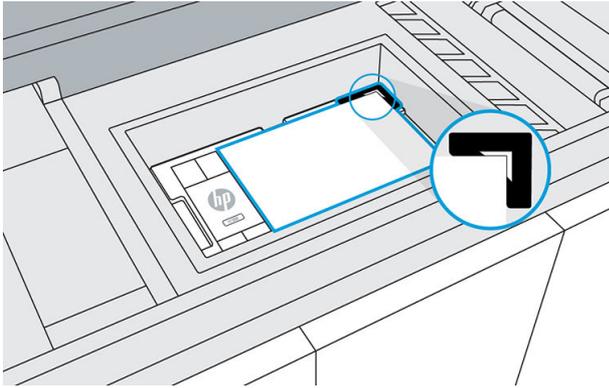
Each printer has one alignment plate. The number on the plate should match the number on the door.



5. Put the alignment plate on the bed and push it down as far as it will go. The HP logo on the plate should be facing up on the left of the build bucket.



6. Select eight sheets of plain white, A4- or US-Letter-sized paper, removing any pieces that are bent or torn.
7. Load one sheet of paper on top of the alignment plate, using the guides at the upper right corner for correct placement.



8. Close the top cover and tap **Print** on the front panel to print a test page.



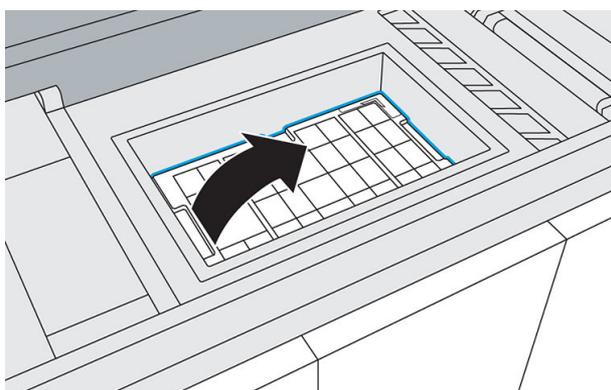
9. Open the top cover.
10. Remove the printed test page.
11. Check the printed test page. Lines on the test pages should be straight and continuous; otherwise, action may be needed.



12. Evaluate the test page according to the following table.

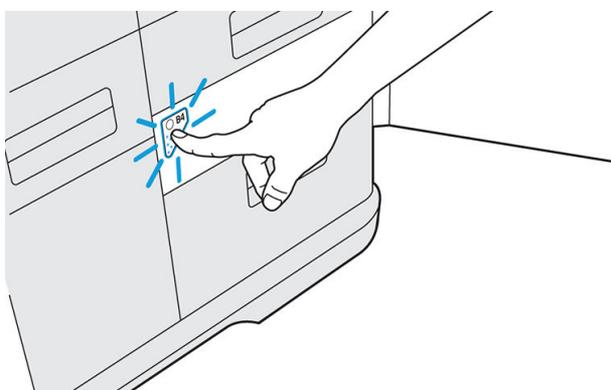
Problem description	Possible causes	Response
White lines in Diagnostic A or D in line with tick mark	Misalignment or missing nozzles	Printhead servicing; realign printheads
White lines in Diagnostic A or D not in line with tick mark	Missing nozzles	Printhead servicing
Staggered lines in Diagnostic B or C, consistent across the page		Realign printheads
Color intensity differences across diagnostic D	Pigment settling, die to die density variation	Printhead servicing; recalibrate color density
Ink mixing in diagnostic D	Internal or external contamination	Printhead servicing
Missing block in diagnostic D	Missing nozzles or die starvation	Replace print bar

13. Load another sheet of paper on top of the alignment plate.
14. Close the top cover and tap **Print** to print the first alignment page.
15. Open the top cover and remove the alignment page.

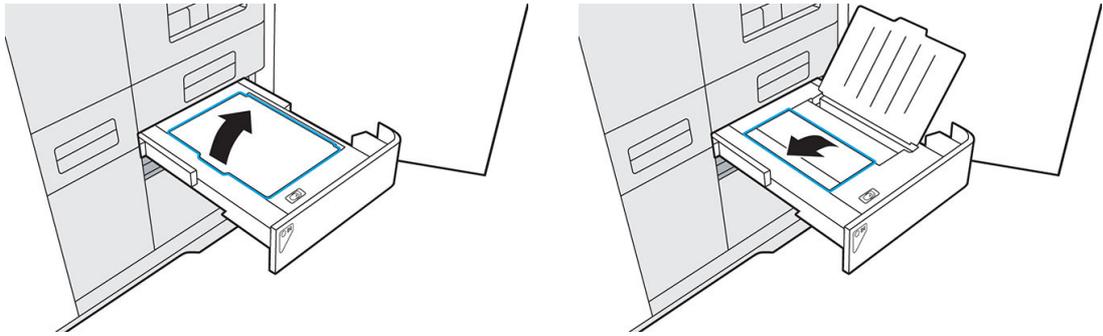


16. Push the cover of scanner drawer B4 to release and open the drawer.

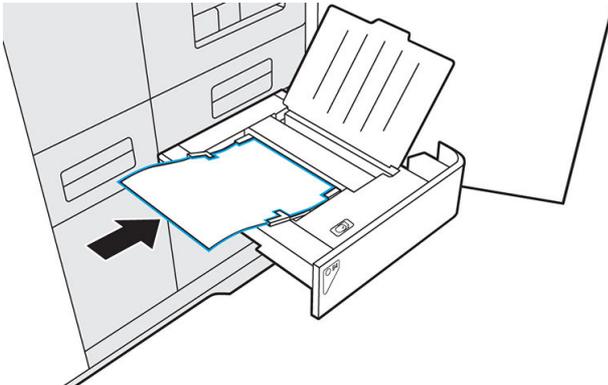
 **NOTE:** HP recommends cleaning the scanner before using it. Make sure there is no material on the scanner glass. See [Clean the scanner on page 83](#).



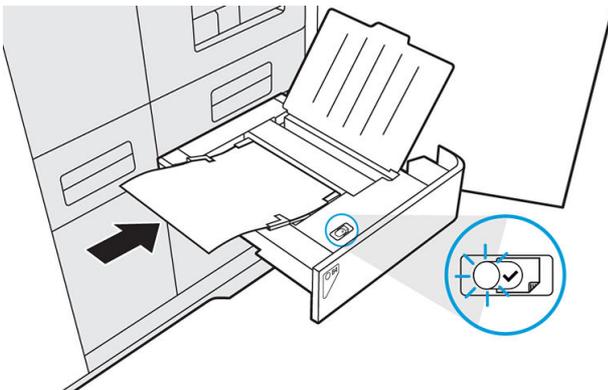
17. Open the scanner paper input and paper output trays to prepare the scanner for use.



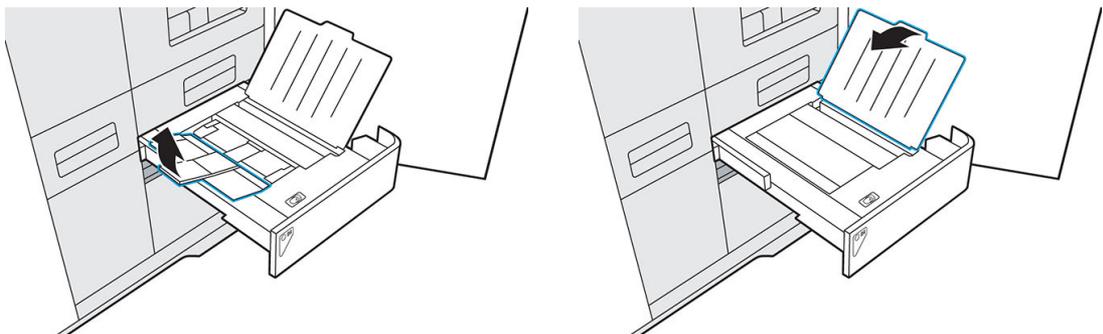
18. Load the first alignment page face-down on the scanner input tray.



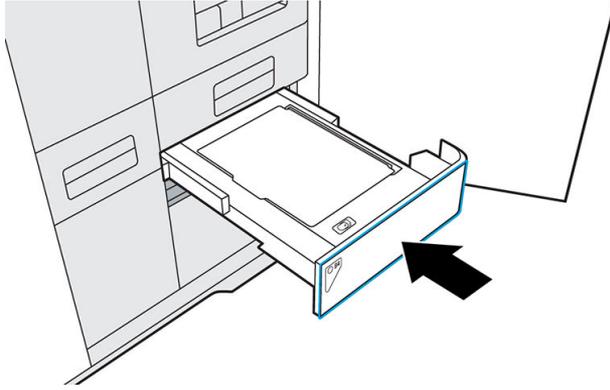
When paper is detected, the paper LED turns on.



19. Tap **Scan** on the front panel.
20. Repeat this process for all eight alignment pages.
21. When the last page has been scanned, remove all alignment pages and close the paper trays.



22. Push in the scanner drawer to close it.



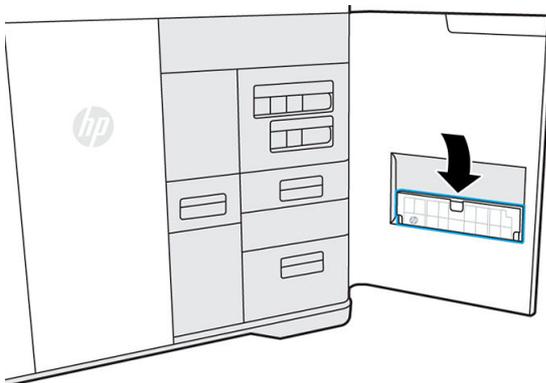
23. Load another sheet of paper onto the alignment plate.

24. Close the top cover and tap **Print**.



25. A second test page is printed to confirm printhead alignment. Lines on the test pages should be straight, continuous, and the same color. Otherwise, further troubleshooting may be required.

26. Remove the alignment plate, and store it inside the agent door.



27. Close the agent door.

28. Close the top cover.

15 Move or store the printer



IMPORTANT: If your printer needs to be moved to a different location or room, you should contact your reseller for assistance. The printer has sensitive components that can be damaged during transportation: special transportation features and tools are needed.

Do not move the printer for any purpose without service assistance. Additional packing precautions and installation calibrations are required for significant displacements of the printer.

Before turning off the printer, ensure that the printing carriage is in its home position. Then follow the shut-down procedure.

To store the printer for an extended period of time (longer than a weekend), first clean it, ensuring that there is no material left inside. See [Clean the print area on page 71](#).

The printer should be stored at a temperature of -20°C to $+50^{\circ}\text{C}$ and humidity of less than 90% (without condensation).

If the printer has been shipped, agent cartridges and printheads may need up to 24 hours to acclimate to operating temperature, depending on previous and current temperatures.

16 Print-quality optimization

- [General advice](#)
- [Printing tips and tricks](#)
 - [General considerations](#)
 - [Optimizing look and feel](#)
 - [Optimizing dimensional accuracy](#)
 - [Optimizing mechanical properties](#)
 - [Design optimization strategies](#)

General advice

When you have any print-quality problem:

- To achieve the best performance from your system, use only genuine manufacturer's supplies and accessories, whose reliability and performance have been thoroughly tested to give trouble-free performance and best-quality prints.
- Check that your environmental conditions (temperature, humidity) are in the recommended range.
- Check that your material cartridges and printheads have not passed their expiration dates.
- Check that you are using the most appropriate settings for your purposes.

For the latest information, see:

- <http://www.hp.com/go/jetfusion540/support/>

The following procedures may help to solve some print-quality issues, see specific print-quality issues for details if the issue is detected:

- [Align the printheads on page 110](#)
- [Recover \(clean\) the printheads on page 63](#)

Printing tips and tricks

General considerations

For optimal part quality, you need to prepare the site as explained in the site preparation guide:

- The operating temperature of the equipment should be between 20–30°C (68–86°F). Going outside these limits could have adverse effects on part quality. Try to prevent big thermal fluctuations, even within the limits.
- Printer operating relative humidity should be between 20–70% without condensation. Maintain this range for optimal system usage and performance.
- Power line quality is important. If you suspect that the power installation at the site will suffer from variability or alterations, HP recommends installing a UPS system.
- Make sure to select the correct altitude for your location. A wrong selection could directly affect the cooling system and pressure parameters.
- Jobs with an extremely high packing density, non-recommended material mix ratios, and bad system maintenance may lead to some part-quality issues.

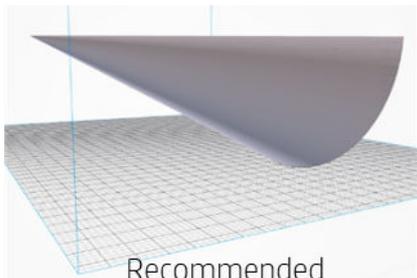
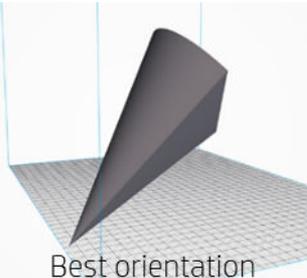
To maintain part quality, follow the cleaning, maintenance, and calibration recommendations of this guide. For details of printer maintenance, see [Maintenance on page 65](#).

Some problems may be caused by printhead issues. Make sure the printheads are correctly aligned and in good condition. There are various actions that can be taken to detect cross-contamination and to help the printer recover from blocked nozzles. See [Printhead health troubleshooting on page 63](#).

Optimizing look and feel

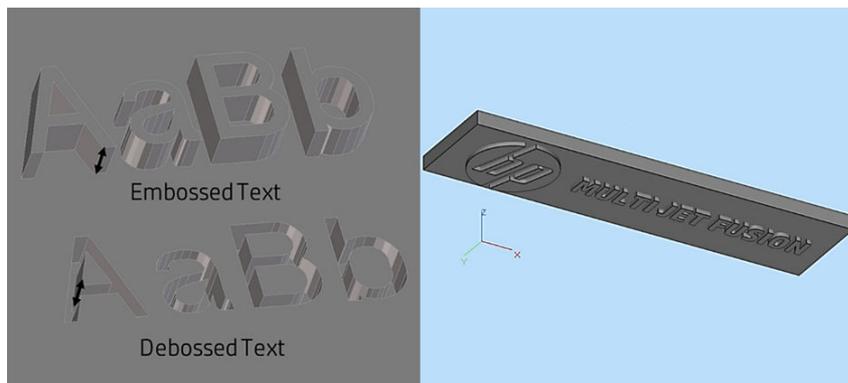
MJF is a layer-by-layer manufacturing technology and, consequently, every measurement in the Z direction is a multiple of the layer thickness (80 µm). The disposition of these layers is not noticed in many situations due to their small size and good inter-layer cohesion, but this ultimately depends on the angle of the part with respect to the building reference system. Therefore, HP recommends avoiding angles below 20° between big, flat areas

and the XY plane. Moreover, heat distribution under parts has been observed to smooth the transition between layers. Thus, placing curved and cosmetic features upside down is recommended, as shown below.

Part placed upside up	Part placed upside down	Part placed avoiding small angles, to completely remove stair stepping
 <p data-bbox="341 595 587 629">Not recommended</p>	 <p data-bbox="794 595 975 629">Recommended</p>	 <p data-bbox="1190 595 1401 629">Best orientation</p>

Some geometries may display position- and orientation-dependent artifacts, such as capillarity, sinks, abraded tops or bubbles that can be reduced by keeping the following advice in mind during the creation of the printing job:

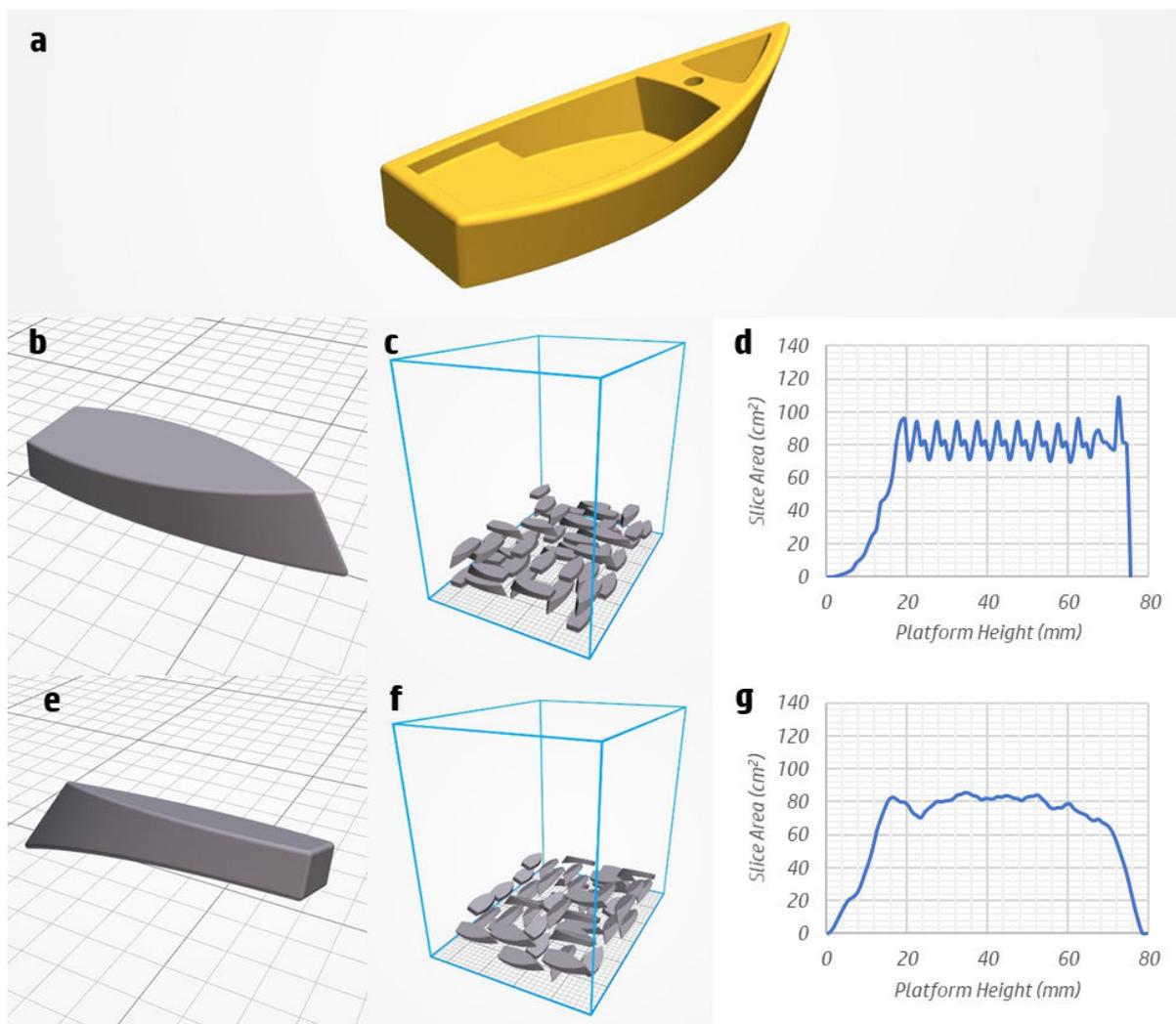
- Since many of these artifacts mainly affect the last printed layer, it is recommended to rotate the part so that the top layers have a reduced cross-section, avoiding flat areas as much as possible (see scenario C above).
- Place small features such as pins and thin walls upside down to improve their look and feel and resolution. This also applies to embossed or debossed text, which should be printed along the XY plane for maximum resolution, as shown below.



- Small rounded features may be prone to collecting small bubbles and should be positioned facing downward to avoid this effect.

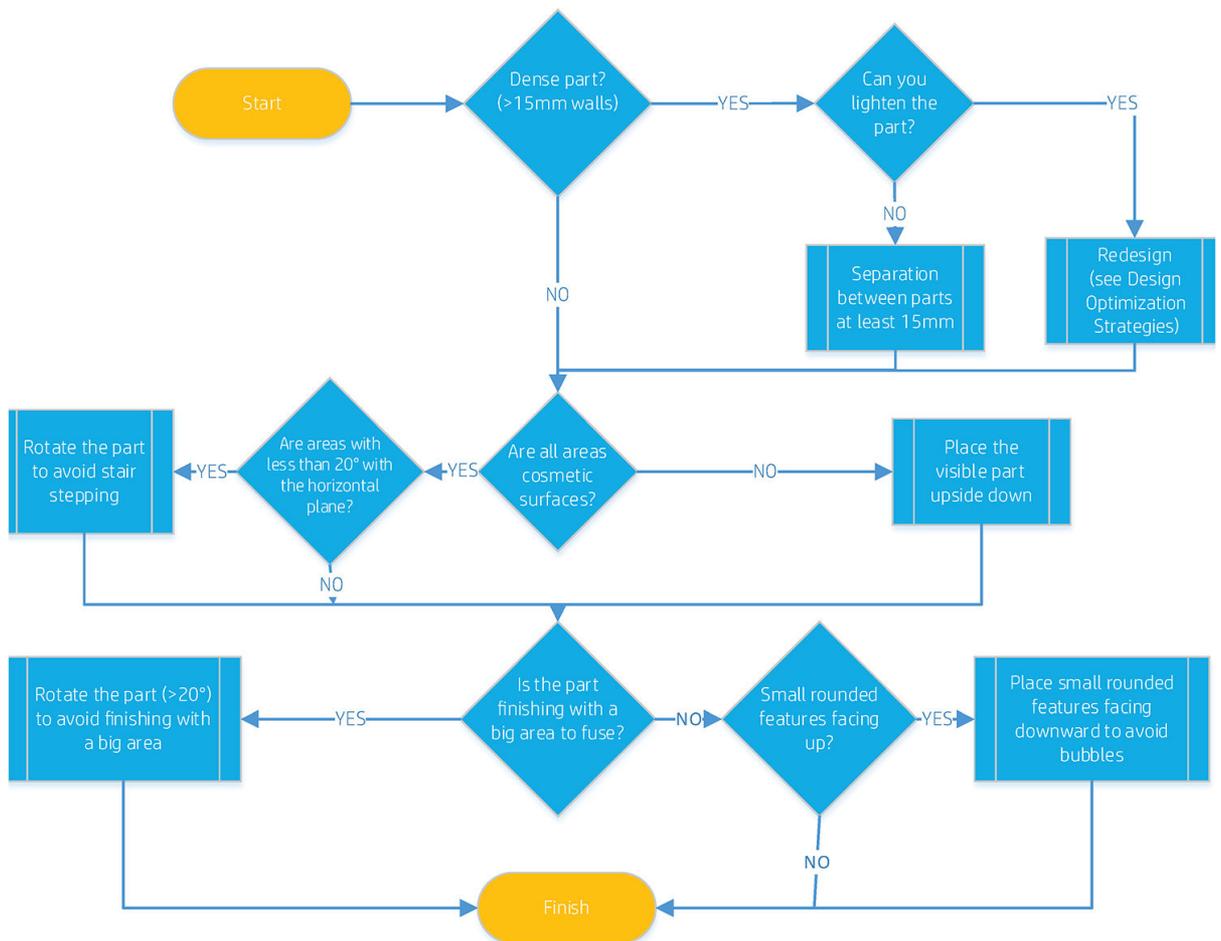
Look-and-feel flowchart and examples

To further illustrate the recommendations provided for cosmetic parts, an example involving a toy sailboat is shown below. Since the most visible area of the object is the inside of the boat, it is immediately clear that the part needs to be placed facing downwards to provide a better finish in that section. A first approach would be to leave it flat (B), but the printed-area distribution of this orientation (especially in the collective case with 50 identical boats) ends sharply after a maximum peak (D), which may cause surface artifacts such as capillarity, abraded tops, and sinks. Consequently, the boat should be angled, but always at more than 20° in order to minimize the visibility of the individual layers (E). Please note that this rotation can be performed around a different axis or a combination of them. The rotation axis along the boat's length is chosen to minimize the required Z-dimension printing and distribute the printed area across the many layers.



In terms of the position of the parts in the build chamber, it is best to look for the center of the platform, but there is not a significant difference in the result whether the parts are oriented along the X or the Y axis. Thus, in the collective scenarios where 50 boats are printed in the same job, rotations around the Z-axis are allowed, which can increase packing density (depending on the geometry of the parts) and, more importantly, helps the required droplets to be shared across more printing elements. This homogeneous distribution of the printing load is important, to avoid overstressing a small set of dies while leaving others idle for long periods of time.

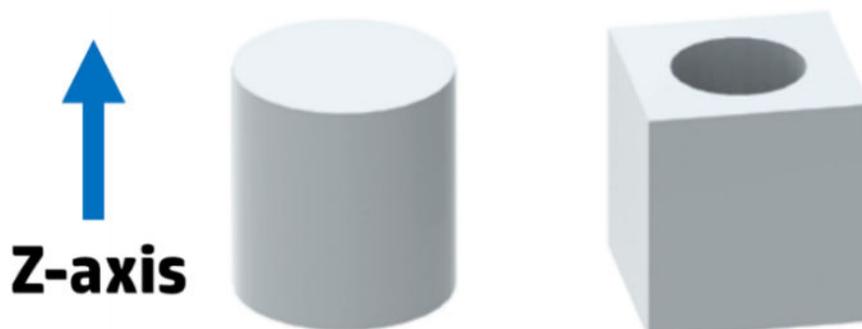
The advice provided in this section is summarized in the flowchart below, which can be used as a guide to optimize the look and feel of printed parts.



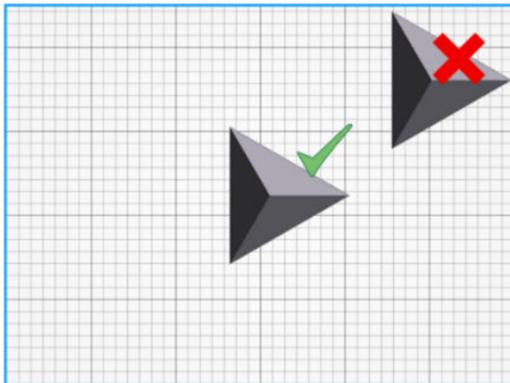
Optimizing dimensional accuracy

To maximize accuracy, the system needs to operate at voxel level with adequate energy delivered to fuse the intended sections layer-by-layer. To achieve this goal, please consider the following:

- Make sure that the cover glasses of both the fusing lamps and the thermal camera are clean.
- Make sure that the file is printable and that the dimensions are within the capabilities of the system.
- Orient each part placing its critical features on the horizontal plane, since it provides the highest resolution. As such, pins and holes should ideally have their diameters contained on the XY plane. For flat and thin parts (with an aspect ratio higher than 10:1), see the following section for additional tips on preventing shrinkage-related deformations.
- Place small features such as pins and thin walls upside down to improve their look and feel and strength. This also applies to embossed or raised texts, which should be printed on the XY plane for maximum resolution.



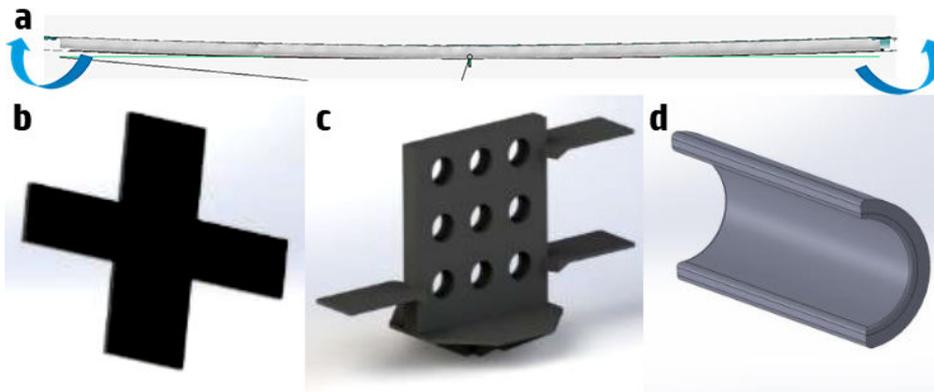
- The recommended minimum distance between parts is 5 mm.
- Leave enough separation (at least 15 mm) between dense parts (wall thickness at least 15 mm) to stop larger objects from heating neighboring parts. This does not mean that the separation between all parts in the job needs to be set to at least 15 mm, as there is specialized software that allows for different separations for different kinds of parts.
- Place the parts with the highest dimensional requirements, especially on the Z axis, centered and as low on the printing platform as possible (see below). For optimum results, leave a margin between the parts and the walls of the build chamber. However, the area outside this optimum region is still valid and can still be used for parts with lower dimensional requirements, particularly in the Z direction.



- Distribute the parts as homogeneously as possible on the XY plane to facilitate similar energy absorption across the printing bed. The reason for this is that, at equal irradiance, sections with lower printed areas receive significantly more energy than zones with higher packing densities due to the radiation reflection of the unfused material and the lamps' cover glasses. Consequently, lower packing densities effectively receive more energy per part than higher packing densities with the same material, print profile, fine-tuning, and type of parts.
- Place the parts in the building chamber avoiding drastic changes in the printed areas per layer (in the Z direction). Information about the printed-area distribution along the Z axis is also provided by some professional suites.
- Redesigning dense parts by hollowing them or putting internal lattices into them (see [Design optimization strategies on page 127](#) for further information) reduces the amount of melted material and therefore the overall temperature of the surrounding areas. These strategies also save both fluid agent and material compared to fully-solid designs.
- Once printed, thorough cleaning by bead-blasting is required to remove all the unfused material that may have accumulated within small cavities. This is crucial, before measuring the parts, to obtain reliable results.
- Bear in mind that post-processes such as machining and inserting additions are possible with MFJ parts, which allow you to increase the resolution of their localized features beyond the capabilities of the system alone. When the parts are machined, it's possible to end up seeing the internal core of the part, which is black, depending on the quantity of material removed.
- Make sure that each part or assembly appears as a separate 'part' within HP 3D Build Manager (listed as a separate line in the parts list) so that the printer can optimize each part's dimensions based on location. The individual meshes that make up an assembly (clearances less than 3 mm) should all be grouped into the same 'part' so that the printer can optimize any tight clearances between meshes.

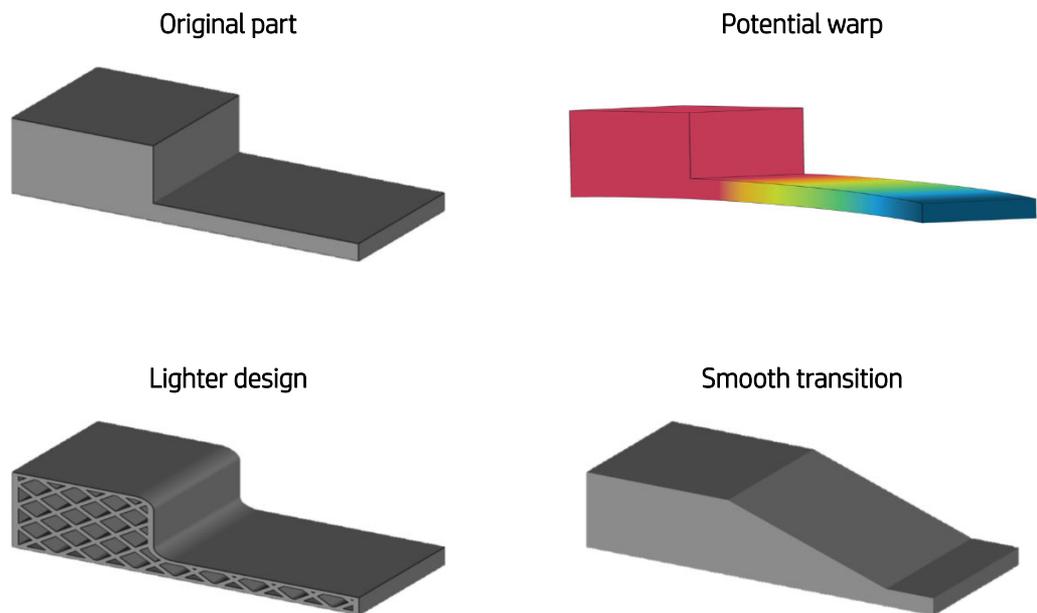
Thin and long parts

Long and thin parts are susceptible to non-uniform cooling, which may cause uneven shrinkage along the printed part, creating a distortion in a certain direction that deviates from the nominal shape. As a rule of thumb, any part with an aspect ratio higher than 10:1, an abrupt change in its cross-section, or a predominantly long and thin curved segment is susceptible to warping.



The following actions can be considered to minimize the possibility of this deformation:

- Increase the thickness of long walls to reduce their aspect ratios. The thicker the part, the stiffer it will be, and the more internal stresses it can withstand.
- Redesign parts with high potential stresses and smooth out their cross-section transitions, as shown below.



- Lighten the parts by hollowing them or by adding internal lattices to them (see [Design optimization strategies on page 127](#) for more details).
- Sacrificial supports may keep thin parts from deforming, but these should be carefully applied to keep from inducing even greater stresses. These scaffolds should be light and should not come into contact with the part at too many points.
- Print short builds, which accumulate less heat and cool down faster but in a controlled way.
- Bear in mind that the stiffness of thin polyamide parts is low, which means that most warped parts can be effortlessly reshaped once they are mounted in their designated place. Furthermore, thermal post-treatments can be applied to conform the material into a different shape after printing, allowing for fine-tuning of finished parts.

Large and/or dense parts

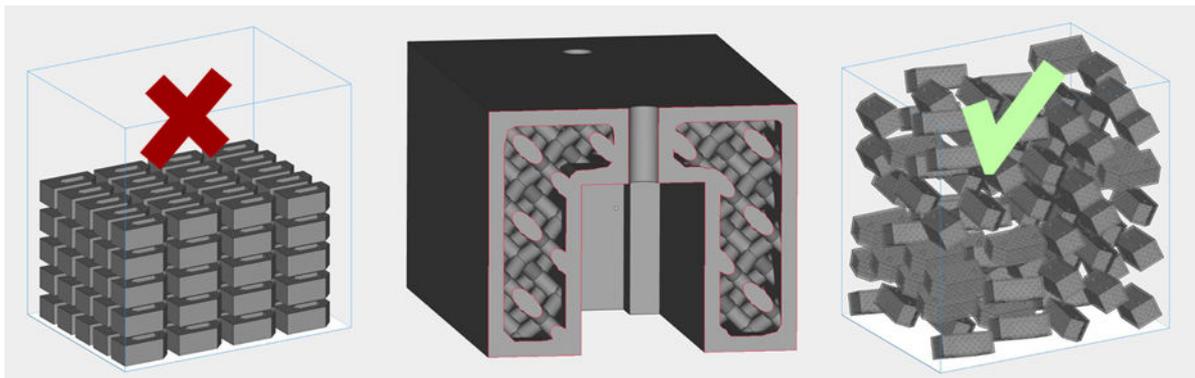
Dense parts are those with a substantial mass concentrated in a reduced volume, so they do not have many cavities or have walls thicker than 15 mm. These massive objects accumulate more heat than the average part and require a special heat-management approach that is built into the system's own printing algorithm. However,

when many of these objects are printed in the same session, the generated heat may exceed the dissipation achieved following the standard recommendations provided in other sections of this document. For these cases, HP has the following recommendations:

- Make sure that the parts are appropriately separated (by 15 mm or more) and that the packing density is not excessive.
- A way of decreasing packing density without drastically reducing the number of parts is to hollow them (see [Design optimization strategies on page 127](#) for more details). However, depending on the thickness of the external walls and the design of the part, hollowing may result in sinks due to slightly different shrinkage rates in different sections. In this case, an internal lattice is recommended to reduce the mass of the object while keeping structural integrity.
- Print jobs containing a fairly high density of massive parts are likely to generate heterogeneous layer distributions. In other words, some layers would contain a big printed area while others would be almost blank. To avoid heating irregularities, follow previous advice on print job design.
- Short builds help reducing the time that the parts spend at high temperature, which improve the general output.
- High packing-density print jobs with dense parts can result in material yellowing. This would not normally affect dimensional accuracy, but can weaken the mechanical properties of thinner parts.

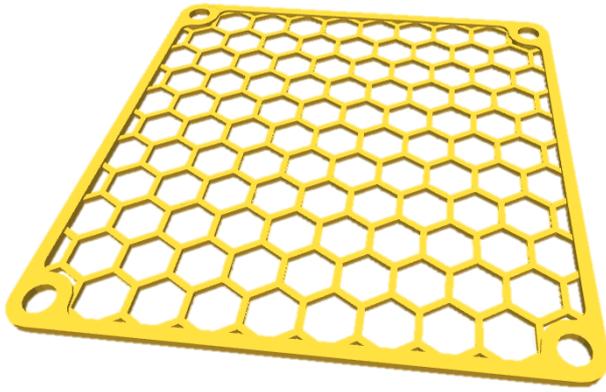
The illustration below shows:

- Left: Job design not recommended due to excessive packing density, dense parts, array configuration, and flat orientation.
- Center: Section of a dense part that has been lightened by applying internal lattices.
- Right: Recommended job design with lightened parts and increased part separation, tilted orientation, and more degrees of freedom during automatic packing.



Dimensional accuracy flowchart and examples

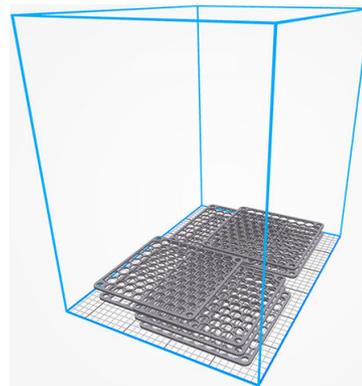
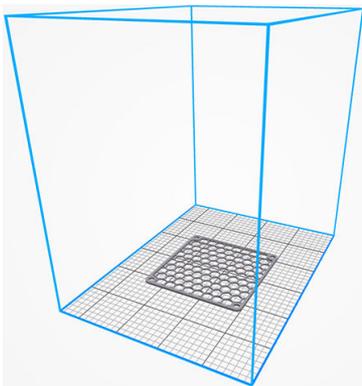
The first example involves the printing of a honeycomb plate with the aim of maximizing dimensional accuracy. For this part, the first thing to notice is that it is very similar to a big, flat plane, and therefore the object is moderately susceptible to warping. However, thanks to its light honeycomb design, this deformation is not expected to be as severe as on a fully-dense plate.



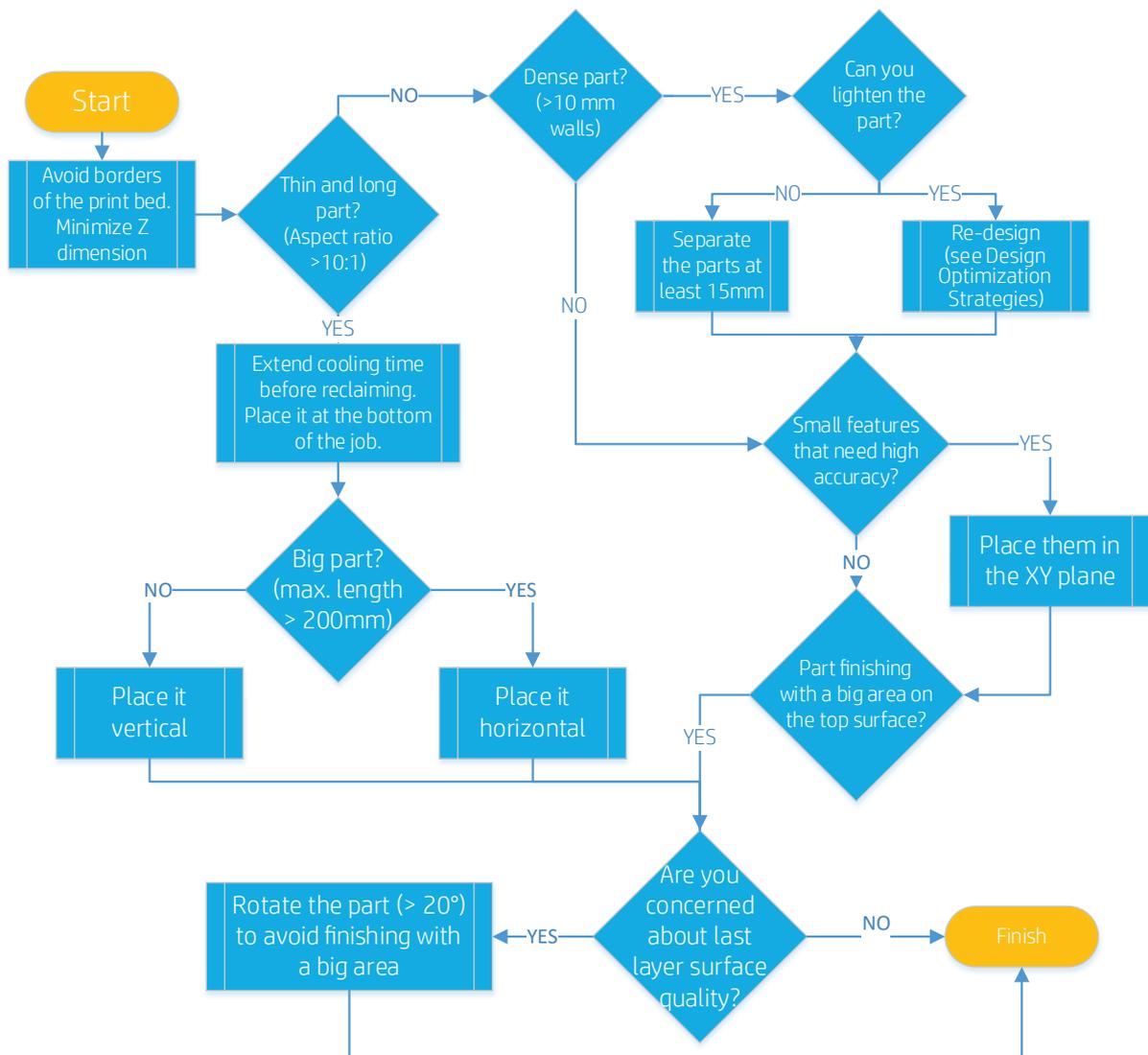
To maximize the accuracy and circularity of positioning holes, HP recommends orienting the part so that these features are contained on the XY plane. Bear in mind that placing a part flat can induce capillarity on its top face, so angle the part slightly to prevent it if this is more critical than obtaining maximum accuracy for the holes. To preserve the flatness of a part, center it as much as possible on the platform, place it in the lowest quarter, use natural cooling, and wait at least 50% longer than the default cooling time before retrieving parts.

In a collective scenario where several plates of this type are required, HP has the following recommendations:

- Print short builds using different build units.
- Center the parts as much as possible.
- Make sure that a similar number of parts are being printed at each level. In the example there are either two parts per level or none.
- Shuffle the parts so that they do not line up along the same XY coordinates. This shares the printing load among more printheads, extending their lifespans.
- In HP SmartStream 3D Build Manager, select **Natural cooling** as the cooling profile so that reclamation does not start automatically. Then wait an extended period of time before reclaiming.



The advice provided in this section is summarized in the flowchart shown below, which can be used as a guide for maximizing the dimensional accuracy of printed parts.



Optimizing mechanical properties

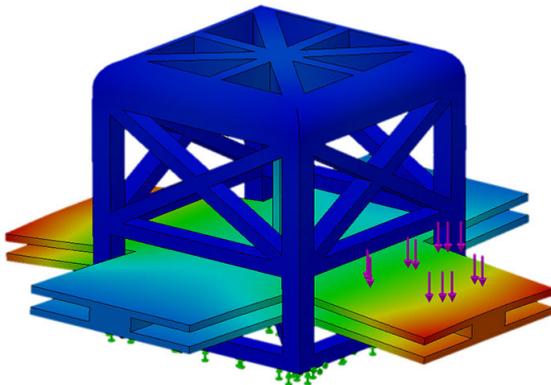
The following points should be considered in order to improve the mechanical performance of the parts:

- Make sure that the cover glasses of the fusing lamps and the thermal camera are clean.
- Best mechanical results are obtained when printing on white material, so you are advised not to re-use material that is showing distinctive yellowing.
- The recommended minimum distance between parts is 5 mm.
- Leave enough separation (at least 15 mm) between dense parts (wall thickness at least 15 mm) to stop larger objects from heating their nearby neighbors. This does not mean that the separation between all parts in the job needs to be set to at least 15 mm, as there is specialized software that allows for different separations for different kinds of parts.
- Distribute the parts as homogeneously as possible in all directions, XYZ, to facilitate similar energy absorption across the printing bed. The reason for this is that at equal irradiances, sections with lower printed areas receive significantly more energy than zones with higher printed areas due to the radiation reflection of the unfused material and the lamps' cover glass. Consequently, lower packing densities effectively receive more energy per part than do higher packing densities with the same material, print profile, fine-tuning, and type of part.

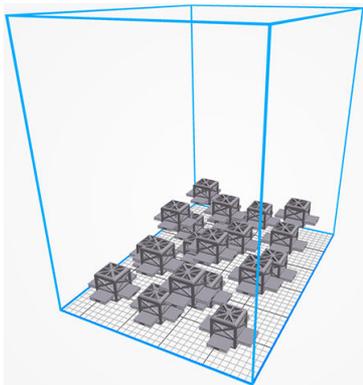
- Place the parts in the build chamber avoiding drastic changes in the printed areas per layer (in the Z direction).
- Print short jobs, minimizing the number of layers, which allows faster printing and cooling stages. This has been observed to increase the elongation at breakpoints and the impact resistance of parts due to faster re-crystallization of the polyamide.
- Place mechanically important features in the XY plane, because tensile and impact properties tend to be slightly better than in the Z plane.
- Avoid placing parts close to the walls of the build chamber, especially if oriented in the Z direction.

Mechanical examples

An example of part orientation for a part that requires increased elongation and impact resistance in its thinner features is shown below. These features will perform best when oriented in the XY plane.



However, as discussed previously, for better mechanical properties, other process factors such as job height and density are also important. Thus, to obtain high elongation and impact resistance values, HP recommends cooling the parts using the **Auto cool & reclaim** cooling profile in HP SmartStream 3D Build Manager, and printing shorter jobs (minimizing Z height) with low packing densities. A short job is shown below with 20 copies of the same part.

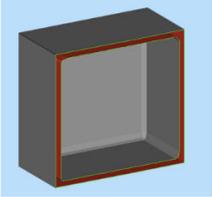
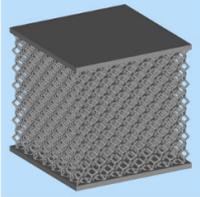
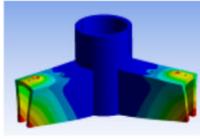


Design optimization strategies

Decreasing the overall mass and wall thickness of printed parts helps to reduce the amount of material used, which has an associated cost reduction. Furthermore, thinner sections accumulate and re-radiate less heat, improving the dimensional accuracy and general look and feel of the parts. The most obvious re-design route is to alter the CAD manually, trying to remove any unnecessary features and sections, as is done for other manufacturing technologies. However, Additive Manufacturing allows the designer to create more complex structures than ever before, enabling substantial savings in time, material, and assembly time.

Semi-automatic re-design routes can be followed to achieve similar or even greater part optimizations, such as hollowing the objects, inserting internal lattices into them, or applying topology optimization algorithms. These

strategies are summarized below and are briefly described in the following sections. They can, of course, be combined for even more significant mass reduction.

HOLLOWED	LATTICE	TOPOLOGY OPTIMIZATION
		
<ul style="list-style-type: none"> • Suited for dense parts that do not have high mechanical requirements • Automatic re-design that can be applied in minutes • Cost and weight of part are highly reduced 	<ul style="list-style-type: none"> • Middle ground between hollow and solid parts • Useful in applications that require fluid flow through the part • Automatic re-design that can also be applied in minutes once the type of lattice is chosen 	<ul style="list-style-type: none"> • Suited for parts that have complex load distributions • Optimized weight reductions are achieved while retaining mechanical properties • The re-design time investment is higher and requires more engineering hours

Hollowing

This method consists of hollowing the CAD file through an automatic process (built into HP SmartStream 3D and other professional software). This is very fast and simple, reducing the mass of a part significantly, but at the expense of its mechanical integrity, as the amount of melted material is diminished. However, the performance of the part compared with the fully solid design is ultimately linked to the remaining wall thickness and the amount of unfused material left within the part.

- The minimum recommended wall thickness is 2 mm, but higher mechanical properties are achieved with thicker walls. The optimum choice is application-dependent.
- At least two drain holes with a minimum diameter of 5 mm in opposite faces of the part are recommended for efficient material removal, which is important in obtaining the highest weight reduction.
- Trapped unfused material can be left within the part if no drain holes are included. This results in heavier and more resistant parts compared with the fully hollow option. However, while the part is still light, it is weaker than the non-hollowed version. The difference in weight stems from the different density of fused and unfused material. Leaving the material trapped within a part also saves post-processing time, since no material extraction is required.

Lattice structures

This method consists of hollowing a part and replacing the internal solid mass by a lattice structure that provides mechanical integrity by the collective action of many rigid cells. The advantage of this method is that it can retain a higher fraction of the fully dense part's mechanical properties than a hollow part does while still noticeably reducing the part's mass and cost. This redesign is also a fast process that can be automated with professional software. The main design parameters in these cases are geometry and the distribution of the lattice cells, beam thickness, wall thickness for enclosed lattices, and the presence of unfused material.

- The geometry of each cell of the lattice defines the load distribution. Lattice geometries can be isotropic or anisotropic. This choice of geometry allows designers to introduce different local properties on the final part.
- The point distribution determines the size of each lattice cell. The higher the cell size given a specific geometry, the fewer cells in the same volume, leading to a higher cost/weight reduction, but also to a greater mechanical trade-off.
- The thicker the beams, the better the mechanical properties, but the lower the reduction in cost and weight.

- There is no minimum wall thickness recommended for enclosed lattices as they are not the main structural agents. Thicker walls provide higher mechanical properties, but lower weight reduction.
- Unfused material can be difficult to remove from a part through drain holes when a part has a lattice structure inside it. Therefore, HP recommends leaving the material trapped within, or leaving the lattice partially open. A minimum separation of 5 mm between lattice beams is recommended in order to facilitate material removal.

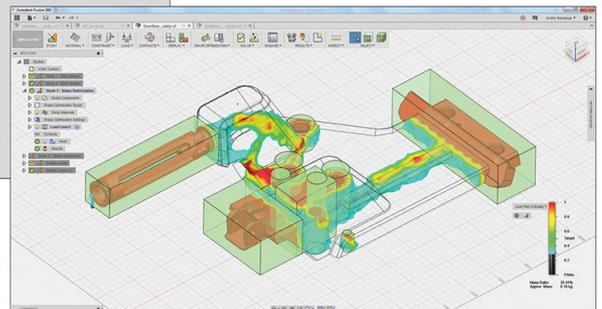
Topology optimization

Topology optimization is a Finite-Elements-Method (FEM) process that finds the best distribution of material given an optimization goal and a set of constraints. Typical optimization goals are mass reduction and creating specific mechanical properties. This process requires the designer to know the part's function and load distribution in depth, but provides the most optimized method of reducing weight and cost from the original design. The time needed to apply this type of redesign is significantly higher than the previous methodologies. Professional software can apply optimization algorithms.

The illustration below shows an example of various topology optimization iterations of an industrial part. Deep knowledge of the geometry and performance requirements of the part is required.



HP Jet Fusion Latch Base



Material: HP 3D High Reusability PA 12
Machine: HP Jet Fusion 3D Printer

17 Ordering information and end-of-life recommendations

This chapter lists the available supplies and accessories, and their part numbers, at the time of writing.

Contact your support representative and check that what you want is available in your area and for your model.

Part number	Name	End-of-life recommendations
V1Q67A	HP 3D400 Printhead Kit	Dispose ¹
U9ZR5E	HP 3D400 Cleaning Roll	HP Planet Partners Program ²
V1Q80A	HP 3D400 500ml Detailing Agent	HP Planet Partners Program ²
V1Q71A	HP 3D400 500ml Fusing Agent	HP Planet Partners Program ²
V1Q81A	HP 3D400 250ml Bright Fusing Agent	HP Planet Partners Program ²
V1R30A	HP 3D HR CB PA 12 10L/4 kg Material	If empty, locally recyclable. If full or partially full, dispose ¹
U9ZR1E	HP 3D400 Air Intake Filter	Dispose ¹
U9ZR2E	HP 3D400 Print Area Filter	Dispose ¹
U9ZR3E	HP 3D400 Air Exhaust Filter	Dispose ¹
U9ZR6E	HP 3D400 Lamp Module	HP Planet Partners Program ²

¹ Dispose of such items in compliance with federal, state, and local regulations. Consult your local authorities to determine the correct manner in which to dispose of waste.

² Visit to see how to participate and for HP Planet Partners program availability: the program may not be available in your area. Where this program is not available, and for other consumables not included in the program, consult your local waste authorities on appropriate disposal.

18 System errors

The system may occasionally display a system error, consisting of a numerical code of 12 digits followed by the recommended action that you should take.

In most cases you will be asked to restart the printer. When the printer starts, it can diagnose the issue better and may be able to fix it automatically. If the problem persists after restarting, contact your support representative and be ready to give the numerical code from the error message. If the error message contains some other recommended action, follow the instructions.

19 When you need help

Request support

Support is provided by your support representative: usually from the company from which you bought the printer. If this is not the case, contact HP Support on the Web:

- <http://www.hp.com/go/jetfusion540/support/>

Before calling your support representative, prepare for the call as follows:

- Review the troubleshooting suggestions in this guide.
- Review your software documentation, if relevant.
- Check that you have the following information ready:
 - The product and serial numbers of the printer you are using.
 - If there is an error code on the front panel, make a note of it. See [System errors on page 131](#).
 - The name and version number of your software.
 - If you have a print-quality problem, the name and product number of the material that you were using.

Customer Self-Repair

HP's Customer Self-Repair program offers our customers the fastest service under either warranty or contract. It enables HP to ship replacement parts directly to you (the end user) so that you can replace them. Using this program, you can replace parts at your own convenience.

Convenient and easy to use

- Your support representative will diagnose and assess whether a replacement part is required to address a defective hardware component.

For more information about Customer Self Repair, see <http://www.hp.com/go/selfrepair/>.

Service information

The Command Center can produce on request a list of many aspects of the printer's current status, some of which may be useful to a service engineer trying to fix a problem.

20 Accessibility

Front panel

If required, the front-panel display brightness and the loudspeaker volume can be changed (see [Change system options on page 18](#)).

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