

## Post-Processing



# Figure 4<sup>®</sup> Modular

## Post-Processing Guide

Rev. F, P/N 42-D117

Original Instructions



NOTE: Use this page to print the Post-Processing Guide as a whole. Scroll down to the bottom of the page and click the  [Printer-friendly version](#) button. On the page in the new tab, press ctrl+P (cmd+P on Mac) to print the document or save it as a PDF.



NOTE: Please refer back to [support.3dsystems.com/s/figure-4-modular](https://support.3dsystems.com/s/figure-4-modular) for the most up-to-date Post-Processing Guide.

## About this Manual

Once your Figure 4 Modular parts have printed, they are considered "green." That is to say that they are not finished parts yet, and are not safe to touch without 100% nitrile gloves. The parts will not be considered finished and safe to touch until they have been properly cleaned, dried, and fully cured in a UV chamber. The purpose of this manual is to guide you in the proper Post-Processing of your Modular parts.

The instructions in this guide are only meant to be applied to those resins that are available for the Figure 4 Modular 3D printer system.

# Important Safety Information

## Safety Symbols and Definitions



**HOT SURFACE HAZARD:** Parts may be hot when handling. Avoid contact. Allow surface to cool before touching.



**HARMFUL IRRITANT WARNING:** Indicates that skin or eye irritation could result while exposed to a chemical composition.



**WARNING: INDICATES THE POSSIBILITY OF INJURY PERSONNEL**



**WEAR GLOVES: WEAR THE APPROPRIATE GLOVES WHEN REQUIRED. FOR EXAMPLE, WHEN TOUCHING SURFACES THAT MAY CONTAIN OR HAVE BEEN EXPOSED TO RESINS, WEAR NITRILE GLOVES. HEAT GLOVES ARE NECESSARY WHEN TOUCHING SURFACES THAT MAY BE HOT TO ENSURE BURNS DON'T OCCUR.**



**NOTE:** A note signifies important information, but not information of a critical content.



**Eye protection:** Indicated the need for eye protection.

## First Aid and Personal Protective Equipment

The following paragraphs provide general first aid procedures and recommendations for protective equipment to minimize the risks from resin exposure. If professional medical attention is necessary, take the Safety Data Sheet (SDS) for the exact resin involved to the attending physician. SDS sheets can be found [here](#).

### Skin Contact

Wear 100% nitrile gloves and lab coats to avoid skin contact. Should resin come in contact with skin, wash thoroughly with soap and cold water and immediately remove contaminated clothing and shoes. If skin is irritated, seek medical attention. Dry-clean contaminated clothing. Discard contaminated shoes and leather products.

### Eye Contact

Safety goggles should be worn to prevent accidental splashes into the eyes. If resin comes in contact with the eye, flush immediately with large amounts of water for 15 minutes, avoid sunlight, fluorescent light, and other ultraviolet light, and obtain immediate medical attention. Eye wash facilities and a first aid kit should be readily available and close to the 3D printer system and post-processing lab.

### Contact Lenses

If resin splashes into the eye when contact lenses are worn, flush the eye with water immediately. Verify that flushing has removed the contact lens from the eye. Protect eyes from light and obtain immediate medical attention. Discard contact lenses that come into contact with liquid resin.

### Fume Inhalation

Inhaling fumes from resin is irritating to the respiratory system. If a person should inhale fumes, bring the exposed person to fresh air. Perform CPR if required. If breathing is difficult, give oxygen and obtain immediate medical attention for the person.

## Material Handling and Safety

For resin handling and safety, please refer to the [SDS](#) sheets and [User Guide](#) for further details.

# Post Processing Instructions

Once your printed parts are removed from a Modular Printer, they are still considered **green**. This means that they are not fully cured and must be handled with 100% nitrile gloves. The print platform that the part is attached to also has uncured resin on it, meaning that it must also be handled with nitrile gloves. This section of the guide will demonstrate how to properly remove the print platform from the machine, remove the printed parts from the platforms, clean the printed parts, and post-cure the printed parts. Once the printed parts have been through all these steps, they will be safe to touch with human hands.



**CAUTION:** Failure to properly post-process a part not only makes it unsafe to touch, but also can result in part defects.

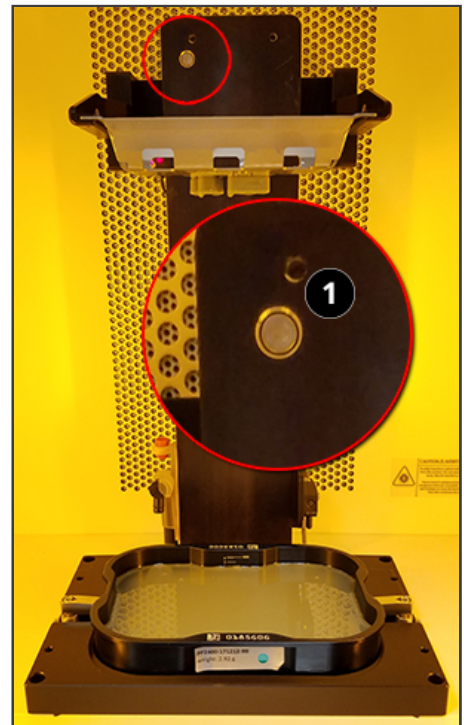
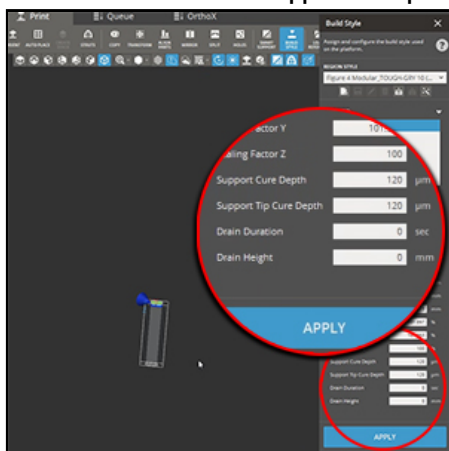
## Remove Print Platform



**CAUTION:** Do not remove the printed part from the print platform while both are still in the machine. Doing so risks getting partially cured print material in the resin tray, which will cause future builds to fail and/or cause the resin-tray membrane to puncture.

1. Wait until the print platform has moved to its offload position, so that the elevator is not moving. The gray dowel near the top of the elevator spine signifies the upper limit (1), or offload position, of the elevator.

**NOTE:** If running 3D Sprint 4.1 and above, you will have the option to add a draining duration and height to your build file packet. The duration will add a timer to the printer UI to let you know when the finished parts are done draining material. The height refers to how high above the resin tray the print job will drain. You cannot add the drain feature after sending the build to the printer. Also, you must set this for each build job, as the drain feature cannot be applied to a printer as a whole.



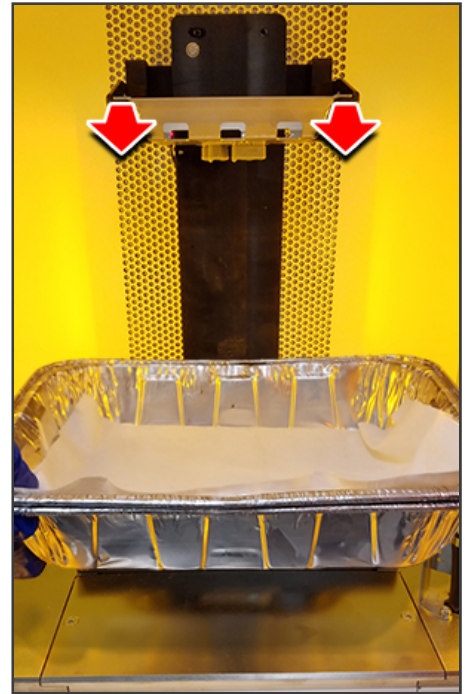
### MODULE 4

#### Draining AB Job

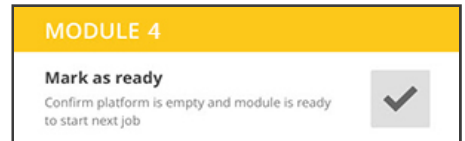
The part will finish draining in 00:03 minutes...



2. Open the upper-build-chamber door and, wearing nitrile gloves and holding a drip tray underneath, remove the print platform with the part attached from the machine.



3. If you have another print job in your print queue for this printer, or if you want to reprint the same job, you may now insert a clean print platform. Close the orange door and mark the printer as **Ready**.



## Remove Printed Parts From Platform

You must now remove the printed part(s) from the print platform to prepare them for cleaning.



**WEAR 100% NITRILE GLOVES WHENEVER HANDLING UNCURED OR PARTIALLY CURED PRINT MATERIAL.**

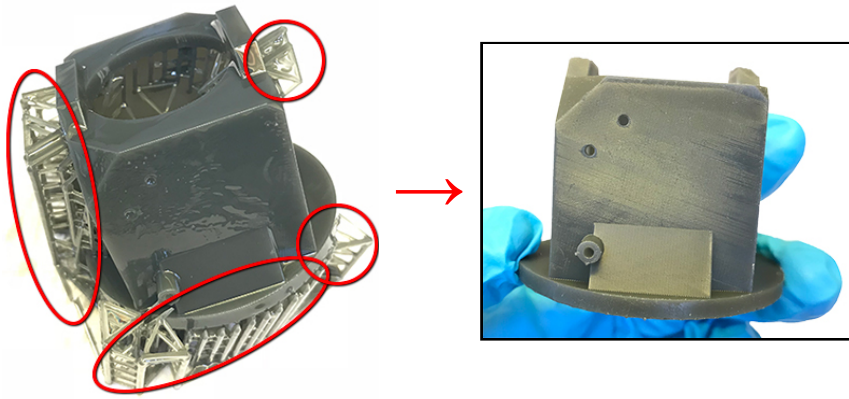


**CAUTION: Ensure that any tools you use in post-processing have been cleaned since their last use.**

1. Put a nonabrasive cloth/lint-free paper towel underneath the print platform. Using the included punch tool, remove printed part from the print platform by pushing on it through the top side of the platform. Hold it the way you would a rubber stamp.



2. Remove any supporting architecture from the part by hand.



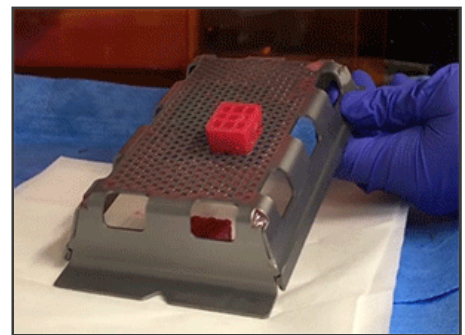
3. Rinse the parts in IPA (isopropyl alcohol) or EtOH (ethanol) by hand, holding them over a container that can catch the solvent.



## Special Considerations for Elastomeric Resins

If you are running elastomeric resins, such as ELAST-BLK 10, it may be difficult to remove parts from the print platform using only the punch tool. If this is the case, perform the following steps:

1. Use the punch tool as described in **Step 1** above. This will get the part started in detaching from the platform.
2. Use the Platform Scraper to fully remove the part from the platform.



3. For instructions on removing the remaining, partially cured resin, see the section [Clean Print Platform](#) in the User Guide.

## Cleaning Parts Printed with Figure 4 Resins

Printed parts must be cleaned with solvents to ensure safer handling, dimensional accuracy, and preparation for post-curing. This section will describe three methods that have been proven to work best for Figure 4 part cleaning: 1. Sonication in IPA; 2. Non-flammable Sonication; and, 3. Manual Cleaning.

### Necessary Cleaning Materials Chart

| Equipment                                                                                                                                                                                                       | Sonication in IPA                  | Non-flammable Sonication | Manual Cleaning |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|--------------------------|-----------------|
| At least 1 ultrasonic unit for wash - this unit should be large enough to hold your cleaning containers (see below)                                                                                             | yes, explosion-proof unit required | yes                      | no              |
| At least 2 containers for part baths - these should be large enough to contain the parts you intend to print. These containers can be stainless steel or glass. Plastic is not recommended for ultrasonication. | yes                                | yes                      | yes             |
| Supply of solvent(s)                                                                                                                                                                                            | yes                                | yes                      | yes             |
| Digital Timer                                                                                                                                                                                                   | yes                                | yes                      | yes             |
| Vented wash/squirt bottle for IPA                                                                                                                                                                               | yes                                | yes                      | yes             |
| Jar to store cleaning brushes                                                                                                                                                                                   | yes                                | yes                      | yes             |
| Soft or medium bristle brushes - 1 brush included with printer                                                                                                                                                  | yes                                | yes                      | yes             |
| Compressed air with air blow gun with chip guard                                                                                                                                                                | yes                                | yes                      | yes             |
| Hydrometer with range or 0.70-0.81 for IPA                                                                                                                                                                      | yes                                | no                       | yes             |
| Hydrometer with range or 0.795-0.910 for EZ Rinse C                                                                                                                                                             | yes                                | no                       | no              |
| Hydrometer with range or 1.00-1.22 for propylene carbonate                                                                                                                                                      | no                                 | yes                      | no              |
| 500ml graduated cylinder                                                                                                                                                                                        | yes                                | yes                      | yes             |
| Optical inspection tool, such as a microscope                                                                                                                                                                   | yes                                | yes                      | yes             |
| Forced-air oven (optional for part drying)                                                                                                                                                                      | yes                                | yes                      | yes             |



**WARNING: IPA IS A FLAMMABLE LIQUID WITH FLAMMABLE VAPORS. KEEP AWAY FROM HEAT, SPARK AND OPEN FLAMES. USE WITH ADEQUATE VENTILATION. STORE AT 20-30°C (68-86°F). DO NOT TAKE INTERNALLY. AVOID PROLONGED OR REPEATED BREATHING OF MIST OR VAPOR. LIQUID AND VAPOR CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT. LIQUID AND VAPOR AFFECT CENTRAL NERVOUS SYSTEM. MAY BE HARMFUL IF ABSORBED THROUGH SKIN. MAY CAUSE IRRITATION TO SKIN.**



**CAUTION: CONSULT SDS FOR EACH SOLVENT AND MATERIAL TYPE PRIOR TO USE FOR ADDITIONAL PERSONAL PROTECTIVE EQUIPMENT.**



**CAUTION: SOLVENTS AND SOLVENT-RELATED TRASH MUST BE DISPOSED OF ACCORDING TO ALL GOVERNMENT REGULATIONS.**



**ALWAYS WEAR GLOVES WHEN CLEANING BUILD PARTS.**

## Figure 4 Cleaning Charts



**NOTE:** If you wish to print this page, scroll to the bottom of this page and click the "printer friendly version" link. On the page in the new tab, press ctrl+P (cmd+P on Mac) to print the document or save it as a PDF. Print/save in landscape orientation and 50% scale for best results to print the full chart.

Depending on your requirements, choose which of the following three methods best suits your printing applications. You only need to clean parts using **one** of these methods:

1. **Sonication in IPA** - Recommended as a starting point for high-volume, robust cleaning systems. This uses 3D Systems' EZ Rinse C cleaning solvent and IPA from your local supplier. Due to the flammability of IPA, you must use an explosion-proof ultrasonic cleaner.
2. **Non-flammable Sonication** - Recommended for ultrasonic users who cannot use IPA. This method is not as effective as method #1 above. Raising the bath temperature of the rinse solution and regularly changing the bath are ways to improve cleaning efficiency.
3. **Manual Cleaning** - Recommended for those without access to ultrasonic equipment, but who can use IPA. This method requires extra steps during washing and rinsing: 1. The part must be brushed with a soft- or medium-bristle brush; and, 2. The part must be sprayed with compressed air. The operator must be careful handling parts which are still delicate at this stage.

Please use the chart below for the recommended cleaning times for each method.

**Recommended solvents for material spills** - For any of the solvents listed below as being used for a "Wash" cycle, you may also use that solvent to clean material spills.

## Three Options For Cleaning

Choose **ONE** of the three options below for part-cleaning based on your needs. See further description of these methods listed above.

If you do not see your material, SCROLL or SWIPE DOWN on the chart below.

| Material Type                                                                                                                | 1. Sonication in IPA   |                    | 2. Non-flammable Sonication     |                                        | 3. Manual Clear         |  |
|------------------------------------------------------------------------------------------------------------------------------|------------------------|--------------------|---------------------------------|----------------------------------------|-------------------------|--|
|                                                                                                                              | Wash                   | Rinse              | Wash                            | Rinse                                  | Wash                    |  |
| Figure 4 TOUGH GRY 10<br>Figure 4 TOUGH GRY 15<br>Figure 4 ELAST-BLK 10                                                      | EZ Rinse C<br>≤ 5 min. | IPA<br>≤ 5 min.    | Propylene Carbonate<br>≤ 5 min. | 5 wt% Elma Tec A4 Solution<br>≤ 5 min. | Dirty IPA<br>≤ 2.5 min. |  |
| Figure 4 FLEX-BLK 10<br>Figure 4 TOUGH-BLK 20<br>Figure 4 FLEX-BLK 20<br>Figure 4 EGGSHELL-AMB 10<br>Figure 4 RUBBER-65A BLK | EZ Rinse C<br>≤ 5 min. | IPA<br>≤ 5 min.    | EZ Rinse C<br>≤ 5 min.          | 5 wt% Elma Tec A4 Solution<br>≤ 5 min. | Dirty IPA<br>≤ 2.5 min. |  |
| Figure 4 MED-AMB 10<br>Figure 4 MED-WHT 10                                                                                   | Dirty IPA ≤ 3 min.     | Clean IPA ≤ 2 min. | n/a                             | n/a                                    | Dirty IPA<br>≤ 2.5 min. |  |
| Figure 4 HI TEMP 300-AMB                                                                                                     | DO NOT SONICATE        | DO NOT SONICATE    | DO NOT SONICATE                 | DO NOT SONICATE                        | Dirty IPA<br>≤ 2.5 min. |  |

| Material Type                                                                                                              | 1. Sonication in IPA                                    |                                                  | 2. Non-flammable Sonication                 |                                                    | 3. Manual Clean                     |
|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|--------------------------------------------------|---------------------------------------------|----------------------------------------------------|-------------------------------------|
|                                                                                                                            | Wash                                                    | Rinse                                            | Wash                                        | Rinse                                              | Wash                                |
| Figure 4 PRO-BLK 10<br>Figure 4 Rigid White                                                                                | EZ Rinse C<br>≤ 5 min.<br>Use lowest sonication setting | IPA<br>≤ 5 min.<br>Use lowest sonication setting | NOT RECOMMENDED                             | NOT RECOMMENDED                                    | Dirty IPA<br>≤ 2.5 min.             |
| Figure 4 RUBBER-BLK 10<br><div>NOTE: Some material components do not dissolve in IPA. Do not use IPA for first bath.</div> | Propylene Carbonate<br>< 2.5 min.                       | IPA<br>< 2.5 min.                                | Propylene Carbonate<br>< 5 min.             | 5 wt% Elma Tec A4 Solution<br>< 5 min.             | Propylene Carbonate<br>≤ 5 min.     |
| Figure 4 RIGID GRAY                                                                                                        | Dirty IPA<br>do not exceed 5 min.                       | Clean IPA<br>do not exceed 5 min.                | Propylene Carbonate<br>do not exceed 5 min. | 5 wt% Elma Tec A4 Solution<br>do not exceed 5 min. | Dirty IPA<br>do not exceed 2.5 min. |
| Figure 4 TOUGH 60C WHITE                                                                                                   | Dirty IPA<br>do not exceed 5 min.                       | Clean IPA<br>do not exceed 5 min.                | Propylene Carbonate<br>do not exceed 5 min. | 5 wt% Elma Tec A4 Solution<br>do not exceed 5 min. | Dirty IPA<br>do not exceed 2.5 min. |
| Figure 4 TOUGH 65C BLACK                                                                                                   | EZ Rinse C<br>do not exceed 5 min.                      | Clean IPA<br>do not exceed 5 min.                | Propylene Carbonate<br>do not exceed 5 min. | 5 wt% Elma Tec A4 Solution<br>do not exceed 5 min. | EZ Rinse C<br>do not exceed 5 min.  |

| Material Type                       | 1. Sonication in IPA |                    | 2. Non-flammable Sonication |                    | 3. Manual Clear                               |  |
|-------------------------------------|----------------------|--------------------|-----------------------------|--------------------|-----------------------------------------------|--|
|                                     | Wash                 | Rinse              | Wash                        | Rinse              | Wash                                          |  |
| Figure 4 High Temp 150C<br>FR Black | DO NOT<br>SONICATE   | DO NOT<br>SONICATE | DO NOT<br>SONICATE          | DO NOT<br>SONICATE | Dirty IPA<br><br>do not<br>exceed<br>2.5 min. |  |
|                                     |                      |                    |                             |                    |                                               |  |

\*minimize ultrasonic power setting to less than 100W

## Overview of Recommended Solvents

| Solvent                | Chemical<br>Abstracts Service<br># | Specific Gravity @<br>25°C (g/ml) | Flash<br>Point         | Boiling<br>Point     | Recommended<br>Form   |
|------------------------|------------------------------------|-----------------------------------|------------------------|----------------------|-----------------------|
| IPA                    | 67-63-0                            | 0.785                             | 12°C<br>(53.6°F)       | 83°C                 | use neat              |
| EZ Rinse C             | 67784-80-9, 68919-<br>53-9         | 0.88                              | > 218°C (><br>424.4°F) | > 301°C<br>(573.8°F) | use neat              |
| Propylene<br>Carbonate | 108-32-7                           | 1.20                              | 116°C<br>(240.8°F)     | 240°C<br>(464°F)     | use neat              |
| Elma Tec<br>Clean A4   | Mix                                | 1.13                              | > 100°C (><br>212°F)   | not<br>applicable    | mix 5 wt% in<br>water |

## When to Change Cleaning Solvents

You may change out the cleaning solvent in your containers whenever you feel that the solvent is not doing a good enough job stripping printed parts of uncured resin. However, you may also choose to have a hydrometer on-hand to measure the specific gravity of your solvent/resin mixture. The table below shows what measurements will prompt which actions you can take.

| Solvent                                     | Specific Gravity Values                                                                                                                                                                                          |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IPA - Hydrometer range 0.700 - 0.810        | <b>Clean:</b> do not change solvent if < 0.787<br><b>Dirty:</b> use the solvent for "dirty" baths if between 0.787 - 0.797<br><b>Discard:</b> Discard solvent according to all government regulations if > 0.797 |
| EZ Rinse C - Hydrometer range 0.795 - 0.910 | <b>Clean:</b> do not change solvent if < 0.886<br><b>Dirty:</b> use the solvent for "dirty" baths if between 0.886 - 0.903<br><b>Discard:</b> Discard solvent according to all government regulations if > 0.903 |

| Solvent                                              | Specific Gravity Values                                                                                                                                                                                                                                                                |
|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Propylene Carbonate - Hydrometer range 1.000 - 1.220 | <p><b>Clean:</b> do not change solvent if <math>&gt; 1.197</math></p> <p><b>Dirty:</b> use the solvent for "dirty" baths if between <math>1.197 &gt; x &gt; 1.190</math></p> <p><b>Discard:</b> Discard solvent according to all government regulations if <math>&lt; 1.190</math></p> |

 **NOTE:** Use IPA  $\geq 90\%$  purity.

 **TIP:** Using compressed air to clear small holes and features of EZ Rinse C prior to IPA cleaning improves ease of cleaning. Use soft brush to aid in cleaning if an ultrasonic cleaner is not available. The clean IPA that becomes saturated in the Rinse container should then be used for the Wash container until it is no longer effective at removing resin. After your Wash container's solvent becomes saturated, discard it according to all government regulations. Please see the table above for how often to change your solvent mixture.

 **WARNING:** IPA IS FLAMMABLE AS BOTH LIQUID AND VAPOR. KEEP AWAY FROM HEAT, SPARK AND OPEN FLAMES. USE WITH ADEQUATE VENTILATION. STORE AT 20-30°C (68-86°F).

 **WARNING:** THE FEDERAL OSHA REQUIREMENT 29 CFR PART 1910.242(B) STATES: COMPRESSED AIR SHALL NOT BE USED FOR CLEANING PURPOSES EXCEPT WHERE REDUCED TO LESS THAN 30 PSI AND THEN ONLY WITH EFFECTIVE CHIP GUARDING AND PERSONAL PROTECTIVE EQUIPMENT. FOR ADDITIONAL INFORMATION, GO TO [HTTPS://WWW.OSHA.GOV/PLS/OSHAWEB/OWADISP.SHOW\\_DOCUMENT?P\\_TABLE=STANDARDS&P\\_ID=9849](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9849).

## Cleaning Parts Using an Ultrasonic Cleaner

 **NOTE:** Follow all safety precautions and guidelines set forth in the User Guide for the ultrasonic cleaner you have purchased.

 **ALWAYS WEAR 100% NITRILE GLOVES WHENEVER HANDLING AN UNCURED PRINTED PART, AS WELL AS WHEN HANDLING ANY SOLVENT USED TO CLEAN SUCH PARTS.**

 **CAUTION:** The federal OSHA requirement 29 CFR Part 1910.242(b) states: Compressed air shall not be used for cleaning purposes except where reduced to less than 30 psi and then only with effective chip guarding and personal protective equipment.

While the User Guide for your ultrasonic cleaner will provide specific-use instructions, the steps outlined below describe how 3D Systems recommends cleaning build parts via an ultrasonic cleaner. This procedure will reference the [Cleaning Charts](#) from the previous section. There are two ways to set up your ultrasonic cleaner:

1. **Indirect ultrasonic energy transfer** - Energy is transferred through a medium, such as water, before it reaches your solvent containers inside the tanks. If space in your cleaner allows, you may place both **Wash** and **Rinse** tanks in the cleaner at the same time. Use this setup if you only have one ultrasonic cleaner available.
2. **Direct ultrasonic energy transfer** - Your Wash and Rinse solvents are the medium for energy transfer. In this case, each solvent is poured directly into its own, dedicated ultrasonic cleaner. Use this setup if you have at least two ultrasonic cleaners available.

## Cleaning Procedure

1. Label your steel or glass containers as **Wash** and **Rinse**.

2. Wearing nitrile gloves, place the printed part inside your Wash container. Pour Wash solvent into the container until you completely submerge the printed part. Ensure the solvent is not saturated for this step. Please see the section [When to Change Cleaning Solvents](#) for more information.

3. Place Wash container inside the ultrasonic cleaner.



**CAUTION: Ensure that your ultrasonic cleaner is properly rated to use flammable solvents. Failure to do so could present a fire hazard.**



4. Follow the instructions in your ultrasonic cleaner's User Guide to power it on and begin cleaning. Run the Wash cycle for the time specified in the [Cleaning Chart](#).

5. After the Wash cycle has finished, remove the printed part from the ultrasonic cleaner using nitrile gloves. You may wish to use shop air or an air compressor to dry the part in between cleanings, as this is an effective method for getting one solvent off the part before cleaning it with another.

6. For the Rinse cycle, follow Steps 2-5 once more, using the Rinse solvent specified in the [Cleaning Chart](#). You may wish to use shop air or an air compressor to dry the part after this Rinse cycle.

7. Inspect the part for shiny areas and surface tackiness. If either exists, there could still be uncured resin on the part. Use your solvent squirt bottle and cleaning brush to further clean the part. Dry the part with compressed air. Repeat this process as needed until no shiny or sticky areas remain on the part.

8. Be sure to rinse your cleaning brush(es) in fresh IPA and place covers on your solvent containers when not in use.

9. The printed part is now ready for drying and UV post-curing.



**CAUTION: Cleaning printed parts for any time longer than is prescribed in this manual risks creating defects in the part.**

## Cleaning Parts Manually



**NOTE:** Some materials require that you use an ultrasonic cleaner, rather than manual cleaning methods, to clean printed parts. Please read your material's User Guide to determine if manual cleaning is sufficient.



**CAUTION:** The federal OSHA requirement 29 CFR Part 1910.242(b) states: Compressed air shall not be used for cleaning purposes except where reduced to less than 30 psi and then only with effective chip guarding and personal protective equipment

The following instructions are recommendations for hand-cleaning parts printed with Figure 4 resins.

1. Mark containers as **Wash** and **Rinse**.
2. Place printed part into Wash container.
3. Add Isopropyl Alcohol (IPA) to Wash container until it completely submerges the printed part(s). Fasten the lid on the container.



**NOTE:** You may use "dirty" solvent for this first part bath, as specified in the chart [When to Change Cleaning Solvents](#). Once the "dirty" solvent has reached "discard" status, according to the chart, discard it according to all government regulations.

4. Lightly shake the container back and forth, just enough to agitate the liquid. Follow the instructions in the [Cleaning Chart](#) for how much time is required for the Wash cycle. Use a countdown timer to assist. You may also need to use a soft- or medium-bristle brush while the part is submerged to clean part surfaces and fine features.
5. Remove part(s) from Wash container and allow excess IPA to drip from the part(s) for 30 seconds. You may wish to use shop air or an air compressor to dry the part in between cleanings, as this is an effective method for getting one solvent off the part before dipping it into another.
6. Place printed part(s) into Rinse container.
7. Follow steps 3-5, but this time using **clean** IPA. Follow the instructions in the [Cleaning Chart](#) for how much time is required for this second bath.



**NOTE:** You must use "clean" IPA for the second part bath, as defined in the chart [When to Change Cleaning Solvents](#). Rinsing with dirty solvent in this step risks not completely cleaning the part of uncured resin.



**TIP:** Once your IPA has become "dirty," as defined in the chart [When to Change Cleaning Solvents](#), you may use it for the Wash cycle in Step 2.

8. Inspect the part for shiny areas and surface tackiness. If either exists, there could still be uncured resin on the part. Use your solvent squirt bottle and cleaning brush to further clean the part. Dry the part with compressed air. Repeat this process as needed until no shiny or sticky areas remain on the part.
9. Be sure to rinse your cleaning brush(es) in fresh IPA and place covers on your solvent containers when not in use.
10. The printed part is now ready for drying and UV post-curing.



**CAUTION:** Cleaning printed parts for any time longer than is prescribed in this manual risks creating defects in the part.

## Specific Gravity Measurement

The section [When to Change Your Solvents](#) lists the ranges of specific gravities at different states of your solvent's cleaning life. This section describes specifically how to measure that specific gravity.

1. Use a cup to pour at least 400mL of your used part-cleaning liquid in a 500mL graduated cylinder.
2. Use the [When to Change Your Solvents](#) table to determine what range hydrometer you need.

3. Gently lower the hydrometer into the graduated cylinder and wait until it stops bobbing up and down.
4. Record where on the hydrometer's graduated markings it hits the solvent's meniscus.
5. Compare that value to what is in the acceptable range according to the chart in Step 2.



**TIP:** To reduce variation in measurements, liquids should be around 25°C (77°F).



**TIP:** Elma Tech A4 has a similar density to that of Figure 4 resin. Because of that, a hydrometer test will not work to test saturation. For this solvent, simply use your best judgment when examining printed parts to determine whether they are sufficiently clean. If part surfaces are sticky or shiny, it is a good indication that your solvent is not cleaning them enough.

## Dry the Build Parts

After cleaning the part(s), it necessary to dry them of any solvent used in the cleaning step. This may be done in several ways, but a few recommended methods follow:

For all parts, be sure there is an absorbent cloth (disposable or otherwise) or container underneath the part to catch the solvent being cleaned off.

1. **Shop air** - if you have shop air in your facility that is not tied up with the printer's air connection, this would be the most-ideal way to air-dry the parts. This is not a replacement for air drying, but will speed up the process. Once finished using compressed air, let the part sit out for 30 minutes to air dry.



2. **Air Compressor** - If you do not have shop air, an air compressor would be the next-best solution. However, be aware that air compressors are fairly loud. This is not a replacement for air drying, but will speed up the process. Once finished using compressed air, let the part sit out for 30 minutes to air dry.



*Air Compressor. This is for sample purposes only, and is not a recommendation or endorsement of any brand of air compressor.*

3. **Air Drying** - Simply leave the part sitting on a paper towel for the [time specified below](#). If a time is not specified for your resin, 60 minutes of air drying should be sufficient.

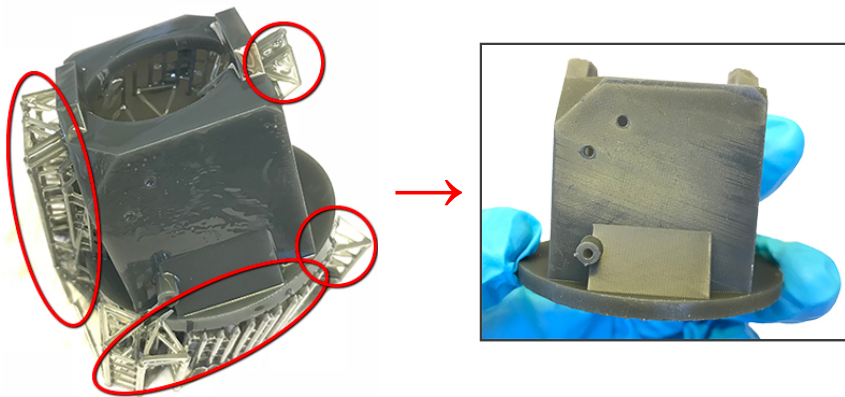
4. **Oven Drying** - You may also use a drying oven, such as the one pictured at the right.



*Drying oven. This is for sample purposes only, and is not a recommendation or endorsement of any brand of drying oven.*

Dry printed parts until you see no more liquid on their surfaces. For any drying method, please use the following guidelines:

1. Always dry printed parts over a tub, lab paper towel, or absorbent cloth. Do NOT dry the part over a sink or tub that drains to normal wastewater.
2. Discard any disposable towels used in the drying process according to all local, state and federal regulations. These towels have been in contact with uncured resin and solvents, and must be treated as such.
3. On a regular basis, have a professional cleaning service wash any absorbent cloths used in the drying process.
4. If you dry the part over a tub, periodically empty/clean it, discarding its contents according to all local, state, and federal regulations. The tub has been in contact with uncured resin and solvents and must be treated as such.
5. If using an air compressor in the same room (as opposed to shop air), wear ear protection when it is in use.
6. Always wear 100% nitrile gloves and safety glasses when handling partially cured printed parts. When drying with a high-pressure method, uncured resin or solvent may splash.
7. If you come into contact with uncured resin during part drying or at any time, wash the affected area with soap and COLD water. Any clothes contaminated with uncured resin or solvent must be dry cleaned promptly.
8. There might be remnants of supporting architecture left on your part(s). You can remove these supports by hand in the majority of cases. If you experience any issues removing supports, please see [Troubleshooting item PCI4](#).



## Drying Time Quick Reference for Figure 4 Resins

No matter which method you use to dry your part, you must ensure it is completely dry before proceeding to the post-curing step. The chart below serves as a quick reference for suggested air-drying times.



**CAUTION:** Using compressed air is not a replacement for air drying. After drying with compressed air, you must still leave the part out for at least 30 minutes to completely dry.

| Material Type         | Drying Time                                                                                                                 |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------|
| All current materials | Ambient or air dry $\geq$ 1hr. <b>or</b><br>Compressed air + 30 min. air dry <b>or</b><br>Oven dry 50°C (122°F) for 10 min. |

## UV Cure the Parts

### Recommended Curing Units

3D Systems recommends one of two UV-curing units that have been tested to fully cure parts according to the curing times seen in the [Resin Curing Chart](#). These curing units are:

- Figure 4 UV Curing Unit 350
- NextDent LC-3DPrint Box

Please see the [Facility Requirements Guide](#) for information on which curing unit might be best for you.

#### Instructions for Using the Figure 4 UV Curing Unit 350

To cure parts using this UV-curing unit, please see the machine's [User Guide](#). Please see the [Resin Curing Chart](#) for proper curing times to use.

#### Instructions for Using the LC-3DPrint Box

To cure parts using this UV-curing unit, please see the machine's [User Guide](#). Please see the [Resin Curing Chart](#) for proper curing times to use.

## General Post-Curing Requirements

If you choose not to use the LC-3DPrint Box or UV Curing Unit 350, please ensure your UV oven meets the following requirements:

- Light source should be at least 4 mWatt/cm<sup>2</sup>.
- A broad light spectrum, in the range of 350nm–430nm
- Part-core temperature should reach 60°C–90°C (140°F–194°F).

## Material Curing Chart

The chart below lists the recommended part-curing times when using the Figure 4 UV Curing Unit 350 or NextDent LC-3DPrint Box for Figure 4 resins.

| Name                  | Curing Time |
|-----------------------|-------------|
| Figure 4 TOUGH-GRY 10 | 60 min.     |
| Figure 4 TOUGH-GRY 15 | 90 min.     |
| Figure 4 ELAST-BLK 10 | 45 min.     |

| Name                             | Curing Time |
|----------------------------------|-------------|
| Figure 4 FLEX-BLK 10             | 60 min.     |
| Figure 4 MED-AMB 10              | 60 min.     |
| Figure 4 TOUGH-BLK 20            | 90 min.     |
| Figure 4 HI TEMP 300-AMB         | 90 min.     |
| Figure 4 EGGSHELL-AMB 10         | 90 min.     |
| Figure 4 PRO-BLK 10              | 90 min.     |
| Figure 4 FLEX-BLK 20             | 90 min.     |
| Figure 4 RUBBER-BLK 10           | 90 min.     |
| Figure 4 RUBBER-65A BLK          | 90 min.     |
| Figure 4 Rigid White             | 90 min.     |
| Figure 4 RIGID GRAY              | 90 min.     |
| Figure 4 TOUGH 60C WHITE         | 90 min.     |
| Figure 4 TOUGH 65C BLACK         | 90 min.     |
| Figure 4 High Temp 150C FR Black | 90 min.     |

## Post-Curing Tips

- Printed part may be cured in a cool, non-flammable liquid if the part is getting too hot during curing.
- Part can be inspected for color – A yellowish color indicates the part is under-cured. Consider the photo below of a part printed with Figure 4 TOUGH-GRY 15, where the part on the left has not been cured at all, the middle part has been cured for only five minutes, and the part on the right has been fully cured for the recommended 90 minutes.



## Sterilization Protocol for MED-AMB 10

For Figure 4 MED-AMB 10 material, it may be necessary to sterilize cured, finished parts to be used in certain medical applications. You can sterilize printed parts by making use of an autoclave or using gamma-ray sterilization. Do not use a dishwasher or thermal disinfectant. 3D Systems recommends the following autoclave method as a baseline starting point for sterilization:

1. Ensure printed parts are fully cleaned and cured before sterilizing them.
2. Place your part in a standard sterilization pouch.
3. Apply sterilization by placing the pouch containing the part in an autoclave for 15 minutes at 121°C or 3 minutes at 138°C. Make sure no mechanical forces are applied to the part during sterilization.

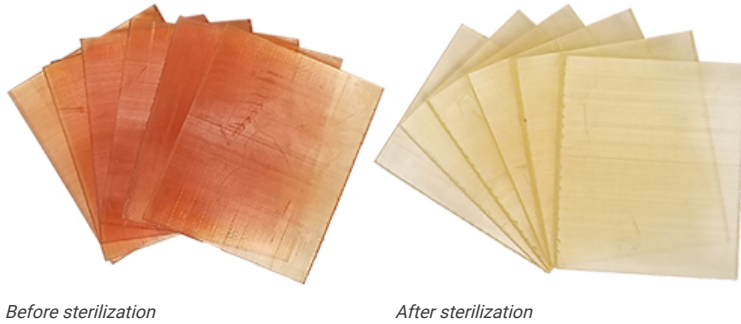
4. Let the part cool down to room temperature before using it. Make sure no mechanical forces are applied to the part during cool-down.



**NOTE:** The above protocol is a recommended starting point and may not be appropriate for all cases. Different geometries and use may require adjustment of this protocol to maximize effectiveness.

If using an autoclave for sterilization, you will notice that your part will change color with the sterilization process. This is normal. Please see the before/after images below for reference.

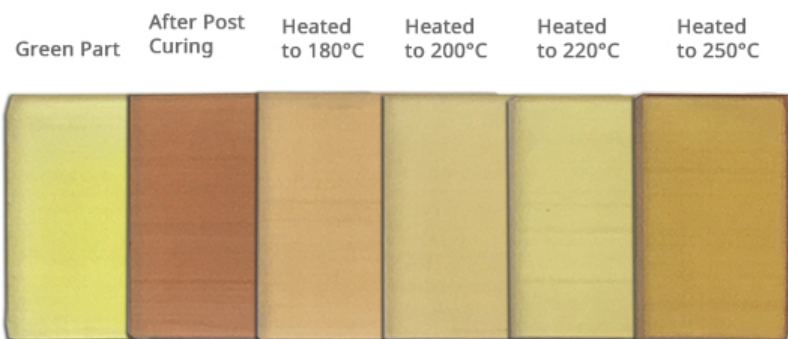
#### MED-AMB 10



**NOTE:** Autoclave sterilization may impact the [mechanical properties](#). Small drops in tensile strength, elongation at break, and impact strength may occur. Such changes are typically less than 20%. Use cases that are sensitive to that should be validated.

## Considerations for Heating Figure 4 HI TEMP 300-AMB

Figure 4 HI TEMP 300-AMB creates printed parts that can withstand high temperatures. However, exposure to different temperatures will change the material's color. A sample set of color changes is seen below:



## Clean Print Platform

Please see the Figure 4 Modular User Guide, in the section [Clean Print Platform](#), for full platform-cleaning instructions.

## Clean Resin Tray

There are two different techniques for cleaning the resin tray. Please see the following Figure 4 Modular User Guide sections to read about both techniques:

[Clean Resin Tray After Normal Build](#)

[Running a Resin Tray Cleaning After a Failed Build](#)

# Clean Finishing Tools

It is necessary to clean any tools you used during post-processing before their next use, even if you are continuing to use the same resin. Items to be cleaned include:

1. Punch Tool
2. Resin Mixer
3. Platform Scraper
4. Part-Cleaning Brush
5. Wire Brush
6. Your own tools

To clean any of these items, you can either soak them in IPA or place them into a beaker of IPA and put them in an ultrasonic cleaner. Ensure that they are **completely dry** before their next use, either by using compressed air or letting them air dry.

# Troubleshooting

The following chart describes Post-Processing Issues you might encounter.

| #    | Issue Description                                                     | Customer Troubleshooting Steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PPI1 | Parts come out of cleaning process dirty, shiny, or sticky.           | <ol style="list-style-type: none"><li>1. Parts may not have been properly cleaned. Ensure you have followed all the steps in the sections under <a href="#">Cleaning Parts Printed with Figure 4 Resins</a>. It is recommended that parts go through the cleaning process within 24 hours of printing. Some resins thicken as they sit over time and will require more vigorous cleaning.</li><li>2. Solvent baths may need to be changed.</li><li>3. Use solvent spray bottle and part-cleaning brush to rid the part of excess resin.</li><li>4. If parts are still unfinished after completing 1-3, contact 3D Systems Service.</li></ol>    |
| PPI2 | Parts show surface cracks or edge erosion during sonication cleaning. | <ol style="list-style-type: none"><li>1. Your particular resin may be sensitive to sonication power. Try one or more of the following:<ol style="list-style-type: none"><li>a. Reduce the power of your ultrasonic cleaner.</li><li>b. Reduce the duration of sonication.</li><li>c. Reduce the temperature of the cleaner's tank.</li></ol></li><li>2. If item 1 did not fix the issue, <a href="#">clean printed parts manually</a>.</li></ol>                                                                                                                                                                                                |
| PPI3 | Parts crack downstream after post curing.                             | <ol style="list-style-type: none"><li>1. Parts may have been overexposed to solvents during cleaning. Ensure that you clean printed parts no longer than the times specified in the <a href="#">Figure 4 Cleaning Charts</a>.</li><li>2. If your cleaning times were correct, there are other cleaning parameters that you can try changing:<ol style="list-style-type: none"><li>a. Reduce sonication power.</li><li>b. If your ultrasonic cleaner's power setting cannot be changed, reduce cleaning time.</li><li>c. Reduce temperature of liquid in ultrasonic cleaner.</li><li>d. Increase drying time after cleaning.</li></ol></li></ol> |
| PPI4 | Supporting architecture not completely removed by hand                | <ol style="list-style-type: none"><li>1. Ensure that for future builds, you have removed the supporting architecture before post-curing the part(s). The post-curing process makes the supports stronger and, therefore, harder to remove.</li><li>2. Use tools such as flat snips and/or tweezers to remove support remnants from tight areas of your part.</li><li>3. Perform wet-sanding with IPA on support remnants.</li></ol>                                                                                                                                                                                                             |

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