Post-processing and finishing methods for stereolithography 3D printed parts.

How to optimize your SL 3D printed designs for your application.

E-Book

Post processing and finishing methods to optimize your SL 3D printed parts.

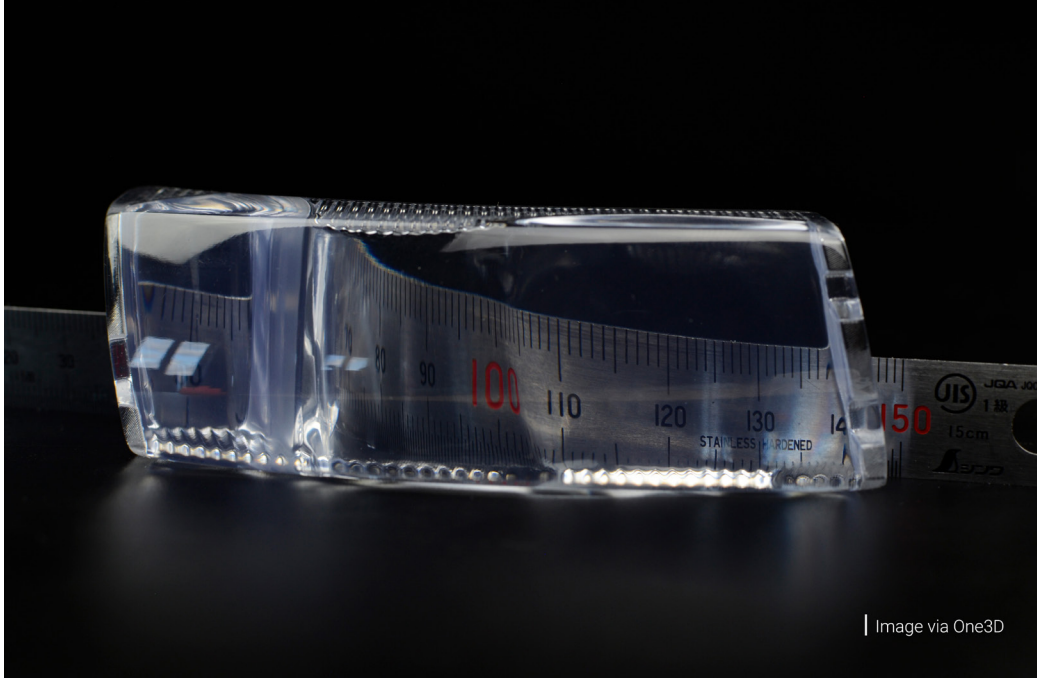


Image via One3D

Stereolithography (SL) is a 3D printing technology used for building prototypes, tooling or casting patterns. SL technology is renowned for building parts with extremely smooth surfaces and intricate detail. This is ideally suited for industries that want part quality without the part preparation time.

Once a build is complete and supports removed, stereolithography parts may appear finished. However, SL 3D printed parts still require an element of post-processing to either improve the mechanical properties or to enhance the cosmetics of the design, if required.

In this guide you will learn more about the stereolithography workflow and the steps required to post-process and finish a SL 3D printed part. Also learn about the methods that can be used for design customization or to further strengthen the part for your specific application.

Neo Stereolithography Workflow

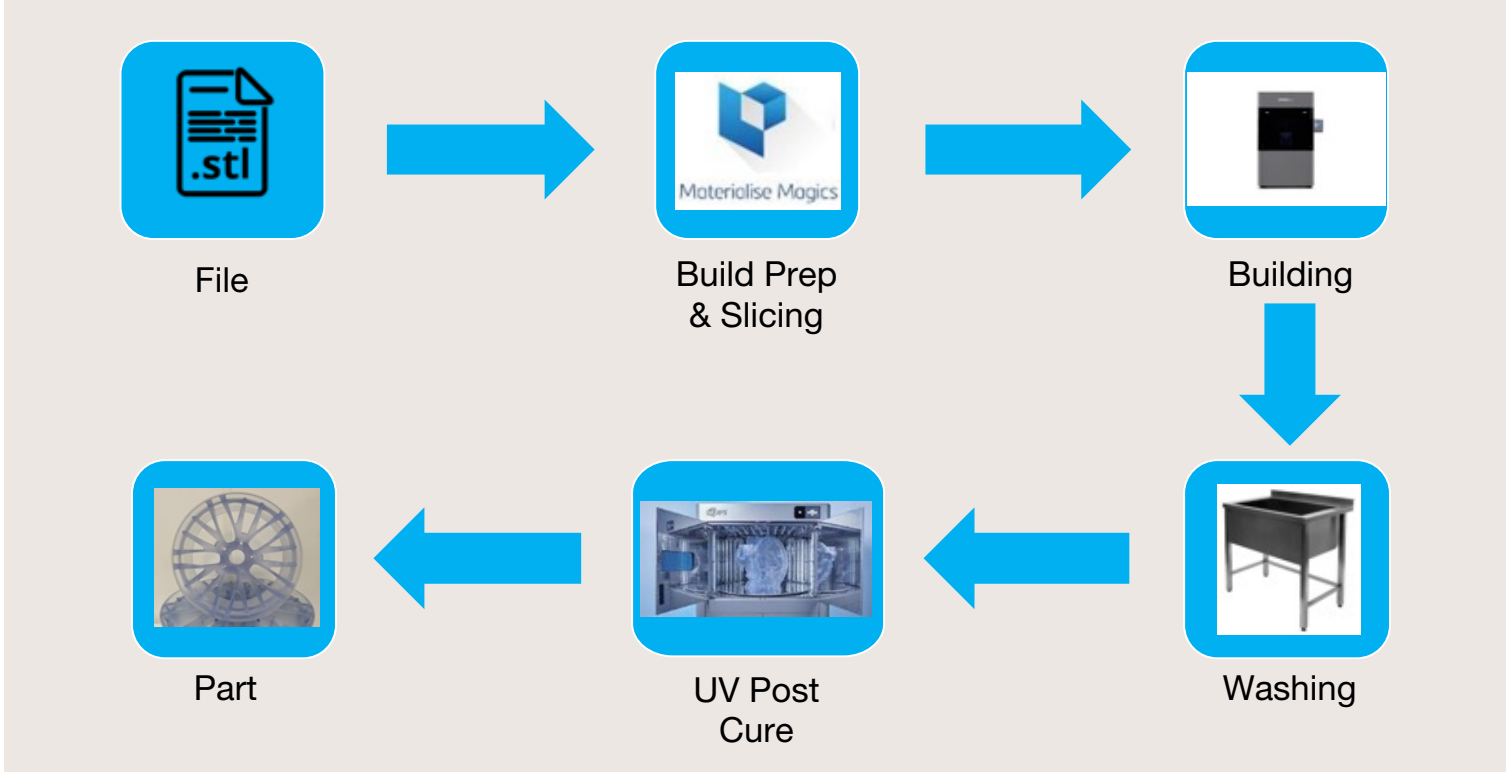
Stereolithography 3D printing is an additive manufacturing process that uses a vat of liquid UV-curable photopolymer resin and a UV laser to build parts one layer at a time.

Once a CAD design is created, it is exported as an STL file to the build-prep software. The build-prep software creates the support structure that is used to support the parts while building.

Once the file has been sent to print and build complete, the parts with supports are removed from the platform. The parts are then washed with cleaning solvents such as propylene carbonate or isopropanol to remove any remaining resin.

Finally, the parts require a UV post cure to strengthen mechanical properties and make the parts safe to handle. Once complete, parts are ready for any additional finishing, if required for the specific application.

Read on to learn more about the specific post-processing steps and finishing methods that can be completed on SL parts for concept prototyping applications.



Neo Stereolithography
Workflow

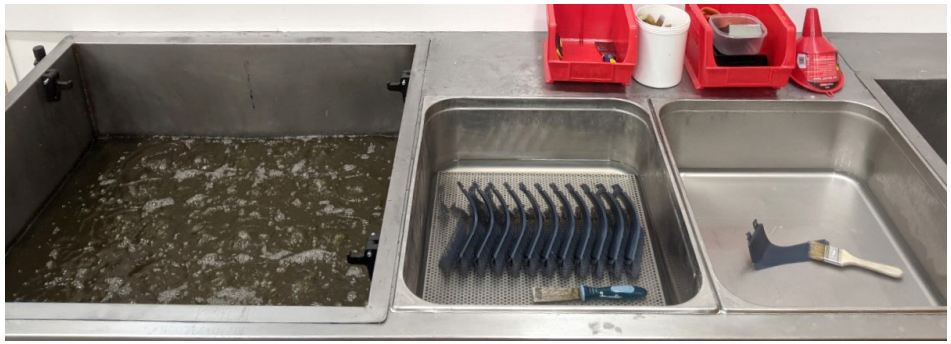
Post-processing Washing Parts

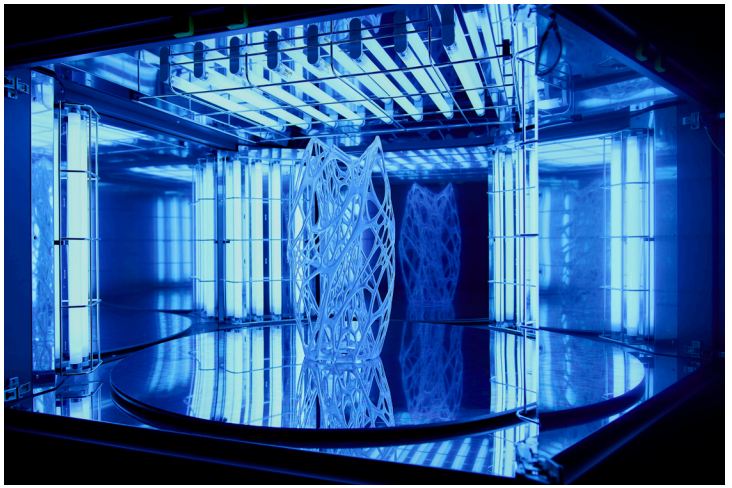
- Parts must be washed to remove any residual resin sticking to the surfaces
- Parts can be washed manually (cleaning solvent and brush) or via semi-automated 3rd party solutions
- Cleaning solvents may include Propylene Carbonate, TPM, or IPA
- After cleaning, parts should be left to dry to allow any solvent which may have penetrated the part to evaporate

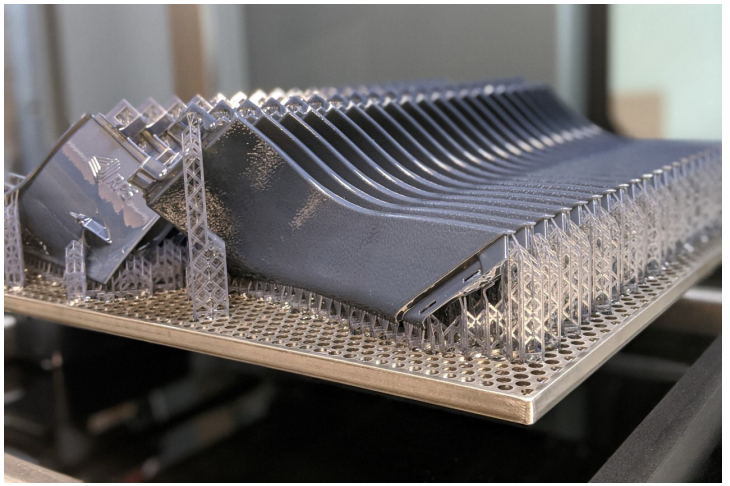
Post-processing UV Curing

SL 3D printed parts need to undergo a final post-cure process. When a 3D printed part has been built, the part is deemed as being in a “green state”. While the parts have reached their final form, the polymerization reaction is not yet complete and full mechanical properties are not yet achieved.

UV post curing achieves the final material properties before any additional finishing can take place.







Finishing methods to customize designs or strengthen mechanical properties of your 3D printed parts.

There are a range of finishing methods that can be applied to SL printed parts. Certain finishes such as sanding or lacquering can enhance an SL part aesthetics. For example, the optical clarity of a part which is a requirement for a lens prototype.

Electroplating is another finishing method that can be used to increase the mechanical properties of the part for specific applications. This method can increase the strength, stiffness and heat deflection - opening SL to further applications.

A range of SL resins are also available to suit the different requirements of specific applications; such as clear resins for optical clarity, stiff materials for wind tunnel models and impact resistant materials for functional prototyping.

Finishing:
Bead Blasting

Bead Blasting involves shooting an abrasive material against a surface to either remove contaminates or to make a surface smooth. Though the Neo range produces parts with exceptional side wall quality; certain geometries can benefit from being blasted to provide an all-over homogeneous finish.

- Blasting clear SL parts creates a frosted finish which can be useful for certain applications

Before

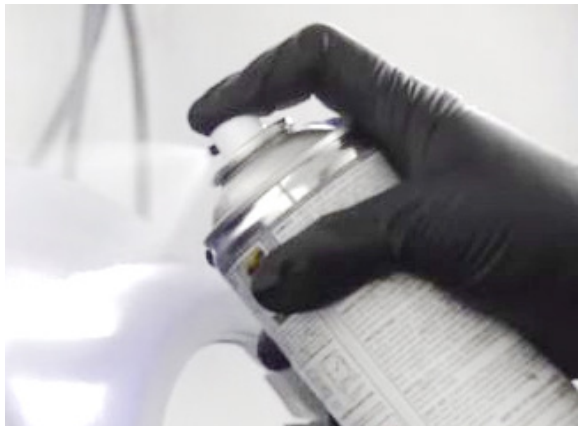
After

- Bead Blasting hides imperfections. The part above has scratches and stains from poor handling during cleaning. 30 seconds in a bead blaster has transformed the surface finish

Finishing: Optical Clarity

When working with clear materials, the transparency of the final part can be improved using the following post process techniques:

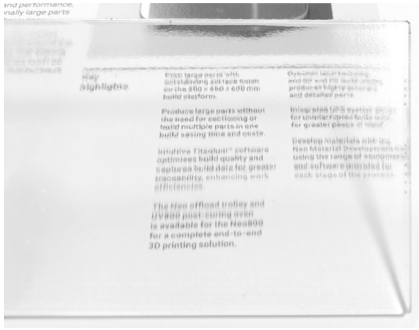
- **Clear Coat, Spray Lacquer**
  - Fast, less labor intensive
  - Provides UV protection
- **Epoxy Coating Resin**
  - Can be poured into internal areas (inside of a bottle)
  - High UV resistance and excellent cured mechanical properties
  - Can be flattened and polished to a high gloss
- **Sand & Polish**
  - If done well, provides a flawless finish
  - Less specialist equipment required
  - Labor intensive
  - Can be coated with either of the above to provide protection



Finishing: Clear Coat

1. Standard finish after part cleaning with isopropyl alcohol
2. Clear coat on each side of part, optical clarity improved with minimal post-processing
3. Part half sanded up to 800 grit and then clear coat on each side

1



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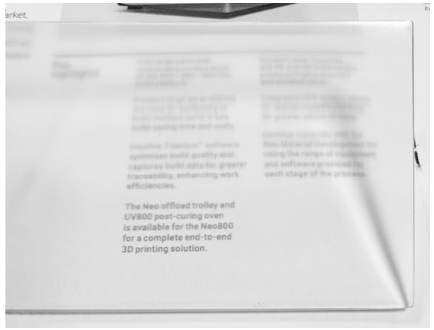

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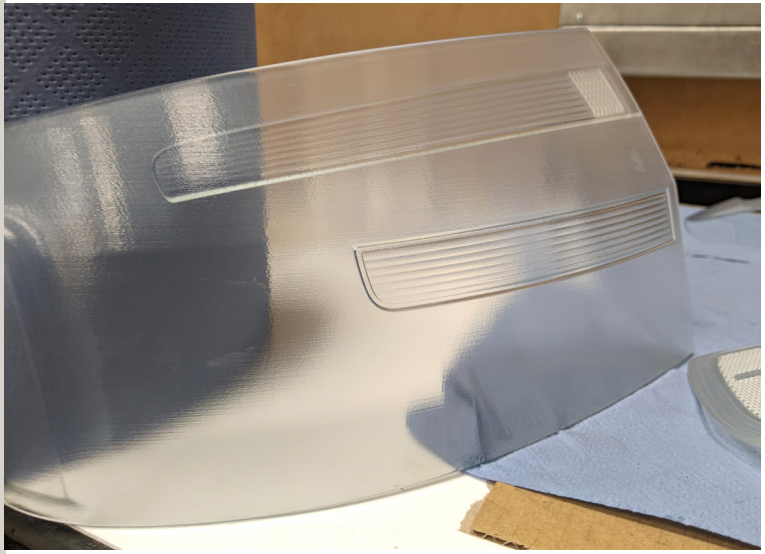
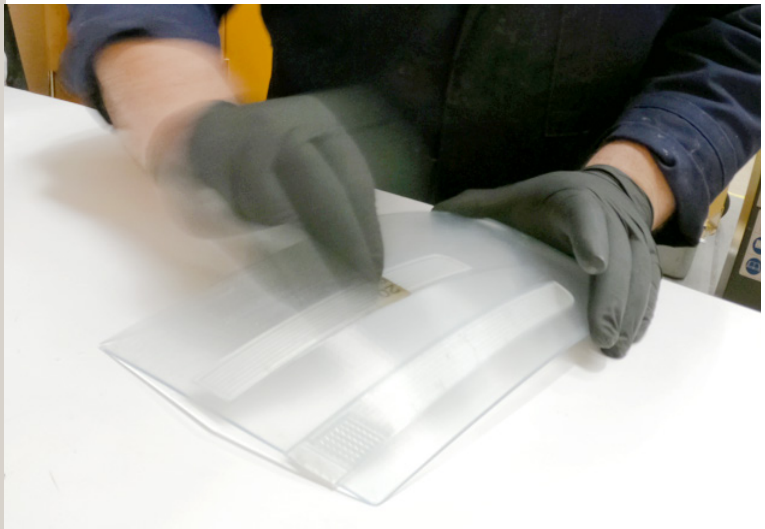
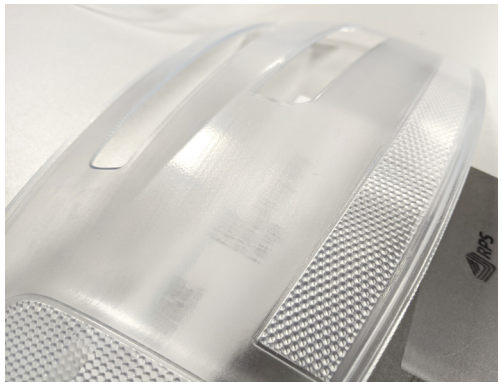
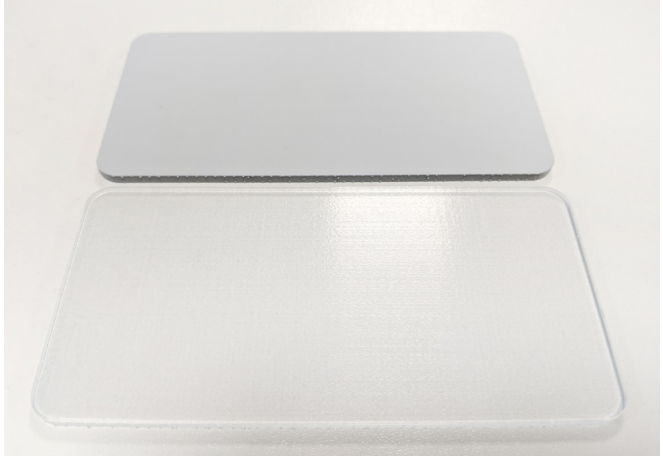




Finishing:
Sand & Polish

- Clean parts in fresh isopropyl alcohol
- Sand from 240 grit up to 2500 grit, spend most time on 240 – 800 grit, 1000 – 2500 is the refining stage
- Polish with cutting compound suited to plastic, car headlight restoration polish works well





Finishing: Painting

- Ensure surface is clean and dry and then apply one or two coats of high build primer
- Once dry, gently sand back to smooth level surface and wipe down with isopropyl alcohol
- Part is now ready for painting

Finishing:
Dye Coloring

You can apply color to finished SL parts by dye coloring or tinting.

Dyeing:

- Place the parts in a dyeing pot/bath and immerse in the specific color at roughly 50°C. Leave to soak for 3 – 5 minutes
- Take the parts out of the dyeing pot/bath and either immerse them into second pot of water to rinse or wait to dry

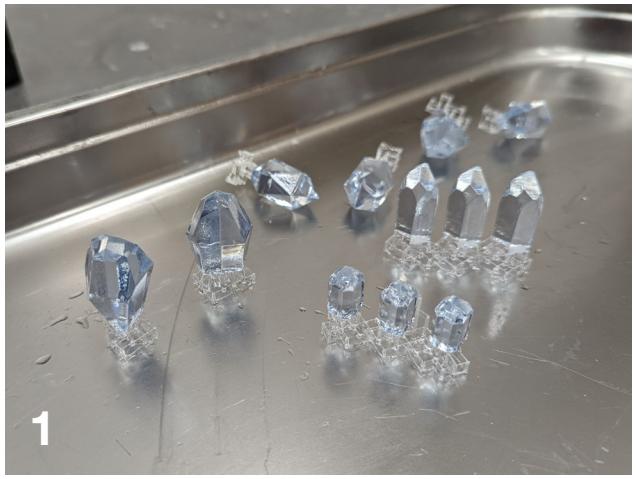
Be aware that at 50°C it is very easy for parts to warp under their own weight, so take care not to overexpose the parts to excessive heat.

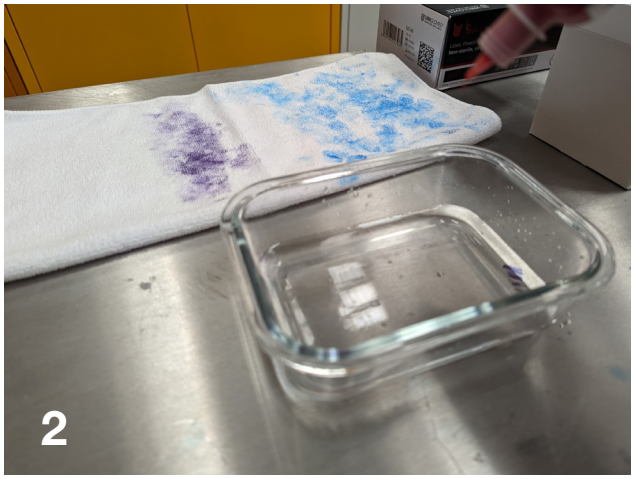
Finishing: Tinting Dye

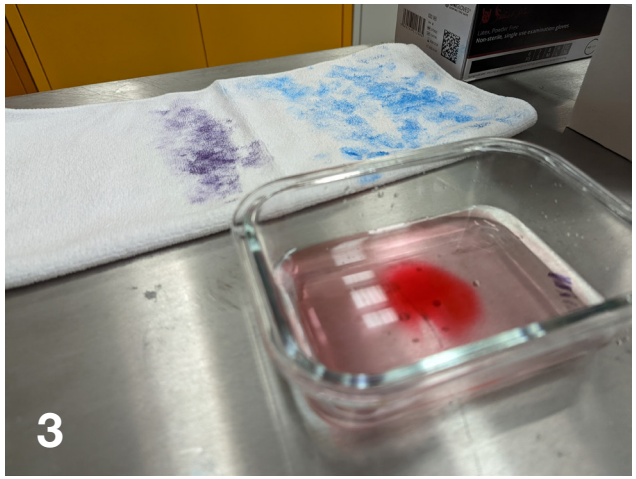
You can also apply color post build using tinting dye. This process reduces the chance of warping as there is no heat involved.

Tinting:

1. Wash in clean IPA and dry
2. Add two to three drop of dye to clean water
3. The dye does not mix but sits on the surface allowing you to dip the part, like hydro dipping
4. Remove excess dye using a clean microfiber cloth and allow to dry
5. The dye will still rub off at this point and needs sealing with a clear coat lacquer
6. Once the lacquer has dried the parts can now be handled







Finishing: Electroplating

Plating is commonly used to give metal parts a thin layer of a different material, for both functional and cosmetic purposes. However, electroplating is not solely for metal. Plating additive manufactured polymers can also improve the mechanical properties of the part.

SL parts have limited chemical resistance and are inherently reactive to ultraviolet light. Electroplating SL parts can create a lasting barrier that will increase the part life and open SL to new and innovative applications.

Electroplating improves the overall strength and stiffness of a part, relative to the thickness of coating applied. Geometry dependent, electroplating can also improve bending and tensile strength.

Neo Stereolithography
3D Printers

The Stratasys Neo stereolithography 3D printers are known for producing outstanding high-quality parts with superior surface finish and detail.

A reliable, stable system proven in high-pressure working environments such as service bureaus and F1, the Neo is the perfect SL 3D printer and delivers:

- Outstanding sidewall accuracy
- Exceptional layer-to-layer alignment
- Crisp feature resolution
- Superior accuracy
- Extremely small variability from part to part

The Neo also has an open resin system and is available in an 31.50×31.50×23.62 in. (800×800×600 mm) or 17.72×17.72×15.75 in. (450×450×400 mm) platform.

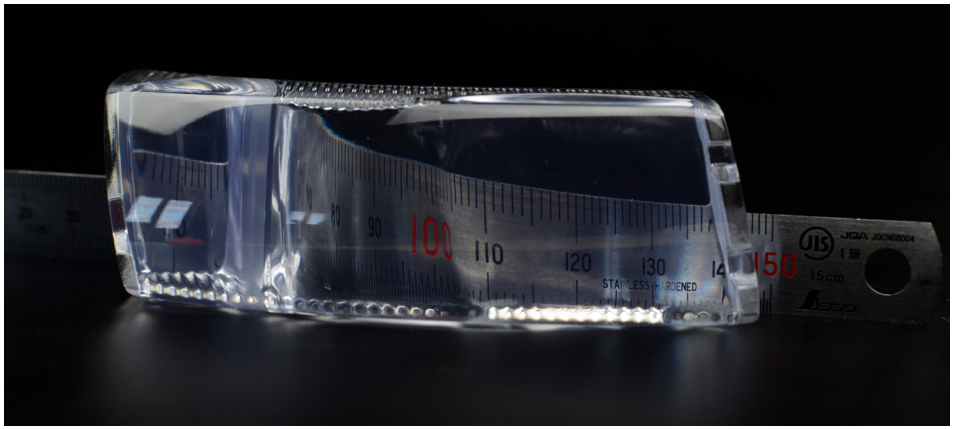
The Neo 3D printer offers outstanding part quality, freedom of resin choice, system reliability and ability to produce large or smaller parts, offering more flexibility to produce parts to suit specific applications that require finishing as mentioned in this guide.

Utilize post-processing and finishing methods, to cater to your SL application needs

Post-processing is an important final step in the stereolithography 3D printing workflow, to develop a strong, final part and to prepare the part for any finishing requirements.

Applying one of the finishing methods highlighted in this guide can enhance the design aesthetics or strengthen the mechanical properties of your parts, offering more solutions and opportunities to cater to specific applications.

Learn more about the Neo series of 3D printers here - https://www.stratasys.com/en/3d-printers/printer-catalog/stereolithography/neo-series-printers/



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