

MANUFACTURING GUIDE

Denture Base Resin V2

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Denture Base Resin V2 is a light-curable resin intended for the fabrication of denture bases, including full and partial removable dentures to restore function and aesthetics. The resin is intended to be processed exclusively using a validated computer-aided design and manufacturing (CAD/CAM) workflow and subsequent post-processing steps as specified in the manufacturer's instructions for use.

Denture Base Resin V2 can be utilized as an aid in bonding denture base to printed denture teeth, as well as for repair using traditional techniques.

Dental professionals are responsible for verifying the suitability of the printed denture base for the specific patient and clinical scenario.

Specific Manufacturing Considerations

Denture Base Resin V2 specifications have been validated using the hardware and parameters indicated below. For biocompatibility compliance, validation used a dedicated resin tank and mixer, build platform, wash unit and post-processing equipment that were not mixed with any other resins.

1. Hardware:

- a. Formlabs 3D Printer: Form 4B, Form 4BL
- b. Print Accessories: Formlabs Build Platforms, Formlabs Standard Resin Tanks

2. Software:

- a. Formlabs PreForm

3. Printing Parameters:

- a. Layer Thickness:
 - Form 4B: 100 μ m
 - Form 4BL: 100 μ m
- b. Part Orientation: Users may print at any angle but fit may be suboptimal at angles steeper than 70 degrees. Similarly, users may print in any orientation, but users may achieve better fit with the occlusal side facing away from the build platform. Supports may be generated automatically or manually. Ensure there are no supports placed in or around the tooth pockets to avoid issues with teeth assembly. Cross arch bars may also be utilized if additional support is needed.
- c. Part Geometry: STL file must be formatted according to the following minimum thickness guidance:

Area	Maxillary	Mandibular
Lingual Ridge Area	≥ 2.5 mm	≥ 2.5 mm
Palatal / Lingual	≥ 2 mm (≥ 3 mm single arch upper)	≥ 2 mm
Facial / Buccal	≥ 2 mm	≥ 2 mm
Implant Over Denture	≥ 2.5 mm	≥ 2.5 mm

Retention elements requiring high-deflection during seating (such as traditional C-clasps) may lead to pre-mature fracture and should not be printed with Denture Base Resin V2.

Users may also utilize cross-arch stabilization bars if desired.

4. Recommended Post-Processing Equipment and Accessories:

- a. Formlabs Validated Wash Unit: Form Wash, Form Wash V2, Form Wash L, Form Wash L V2
- b. Formlabs Validated Cure Unit: Form Cure, Form Cure L, Form Cure V2, Form Cure L V2
- c. Dental handheld tools (bur, cutting disk and handpiece, or other appropriate finishing tools)
- d. Handheld UV cure light (Note: All in-house testing at Formlabs was done with a 405 nm handheld UV light, but any light source between 365 nm and 405 nm may also be used)
- e. Polishing lathe

A. PRINTING

1. **Shake cartridge:** Shake the cartridge before every print job. Color deviations and print failures may occur if the cartridge is shaken insufficiently.
2. **Set up:** Insert resin cartridge into a compatible Formlabs 3D printer. Insert resin tank and attach mixer.
3. **Printing:**
 - a. Prepare a print job using PreForm software. Import desired part file.
 - b. Orient and generate supports.
 - c. Send the print job to the printer.
 - d. Begin print by selecting a print job from the print menu. Follow any prompts or dialogs shown on the printer screen. The printer will automatically complete the print.

B. PART REMOVAL

Remove the build platform from the printer. To remove parts from the build platform, wedge the part removal tool under the printed part raft, and rotate the tool. Formlabs Flex Build Platforms may be used for easy, tool free removal. For detailed techniques visit support.formlabs.com.

C. WASHING

Place the printed parts in a Formlabs-validated wash unit with 99% Isopropyl Alcohol.

Form Wash, Form Wash V2, Form Wash L, or Form Wash L V2:

- a. Wash for 10 minutes or until clean.
- b. If parts do not appear clean after washing, use a soft-bristle brush and Isopropyl Alcohol in a squirt bottle to clear the denture of residue and replace solvent in wash.

Do not let parts sit in Isopropyl Alcohol for longer than needed.

Users may wash parts with or without supports, but washing without supports will allow for optimal resin removal. If users want to continue processing with supports, it is important to ensure all resin residue is removed from the part.

D. DRYING

1. Remove parts from Isopropyl Alcohol. Leave to air dry at room temperature for at least 30 minutes. Alternatively, parts can be dried using compressed air. **NOTE:** Dry times can vary depending on the geometry of parts and ambient condition. Insufficient drying may lead to eventual aesthetic abnormalities/part whitening.
2. Inspect printed parts to ensure that parts are clean and dry. No residual solvent, excess liquid resin, or residue particles should remain on the surface before proceeding to subsequent steps.
3. If residual solvent is still present, dry parts longer. If resin residue is still visible, rewash parts or scrub using a soft-bristle brush and repeat the drying process until parts are clean and dry.

E. DENTURE TEETH ASSEMBLY

Denture Base Resin V2 may be joined with teeth in a variety of ways.

Teeth Type	Adhesive	Mandibular
Formlabs Premium Teeth Resin	Denture Base Resin V2	Ensure parts are completely dry and free of IPA. Ensure tooth arch fits without obstructions and adjust as necessary. Prepare denture base by applying, in each pocket, a small amount of liquid Denture Base Resin V2 to uncured denture. Affix uncured teeth printed in Premium Teeth Resin to base. Remove any excess liquid resin with a brush and/or a lint-free cloth. Tack cure interproximal spaces between each tooth for 5-10 seconds each or as necessary to secure bond. Follow curing instructions in section F. Post-Curing.

Teeth Type	Adhesive	Mandibular
	Bonding systems compatible with acrylic/ resin-based denture materials such as Ivoclar Ivotion Bond Kit.	Cure denture base following curing instructions in Section F. Post-Curing. Separately cure teeth following the manufacturing guide for Premium Teeth Resin. Prepare the bonding surfaces by physically roughening with a hand bur or coarse-grit sandblast media. Bond teeth to the cured base following instructions provided by the bonding system manufacturer.
Milled teeth, Stock/carded teeth, Other 3D-printed teeth	Bonding systems compatible with acrylic/ resin-based denture materials such as Ivoclar Ivotion Bond Kit.	Cure denture base following curing instructions in section F. Post-Curing. Prepare the bonding surfaces by physically roughening with a hand bur or coarse-grit sandblasting media. Bond teeth to the cured base following instructions provided by the bonding system manufacturer.

F. POST-CURING

PRIOR TO CURING: *Ensure the proper order of operations by consulting section E. Denture Teeth Assembly*

Place the printed parts occlusal side up in a room temperature Formlabs-validated post-curing unit. Do not preheat the unit empty; parts must be inside the chamber during both the preheating phase and for the required cure time.

1. Form Cure or Form Cure L:
 - a. Select Denture Base V2 (30 minutes at 80 °C)
 - b. Allow the cure unit to cool down to room temperature between cure cycles.
2. Form Cure V2 or Form Cure L V2:
 - a. Select Denture Base V2 (15 minutes 80 °C preheat followed by 5 minutes 80 °C cure)
 - b. Allow the cure unit to cool down to room temperature between cure cycles.

G. FINISHING & POLISHING

1. Support marks can cause abrasion if not removed and polished. Remove any residual marks using a cutting disk and handpiece, cutting plier, or other appropriate finishing tools.
2. (OPTIONAL) If desired, use a sandblaster with glass bead blasting material to remove any surface artifacts or residual resin on the part surface.
3. Polish the printed appliances using typical dental polishing methods prior to clinical use. Polishing is required to remove any residual resin or bonding agent from the surface. Polishing also helps to avoid whitening of the denture base and to maintain a high-quality aesthetic appearance. Unpolished surfaces may whiten in the mouth or with prolonged exposure to water or other liquids.
4. (OPTIONAL) Light-cured glaze and characterization can also be used. Follow the instructions from the material manufacturer.

NOTE: Denture Base Resin V2 and Premium Teeth Resin are photopolymers. Any additional UV exposure has the potential to alter the color of the finished product

5. Inspect the parts for any cracks. Discard if any damage or cracks are detected.
6. Parts may be cleaned using a mild soap and water and a soft-bristle brush or sonicator. Avoid the use of extremely hot water to avoid aesthetic defects.

H. REPAIR & RELINING

If using Denture Base Resin V2 as an agent for repair, use the following information:

NOTE: For maximum bond strength for repair and bonding, ensure the use of reliners/repair agents that are compatible with acrylic/resin-based denture materials. It is very important to thoroughly roughen the part surface completely up to the edges with a carbide bur or coarse-grit sandblasting media to ensure a sufficient bond. The use of a “universal” or “multipurpose” primer may be used to aid in bonding.

1. Surface Repair
 - a. Ensure the part is disinfected (see section I below) and dry.
 - b. Physically etch the repair surface with a carbide bur and/or coarse-grit sandblasting media.
 - c. Apply Denture Base Resin V2 to the repair area with a brush, allowing the material to flow to avoid bubbles.
 - d. Tack cure with a handheld UV light to secure repair. All in-house testing at Formlabs was done with a 405 nm handheld UV light, but any light source between 365 nm and 405 nm may also be used.
 - e. Repeat steps 1.c - 1.d until desired thickness is reached.
 - f. Place the appliance in the cure unit repair side up and cure according to section F. Post-Curing
 - g. Finish and polish the denture following section G. Finishing & Polishing to remove any surface residue.
2. Fracture Repair
 - a. Ensure the part is disinfected (see section I below) and dry.
 - b. Tack fractured denture together with sticky wax or glue.
 - c. Fabricate a putty model using an appropriate dental stone or plaster.
 - d. After denture is removed from the model, wax may be removed with mild steam cleaning or warm (not hot) soap and water.
 - e. Prepare the fracture area for repair by physically etching the repair surface with a carbide bur and/or coarse-grit sandblasting media.
 - f. A third party release agent may be applied to the putty model. Secure denture onto a putty model with sticky wax, being sure to keep the repair area free from wax or other contamination.
 - g. Apply Denture Base Resin V2 to the repair area with a brush, allowing the material to flow to avoid bubbles.
 - h. Tack cure with a handheld UV light to secure repair. All in-house testing at Formlabs was done with a 405 nm handheld UV light, but any light source between 365 nm and 405 nm may also be used.
 - i. Repeat steps 2.g - 2.h until desired thickness is reached.
 - j. Manually remove any excess sticky wax if needed.
 - k. Place the appliance in the cure unit repair side up and cure according to section F. Post-Curing
 - l. Finish and polish the denture following section G. Finishing & Polishing to remove any residual resin from the surface.
3. Tooth Replacement
 - a. Ensure the part is disinfected (see section I below) and dry.
 - b. If any tooth material remains in the tooth socket, remove by grinding with a bur.
 - c. If replacement teeth are manufactured using Premium Teeth Resin, ensure replacement teeth are fully cured before bonding. See Premium Teeth Resin Instructions for Use.
 - d. Prepare the denture to receive the replacement tooth/teeth by physically etching the repair surfaces with a carbide bur and/or coarse-grit sandblasting media.
 - e. Use sticky wax, if desired, to position the new tooth/teeth. Wax may be removed with mild steam cleaning or warm (not hot) soap and water.
 - f. Using a third party dental-grade, self-polymerizing, gap-filling bond agent (such as Ivoclar Ivotion Bond Kit), follow the manufacturer's instructions for use to attach the new tooth/teeth to the denture base.
 - g. Finish and polish the denture following section G. Finishing & Polishing to remove any residue from the surface.

Hard and soft reliners that are compatible with acrylic/resin-based denture materials may be used with Denture Base Resin V2.

Prepare the surface for relining by thoroughly roughening the part surface completely up to the edges using a coarse carbide bur. Refer to the reliner manufacturer's Instructions for Use.

I. CLEANING & DISINFECTION

1. Appliances may be cleaned using a dedicated tooth brush with neutral soap and warm water or effervescent dental appliance cleaning tablets (used according to manufacturer's directions).
2. Appliances may be disinfected by soaking in 70% Isopropyl Alcohol for five minutes per CDC guidance (Guideline for Disinfection and Sterilization in Healthcare Facilities (2008)).
3. Inspect appliances for cracks after cleaning or disinfection. Do not use if damaged or cracked. Replace or repair device.

J. HAZARDS, STORAGE & DISPOSAL

1. Printed parts, when not in use, should be stored in a dark, dry environment such as a light-tight case.
2. Cured resin is non-hazardous and may be disposed of as regular waste.
3. See SDS for more information at support.formlabs.com.