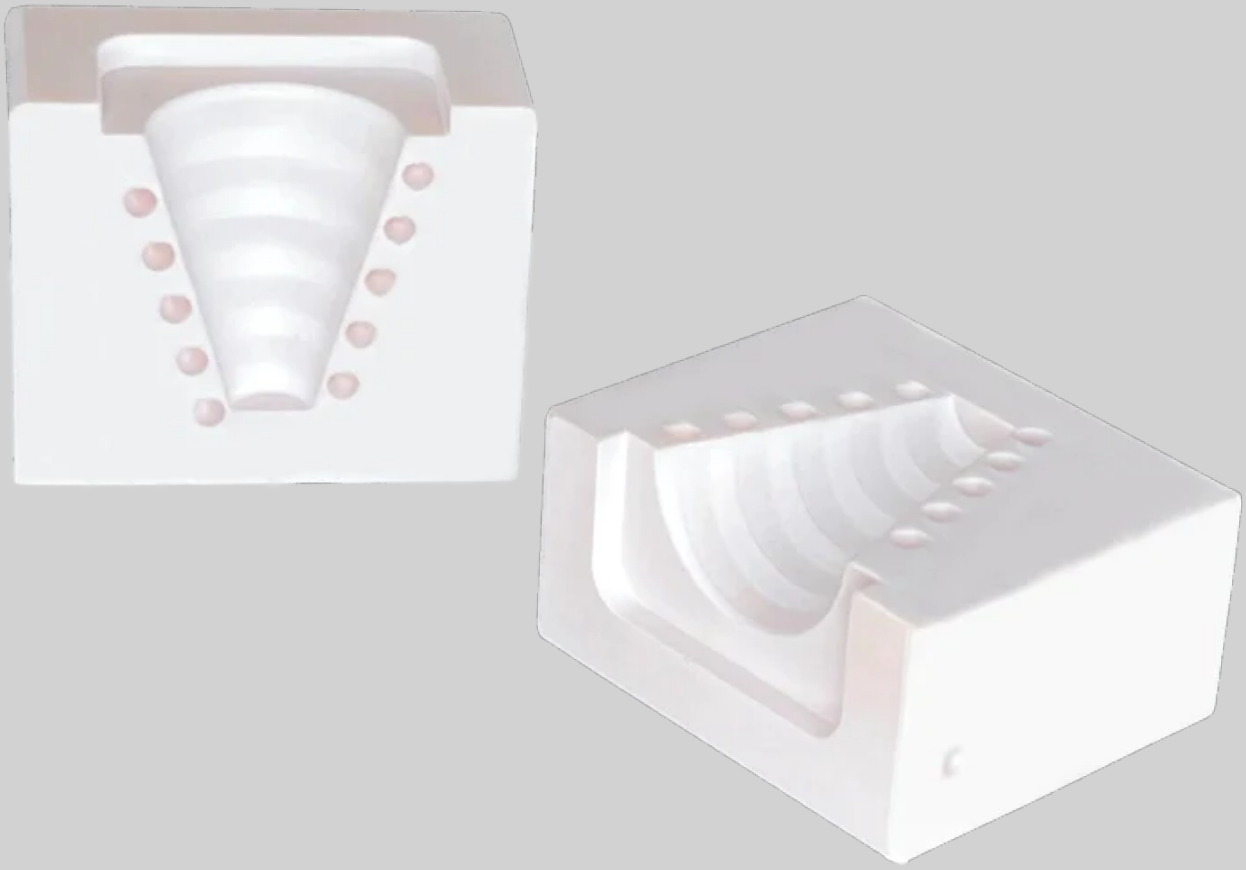
BASF Ultracur3D RG 3280

January 2024

Material Best Practice Guide for Pro XL™



ETEC

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History of Changes

Date	Changes	Revision
November 2023	Document creation	2.0
January 2024	■ Updated About BASF Ultracur3D RG3280 ■ Updated Post-Processing	3.0

About This Guide

This document helps you prepare, post-process, and finish parts using BASF Ultracur3D RG 3280 material.

BASF Ultracur3D RG 3280 Material Best Practice Guide: 81-00269_R03_EN, January 2024.

About BASF Ultracur3D RG3280

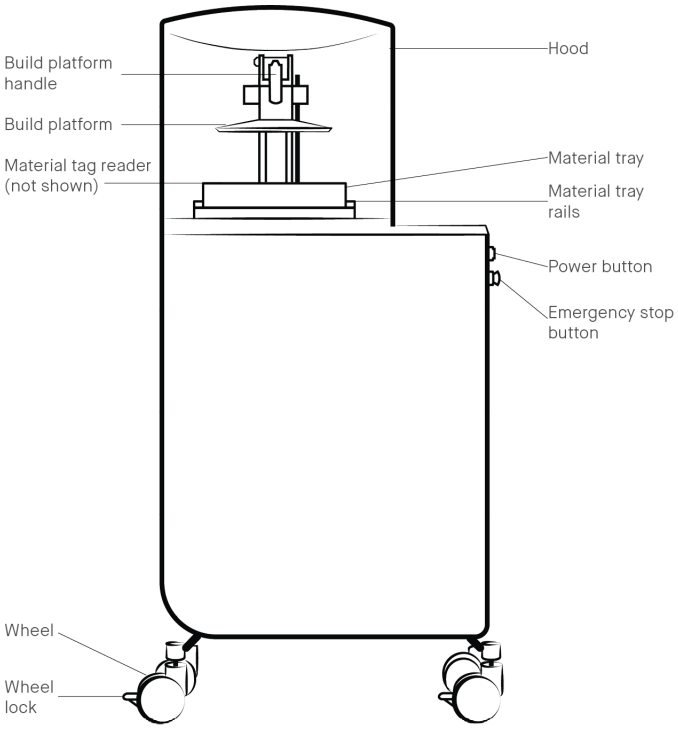
BASF Ultracur3D® RG 3280 is a ceramic filled resin with a temperature resistance above 280° C (536° F) and a modulus around 10 GPa. The material is low in viscosity and has high ceramic suspension stability, making this material very easy to print. The stiffness and temperature resistance make this material ideal for tooling, molding and wind tunnel testing.

Other features of BASF Ultracur3D RG 3280 are its resistance to various chemicals and its ability to be sterilized.

Applicable Printers

This material is tested and approved for the following printer:

- Pro XL™



Pro XL Front View

Mechanical Properties Summary

The following table provides a summary of the mechanical properties for BASF Ultracur3D RG3280 printed on the Pro XL:

Workflow	Curing Unit	Modulus	Tensile Strength	Elongation at Break	HDT @ 0.45 MPa	HDT @ 1.82 MPa
TDS: UV		10,600 MPa	87 MPa	1.30%	284° C	132° C
ETEC Workflow: UV Only	PCA 4000	10,200 MPa	61 MPa	0.62%	261° C	114° C
TDS: UV + Thermal		10,500 MPa	85 MPa	1%	284° C	162° C
ETEC Workflow: UV + Thermal	PCA 4000	10,500 MPa	49 MPa	0.50%	284° C	156° C
ETEC Workflow: UV + Thermal	Otoflash	10,800 MPa	69 MPa	0.69%	278° C	161° C

Getting Started

Primary Supplies

Primary supplies should be acquired prior to product delivery. Obtain the proper tools to prepare for successful printing and post-processing.

The following supplies are required to print BASF Ultracur3D RG 3280 material:

- BASF Ultracur3D RG 3280: Product Code RES-01-7501 (1 L).
- Personal Protective Equipment (PPE).
- Paper towels.
- Material mixing: Dual Motion Bottle Roller, Product Codes ACC-26-1000 (110 V) and ACC-26-1000 (220 V), and rubber spatula.
- Material filtering: Cone-shaped paint filter and spare material storage bottle.
- Part removal: Paint scraper.
- Washing unit options:
  - Small parts: PWA 2000, Product Code ACC-22-2000.
  - Medium and large parts: Desktop Orbital Shaker Washer, Product Code ACC-02-6000.
- Washing agent: 99% Isopropyl alcohol.
- Air compressor.
- Curing unit options:
  - PCA 4000, Product Code ACC-06-1000.
  - Otoflash G171, Product Code ACC-00- 0007.
- Drying oven: Programmable thermal oven up to 150° C, such as Desktop Metal's Shop System Drying Oven, Product Code SHP-PC0001.

Note: See the Pro XL Site Prep Guide for more information on the recommended accessories.

Design Parts BASF Ultracur3D RG 3280

Some parts printed in BASF Ultracur3D RG 3280 should be printed on supports rather than on the build platform, depending on the application. Keep this in mind when designing parts for BASF Ultracur3D RG 3280.

Add channels or drainage holes to hollow parts. This allows uncured material to drain from the hollow feature during the printing process.

Minimum Feature Size

Minimum feature size is dependent on:

- Printer
- Material
- Feature geometry

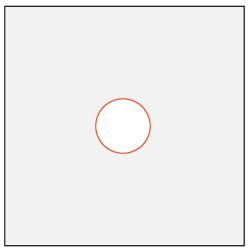
All design features include recommendations for absolute minimum feature size and recommended minimum feature size. Absolute minimums are the smallest resolvable feature size based on printability. Recommended minimums are provided to minimize potential warpage and account for part fragility. Part feature dimensions that are lower than the recommended minimum can fracture with minimal force.

Note: Absolute minimum feature sizes are only valid for smaller features within the part geometry (Ex: text, small channels, etc.). They should not be used for the main components of design methodology.

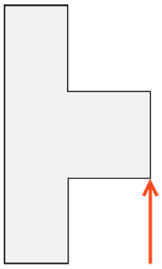
ETEC recommends the following minimum feature sizes for parts printed in BASF Ultracur3D RG 3280:

Design Feature	Absolute Minimum	Recommended Minimum
Wall Thickness	0.45 mm	0.60 mm
Cylinder Wall Thickness	0.30 mm	0.50 mm
Wire Thickness	0.30 mm	0.50 mm
Engraving Depth	0.30 mm	0.50 mm
Embossing Height	0.30 mm	0.50 mm
Positive Features	0.40 mm	0.60 mm
Negative Features	0.80 mm	1.0 mm
Text Depth	0.30 mm	0.50 mm
Text Height	0.30 mm	0.50 mm

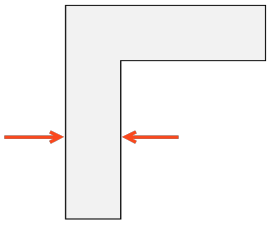
Design Feature	Absolute Minimum	Recommended Minimum
Text Thickness	0.50 mm	0.70 mm
Hole Diameter	1.0 mm	1.50 mm
Minimum Spacing	3.0 mm	4.0 mm
Bridge Gap **Note:** The value is maximum, not minimum.	0.40 - 1.50 mm	0.60 - 2.0 mm
Unsupported Horizontal Overhang **Note:** The value is maximum, not minimum.	2.0 mm	2.50 mm



Hole diameter



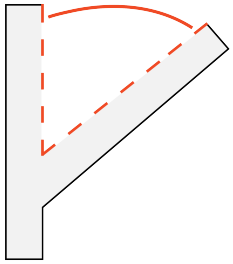
Unsupported horizontal overhang



Minimum wall thickness

Self-Supporting Angle

The absolute maximum self-supporting angle for parts printed with BASF Ultracur3D RG 3280 is 55° from vertical.



Self-supporting angle from vertical

Software

Orient Parts Envision One RP Software

Envision One RP Software automatically orients your model, adds supports, if necessary, and sends the file to the printer, resulting in your three-dimensional model. Everything that is printed using ETEC printers must pass through this software successfully.

	Pro XL
Spacing	Place parts a minimum of 2.50 mm apart.
Level at build platform	Place supported parts 5.0 mm from the build platform.
Resolution	100 µm Z resolution (dependent on layer thickness).

Support Parts Envision One RP Software

It is recommended to print most applications on supports, lifted above the platform. Larger surface areas that are printed flat to the platform have an increased risk of fracturing during the part removal process.

Recommended Support Settings

Support Setting Feature	Pro XL Recommended Support Setting
Minimum contact tip thickness	0.3 mm
Minimum support beam thickness	0.8 mm
Minimum support beam height	10.0 mm
Minimum space between supports	2.50 mm
Minimum support base	0.80 mm
Clearance from part	1.0 mm
Only from platform	Yes
Reinforcement spacing	3.0 mm
Maximum angle	55°
Maximum height	10 mm
Base type	Fence

Print Preparation

Mix Material

BASF Ultracur3D RG 3280 must be mixed before use.

1. Mix the sealed material bottle on the bottle roller for two hours.
2. Wait for bubbles to subside before filling the material tray.
3. Gently mix the material in the material tray for one minute with the rubber spatula.
4. Repeat **Step 3** before every print.

Fill Material Tray

Do not overfill the material tray. Overfilling can cause the material to overflow at the start of the print job.

Important: Ensure there are no small, cured particles in the material. If found, then the material must be filtered. See Maintain Materials Pro XL.

To add more material to the printer, carefully pour material into the material tray between prints. See Add Material Pro XL.

Note: Do not add material to the material tray during a print. Adding material while the print is paused, or during a print, will cause a small shift line in the part.

Print BASF Ultracur3D RG 3280

Before starting a print:

- Ensure the build platform is clean and free of cured material.
- Ensure the material level is correct.

To start and complete the print, see Pro XL Operations & Maintenance Guide.

Tip: Allow excess material to drip off before parts are removed off the plate.

Tip: Parts should be cleaned within 30 minutes after the print is complete. Time prints with this in mind.

Post-Processing

Materials Safety

The Safety Data Sheet (SDS) for materials used in the printing process are available from ETEC or directly from suppliers. Read and understand the information provided in these documents prior to attempting to operate the printer or handle any media.

⚠ WARNING

Fire hazard: Some materials used for washing may be flammable. Do not wash parts in proximity of any potential ignition source. Washing or drying equipment must be approved for use with flammable solvents. Read SDS and contact your EHS Representative.

Clean Printed Parts

Clean parts using one of the following cleaning options:

- **Small parts:** PWA 2000.
- **Medium and large parts:** Desktop Orbital Shaker Washer.

Important: Do not expose BASF Ultracur3D RG 3280 to the cleaning agent for longer than three minutes. Excess exposure to alcohol may cause cracking in the final parts and may decrease mechanical performance.

Note: A slight discoloration of the subsurface of parts may be observed following the cleaning procedure. The discoloration will not affect part performance.

Clean parts with PWA 2000:

1. Remove excess resin from the parts using compressed air.
2. Wash the parts in the PWA 2000 with 99% IPA for two minutes on **High**.
3. Remove the parts as soon as the program is done and dry with compressed air for 20 to 40 seconds.
4. If the surface of the parts is glossy after drying, spray with IPA and remove residue with compressed air. The surface should be matte and smooth.

Clean parts with the Desktop Orbital Shaker Washer:

1. Remove excess resin from the parts using compressed air.
2. Wash the parts in the Desktop Orbital Shaker Washer with 99% IPA for two minutes at 100 RPM.

3. Remove the parts as soon as the program is done and dry with compressed air for 20 to 40 seconds.
4. If the surface of the parts is glossy after drying, spray with IPA and remove residue with compressed air. The surface should be matte and smooth.

Dry Parts

Parts printed in BASF Ultracur3D RG 3280 must be completely dry before post curing.

1. Dry parts with compressed air.
2. Place the parts in a dark room on a clean surface lined with parchment paper.
3. Leave the parts to dry for 30 minutes.

Tip: We do not recommend drying at elevated temperatures as this can lead to lower tensile properties and lower temperature stability. Also, try to keep the time between printing, washing and UV post-curing short, as the material is quite sensitive in the green state.

Post Cure Printed Parts

Post cure parts using one of the following curing options:

- PCA 4000. See Programs and Features PCA 4000.
- Otoflash G171. See Hardware Operations Otoflash.

Cure parts with the PCA 4000:

1. Place parts in the curing unit with as much space between parts as possible. Parts should never touch one another while curing.
2. Cure the parts in the PCA 4000 for 15 minutes at 60° C and 100% power.
3. When the cycle ends, let the parts cool completely before handling.
4. Repeat **Steps 2-3**. Flip the parts between cycles for an even cure.

Cure parts with the Otoflash:

1. Place parts in the curing unit with as much space between parts as possible. Parts should never touch one another while curing.
2. Cure the parts in the Otoflash for 6,000 flashes.
3. When the cycle ends, let the parts cool completely before handling.
4. Repeat **Steps 2-3**. Flip the parts between cycles for an even cure.

Thermal Treatment

Thermal treatment of parts is required for all part applications. The Shop System Drying Oven from Desktop Metal is recommended for thermal treatment. See Desktop Metal's Shop System Drying Oven.

Important: Thermal treatment is required for all applications.

1. Preheat the oven to 30° C.
2. Once the required temperature is reached, place the parts in the oven.
3. Ramp up the oven temperature from 30° C to 150° C over two hours.
4. Hold the oven temperature at 150° C for three hours.
5. Ramp down the oven temperature from 150° C to 30° C over two hours.
6. Remove the parts from the oven. Allow the parts to cool completely before use.

Mold Release Guidance

Use mold release agents to achieve high quality results for injection mold tooling applications.

Multiple release agents were tested with a variety of thermoplastic materials:

- Testing showed that for all thermoplastics, silicone oil had the best performance.
- Silicone free general release agents also showed good performance but reduced shot counts between re-application.

Note: For the full white paper, see Evaluation of DLP 3D Printing for Injection Molding Inserts: A Case Study on BASF Ultracur3D® RG 3280.

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