Figure 4® MED-WHT 10

Biocompatible* Rigid

A rigid white material for applications requiring biocompatibility and/or thermal resistance

Figure 4

BEAUTIFUL WHITE PARTS, THAT CAN BE STERILIZED AND TESTED AT HIGH TEMPERATURE

Figure 4® MED-WHT 10 is a rigid, white material for a range of medical and industrial applications, including when biocompatibility, sterilization and/or thermal resistance is required. It delivers parts with excellent feature resolution and high definition.

HANDLING AND POST-PROCESSING GUIDELINES

Proper mixing, cleaning, drying and curing is required for this material. Post-processing information can be found at the end of this document.

Note: all properties are based on using the documented post-processing method. Any deviation from this method could yield a different result.

More details can be found in the Figure 4 User Guide available at http://infocenter.3dsystems.com

Figure 4 Standalone:
http://infocenter.3dsystems.com/figure4standalone/node/1546

Figure 4 Modular:
http://infocenter.3dsystems.com/figure4modular/node/1741

APPLICATIONS

- General medical applications requiring biocompatibility, sterilization and/or thermal resistance
- Surgical drill guides, splints
- Bone models
- Parts requiring rigidity with high temperature and/or water resistance
- Parts with high definition details

BENEFITS

- Smooth surfaces for beautiful display models and prototypes
- High temperature testing
- True-to-CAD accuracy and crisp feature detail

FEATURES

- Biocompatible capable per ISO10993-5 and ISO10993-10
- Sterilizable by autoclave
- Thermal resistance over 100 °C
- Excellent humidity/moisture resistance
- Rigid and white

Note: Not all products and materials are available in all countries — please consult your local sales representative for availability.

3D SYSTEMS®

Figure 4 MED-WHT 10

MATERIAL PROPERTIES

The full suite of mechanical properties are given per ASTM and ISO standards where applicable. In addition, properties such as flammability, dielectric properties, and 24 hour water absorption. This allows for better understanding of the material capability to aid in design decisions for the material. All parts are conditioned per ASTM recommended standards for a minimum of 40 hours at 23 °C, 50% RH.

Solid material properties reported were printed along the vertical axis (ZY-orientation). Figure 4 material properties are relatively uniform across print orientations, as detailed in the following section on Isotropic Properties. Because of this, parts do not need to be oriented in a particular direction to exhibit these properties.

LIQUID MATERIAL			
MEASUREMENT	**CONDITION/METHOD**	**METRIC**	**ENGLISH**
Viscosity	Brookfield Viscometer @ 25 °C (77 °F)	937 cps	2270 lb/ft-hr
Color		White	
Liquid Density	Kruss K11 Force Tensiometer @ 25 °C (77 °F)	1.18 g/cm³	0.043 lb/in³
Default Print Layer Thickness (Standard Mode)		0.05 mm	0.002 in
Speed - Standard Mode		41 mm/hr	1.6 in/hr
Speed - Draft Mode		56 mm/hr	2.2 in/hr
Package Volume		1 kg bottle - Figure 4 Standalone	

SOLID MATERIAL						
METRIC	**ASTM METHOD**	**METRIC**	**ENGLISH**	**ISO METHOD**	**METRIC**	**ENGLISH**
	PHYSICAL				**PHYSICAL**	
Solid Density	ASTM D792	1.27 g/cm³	0.046 lb/in³	ISO 1183	1.27 g/cm³	0.046 lb/in³
24 Hour Water Absorption	ASTM D570	0.25%	0.25%	ISO 62	0.25%	0.25%
	MECHANICAL				**MECHANICAL**	
Tensile Strength Ultimate	ASTM D638	60 MPa	8700 psi	ISO 527 -1/2	61 MPa	8858 psi
Tensile Modulus	ASTM D638	3090 MPa	450 ksi	ISO 527 -1/2	2436 MPa	353 ksi
Elongation at Break	ASTM D638	3%	3%	ISO 527 -1/2	3 %	3 %
Flex Strength	ASTM D790	112 MPa	16240 psi	ISO 178	104 MPa	15146 psi
Flex Modulus	ASTM D790	3290 MPa	480 MPa	ISO 178	3250 MPa	471 ksi
Izod Notched Impact	ASTM D256	17 J/m	0.3 ft-lb/in	ISO 180-A	1.8 J/m²	0.0009 ft-lb/in²
Izod Unnotched Impact	ASTM D4812	91 J/m	1.7 ft-lb/in	ISO 180-U		
Shore Hardness	ASTM D2240	84D	84D	ISO 7619	84D	84D
	THERMAL				**THERMAL**	
Tg (DMA, E")	ASTM E1640 (E"at 1C/min)	102 °C	216 °F	ISO 6721-1/11 (E"at 1C/min)	102 °C	216 °F
HDT @ 0.455 MPa/66 PSI	ASTM D648	102 °C	216 °F	ISO 75- 1/2 B	112 °C	234 °F
HDT @ 1.82 MPa/264 PSI	ASTM D648	79 °C	175 °F	ISO 75-1/2 A	93 °C	199 °F
CTE below Tg	ASTM E831	83 ppm/°C	46 ppm/°F	ISO 11359-2	83 ppm/°C	46 ppm/°F
CTE above Tg	ASTM E831	154 ppm/°C	86 ppm/°F	ISO 11359-2	154 ppm/°C	86 ppm/°F
UL Flammability	UL94	HB	HB			
	ELECTRICAL				**ELECTRICAL**	
Dielectric Strength (V/mil) @ 3.0 mm thickness	ASTM D149					
Dielectric Constant @ 1 MHz	ASTM D150					
Dissipation Factor @ 1 MHz	ASTM D150					
Volume Resistivity (ohm-cm)	ASTM D257					

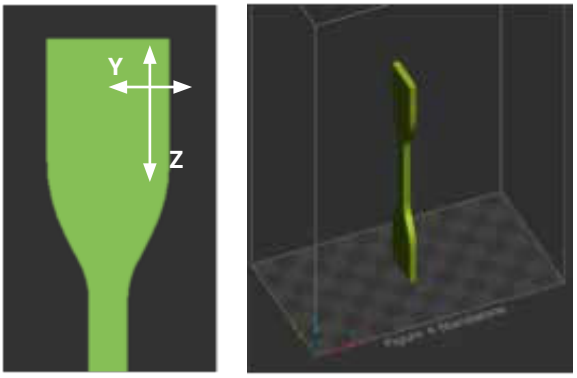
Figure 4 MED-WHT 10

ISOTROPIC PROPERTIES

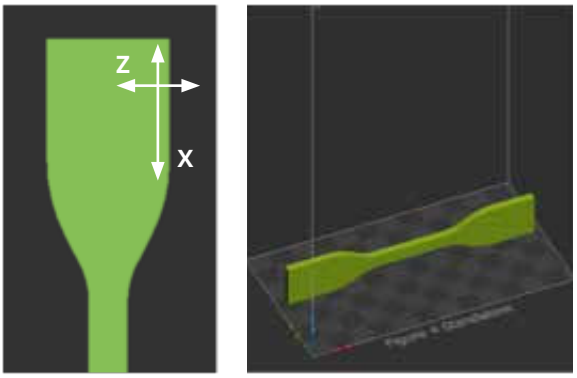
Figure 4 technology prints parts that are isotropic in mechanical properties meaning the parts printed along either the XYZ axis will give similar results.

Parts do not need to be oriented to get the highest mechanical properties, further improving the degree of freedom for part orientation for mechanical properties.

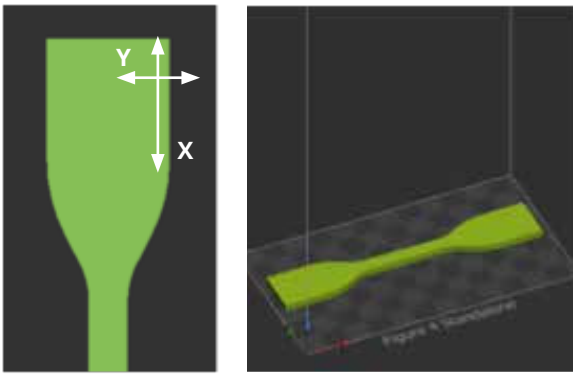
SOLID MATERIAL					
METRIC	METHOD	METRIC			
MECHANICAL					
		ZY	XZ	XY	Z45
Tensile Strength Ultimate	ASTM D638	60 MPa	66 MPa	61 MPa	59 MPa
Tensile Strength at Yield	ASTM D638	N/A	N/A	N/A	N/A
Tensile Modulus	ASTM D638	3100 MPa	3200 MPa	3200 MPa	3100 MPa
Elongation at Break	ASTM D638	3%	4 %	3 %	3 %
Elongation at Yield	ASTM D638	N/A	N/A	N/A	N/A
Flex Strength	ASTM D790	112 MPa	114 MPa	103 MPa	88 MPa
Flex Modulus	ASTM D790	3300 MPa	3600 MPa	2900 MPa	2600 MPa
Izod Notched Impact	ASTM D256	17 J/m	16 J/m	15 J/m	16 J/m
Shore Hardness	ASTM D624	84D	84D	82D	85D



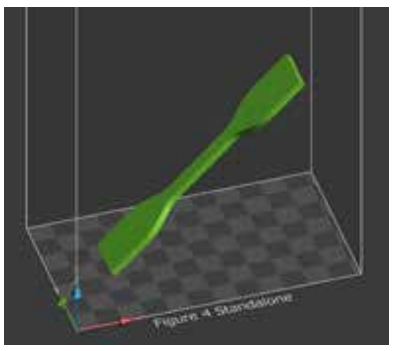
YZ - orientation



XZ - orientation



XY - orientation



Z45-Degree - orientation

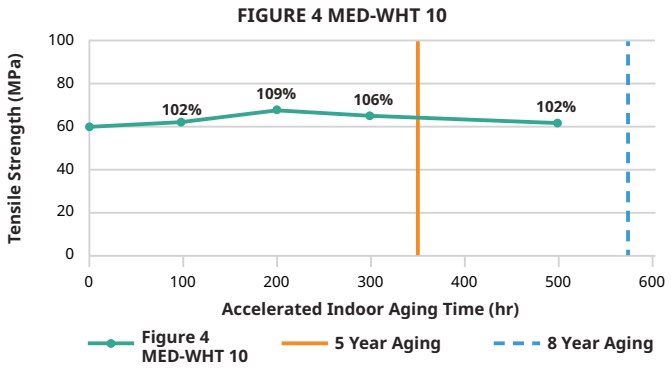
Figure 4 MED-WHT 10

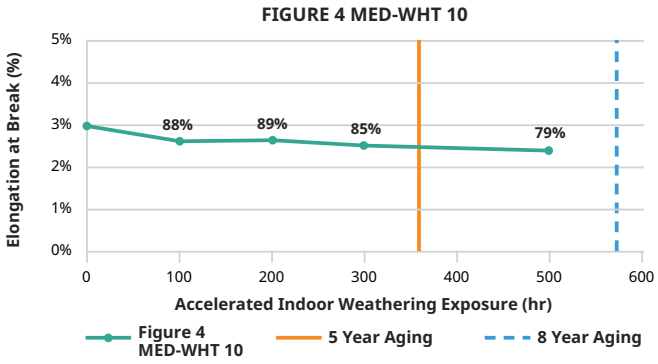
LONG TERM ENVIRONMENTAL STABILITY

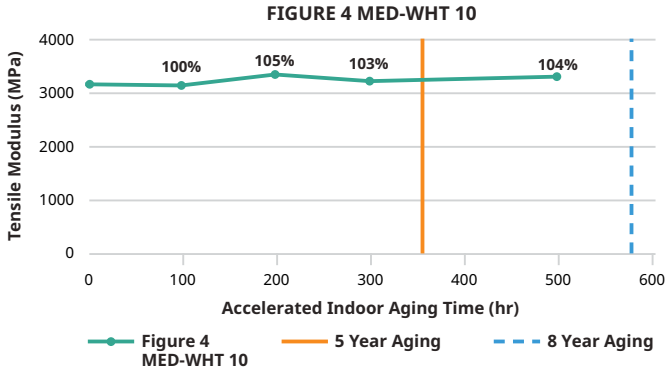
Figure 4 MED-WHT 10 is engineered to give long term environmental UV and humidity stability. This means the material is tested for the ability to retain a high percent of the initial mechanical properties over a given period of time. This provides real design conditions to consider for the application or part. **Actual data value is on Y-axis, and data points are % of initial value.**

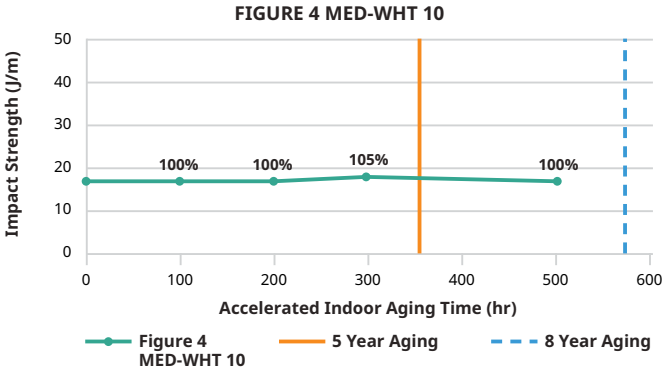
INDOOR STABILITY

INDOOR STABILITY: Tested per ASTM D4329 standard method.









OUTDOOR STABILITY: Tested per ASTM G154 standard method.

Testing in progress and data will be updated in next version of the datasheet

Figure 4 MED-WHT 10

AUTOMOTIVE FLUID COMPATIBILITY

The compatibility of a material with hydrocarbons and cleaning chemicals is critical to part application. Figure 4 MED-WHT 10 parts were tested for sealed and surface contact compatibility per USCAR2 test conditions. The fluids below were tested in two different ways per the specs.

- Immerse for 7-days, then take mechanical property data for comparison.
- Immerse for 30-minutes, remove, and take mechanical property data for comparison in 7-days

Data reflects the measured value of properties over that period of time.

AUTOMOTIVE FLUIDS		
FLUID	**SPECIFICATION**	**TEST TEMP °C**
Gasoline	ISO 1817, liquid C	23 ± 5
Diesel Fuel	905 ISO 1817, Oil No. 3 + 10% p-xylene*	23 ± 5
Engine Oil	ISO 1817, Oil No. 2	50 ± 3
Ethanol	85% Ethanol + 15% ISO 1817 liquid C*	23 ± 5
Power Steering Fluid	ISO 1917, Oil No. 3	50 ± 3
Automative Transmission Fluid	Dexron VI (North American specific material)	50 ± 3
Engine Coolant	50% ethylene glycol + 50% distilled water*	50 ± 3
Brake Fluid	SAE RM66xx (Use latest available fluid for xx)	50 ± 3
Diesel Exhaust Fluid (DEF)	API certified per ISO 22241	23 ± 5

*Solutions are determined as percent by volume

FIGURE 4 MED-WHT 10

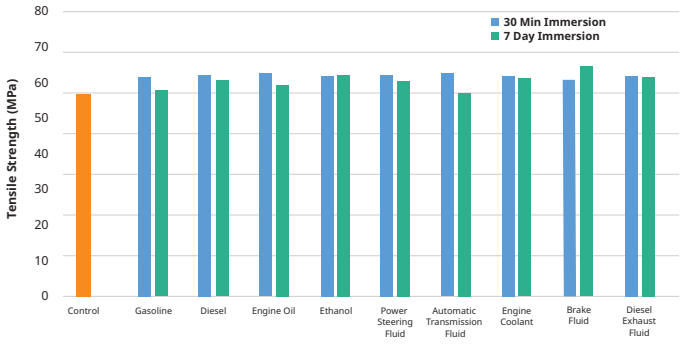
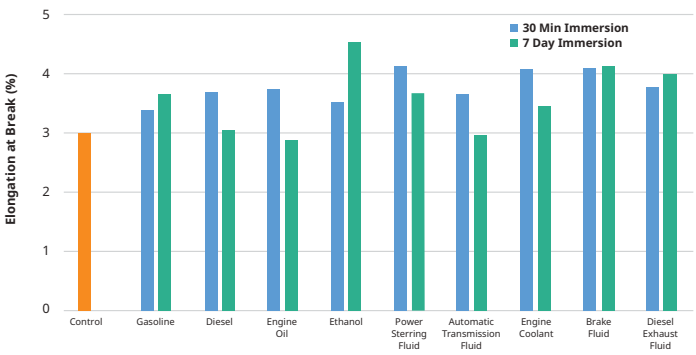


FIGURE 4 MED-WHT 10



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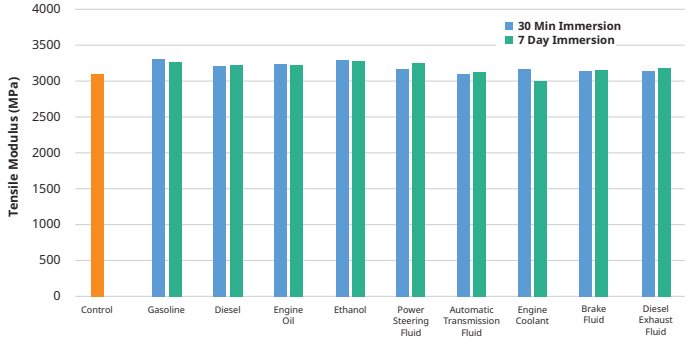

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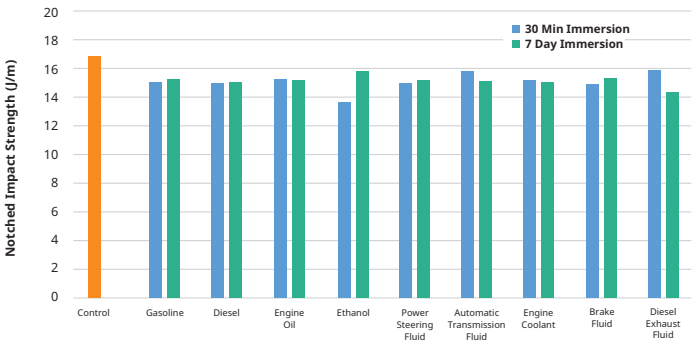


Figure 4 MED-WHT 10

CHEMICAL COMPATIBILITY

The compatibility of a material with cleaning chemicals is critical to part application. Figure 4 MED-WHT 10 parts were tested for sealed and surface contact compatibility per ASTM D543 test conditions. The fluids below were tested in two different ways per the specs.

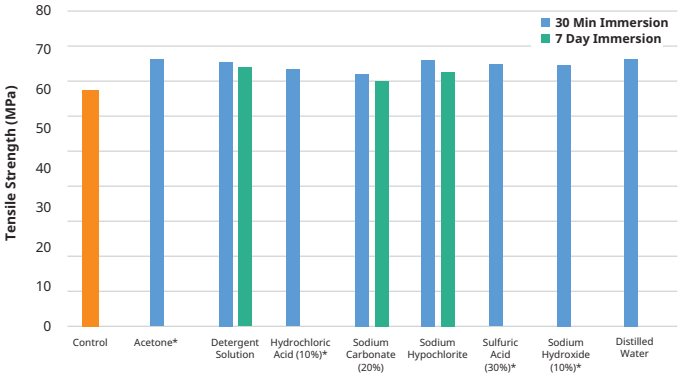
- Immerse for 7-days, then take mechanical property data for comparison.
- Immerse for 30-minutes, remove, and take mechanical property data for comparison in 7-days.

Data reflects measured value of properties over that period of time.

*Denotes materials did not go thru 7-day soak conditioning.

CHEMICAL COMPATIBILITY
6.3.3 Acetone
6.3.12 Detergent Solution, Heavy Duty
6.3.23 Hydrochloric Acid (10%)
6.3.38 Sodium Carbonate Solution (20%)
6.3.44 Sodium Hypochlorite Solution
6.3.46 Sulfuric Acid (30%)
6.3.42 Sodium Hydroxide Soln (10%)
Distilled Water

FIGURE 4 MED-WHT 10



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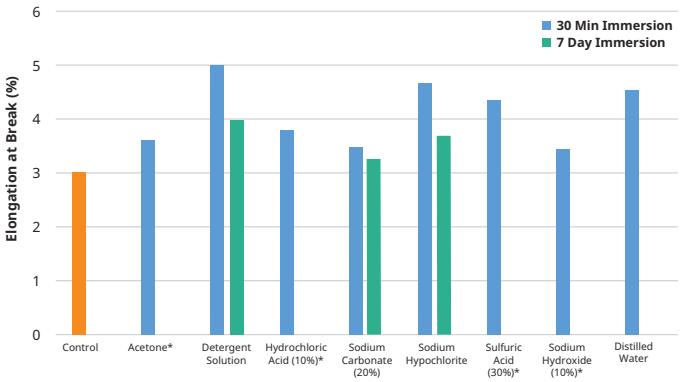

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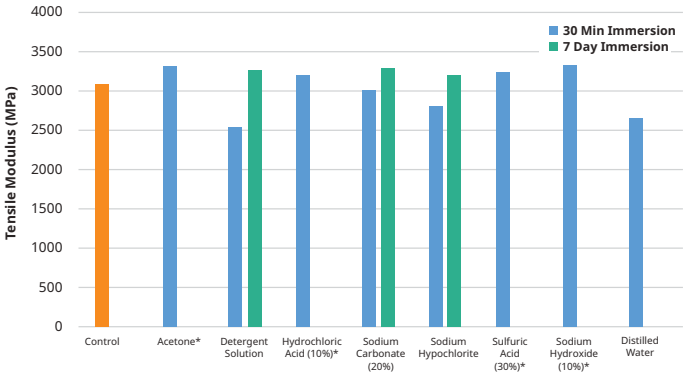

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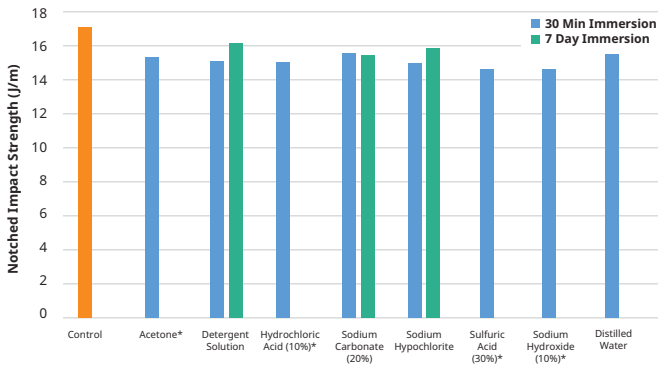

BIOCOMPATIBILITY STATEMENT

Figure 4® MED-WHT 10 test coupons printed and processed according to the post processing instructions below were provided to an external biological testing laboratory for evaluation in accordance with *ISO 10993-5, Biological evaluation of medical devices - Part 5: Tests for in vitro cytotoxicity, and ISO 10993-10, Biological evaluation of medical devices - Part 10: Tests for irritation and skin sensitization (GPMT)*. The test results indicate that Figure 4® MED-WHT 10 has passed the requirements for biocompatibility according to the above tests.

It is the responsibility of each customer to determine that its use of Figure 4® MED-WHT 10 material is safe, lawful and technically suitable to the customer's intended applications. Customers should conduct their own testing to ensure that this is the case. Because of possible changes in the law and in regulations, as well as possible changes in these materials, 3D Systems cannot guarantee that the status of these materials will remain unchanged or that it will qualify as biocompatible in any particular use. Therefore, 3D Systems recommends that customers continuing to use these materials verify their status on a periodic basis.

Figure 4 MED-WHT 10

POST-PROCESSING INSTRUCTIONS REQUIRED TO PASS ISO 10993-5 AND ISO 10993-10

MIXING INSTRUCTIONS

This material has a pigment that settles very slowly over time before printing. For best results mix material in the bottle:

1 kg bottle for Figure 4 Standalone

- Roll bottle for 2.5 hours on 3D Systems LC-3D Mixer for first use
- Roll for 1 hour before subsequent uses

MANUAL CLEANING INSTRUCTIONS

- Manual cleaning with 2 containers of IPA (wash and rinse)
- Clean in 'wash' IPA for 2.5 minutes while agitating part
- Rinse in 'clean' IPA for 2.5 minutes while agitating part
    - DO NOT EXCEED more than 5 minutes total exposure to IPA to preserve mechanical properties
- Manual agitation and/or a soft brush can be used to aid cleaning
- Refresh IPA when cleaning becomes ineffective

DRYING INSTRUCTIONS

- Ambient air dry > 1 hour before post cure

UV CURE TIME

- 3D Systems LC-3DPrint Box UV Post-Curing Unit or Figure 4 UV Cure Unit 350 : 60 minutes

More details can be found in the Figure 4 User Guide available at http://infocenter.3dsystems.com

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