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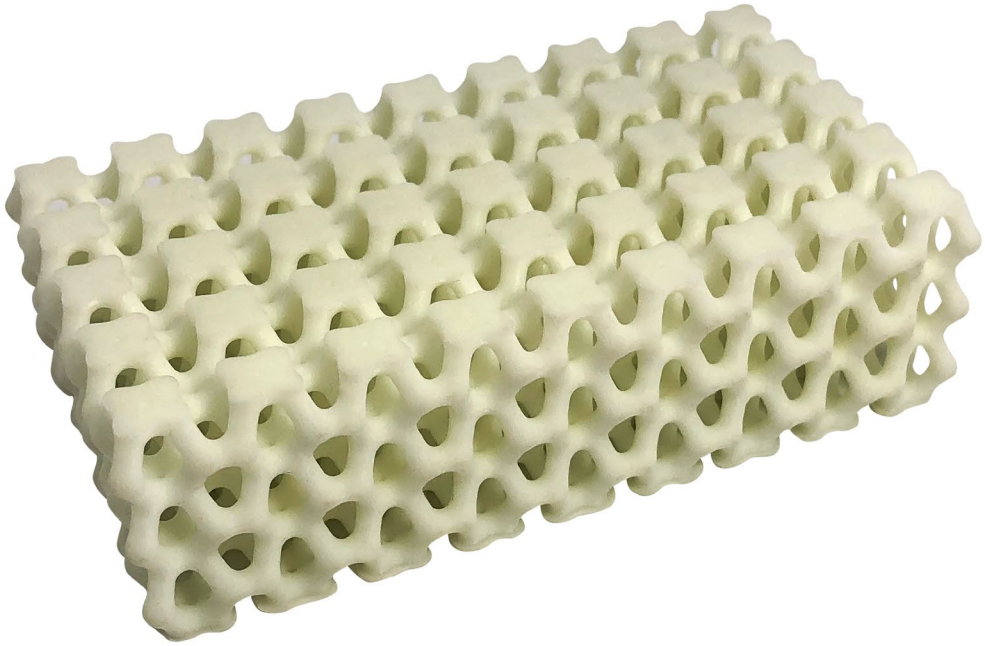

LOCTITE 3D IND475™

A60 High Rebound
Photoelastic
White, Black

LOCTITE®
Henkel Corporation
loctite3dp@henkel.com

Henkel

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IND475™

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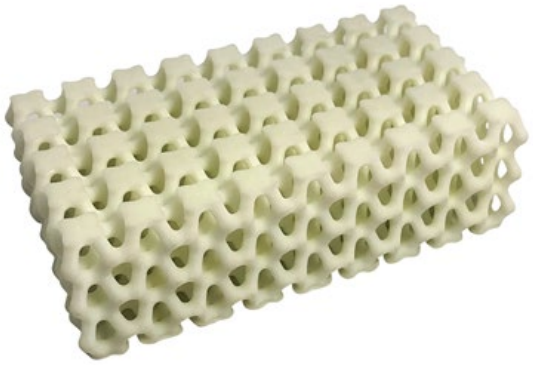
PHOTOELASTIC
WHITE, BLACK



LOCTITE 3D IND475™

LOCTITE 3D IND475 is a single component UV resin that cures to a soft, elastomeric material.

LOCTITE 3D IND475 is a flexible material that gives a good balance of hardness, strength and elongation.

LOCTITE 3D IND475 is a low viscosity liquid, printable at room temperature across various DLP platforms.

Benefits:

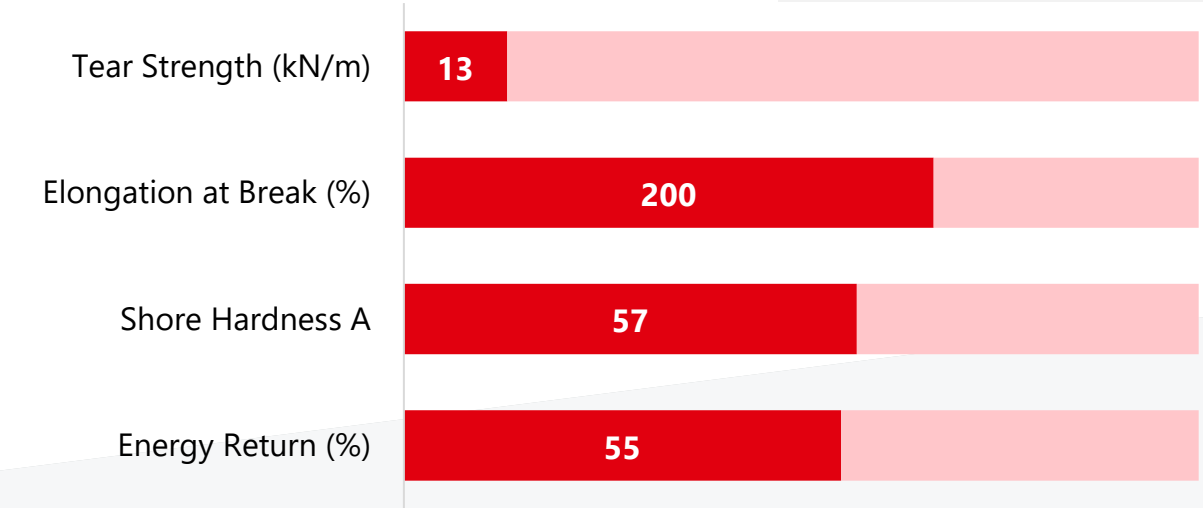
- True elastomeric behavior
- Fast Printing with low shrinkage behavior
- High resilience / High energy return

Ideal for:

- Air and dust gaskets
- Flexible seals and housings
- Cushioning pads

Markets:

Industry **Automotive** **Consumer Goods**



**Values shown are linked to LOCTITE IND475 White as reference, please refer to the specific mechanical properties for each of the colors shown in this document*

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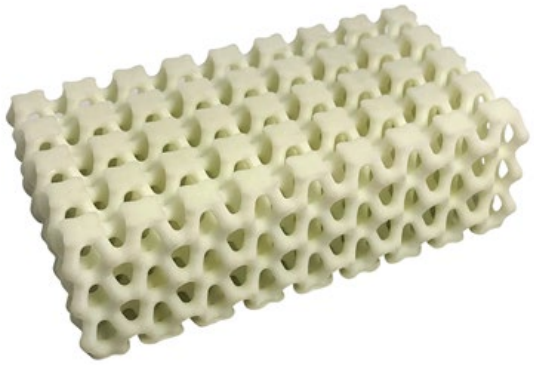

PROPERTIES

Mechanical Properties	Measure	Method	Green	Post Processed
Tensile Stress at Break	MPa	ASTM D638	-	3.1 ± 0.3 [1]
Young's Modulus	MPa	ASTM D638	-	1.1 ± 0.5 [1]
Elongation at Break	%	ASTM D638	-	201 ± 16 [1]
Stress at 50% Strain	MPa	ASTM D412	-	1.3 ± 0.1 [10]
Stress at 100% Strain	MPa	ASTM D412	-	2.4 ± 0.3 [10]
Strain at Break	%	ASTM D412	-	157 ± 23 [10]
Stress at Break	MPa	ASTM D412	-	4.6 ± 0.6 [10]
Tear Strength	kN/m	ASTM D624	-	12.6 ± 0.6 [2]
Energy Return	%	Internal	-	55 [3]
Other Properties				
Shore Hardness (5s)	A	ASTM D2240	-	57 [4]
Solid Density (Green)	g/cm^3	ASTM D792	-	1.03 [5]
Solid Density (Cured)	g/cm^3	ASTM D792	-	1.06 [5]
Volumetric Shrinkage	%	Internal	-	-27 [5]
Water Absorption (24hr)	%	ASTM D570	-	2.1 ± 0.1 [6]
Water Absorption (72hr)	%	ASTM D570	-	4.5 ± 0.1 [6]
Water Absorption (168hr)	%	ASTM D570	-	6.5 ± 0.1 [6]
Compression Set	%	D395, 22hr	-	28.7 [9]
Biocompatibility				
Irritation		ISO 10993-23*		Comply[8]

Test parameters:
"All specimen are printed unless otherwise noted. All specimen were conditioned in ambient lab conditions at 19-23°C / 40-60% RH for at least 24 hours. ASTM Methods: D638 Type IV, 50 mm/min, D570 0.125" x 2" Disc 24hr@ 25°C, D412 Type C 500mm/min.
*The biological assessment has been performed based on the in vitro method according to ISO10993-23

Internal Data Sources:
[1] FOR22878, [2] FOR22879, [3] FOR22952, [4] FOR22950, [5] FOR334387, [6] FOR22955, [7] FOR22875, [8] FOR52819(in vitro), [9] FOR162999, [10] FOR466947

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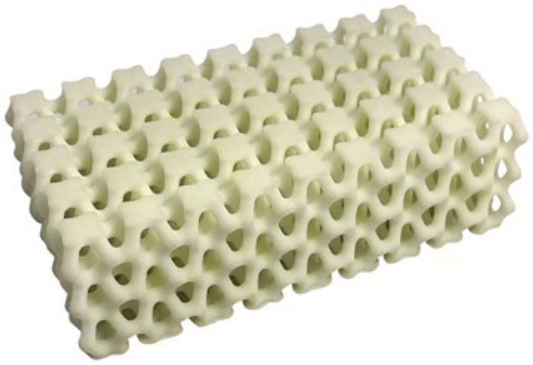

PROPERTIES

Liquid Properties	Measure	Method	Value
Viscosity @ 25°C (77°F)	cP	ASTM D7867	1,400 [4]
Liquid Density	g/cm³	ASTM D1475	1.00 [5]

Electrical Properties	Measure	Method	Green	Post Processed
Volume Resistivity	Ω·cm	ASTM D257	-	8.95E +11 [1]
Surface Resistivity	Ω	ASTM D257	-	2.53E +13 [1]
Dielectric Strength	kV/mm	ASTM D149	-	29.6 [2]
AC Relative Permittivity (Dielectric Constant)[3]				
at 50 Hz (XY)	none	ASTM D150	-	5.1
at 1 kHz (XY)	none	ASTM D150	-	4.6
at 1 MHz (XY)	none	ASTM D150	-	4.3
AC Loss Characteristic (Dissipation Factor)[3]				
at 50 Hz (XY)	none	ASTM D150	-	0.061
at 1 kHz (XY)	none	ASTM D150	-	0.070
at 1 MHz (XY)	none	ASTM D150	-	0.107

Internal Data Sources:
[1] FOR106280 [2] FOR106282 [3] FOR106281, [4] FOR22875, [5] FOR334387

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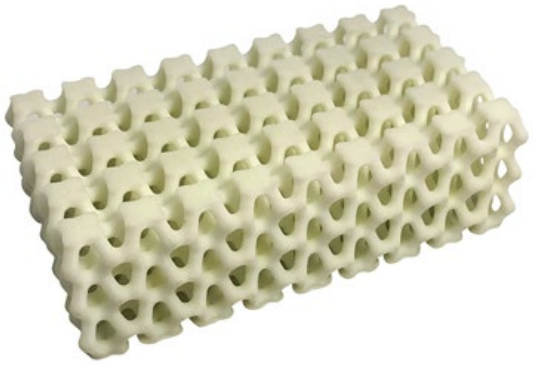

WORKFLOW

Validated workflows need to be followed to achieve properties as provided in the TDS. Examples of validated workflow steps are listed below. Users should defer to the most current workflow information for best results which can be found at https://www.loctiteam.com/printer-validation-settings

PRINTER SETTINGS

LOCTITE 3D IND475 WH is formulated to print optimally on industrial DLP printer. Read the safety data sheet carefully to get details about health and safety instructions. Recommended print parameters:

- Shake resin bottle well before usage
- Temperature: 20°C to 30°C
- Intensity: 3 mW/cm² to 10 mW/cm²

Exposure time for an intensity of 5 mW/cm²

Layer Thickness (µm):	100	Ec (mJ/cm²)	3.55
First layer time (s)	60	Dp (mm):	0.13
Burn in region (s):	35	Model Layer Exposure (s):	3.5

CLEANING

LOCTITE 3D IND475 WH requires post processing to achieve specified properties. Prior to post curing, support structures should be removed from the printed part, and the part should then be washed. Use compressed air to remove residual solvent from the surface of the material between intervals.

Post Process Step	Agent	Method	Duration	Interval	Additional Info
Cleaning #1	LOCTITE Cleaner T	Sonic	2 min	1	Alternative: TPM
Cleaning #2	IPA	Sonic	2 min	1	Use fresh IPA
Dry	n.a.	Compressed air	30 s	1	Air pressure (30 psi)
Wait before post curing	n.a.	Ambient	60 min	1	Room temperature

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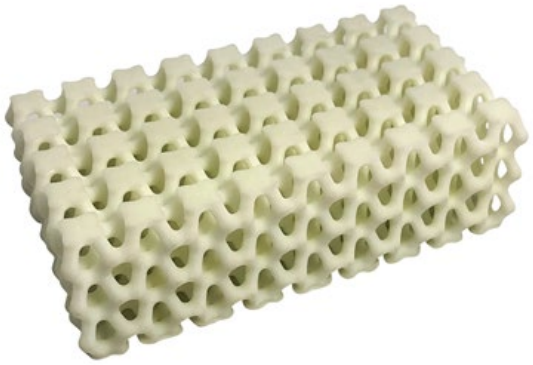

WORKFLOW

Validated workflows need to be followed to achieve properties as provided in the TDS. Examples of validated workflow steps are listed below. Users should defer to the most current workflow information for best results which can be found at https://www.loctiteam.com/printer-validation-settings

POST CURING

LOCTITE 3D IND475 WH requires **post curing in water** to achieve specified properties. It is recommended to apply a mold release on the parts before submerged in a transparent water container.

UV Curing Unit	UV Source	Intensity	Cure time Per side	Additional Settings (Shelf, Output Energy)
Loctite UVALOC 1000	Mercury Arc Bulb (broad spectrum)	30 mW/cm^2 at 365nm	5 min	500 W, 3rd shelf from the top
Dymax 5000 EC Flood	Mercury Arc Bulb (broad spectrum)	150 - 175 mW/cm^2 at 380nm	10 min	400W, Shelf K
Loctite CL36	405nm LED	80 mW/cm^2 at 405 nm	90 min	100% top & side

STORAGE

Store LOCTITE 3D IND475 WH in the unopened container in a dry location. Optimal Storage: 8°C to 30°. Storage below 8°C or above 30°C can adversely affect product properties. Material removed from containers may be contaminated during use. For this reason, filter used resin with 190µm mesh filter before placing back into proper storage container.

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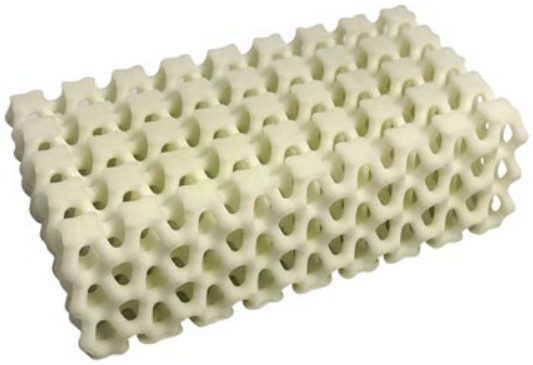
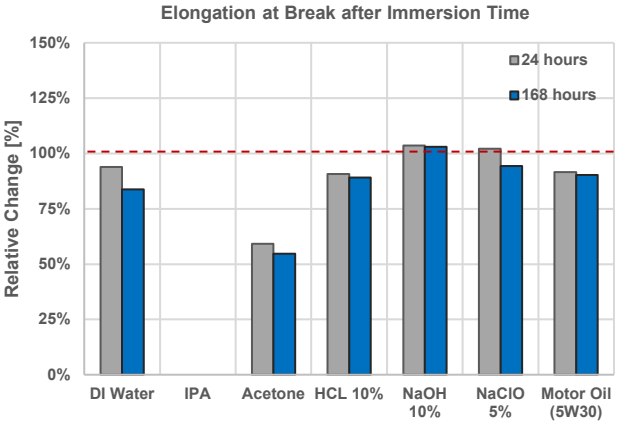
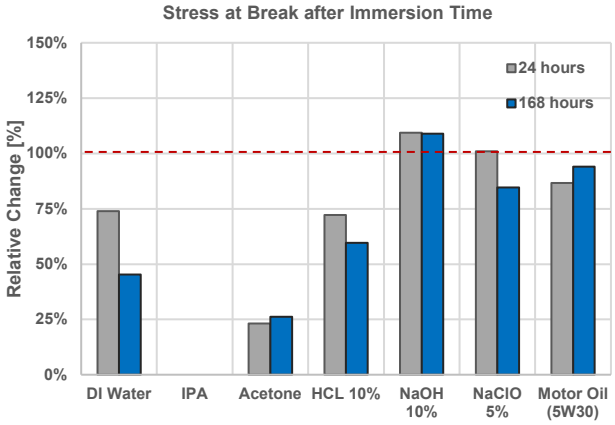


AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (1/2)

LOCTITE 3D IND475 WH has been tested after chemical ageing according to ASTM D543. The influence of chemicals was tested by measuring mechanical properties after different test times (Immersion test for 24 and 168 hours). Exposed samples were stored in containers and fully immersed in different chemicals. Samples were stirred every 24 hours using a shaker. After removal, exposed samples were washed and conditioned for 24 hours at 22°C before mechanical testing. All samples were printed using a validated workflow. Mechanical testing was conducted according to ASTM D412 at standard lab conditions (22°C). "100%" represents non-aged samples stored at 22°C and tested 24 hours after post-processing.





Test parameters:
ASTM D412: Type Die C, Pull speed: 500 mm/min, 22°C
ASTM D543: Samples immersed in different chemicals were stored at 22°C. Samples immersed in Motor Oil were stored at 50°C.
Properties of media used: pH(HCl, 10%) = 1; pH(NaOH, 10%) = 14; pH(NaClO, 5%) = 13

Internal Data Sources:
Di water: FOR437315, IPA: FOR437333, Acetone: FOR437337, HCl 10 %: FOR437972, NaOH 10 %: FOR446891, NaClO 5%: FOR446895, 5W30: FOR446900

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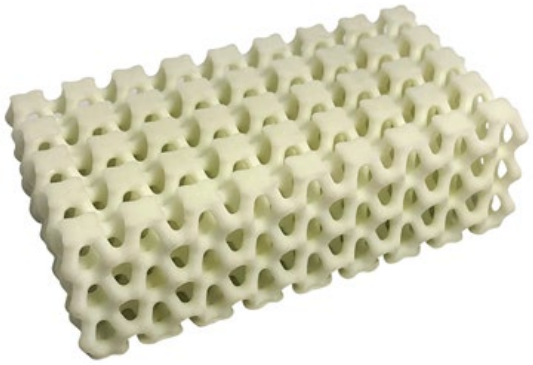
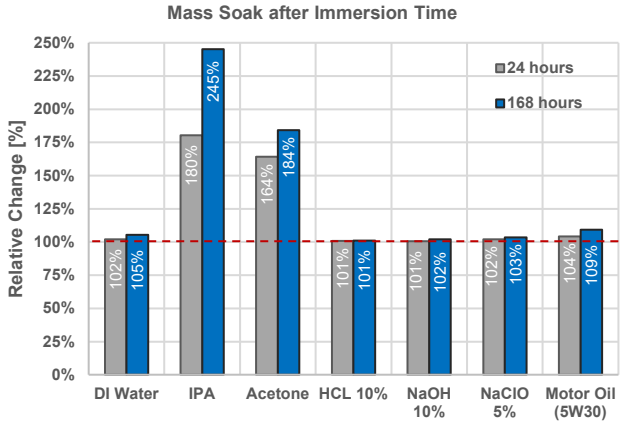


AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (2/2)

LOCTITE 3D IND475 WH has been tested after chemical ageing according to ASTM D543. The influence of chemicals was tested by measuring the mass change after different test times (Immersion test for 24 and 168 hours). Exposed samples were stored in containers and fully immersed in different chemicals. Samples were stirred every 24 hours using a shaker. After removal exposed samples were washed, dried and immediately weighed. All samples were printed using a validated workflow. "100%" represents the initial weight 24 hours after post-processing.



Test parameters:
ASTM D543: Samples immersed in different chemicals were stored at 22°C. Samples immersed in Motor Oil were stored at 50°C.
Properties of media used: pH(HCl, 10%) = 1; pH(NaOH, 10%) = 14; pH(NaClO, 5%) = 13

Internal Data Sources:
Di water: FOR438001, IPA: FOR438002, Acetone: FOR438003, HCl 10 %: FOR438014, NaOH 10 %: FOR446907, NaClO 5%: FOR446909, 5W30: FOR446910

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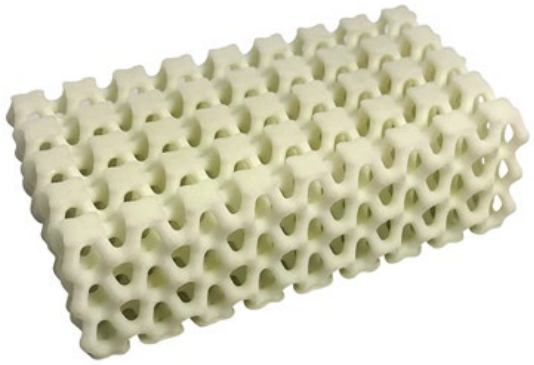

PROPERTIES

Mechanical Properties	Measure	Method	Green	Post Processed
Tensile Stress at Break	MPa	ASTM D638	-	2.4 ± 0.6 [1]
Young's Modulus	MPa	ASTM D638	-	2.5 ± 0.3 [1]
Elongation at Break	%	ASTM D638	-	122 ± 11 [1]
Stress at 50% Strain	MPa	ASTM D412	0.37 ± 0.01 [9]	0.75 ± 0.01 [9]
Stress at 100% Strain	MPa	ASTM D412	-	1.70 ± 0.04 [9]
Strain at Break	%	ASTM D412	96.0 ± 17.1 [9]	140.5 ± 10.1 [9]
Stress at Break	MPa	ASTM D412	0.83 ± 0.22 [9]	3.2 ± 0.5 [9]
Tear Strength	kN/m	ASTM D624	-	7.5 ± 1.2 [2]
Energy Return	%	Internal	-	77 ± 4 [3]
Other Properties				
Shore Hardness (5s)	A	ASTM D2240	-	45 [4]
Solid Density (Green)	g/cm³	ASTM D792	-	1.03 [5]
Solid Density (Cured)	g/cm³	ASTM D792	-	1.04 [5]
Volumetric Shrinkage	%	Internal	-	-9 [5]
Water Absorption (24hr)	%	ASTM D570	-	3.2 [6]
Water Absorption (72hr)	%	ASTM D570	-	5.4 [6]
Water Absorption (168hr)	%	ASTM D570	-	8.5 [6]
Compression Set	%	D395, 22hr	-	25.4 [8]

Liquid Properties	Measure	Method	Value
Viscosity @ 25°C (77°F)	cP	ASTM D7867	1,500 [7]
Liquid Density	g/cm³	ASTM D1475	1.01 [5]

Test parameters:
"All specimen are printed unless otherwise noted. All specimen were conditioned in ambient lab conditions at 19-23°C / 40-60% RH for at least 24 hours." ASTM Methods: D638 Type IV, 5 mm/min, D570 0.125" x 2" Disc 24hr@ 25°C, D412 Type C 500mm/min.

Internal Data Sources:
[1] FOR40695, [2] FOR40696, [3] FOR40697, [4] FOR40692, [5] FOR334386, [6] FOR29248, [7] FOR40548, [8] FOR167730, [9] FOR454582

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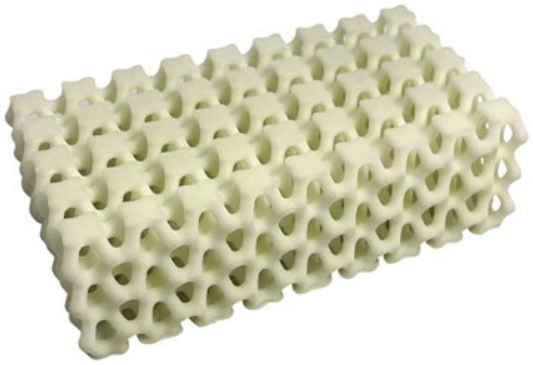

PROPERTIES

Electrical Properties	Measure	Method	Green	Post Processed
Volume Resistivity	Ω·cm	ASTM D257	-	5.79E +10 [1]
Surface Resistivity	Ω	ASTM D257	-	1.43E +12 [1]
Dielectric Strength	kV/mm	ASTM D149	-	27.9 [2]
AC Relative Permittivity (Dielectric Constant)[3]				
at 50 Hz (XY)	none	ASTM D150	-	7.2
at 1 kHz (XY)	none	ASTM D150	-	5.7
at 1 MHz (XY)	none	ASTM D150	-	4.2
AC Loss Characteristic (Dissipation Factor)[3]				
at 50 Hz (XY)	none	ASTM D150	-	0.067
at 1 kHz (XY)	none	ASTM D150	-	0.090
at 1 MHz (XY)	none	ASTM D150	-	0.193

Internal Data Sources:
[1] FOR106283 [2] FOR106286 [3] FOR106285

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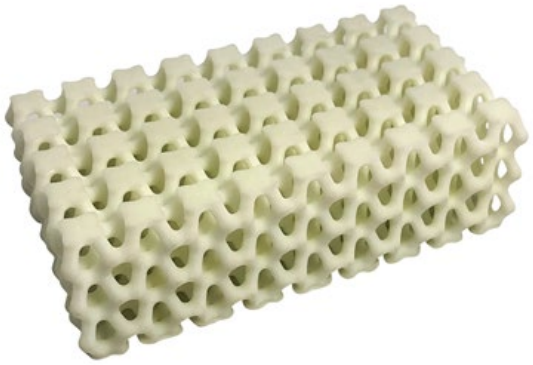

WORKFLOW

Validated workflows need to be followed to achieve properties as provided in the TDS. Examples of validated workflow steps are listed below. Users should defer to the most current workflow information for best results which can be found at https://www.loctiteam.com/printer-validation-settings

PRINTER SETTINGS

LOCTITE 3D IND475 BK is formulated to print optimally on industrial DLP printer. Read the safety data sheet carefully to get details about health and safety instructions. Recommended print parameters:

- Shake resin bottle well before usage
- Temperature: 20°C to 30°C
- Intensity: 3 mW/cm² to 10 mW/cm²

Exposure time for an intensity of 3 mW/cm²

Layer Thickness (µm):	100	Ec (mJ/cm²)	
First layer time (s)	60	Dp (mm):	
Burn in region (s):	35	Model Layer Exposure (s):	4.7

CLEANING

LOCTITE 3D IND475 BK requires post processing to achieve specified properties. Prior to post curing, support structures should be removed from the printed part, and the part should then be washed. Use compressed air to remove residual solvent from the surface of the material between intervals.

Post Process Step	Agent	Method	Duration	Interval	Additional Info
Cleaning #1	LOCTITE Cleaner T	Sonic	2 min	1	Alternative: TPM
Cleaning #2	IPA	Sonic	2 min	1	Use fresh IPA
Dry	n.a.	Compressed air	30 s	1	Air pressure (30 psi)
Wait before post curing	n.a.	Ambient	60 min	1	Room temperature

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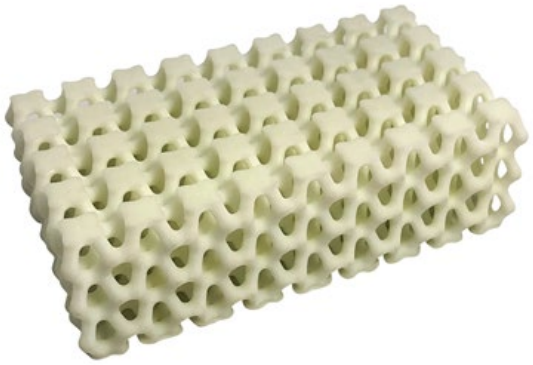

WORKFLOW

Validated workflows need to be followed to achieve properties as provided in the TDS. Examples of validated workflow steps are listed below. Users should defer to the most current workflow information for best results which can be found at https://www.loctiteam.com/printer-validation-settings

POST CURING

LOCTITE 3D IND475 BK requires **post curing in water** to achieve specified properties. It is recommended to apply a mold release on the parts before submerged in a transparent water container.

UV Curing Unit	UV Source	Intensity	Cure time Per side	Additional Settings (Shelf, Output Energy)
Loctite UVALOC 1000	Mercury Arc Bulb (broad spectrum)	30 mW/cm^2 at 365 nm	10 min	500 W, 3rd shelf from the top
Dymax 5000 EC Flood	Mercury Arc Bulb (broad spectrum)	150 - 175 mW/cm^2 at 380 nm	10 min	400W, Shelf I
Nexa Cure	365nm and 405nm LED	20-25mW/cm^2	60 min	Middle shelf

STORAGE

Store LOCTITE 3D IND475 BK in the unopened container in a dry location. Optimal Storage: 8°C to 30°. Storage below 8°C or above 30°C can adversely affect product properties. Material removed from containers may be contaminated during use. For this reason, filter used resin with 190µm mesh filter before placing back into proper storage container.

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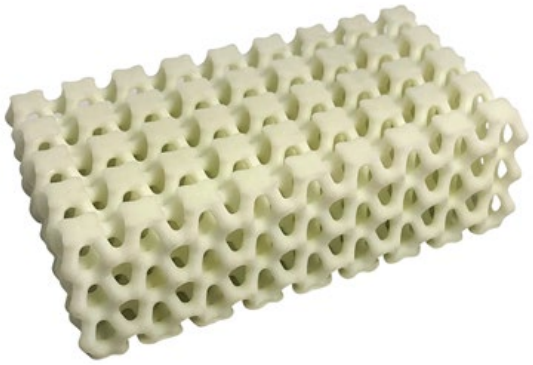
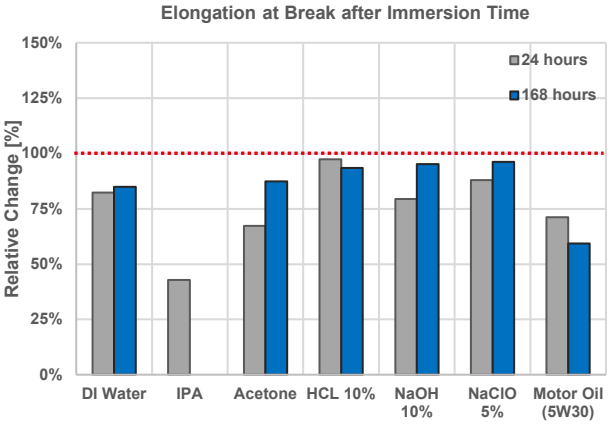
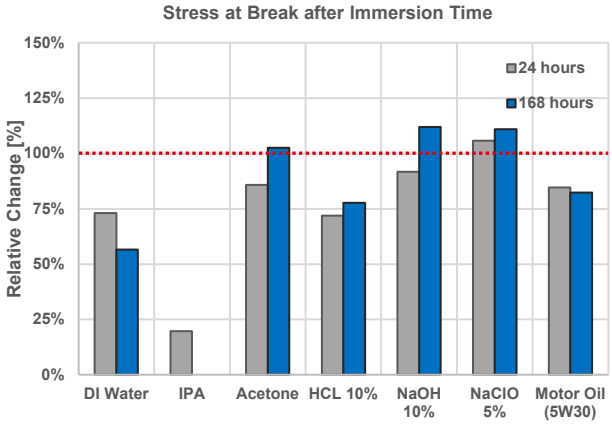


AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (1/2)

LOCTITE 3D IND475 BK has been tested after chemical ageing according to ASTM D543. The influence of chemicals was tested by measuring mechanical properties after different test times (Immersion test for 24 and 168 hours). Exposed samples were stored in containers and fully immersed in different chemicals. Samples were stirred every 24 hours using a shaker. After removal, exposed samples were washed and conditioned for 24 hours at 22°C before mechanical testing. All samples were printed using a validated workflow. Mechanical testing was conducted according to ASTM D412 at standard lab conditions (22°C). "100%" represents non-aged samples stored at 22°C and tested 24 hours after post-processing.





Test parameters:
ASTM D412: Type Die C, Pull speed: 500 mm/min, 22°C
ASTM D543: Samples immersed in different chemicals were stored at 22°C. Samples immersed in Motor Oil were stored at 50°C.
Properties of media used: pH(HCl, 10%) = 1; pH(NaOH, 10%) = 14; pH(NaClO, 5%) = 13

Internal Data Sources:
FOR337018, FOR337011, FOR337009, FOR330853, FOR330846, FOR330842, FOR330827

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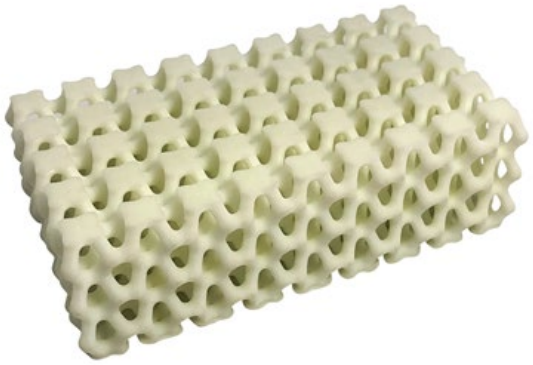
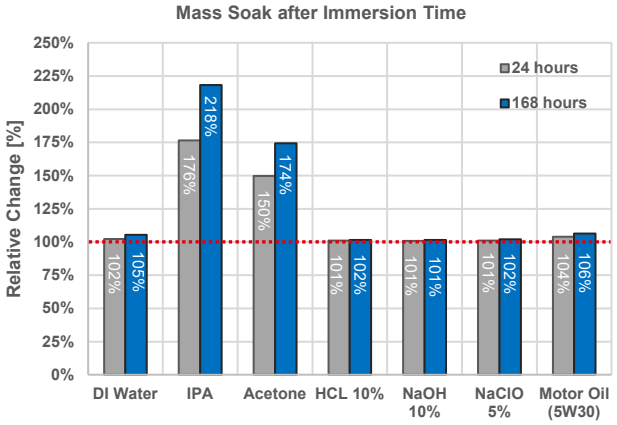


AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (2/2)

LOCTITE 3D IND475 BK has been tested after chemical ageing according to ASTM D543. The influence of chemicals was tested by measuring the mass change after different test times (Immersion test for 24 and 168 hours). Exposed samples were stored in containers and fully immersed in different chemicals. Samples were stirred every 24 hours using a shaker. After removal exposed samples were washed, dried and immediately weighed. All samples were printed using a validated workflow. "100%" represents the initial weight 24 hours after post-processing.



Test parameters:
ASTM D543: Samples immersed in different chemicals were stored at 22°C. Samples immersed in Motor Oil were stored at 50°C.
Properties of media used: pH(HCl, 10%) = 1; pH(NaOH, 10%) = 14; pH(NaClO, 5%) = 13

Internal Data Sources:
FOR337002, FOR336998, FOR336765, FOR329945, FOR329944, FOR329939, FOR329933

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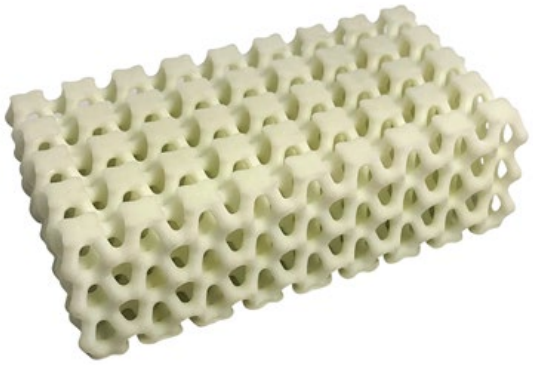
IND475™

A60 HIGH REBOUND
PHOTOELASTIC
WHITE, BLACK



Additional Workflow Notes

Printing with LOCTITE® 3D IND475™ requires detailed attention to interactions between the material and the hardware in use. Mechanical process settings must be optimized for each printer based on the hardware and software capabilities. Due to the low durometer and high elasticity of the material, printed parts may sway during tray release, build head movement, and upon re-entering the resin. For this reason, the user must consider many variables while printing. Some applicable print process considerations and respective guidelines are discussed below. Critical considerations include adhesion behavior at the print interface, model geometry, and model print orientation.

Lift Height Between Layers: Larger parts may require larger lift heights due to overall elongation magnitude.

- Small parts (<25 mm height): 10-15mm
- Medium parts (25 - 100 mm height): 20-25 mm
- Large parts (>100mm height): 25-30 mm

Build Head Movement Rates: Thicker parts allow for more rapid rates due to overall part rigidity compared to printing forces.

- Low Thickness (<5mm thickness): 3-5 mm/second
- Medium Thickness (5-10 mm thickness): 3-10 mm/second
- High Thickness (>10 mm thickness): 3-20 mm/second

Time Delay Before Layer Exposure:

- Generally, 3-5 seconds is sufficient due to the resin's low viscosity. Parts with thin features may require longer times for the small features to return to the correct position as they normalize with the resin's viscosity forces.

Support Structures:

- Place supports on non-critical model surfaces if possible. Support structure placement and geometry is model-dependent based on model layer surface area. General recommendations are provided.
- Support Thickness: 0.6-0.8 mm diameter
- Support Contact Area: 25-75% support thickness

POST PROCESSING

- LOCTITE® 3D IND475™ requires post processing to achieve specified properties. Prior to post curing, the part should be washed in a friendly cleaner. We recommend in LOCTITE® Cleaner T.
- Post curing of LOCTITE® 3D IND475™ to reach stated property targets must be cured in water or an alternative inert medium.
- Coating parts with a spray-on mold release agent such as LOCTITE® Frekote 770-NC or Smooth-On Universal Mold Release prior to post curing can reduce the surface tack of a final part. After curing, the mold release can be rinsed off with water or Isopropanol.

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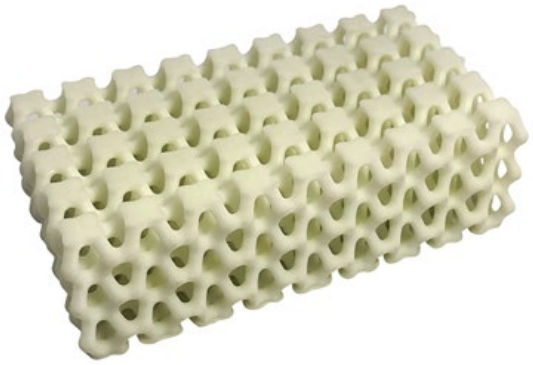

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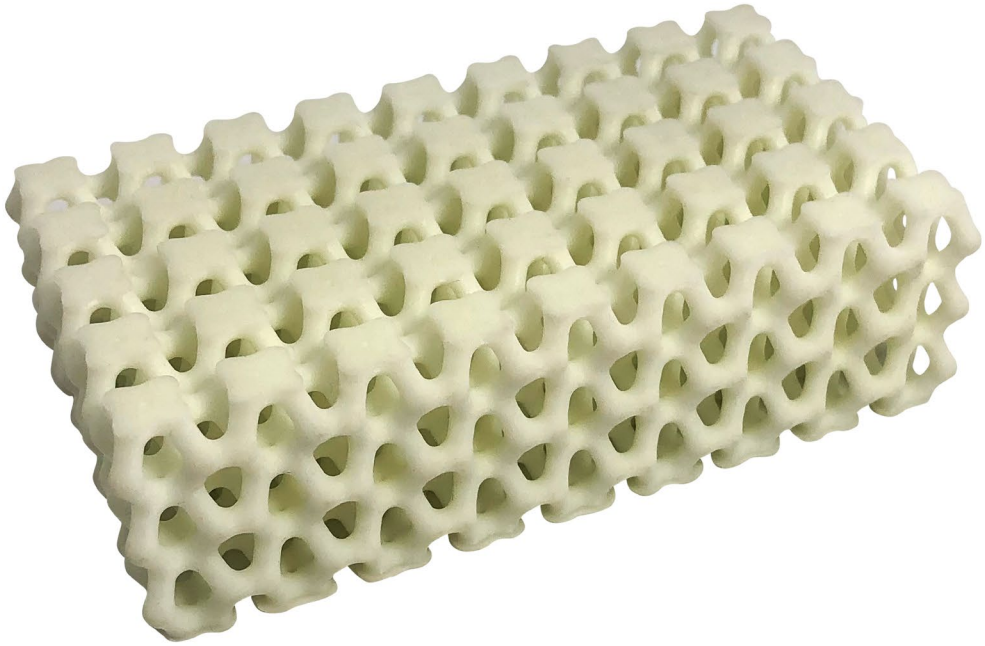

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LOCTITE®
Henkel Corporation
loctite3dp@henkel.com

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