

**LOCTITE®**



# LOCTITE® 3D IND147™

HDT230 High Heat  
Photoplastic  
Black

**LOCTITE®**

Henkel Corporation

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## IND147™

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### LOCTITE 3D IND147™

LOCTITE 3D IND147 is a high temperature resistant resin with HDT 230°C, and good dimensional stability for low loads processes in molding applications

LOCTITE 3D IND147 shows good surface finish and sufficient toughness to withstand mechanical stresses from molding processes. Its unique properties make it ideal for applications such as polyurethane and silicone molding



#### Benefits:

- High HDT >230 °C
- Tough with good dimensional stability
- Good surface finish



#### Ideal for:

- Tooling at high temperature, low pressure
- Prototyping of high temperature parts
- Customized Molds



#### Markets:



Industry



Consumer Goods



Automotive

Tensile Stress at Break (MPa)

67

Young's Modulus (MPa)

3,190

Elongation at Break (%)

2

HDT at 0.455 (MPa)

291

*\*Values shown are linked to LOCTITE IND147 Black 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	31 ± 2 [2]	67 ± 16 [1]
Young's Modulus	MPa	ASTM D638	1150 ± 160 [2]	3190 ± 80 [1]
Elongation at Break	%	ASTM D638	6 ± 2 [2]	2.4 ± 0.7 [1]
Flexural Modulus	MPa	ASTM D790	1170 ± 100 [11]	3690 ± 60 [12]
Flexural Stress at Break	MPa	ASTM D790	-	120 ± 4 [12]
Flexural Strain at Break	%	ASTM D790	>5 [11]	3.5 ± 0.2 [12]
IZOD Impact Strength (Notched)	J/m	ASTM D256	-	14.6 ± 0.1 [7]
Shore Hardness (3s)	D	ASTM D2240	-	94 [8]
<b>Thermal Properties</b>				
HDT @ 0.455 MPa	°C	ASTM D648	-	235 - 291 [15/13]
HDT @ 1.82 MPa	°C	ASTM D648	-	136 - 163 [14]
Thermal Conductivity	W/(m·K)	ASTM D5930	-	0.20 [5]
Heat Capacity	J/(g·K)	ASTM D5930	-	1.3 [5]
Coef. Thermal Expansion	µm/(m·°C)	ASTM E831	-	114 [6]
<b>Other Properties</b>				
Water Absorption (24hr)	%	ASTM D570	-	0.25 [9]
Solid Density	g/cm <sup>3</sup>	ASTM D1475	1.25 [10]	1.26 [10]

### Test parameters:

All specimen are printed unless otherwise noted. All specimen were conditioned in ambient lab conditions at 19-23C / 40-60% RH for at least 24 hours.\* ASTM Methods: D638 Type IV, 5mm/min., D256 Notched IZOD (Machine Notched), 6 mm x 12 mm, D648, D2240, Type "D" (0 seconds), D570 0.125" x 2" Disc 24hr@ 25°C, D7867@ 25°C (77°F), D1475

### Internal Data Sources:

[1] FOR27962, [2] FOR8167, [3] FOR46762, [4] FOR46761, [5] FOR26267, [6] FOR8169, [7] FOR8157, [8] FOR8160, [9] FOR12288, [10] FOR19479, [11] FOR48828, [12] FOR48829, [13] FOR48840, [14] FOR50508, [15] FOR328216



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## PROPERTIES

Electrical Properties	Measure	Method	Green	Post Processed
Dielectric Strength	kV/mm	ASTM D149	-	29 ± 2 [1]
Dielectric Constant (50 Hz)	-	ASTM D150	-	3.0 [2]
Dielectric Constant (1 kHz)	-	ASTM D150	-	3.0 [2]
Dielectric Constant (1 MHz)	-	ASTM D150	-	2.8 [2]
Dissipation Factor (50 Hz)	-	ASTM D150	-	-0.002 [2]
Dissipation Factor (1 kHz)	-	ASTM D150	-	0.008 [2]
Dissipation Factor (1 MHz)	-	ASTM D150	-	0.016 [2]
Volume Resistivity	Ω·cm	ASTM D257	-	3.56 E+16 [3]
Surface Resistivity	Ω	ASTM D257	-	3.38 E+16 [3]

Liquid Properties	Measure	Method	Value
Viscosity @ 25°C (77°F)	cP	ASTM D7867	2,100 ± 200 [4]
Liquid Density	g/cm <sup>3</sup>	ASTM D1475	1.15 [5]

"All specimen are printed unless otherwise noted. All specimen were conditioned in ambient lab conditions at 19-23C / 40-60% RH for at least 24 hours." ASTM Methods: D638 Type IV, 5mm/min, D790-B, 2mm/min, D256 Notched IZOD (Machine Notched), 6 mm x 12 mm, D648, D2240, Type "D" (0, 3 seconds), D570 0.125" x 2" Disc 24hr@ 25°C, D7867@ 25°C (77°F), D1475

**Internal Data Sources:**

[1] FOR25926, [2] FOR25927, [3]FOR25925, [4] FOR20535, [5] FOR8163





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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 IND147 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 35°C
- Intensity: 2 mW/cm<sup>2</sup> to 12 mW/cm<sup>2</sup>

### Exposure time for an intensity of 5 mW/cm<sup>2</sup>

Layer Thickness (µm):	25	50	100	Ec (mJ/cm <sup>2</sup> )	9.496
Base Cure Time (s)	25	25	25	Dp (mm):	0.119
Model Layer Exposure (s):	3	4	5		

## CLEANING

**LOCTITE 3D IND147 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	Intervals	Additional Info
Cleaning	IPA	Ultrasonic	2 min	1	
Dry	n.a.	Compressed air	20 s	1	Air pressure (20 psi)
Wait before post curing	n.a.	Ambient condition	60 min	1	Room temperature



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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 IND147 BK requires post curing to achieve specified properties. It is recommended that a wide spectrum lamp is used to post cure parts.

If a lower energy LED or other post cure unit is used, a post bake at 170°C for 3 hours may be required to realize highest HDT performance.

UV Curing Unit	UV Source	Intensity	Cure time Per side	Additional Settings (Shelf, Output Energy)
Uvitron Intelliray 600W	Metal Halide	120 mW/cm <sup>2</sup> (600W, 66%)	10 min	Shelf 3 (=2 <sup>nd</sup> from below)
Dymax 5000 EC Flood	Mercury Arc Bulb (broad spectrum)	150 mW/cm <sup>2</sup> at 380 nm	10 min	Shelf "K"

## PRE-HEAT REQUIREMENTS

LOCTITE 3D IND147 BK requires pre-heat of material before use. It is recommended to heat it in the provided 1kg or 5kg containers at 60°C for 24 hours in the container. Let the bottle and resin cool down to ambient temperature and shake container well before pouring resin into the resin tray. The pre-heated material should be used within 2 weeks for best results. Be advised the container should not be exposed to temperature above 65°C as higher temperature exposure could weaken the HDPE container.

## STORAGE

Store LOCTITE 3D IND147 BK in the unopened container in a dry location. Optimal storage: 20°C to 30°C, storage below 20°C or greater than 30°C can adversely affect products properties. More specific information is given in the Safety Data Sheet.

Material removed from container may be contaminated during use. For this reason, filter used resin with 190µm mesh filter before placing back into proper storage container.

If LOCTITE 3D IND147 BK is exposed to temperature below 20°C compounds in the resin might crystallize. If crystals are observed during storage, place the closed bottle in a 60°C oven for 24 hours, then remove from the oven and shake the bottle vigorously. Allow the bottle and resin to cool to ambient temperature before usage.



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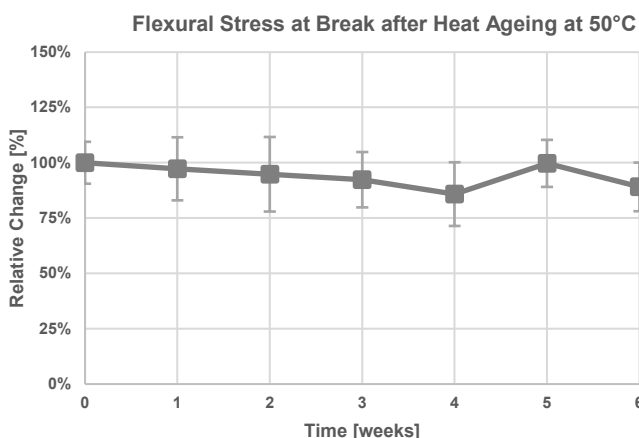
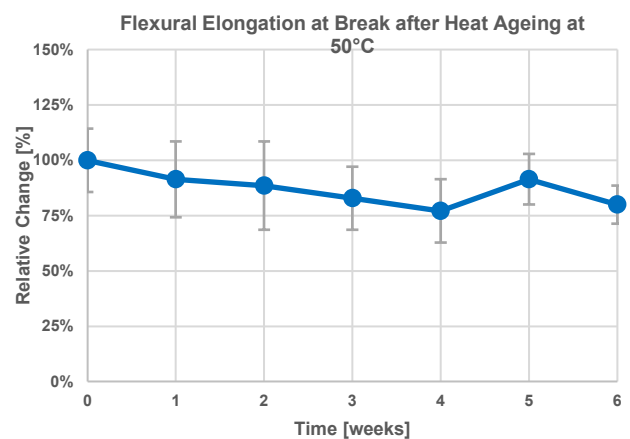
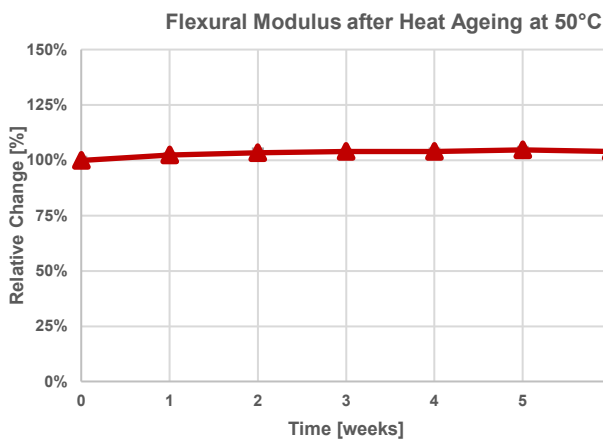


### AGEING AND ENVIRONMENTAL EFFECTS – HEAT AGEING

LOCTITE 3D IND147 BK was heat aged without load according to ASTM D3045. Test samples were exposed for a defined time at 50°C and conditioned for 24 hours at 22°C before mechanical testing. Control samples were stored at a constant 22°C. All samples were printed in the same print job using a validated workflow. Mechanical testing was conducted according to ASTM D790 at standard lab conditions (22°C).

“0 weeks” represents non-aged samples stored at 22°C and tested 24 hours after post-processing.

Based on temperature dependence of reaction rates a test time of 6 weeks at 50°C can be interpreted as approximately 12 months at ambient temperature.



#### Test parameters:

ASTM D790: Test speed: 1.3 mm/min, Test specimens: 85x12x3 mm, Flexural modulus measured at 0.1-1.0% (regression), 22°C

Internal Data Sources:  
[FOR230949](#), [FOR230948](#)





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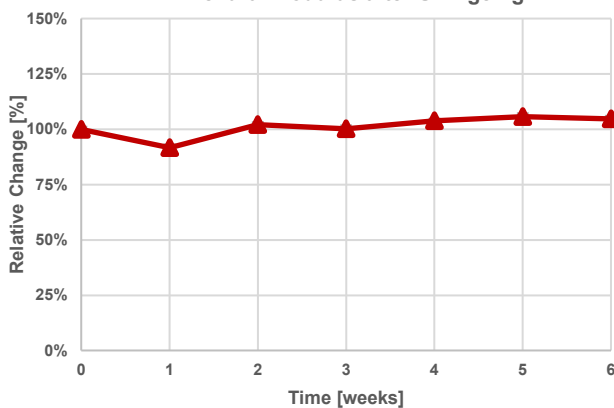


## AGEING AND ENVIRONMENTAL EFFECTS – ACCELERATED WEATHERING (UV AGEING)

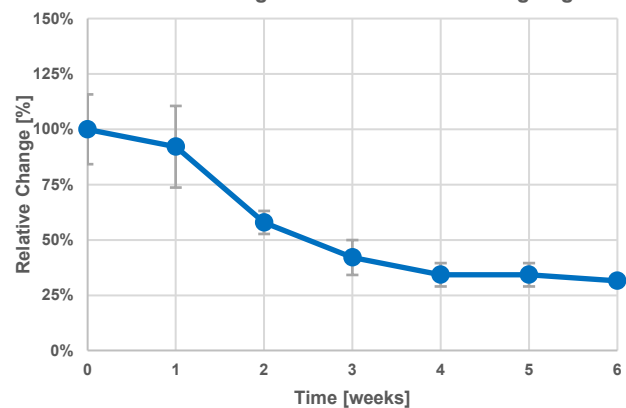
LOCTITE 3D IND147 BK has been tested after accelerated outdoor weathering according to ASTM D4329 (Cycle A). Test samples were exposed to defined conditions of heat, water condensation and UV light. Exposed samples were conditioned for 24 hours at 22°C before mechanical testing. Control samples were stored at a constant 22°C. All samples were printed in the same print job using a validated workflow. Mechanical testing was conducted according to ASTM D790 at standard lab conditions (22°C). "0 weeks" represents non-aged samples stored at 22°C and tested 24 hours after post-processing.

Please note, accelerated weathering testing can never fully represent real outdoor conditions and complexity. It is therefore recommended to conduct additional (outdoor) testing relevant for your specific application needs.

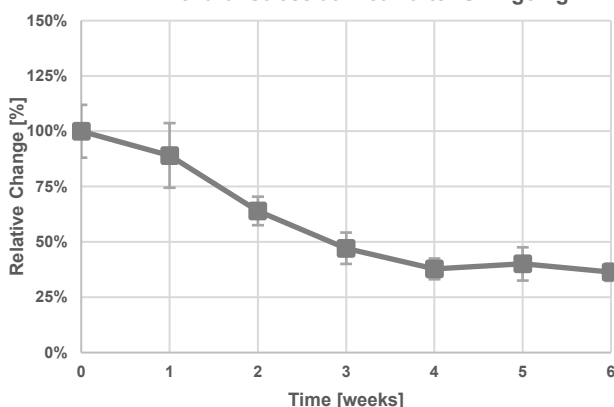
Flexural Modulus after UV Ageing



Flexural Elongation at Break after UV Ageing



Flexural Stress at Break after UV Ageing



### Test parameters:

ASTM D790: Test speed: 1.3 mm/min, Test specimens: 85x12x3 mm, Flexural modulus measured at 0.1-1.0% (regression), 22°C

ASTM D4329: Cycle A for general applications, QUV/se, UVA 340 nm, 0.89 W/m<sup>2</sup>·nm, 8 hours UV light at 60°C followed by 4 hours at 50°C condensation in the dark. To reduce any sample warpage during test time samples were placed in tailor-made holders without any fixation clamps or mechanical load. Exposed samples were always removed from QUV before next condensation cycle to avoid samples that are soaked excessively with water before testing.

### Internal Data Sources:

FOR219906, FOR219909





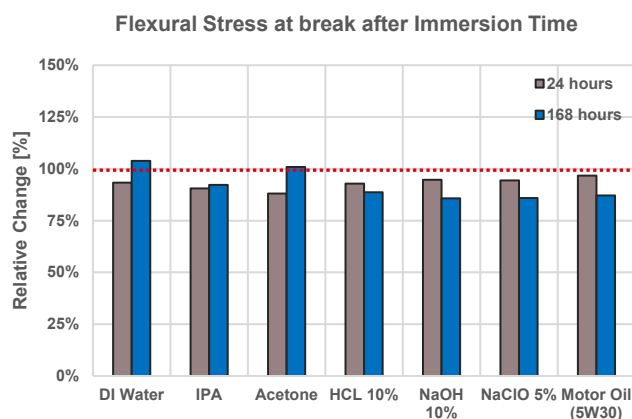
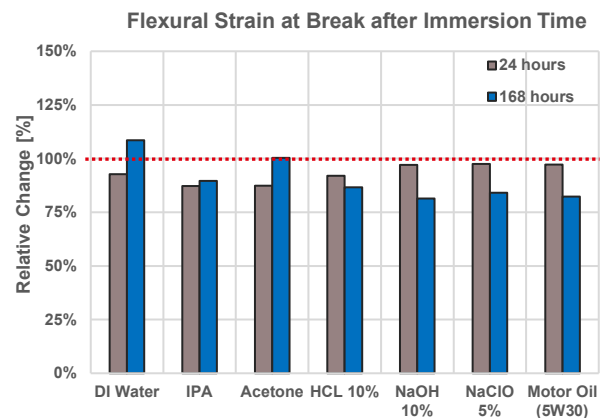
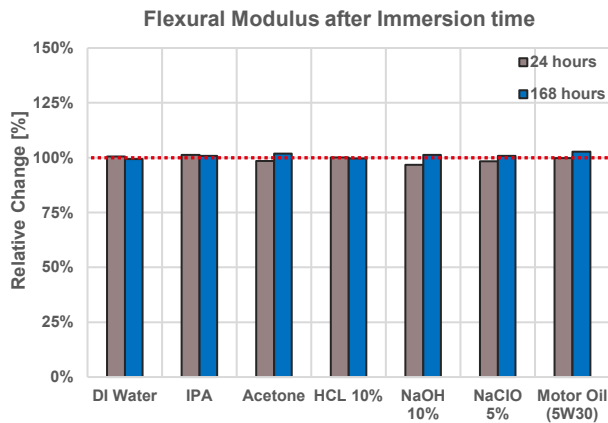


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## AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (1/2)

LOCTITE 3D IND147 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 D790 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 D790: Test speed: 1.3 mm/min, Test specimens: 85x12x3 mm, Flexural modulus measured at 0.1-1.0% (regression), 22°C  
 ASTM D543: Samples immersed in different chemicals were stored at 22°C. Samples immersed in Motor Oil were stored at 50°C

Internal Data Sources:  
[FOR247326](#), [FOR247330](#), [FOR247333](#), [FOR247334](#), [FOR252243](#), [FOR252244](#), [FOR252247](#)



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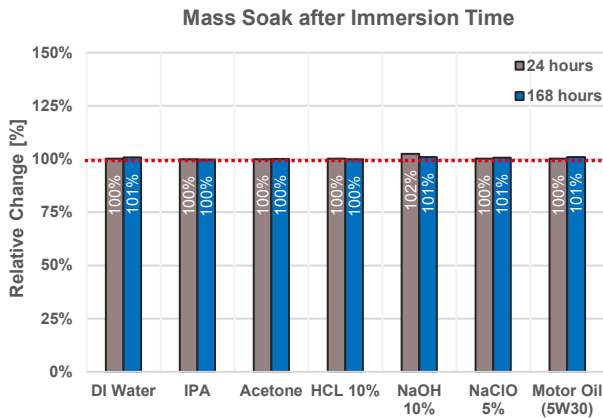
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### AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (2/2)

LOCTITE 3D IND147 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

#### Internal Data Sources:

[FOR247342](#), [FOR247427](#), [FOR247428](#), [FOR247429](#), [FOR252248](#), [FOR252257](#), [FOR252270](#)



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## NOTE

The information provided in this Technical Data Sheet (TDS) including the recommendations for use and application of the product are based on our knowledge and experience of the product as at the date of this TDS. The product can have a variety of different applications as well as differing application and working conditions in your environment that are beyond our control. Henkel is, therefore, not liable for the suitability of our product for the production processes and conditions in respect of which you use them, as well as the intended applications and results. We strongly recommend that you carry out your own prior trials to confirm such suitability of our product.

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