

**LOCTITE®**



# **LOCTITE® 3D IND402™**

A70 High Rebound  
Photoelastic  
Black

**LOCTITE®**

Henkel Corporation

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## IND402™

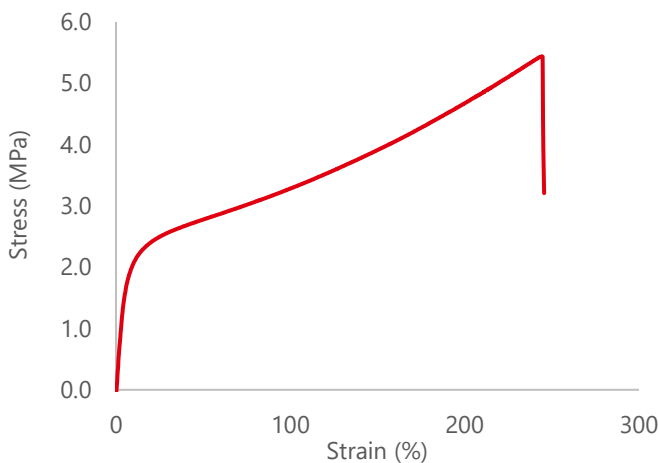
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### LOCTITE 3D IND402™

LOCTITE 3D IND402 is a single component elastomer material with high elongation and high resilience, excellent tensile strength and high energy return while also not requiring thermal post processing.

Parts can be printed with various DLP platforms.



#### Benefits:

- True elastomeric behavior
- Excellent interlayer adhesion
- Good rebound performance



#### Ideal for:

- Consumer products
- Lattice structures for sportswear



#### Markets:



Industry



Automotive



Consumer Goods

Tear Strength (kN/m)

28

Young's Modulus (MPa)

42

Elongation at Break (%)

230

Shore Hardness (0s)

76

Energy Return (%)

33

*\*Values shown are linked to LOCTITE IND402 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	2.3 ± 0.31 [7]	5.5 ± 0.2 [1]
Young's Modulus	MPa	ASTM D638	15 ± 2 [7]	42 ± 5 [1]
Elongation at Break	%	ASTM D638	176 ± 44 [7]	230 ± 10 [1]
Tear Strength	kN/m	ASTM D624	-	28 +/- 1 [4]
Energy Return	%	Internal	-	30 – 35 [2]
Stress at 50% Strain	MPa	ASTM D412	-	3.0-3.5[8]
Stress at 100% Strain	MPa	ASTM D412	-	3.4-4.0[8]
Stress at 150% Strain	MPa	ASTM D412	-	4.0-4.6[8]
Strain at Break	%	ASTM D412	-	260-295[8]
Stress at Break	MPa	ASTM D412	-	6.1-7.0[8]
Other Properties				
Water Absorption (24hr)	%	ASTM D570	-	3.15 [3]
Water Absorption (72hr)	%	ASTM D570	-	-
Shore Hardness (3s)	A	ASTM D648	-	73 [5]
Solid Density	g/cm <sup>3</sup>	ASTM D1475	-	1.1 [6]
CTE (-40°C to 40°C)	µm/(m·K)	ISO 11359-2	-	187.1 [9]
Glass Transition (T <sub>g</sub> )	°C	ASTM E1356	-	-66 [10]
Compression Set (22hr)	%	ASTM D395	-	57.1 [11]
Biocompatibility				
Irritation		ISO 10993-23*		Comply <sup>[12]</sup>

All specimen are printed unless otherwise specified. ASTM Methods: D638 Type IV, 50mm/min, 2mm/min, D624, D570-98 24-hour water immersion, specimen 50.8mm diameter, 3.2mm thick, 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]FOR18387, [2]FOR18388, [3]FOR18665, [4]FOR18664, [5]FOR20027, [6]FOR20028, [7]FOR18709, [8]GEN1526, [9]FOR94747, [10]FOR99382, [11]FOR146871, [12]FOR52817



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## PROPERTIES

Liquid Properties	Measure	Value
Viscosity at 25°C (77°F)	cP	14500 <sup>[1]</sup>
Viscosity at 35°C (95°F)	cP	8400 <sup>[2]</sup>
Viscosity at 40°C (104°F)	cP	6000 <sup>[2]</sup>
Liquid Density	g/cm <sup>3</sup>	1.0439 <sup>[3]</sup>
Flow Characteristic	-	Self-leveling
Appearance Color	-	Black

Internal Data Sources:  
<sup>[1]</sup>FOR18389, <sup>[2]</sup>FOR19857, <sup>[3]</sup>FOR20028



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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 IND402 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: 3 mW/cm<sup>2</sup> to 7 mW/cm<sup>2</sup>

### Exposure time for an intensity of 6 mW/cm<sup>2</sup>

Layer Thickness (μm):	50	100	50	Ec (mJ/cm <sup>2</sup> )	6.06
First layer time (s)	25	25	25	Dp (mm):	0.09
Burn in region (s):	2-4	4-6	2-4		
Model Layer Exposure (s):			6.5		

## CLEANING

LOCTITE 3D IND402 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	Manual	2 min	2	Ensure parts are dry before next interval
Dry	n.a.	Compressed air	30 s	1	Air pressure (30 psi)
Wait before post curing	n.a.	Ambient condition	60 min	1	Room temperature





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## POST CURING

LOCTITE 3D IND402 BK requires post curing to achieve specified properties. It is recommended that either an LED or wide spectrum lamp be used to post cure parts.

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 <sup>2</sup> at 365 nm	5 min	500 W, lowest shelf
Dymax 5000 EC Flood	Mercury Arc Bulb (broad spectrum)	148 mW/cm <sup>2</sup> at 380 nm	2 min	400W, Shelf K

## STORAGE

Store LOCTITE 3D IND402 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.

## LIQUID HANDLING

When handling liquid, always wear gloves and protective glasses to prevent skin and eye contact. **User must provide adequate ventilation (like fume hood) or wear suitable respiratory protection (like filter type: A per EN 14387) when printing/processing.**

Please refer to the Safety Data Sheet (SDS) on this product for more information on safe handling.

## LIMITATIONS & OPTIONS

**Post Cure:** LOCTITE 3D IND402 BK requires broadband spectrum for post cure.

**Modification:** LOCTITE 3D IND402 BK has limited potential for any tensile property adjustments.

**Colors:** LOCTITE 3D IND402 BK formula can be made in additional pigment colors

**Vat Printer:** LOCTITE 3D IND402 BK is not compatible with SLA printing process

**LCD printers:** LOCTITE 3D IND402 BK formula shows limited path forward for LCD projector printers





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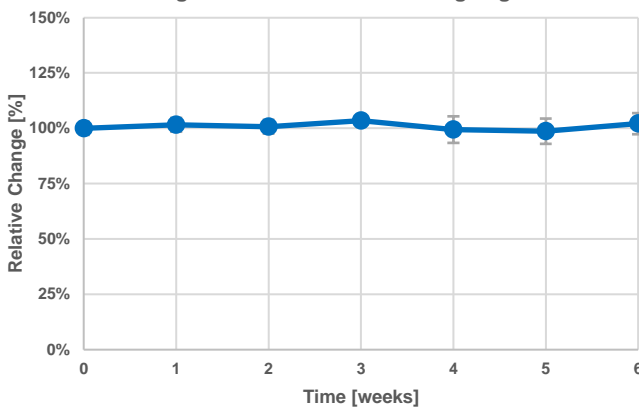


### AGEING AND ENVIRONMENTAL EFFECTS – HEAT AGEING

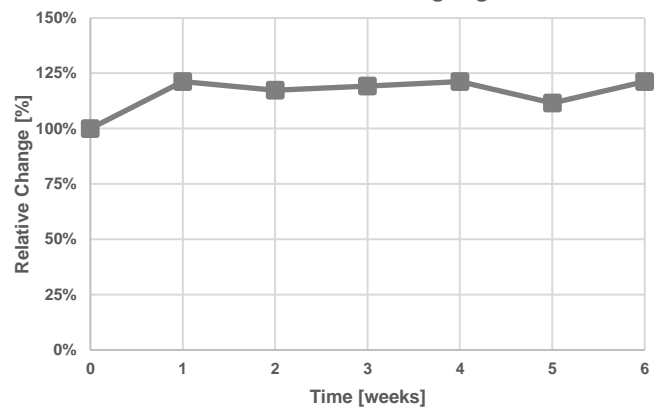
LOCTITE 3D IND402 BK was heat aged without load according to ASTM D3045. Test samples were exposed for a defined time at 50°C and conditioned for 24 hours at 22°C before mechanical testing. Control samples were stored at a constant 22°C. All samples were printed in the same print job using a validated workflow. Mechanical testing was conducted according to ASTM D412 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.

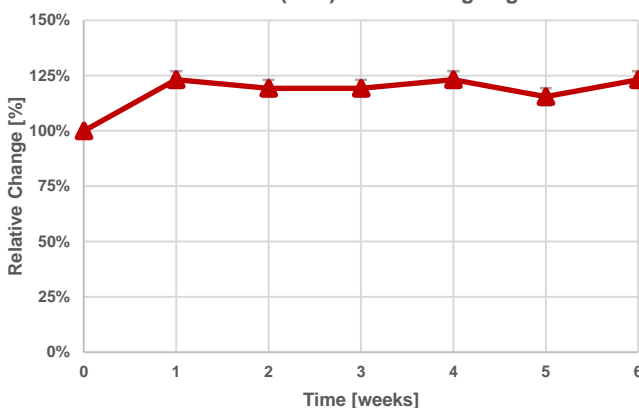
Elongation at Break after Heat Ageing at 50°C



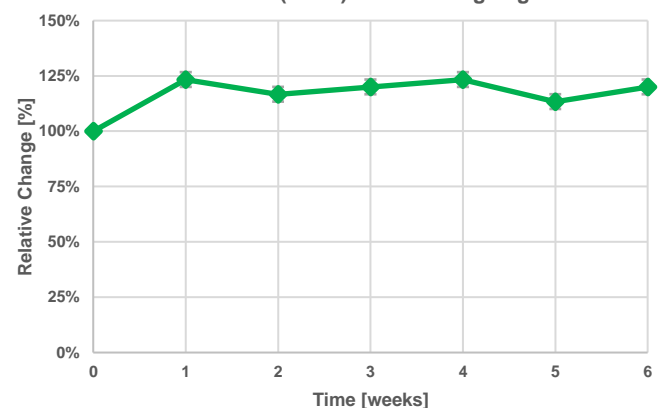
Stress at Break after Heat Ageing at 50°C



Stress at Strain (50%) after Heat Ageing at 50°C



Stress at Strain (100%) after Heat Ageing at 50°C



#### Test parameters:

ASTM D412: Type Die C, Pull speed: 500 mm/min, 22°C

#### Internal Data Sources:

FOR154441, FOR154442



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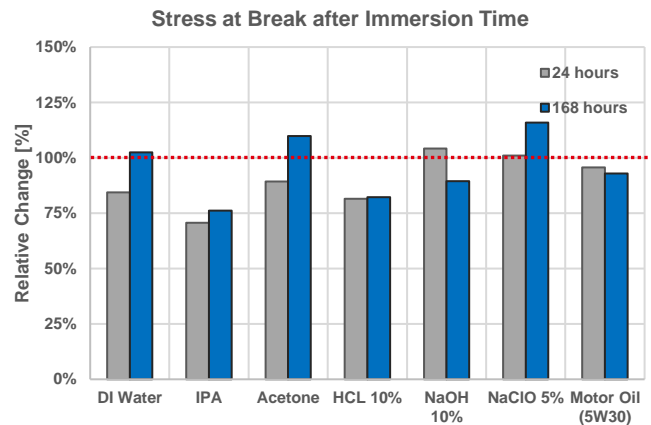
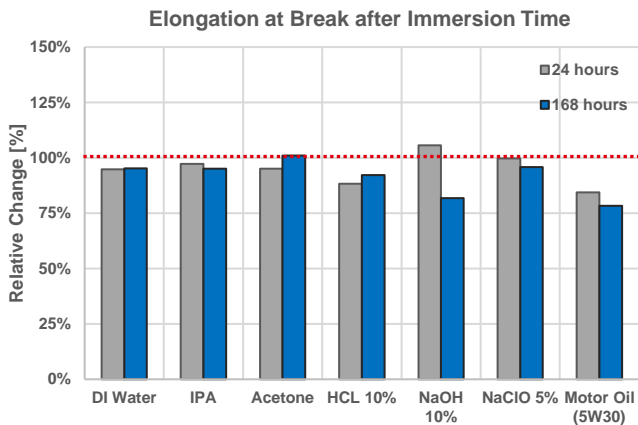
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### AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (1/2)

LOCTITE 3D IND402 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.

#### Internal Data Sources:

FOR228570, FOR228564, FOR228558, FOR228550, FOR235260, FOR235270, FOR235328





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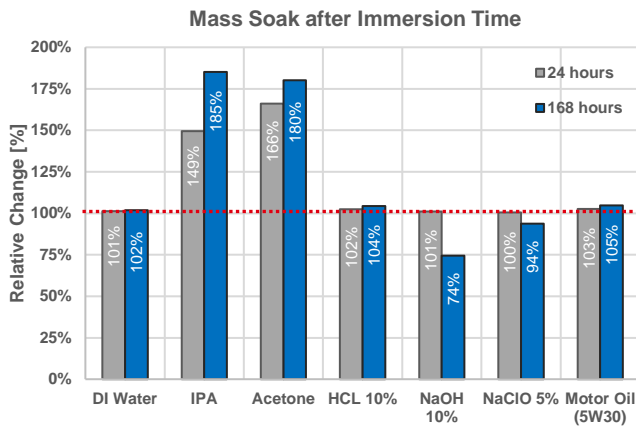
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### AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (2/2)

LOCTITE 3D IND402 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:

FOR225180, FOR225181, FOR225182, FOR225184, FOR235312, FOR235315, FOR235289



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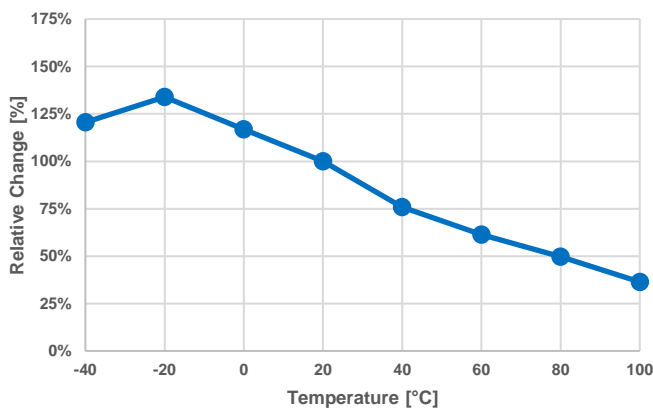
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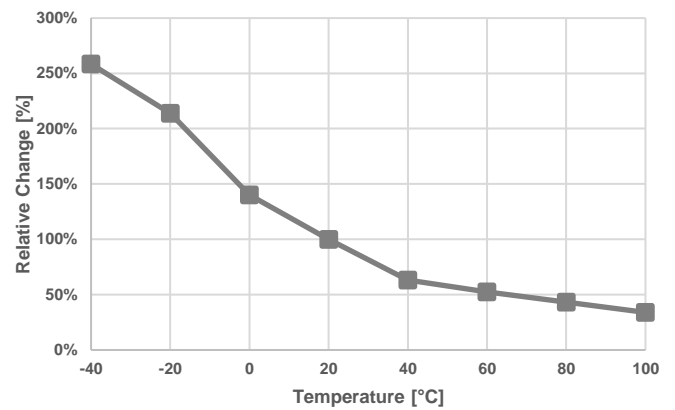
### THERMAL INFLUENCE ON MECHANICAL PROPERTIES

LOCTITE 3D IND402 BK has been tested according to ASTM D412 at varied environmental temperatures, from -40°C to 100°C. All samples were printed in the same print job using a validated workflow. Mechanical testing was conducted according to ASTM D412. Before each test series samples were conditioned for 60 minutes at the specific test temperature.

Elongation at Break at -40 to 100 °C



Stress at Break at -40 to 100 °C



**Test parameters:**

ASTM D412: Type Die C, Pull speed: 500 mm/min

**Internal Data Sources:**

FOR178967



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## NOTE

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