

The  
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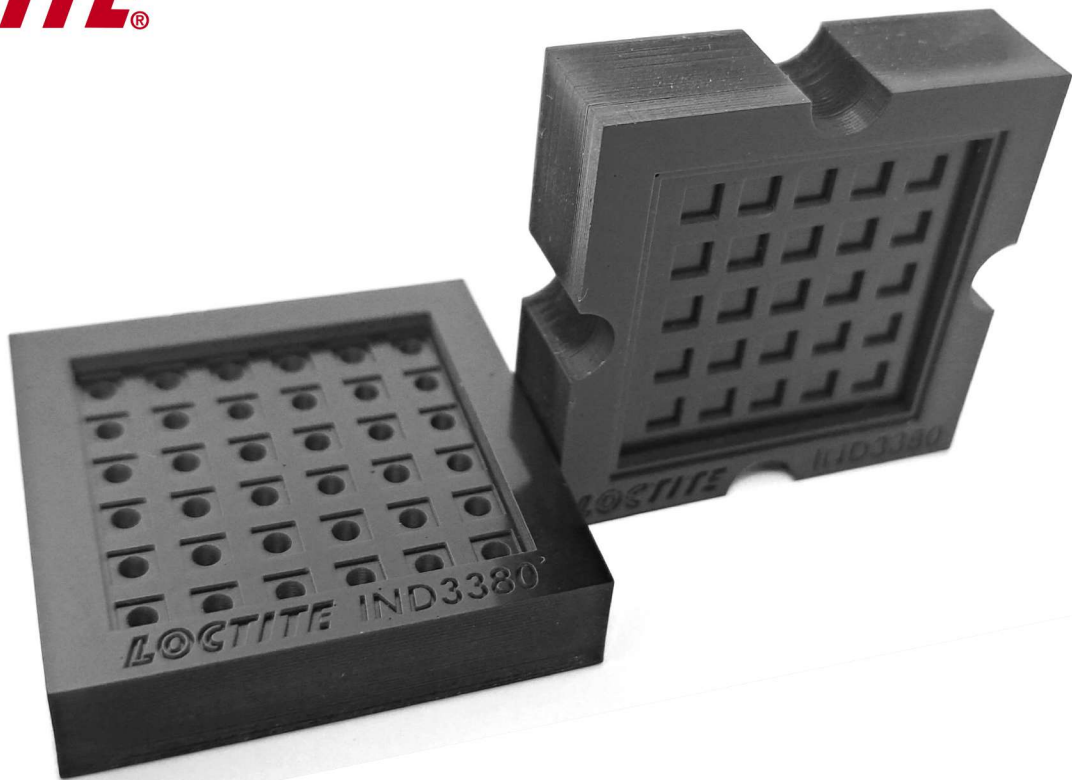


# *MATERIAL* **IND3380™ ESD** OVERVIEW

For more information or advice:  [theD2Mco.com/contact-us](https://theD2Mco.com/contact-us)

 [info@theD2Mco.com](mailto:info@theD2Mco.com)

**LOCTITE®**



# LOCTITE 3D IND3380™

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ESD

## LOCTITE 3D IND3380™

LOCTITE 3D IND3380 is a high temperature resistant resin with HDT of 190°C, electrostatic dissipative properties (ESD), and high stiffness.

LOCTITE 3D IND3380 offers a smooth surface finish and high chemical resistance, making it an ideal choice for jigs and fixtures in general and electronic manufacturing. Additionally, its unique characteristics make it a reliable option for tooling applications, offering versatile solutions for manufacturing needs.

LOCTITE 3D IND3380 is compatible with a broad range of DLP and LCD machines.



### Benefits:

- Displays electrostatic dissipative properties (ESD)
- High HDT of 190°C
- High accuracy and fine detail printing



### Ideal for:

- Tooling at high temperature, low pressure
- Jigs and fixtures for electronic device manufacturing processes



### Markets:



Industry



Consumer  
Goods



Automotive

Tensile Stress at Break (MPa)

50

Young's Modulus (MPa)

3,000

Elongation at Break (%)

2

HDT at 0.455 (MPa)

190





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## PROPERTIES

| Mechanical Properties    | Measure           | Method     | Green       | Post Processed             |
|--------------------------|-------------------|------------|-------------|----------------------------|
| Young's Modulus          | MPa               | ASTM D638  | 1300 – 1500 | 2800 – 3000 <sup>[1]</sup> |
| Tensile Stress at Break  | MPa               | ASTM D638  | 25 – 30     | 40 – 50 <sup>[1]</sup>     |
| Elongation at Break      | %                 | ASTM D638  | 2 – 3       | 1 – 2 <sup>[1]</sup>       |
| Flexural Modulus         | MPa               | ASTM D790  | 1250 – 1350 | 3200 – 3400 <sup>[2]</sup> |
| Flexural Strength        | MPa               | ASTM D790  | 40 – 50     | 75 – 85 <sup>[2]</sup>     |
| Flexural Strain at Break | %                 | ASTM D790  | 3.0 – 4.3   | 2.0 – 2.8 <sup>[2]</sup>   |
| IZOD Impact (Notched)    | J/m               | ASTM D256  |             | 11.5 – 12.5 <sup>[3]</sup> |
| Shore Hardness (3s)      | D                 | ASTM D2240 |             | 86.5 <sup>[4]</sup>        |
| <b>Other Properties</b>  |                   |            |             |                            |
| HDT at 0.455 MPa         | °C                | ASTM D648  |             | 180 – 190 <sup>[5]</sup>   |
| HDT at 1.82 MPa          | °C                | ASTM D648  |             | 100 – 110 <sup>[5]</sup>   |
| Water Absorption (24 hr) | %                 | ASTM D570  |             | 0.36 <sup>[6]</sup>        |
| Water Absorption (72 hr) | %                 | ASTM D570  |             | 0.59 <sup>[6]</sup>        |
| Solid Density            | g/cm <sup>3</sup> | ASTM D1475 |             | 1.20 – 1.25 <sup>[7]</sup> |
| Thermal Conductivity     | W/(m·K)           | ASTM D5930 |             | 0.2 <sup>[8]</sup>         |
| Heat Capacity            | J/(g·K)           | ASTM D5930 |             | 1.4 <sup>[8]</sup>         |

**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. D638-14 Type IV, 5 mm/min; D790-17 Method B, 1.5 mm/min; D648-18 Method A; D256-10 (18) - Machine Notched, 6 mm x 12 mm, 2.75 J Striker; D570-98 (18) - 0.125" x 2" Disc, 24hr @ 25°C; D2240-15 (21); D7867-13 (20); D1475-13 (20)





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## PROPERTIES

| Liquid Properties        | Measure           | Method     | Value                         |  |
|--------------------------|-------------------|------------|-------------------------------|--|
| Viscosity at 25°C (77°F) | cP                | ASTM D7867 | 9,000 – 11,000 <sup>[1]</sup> |  |
| Liquid Density           | g/cm <sup>3</sup> | ASTM D1475 | 1.1 – 1.2 <sup>[2]</sup>      |  |

| Electrical Properties | Measure | Method          | Green                                                     | Post Processed |
|-----------------------|---------|-----------------|-----------------------------------------------------------|----------------|
| Surface Resistivity   | Ω       | DIN EN61340-2-3 | 10 <sup>4</sup> – 10 <sup>11</sup> <sup>[3]</sup>         |                |
| Volume Resistivity    | Ω·cm    | DIN EN61340-2-3 | 4 · 10 <sup>6</sup> – 24 · 10 <sup>6</sup> <sup>[4]</sup> |                |

### 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. D638-14 Type IV, 5 mm/min; D790-17 Method B, 1.5 mm/min; D648-18 Method A; D256-10 (18) - Machine Notched, 6 mm x 12 mm, 2.75 J Striker; D570-98 (18) - 0.125" x 2" Disc, 24hr @ 25°C; D2240-15 (21); D7867-13 (20); D1475-13 (20)







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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 IND3380 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 gently to prevent foaming
- Print Temperature: 20°C to 45°C
- Intensity: 5 mW/cm<sup>2</sup> to 10 mW/cm<sup>2</sup>

| Settings: 385nm at 5mW/cm <sup>2</sup> | Measure | Method   | Value |
|----------------------------------------|---------|----------|-------|
| Layer Thickness                        | µm      | Internal | 100   |
| Burn-In region                         | s       | Internal | 40-50 |
| Transition region                      | s       | Internal | 15-25 |
| Model region                           | s       | Internal | 7-8   |

| Settings: 385nm at 5mW/cm <sup>2</sup> | Measure            | Method   | Value               |
|----------------------------------------|--------------------|----------|---------------------|
| E <sub>C</sub>                         | mJ/cm <sup>2</sup> | Internal | 4.9 <sup>[1]</sup>  |
| D <sub>p</sub>                         | mm                 | Internal | 0.09 <sup>[1]</sup> |

| Settings: 385nm at 5mW/cm <sup>2</sup> | Measure | Method   | Exposure time |
|----------------------------------------|---------|----------|---------------|
| D <sub>C</sub> = 50µm                  | s       | Internal | 1.7           |
| D <sub>C</sub> = 100µm                 | s       | Internal | 2.9           |

**Test parameters:**  
Exposure times are calculated without a safety factor





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### CLEANING

**LOCTITE 3D IND3380 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 Step           | IPA   | Ultrasonic        | 2 min      | 1 or 2    | Allow parts to dry    |
| Dry                     | n.a.  | Compressed air    | 10 to 60 s | 1 or 2    | Air pressure (50 psi) |
| Wait before post curing | n.a.  | Ambient condition | 60 min     | 1         | Room temperature      |

### POST CURING

**LOCTITE 3D IND3380 BK** requires a two-step post curing to achieve specified properties. In the first step it is recommended that either an LED or wide spectrum lamp be used to UV post cure parts. In the second step the UV post cured parts require an additional Heat post cure to achieve final properties.

#### STEP 1: UV post cure

| UV Curing Unit        | UV Source                         | Intensity                        | Cure time per side | Additional Settings (Shelf, Output Energy) |
|-----------------------|-----------------------------------|----------------------------------|--------------------|--------------------------------------------|
| Dymax 5000 EC Flood   | Mercury Arc Bulb (broad spectrum) | 148 mW/cm <sup>2</sup> at 380 nm | 10 min             | 400W, Shelf K                              |
| Loctite CL36          | 405nm LED                         | 80 mW/cm <sup>2</sup> at 405 nm  | 30 min             | 100% top & side                            |
| Rapidshape RS Cure XL | Multiple LEDs                     | 150%                             | 30 min             | Third shelf from bottom                    |



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### WORKFLOW

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### POST CURING

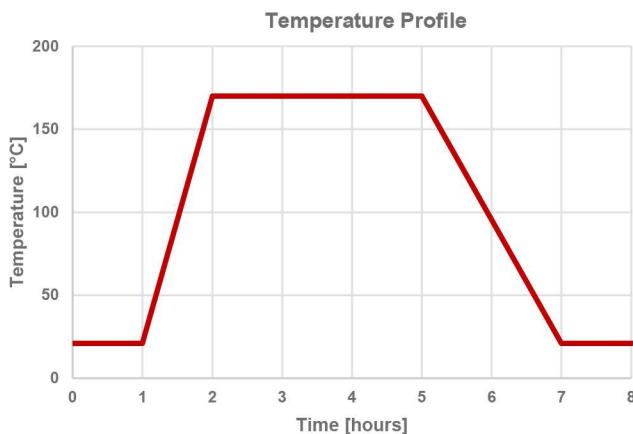
LOCTITE 3D IND3380 BK requires a two-step post curing to achieve specified properties.

#### STEP 2: Heat post cure

After UV post curing, an additional Heat post cure at 170°C for 3 hours is required to reach final properties. Let parts rest one hour between UV post cure and Heat post cure.

To minimize risk of warpage place parts in the oven at standard lab conditions with  $T_{\text{start}} = 22^{\circ}\text{C}$  before ramping temperature with are rate of  $R_T \leq 5^{\circ}\text{C}/\text{min}$  to target value of  $T_{\text{cure}} = 170^{\circ}\text{C}$ .

After 3 hours at  $T_{\text{cure}} = 170^{\circ}\text{C}$  cool down parts slowly in the switched off oven to standard lab conditions with  $T_{\text{end}} = 22^{\circ}\text{C}$ . Do not remove the parts from the oven before they reached lab temperature to prevent thermal stress and warpage.







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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>

## STORAGE

Store **LOCTITE 3D IND3380 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.

## ESD PROPERTIES

**LOCTITE 3D IND3380 BK** provides ESD properties with a surface resistivity in the range of  $10^4\Omega$  to  $10^{11}\Omega$  accordingly to DIN EN61340-2-3.

The exact value of the surface resistivity depends on the print orientation and part geometry. Please note that the burn-in region can show higher surface resistivity outside of the ESD range. Due to that we recommend to print with parts on supports or to adjust the print orientation accordingly to ensure that the printed part provides ESD properties at the desired surface.



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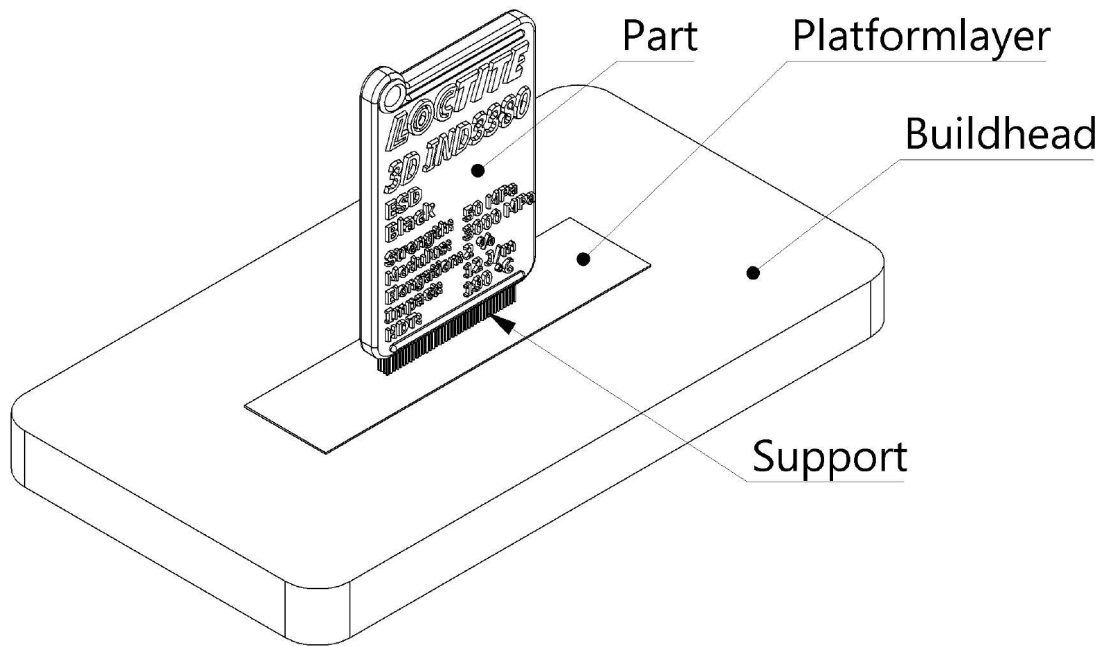
### TIPS & TRICKS

This section is a collection of useful advices, guides, and recommendations designed to help users of the **LOCTITE 3D IND3380 BK** deal with specific process tasks more efficiently.

#### PRINT ORIENTATION

To enhance the buildhead adhesion of **LOCTITE 3D IND3380 BK**, it is recommended to use an initial platform layer. The required part should be attached to this layer using supports. The burn-in region, which will be the initial platform layer, can be discarded afterwards. This also ensures that the printed part provides the desired ESD performance since the burn-in region can show higher surface resistivity outside of the ESD range.

The part should be orientated to have the smallest possible cross-sectional area in the z-direction to minimize detachment forces during the print process.



#### POSTPROCESSING

For complex geometries, such as those containing internal channels, it has proven beneficial to dry the components in an oven for 45min@60°C after the cleaning process, prior to UV curing. This ensures that the IPA is completely evaporated, preventing any adverse effects on the mechanical properties during post-curing processes.



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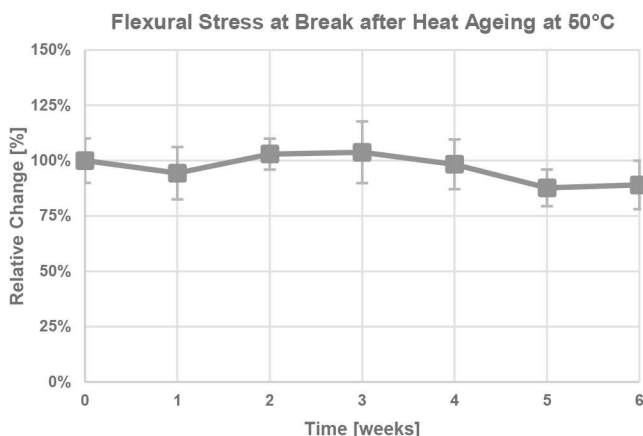
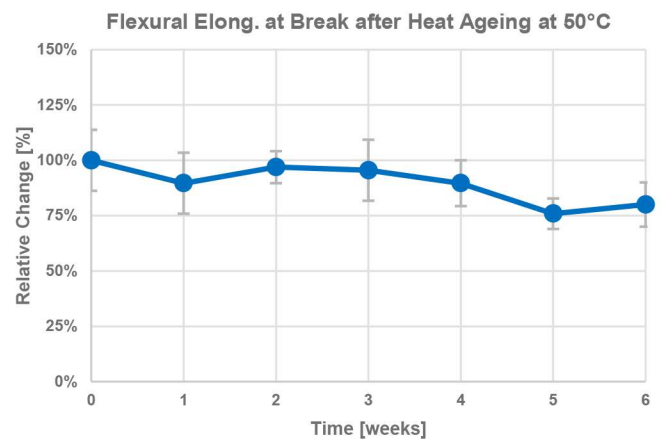
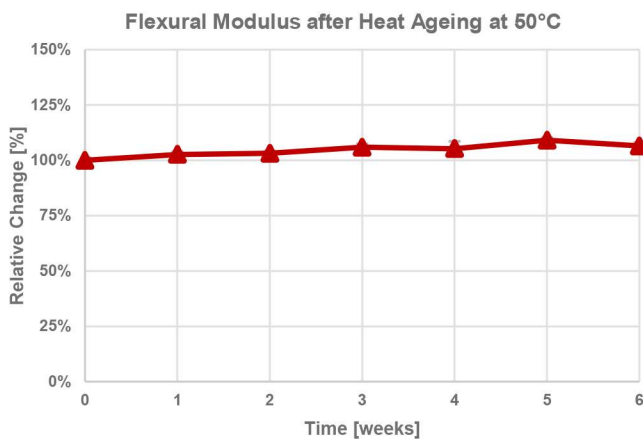
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## AGEING AND ENVIRONMENTAL EFFECTS – HEAT AGEING

LOCTITE 3D IND3380 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





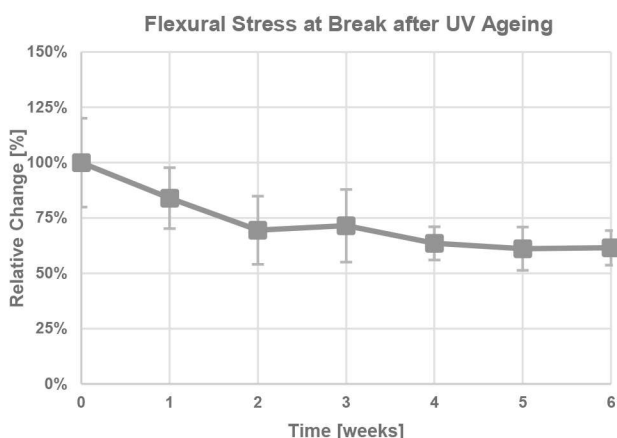
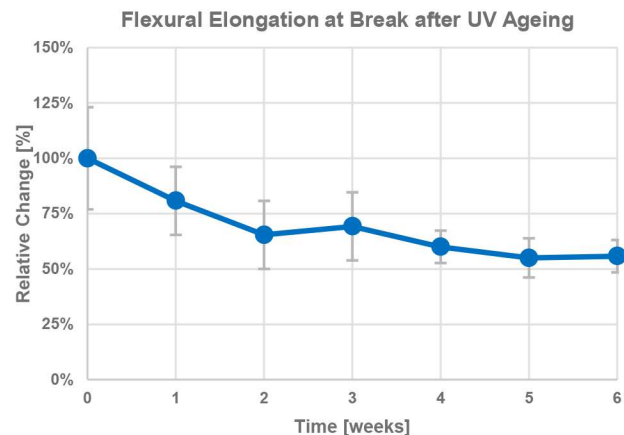
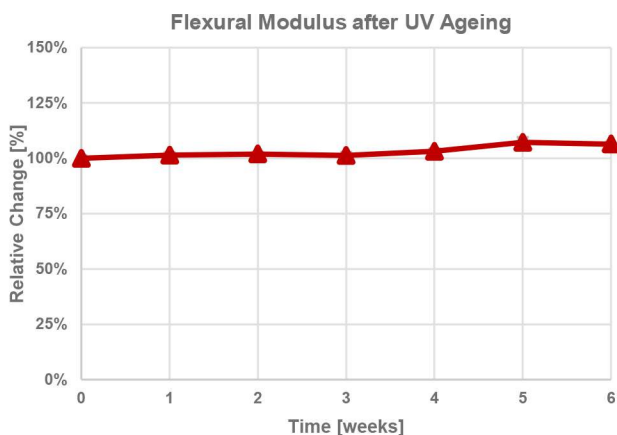
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### AGEING AND ENVIRONMENTAL EFFECTS – ACCELERATED WEATHERING (UV AGEING)

LOCTITE 3D IND3380 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.



#### 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.







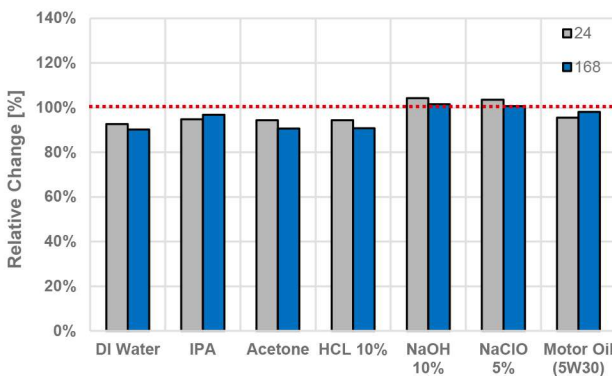
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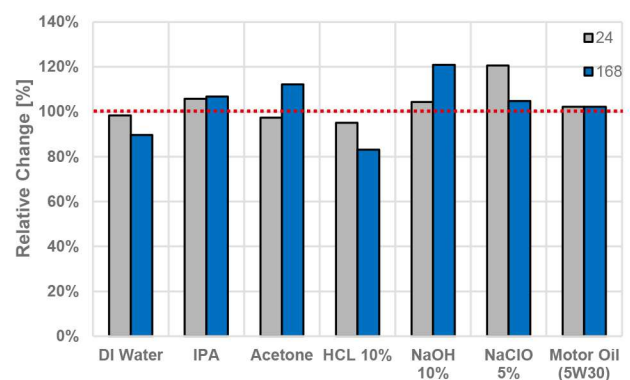
## AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (1/2)

**LOCTITE 3D IND3380 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.

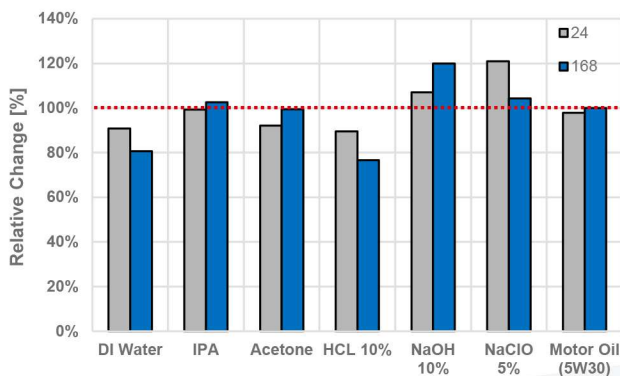
Flexural Modulus after Immersion Time



Flexural Strain at Break after Immersion Time



Flexural Stress at break after Immersion Time



### Test parameters:

ASTM D790: Pull 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.  
Properties of media used: pH(HCL, 10%) = 1; pH(NaOH, 10%) = 14; pH(NaClO, 5%) = 13





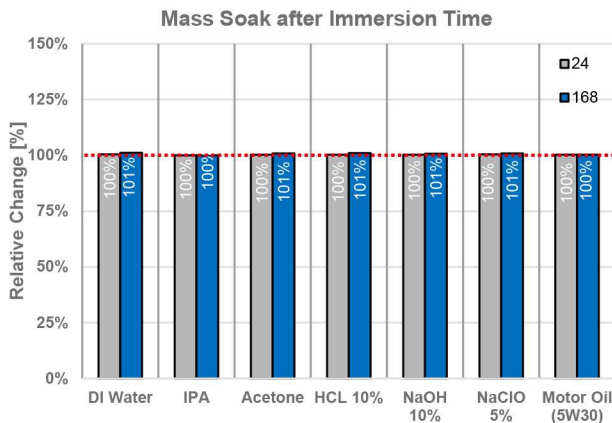


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## AGEING AND ENVIRONMENTAL EFFECTS – CHEMICAL RESISTANCE (2/2)

LOCTITE 3D IND3380 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





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## NOTE

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