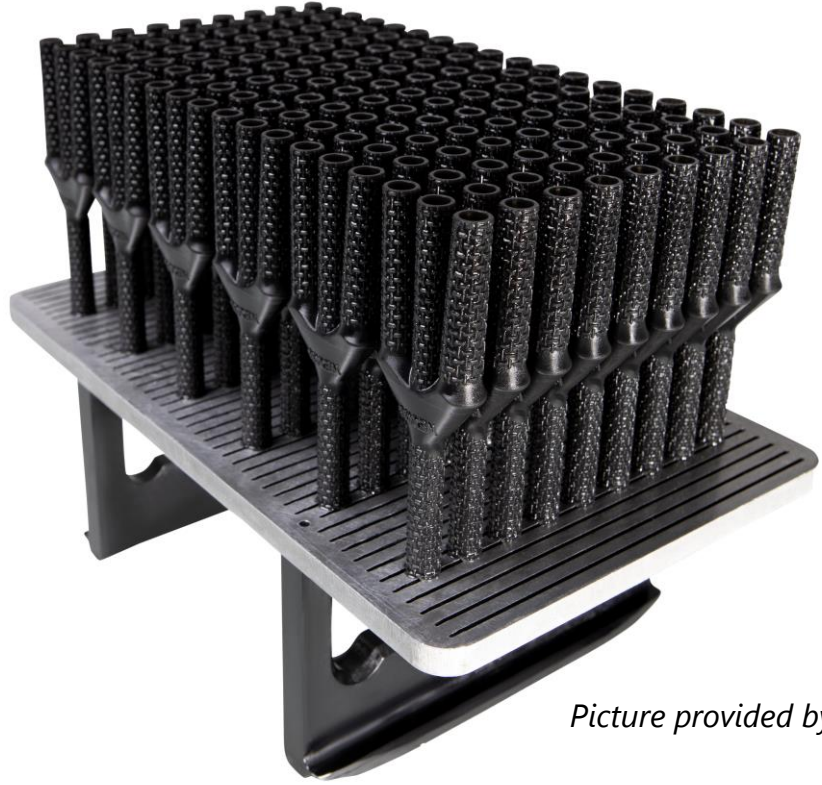


LOCTITE®



Picture provided by Nexa3D

LOCTITE® 3D IND405™

HDT50 High Elongation

Photoplastic

Black, Clear

LOCTITE®

Henkel Corporation

loctite3dp@henkel.com





IND405™

HDT50 HIGH ELONGATION
PHOTOPLASTIC
BLACK, CLEAR



LOCTITE 3D IND405™

LOCTITE 3D IND405 is a rigid, high-strength, high elongation engineering material with outstanding impact resistance and excellent surface finish properties.

This stiff and durable high-performance material is ideal for a wide variety of tools in the production floor, including manufacturing aids and final parts such as housings and consumer goods applications.

Parts can be printed with various DLP printers and machined, tapped, or polished for final finish.



Benefits:

- High impact resistance with high elongation
- Easy to print (one-part material)
- Tough and Durable
- The toughest clear resin (only applicable for clear material)
- Functional Prototyping



Ideal for:

- Clear prototypes (clear version)
- Fluid routing & consumer goods prototypes
- Manufacturing aids/tools
- Housings



Markets:



Industry



Consumer Goods

Tensile Stress at Break (MPa)

52

Elongation at Break (%)

127

Young's Modulus (MPa)

1300

HDT at 0.455 MPa

53

IZOD Impact (Notched, J/m)

72

**Values shown are linked to LOCTITE IND405 Clear as reference, please refer to the specific mechanical properties for each of the colors shown in this document*



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MECHANICAL PROPERTIES

| Mechanical Properties | Measure | Method | Green | Post Processed |
|-------------------------|-------------------|------------|-------------------------|---------------------------|
| Tensile Stress at Yield | MPa | ASTM D638 | 25 ± 1 ^[1] | 44 ± 1 ^[2] |
| Tensile Stress at Break | MPa | ASTM D638 | 24 ± 1 ^[1] | 45 ± 2 ^[2] |
| Tensile Modulus | MPa | ASTM D638 | 897 ± 20 ^[1] | 1,434 ± 80 ^[2] |
| Elongation at Break | % | ASTM D638 | 89 ± 9 ^[1] | 101 ± 11 ^[2] |
| Other Properties | | | | |
| HDT at 0.455 MPa | °C | ASTM D648 | - | 52.8 ^[3] |
| IZOD Impact (Notched) | J/m | ASTM D256 | - | 51 ± 4 ^[4] |
| Water Absorption (24hr) | % | Internal | - | 1 ^[5] |
| Shore Hardness (0s, 3s) | D | ASTM D648 | - | 80, 76 ^[6] |
| Solid Density | g/cm ³ | ASTM D1475 | 1.116 ^[7] | 1.121 ^[7] |
| CTE (-30°C to 45°C) | (µm/m)/°C | ASTM E831 | - | 98.47 ^[9] |

| Liquid Properties | Measure | Method | Value |
|--------------------------|-------------------|------------|------------------------------|
| Viscosity at 25°C (77°F) | cP | ASTMD7867 | 2,200 – 2,400 ^[8] |
| Liquid Density | g/cm ³ | ASTM D1475 | 1.046 ^[7] |

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, 50mm/min, D790-B, 2mm/min, D256 Notched IZOD (Machine Notched), 6 mm x 12 mm, D648, D2240, Type "D" (0, 3 seconds), D1475, D7867

Internal Data Sources:

[1] FOR19614, [2] FOR18201, [3] FOR18828, [4] FOR18611, [5] FOR18206, [6] FOR18207, [7] FOR18208, [8] FOR48490, [9] FOR76890





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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 IND405 Black is formulated to print optimally on industrial DLP printer. Read the safety data sheet carefully to get details about health and safety instructions.

- Shake resin bottle well before usage
- Temperature: 20°C to 35°C
- Intensity: 3 mW/cm² to 7 mW/cm²

Exposure time for an intensity of 5 mW/cm²

| | | | | | |
|---------------------------|----|----|-----|--------------------------|------|
| Layer Thickness (µm): | 25 | 50 | 100 | Ec (mJ/cm ²) | 6.1 |
| First layer time (s) | 15 | 25 | 45 | Dp (mm): | 0.14 |
| Burn in region (s): | 8 | 15 | 30 | | |
| Model Layer Exposure (s): | 3 | 4 | 8 | | |

POST PROCESSING

LOCTITE 3D IND405 Black 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 | IPA | Orbital | 2.5 min | 2 | |
| Dry | n.a. | Compressed air | 10 to 60 s | 1 | Air pressure (30psi) |
| Wait before post curing | n.a. | Ambient condition | 60 min | 1 | Room temperature |

POST CURING

LOCTITE 3D IND405 Black requires post curing to achieve specified properties. It is recommended that either an LED or wide spectrum lamp be used to post cure parts.

| UC Curing Unit | UV Source | Intensity | Cure time/ side | Additional Settings (Shelf, Output Energy) |
|-------------------------|-----------------------------------|---------------------------------|-----------------|--|
| Loctite UVALOC 1000 | Mercury Vapor (H-bulb) | 30 mW/cm ² | 10 min | |
| Loctite CL36 | 405nm LED | 80 mW/cm ² at 405 nm | 20 min | 100% top & side |
| Uvitron Intelliray 600W | Mercury Arc Bulb (broad spectrum) | 66% Intensity | 10 min | |





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MECHANICAL PROPERTIES

| Mechanical Properties | Measure | Method | Green | Post Processed |
|-------------------------|---------|-----------|-------------------------|---------------------------|
| Tensile Stress at Yield | MPa | ASTM D638 | 23 ± 1 ^[1] | 39 ± 1 ^[2] |
| Tensile Stress at Break | MPa | ASTM D638 | 35 ± 3 ^[1] | 52 ± 3 ^[2] |
| Young's Modulus | MPa | ASTM D638 | 847 ± 26 ^[1] | 1,378 ± 41 ^[2] |
| Elongation at Break | % | ASTM D638 | 166 ± 14 ^[1] | 127 ± 6 ^[2] |

Other Properties

| | | | | |
|--------------------------------|-------------------|------------|----------------------|-----------------------|
| HDT at 0.455 MPa | °C | ASTM D648 | - | 53 ^[3] |
| IZOD Impact Strength (Notched) | J/m | ASTM D256 | - | 72 ± 2 ^[4] |
| Water Absorption (24hr) | % | Internal | - | 2 ^[5] |
| Shore Hardness (0s, 3s) | D | ASTM D2240 | - | 79, 76 ^[6] |
| Solid Density | g/cm ³ | ASTM D1475 | 1.126 ^[7] | 1.134 ^[7] |
| CTE (-30°C to 45°C) | (µm/m)/°C | ASTM E831 | - | 91.14 ^[11] |

Biocompatibility

| | | | | |
|--------------|--|--------------|---|------------------------|
| Cytotoxicity | | ISO10993-5 | - | Comply ^[9] |
| Irritation | | ISO10993-23* | - | Comply ^[10] |

| Liquid Properties | Measure | Method | Value |
|--------------------------|-------------------|-----------|------------------------------|
| Viscosity at 25°C (77°F) | cP | ASTMD7867 | 2,100 - 2,300 ^[8] |
| Liquid Density | g/cm ³ | ASTMD1475 | 1.050 ^[7] |

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, 50mm/min, D790-B, 2mm/min, D256 Notched IZOD (Machine Notched), 6 mm x 12 mm, D648, D2240, Type "D" (0, 3 seconds), D1475, D7867

*The biological assessment has been performed based on the in vitro method according to ISO10993-23

Internal Data Sources:

[1] FOR19711, [2] FOR16273, [3] FOR18829, [4] FOR516321, [5] FOR16322, [6] FOR18476, [7] FOR17633, [8] FOR43175, [9] FOR40216, [10] FOR52782 (in-vitro), [11] FOR76865





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CLEAR COLOR PROPERTIES

In order to assess clear properties, color variation is measured as Delta-E (dE) to define parts transmittance.

dE measures changes from $L^*a^*b^*C^*h$. The table below shows the color variation for two different workflows:

Method: ASTM E308, Total Transmission

| Part State | L* | a* | b* | C* | h | dE |
|-------------------------------|--------|--------|-------|------|--------|------|
| Green / no post-processing | 92.425 | -1.205 | 2.195 | 2.5 | 118.74 | NA |
| Dymax 5000EC 5 minutes / side | 92.255 | -0.52 | 1.265 | 1.37 | 112.28 | 1.17 |
| Loctite CL36 60 min/side | 92.18 | -0.32 | 0.89 | 0.94 | 109.88 | 1.83 |

QUV exterior weathering conditions (ASTM G-154 - Cycle 1): Clear color
ASTM E308 Transmission

| QUV Exposure Time (Hrs) | L* | a* | b* | C* | h | dE |
|-------------------------|-------|-------|------|------|--------|------|
| 0 | 90.86 | -0.65 | 1.03 | 1.22 | 122.49 | NA |
| 240 | 91.06 | -0.47 | 1.42 | 1.49 | 108.47 | 0.47 |

QUV exterior weathering conditions (ASTM G-154 - Cycle 1): Clear color mechanical properties

| QUV Exposure Time (Hrs) | Tensile Stress at break (MPa) | Yield Stress (MPa) | Young's Modulus (MPa) | Elongation at break (%) |
|-------------------------|-------------------------------|--------------------|-----------------------|-------------------------|
| 0 | 49 ± 3 | 42 ± 1 | 1412 ± 60 | 116 ± 12 |
| 300 | 41 ± 3 | 40 ± 1 | 1343 ± 103 | 78 ± 12 |
| 520 | 41 ± 2 | 44 ± 1 | 1469 ± 35 | 63 ± 16 |
| 800 | 38 ± 1 | 45 ± 1 | 1478 ± 51 | 46 ± 16 |





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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 IND405 Clear 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/cm² to 7 mW/cm²

Exposure time for an intensity of 5 mW/cm²

| | | | | | |
|---------------------------|----|----|-----|--------------------------|------|
| Layer Thickness (µm): | 25 | 50 | 100 | Ec (mJ/cm ²) | 6.2 |
| First Layer Time (s): | 10 | 20 | 40 | Dp (mm): | 0.15 |
| Burn In Region Time (s): | 6 | 12 | 25 | | |
| Model Layer Exposure (s): | 2 | 3 | 6 | | |

POST PROCESSING

LOCTITE 3D IND405 Clear 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 | 1 | |
| Dry | n.a. | Compressed air | 10 to 60 s | 1 | Air pressure (30psi) |
| Wait before post curing | n.a. | Ambient condition | 60 min | 1 | Room temperature |

POST CURING

LOCTITE 3D IND405 Clear requires post curing to achieve specified properties. It is recommended that either an LED or wide spectrum lamp be used to post cure parts.

| UC Curing Unit | UV Source | Intensity | Cure time/ side | Additional Settings (Shelf, Output Energy) |
|-------------------------|-----------------------------------|----------------------------------|--------------------|---|
| Uvitron Intelliray 600W | Mercury Arc Bulb (broad spectrum) | 66% Intensity | 2 min | Shelf Second from Bottom |
| Dymax 5000 EC Flood | Mercury Arc Bulb (broad spectrum) | 148 mW/cm ² at 380 nm | 2 min | 400W, Shelf K |
| Loctite CL36 | 405nm LED | 80 mW/cm ² at 405 nm | 10 min | 100% top & side |



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POST PROCESSING OPTIONS

Polishing/ Clear Coating is needed for optimum clarity to be obtained. The following steps can be used as initial guidance for improving the clarity of the **LOCTITE 3D IND405 Clear**, the exact steps and method will be determined by the end user's requirements:

1. Mark both sides of the printed object with a black ink or an available guide coating material.
2. Using 240 grit sandpaper, evenly sand the surface in an opposing 45-degree angle pattern until the surface has been fully sanded and the guide coat has been removed.
3. Remove sanding dust and any other debris from the surface of the part before proceeding to the next step.
4. Repeat steps 1 through 3 stepping up the numerical grit size: 400, 600, 800 and finishing at a buffing compound until the surface is smooth and has achieved the desired level of clarity.
5. Optional step: After using the above sanding method through grit size 800, thoroughly clean the surface of the part removing all dust and debris. Using multiple light coats of a high quality automotive clear coat, coat the surface of the printed part. Once the clear coating has fully cured buff the surface as needed to achieve the desired level of clarity.

Color/Dyeing - Laboratory testing shows that dyeing **LOCTITE 3D IND405 Clear** using solvent solutions is possible. In order to maintain mechanical properties, we recommend dyeing after post cure is completed. Dyeing prior to post cure, results may vary and effect mechanical properties.



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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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Henkel Corporation

loctite3dp@henkel.com



Version 2022/03/10