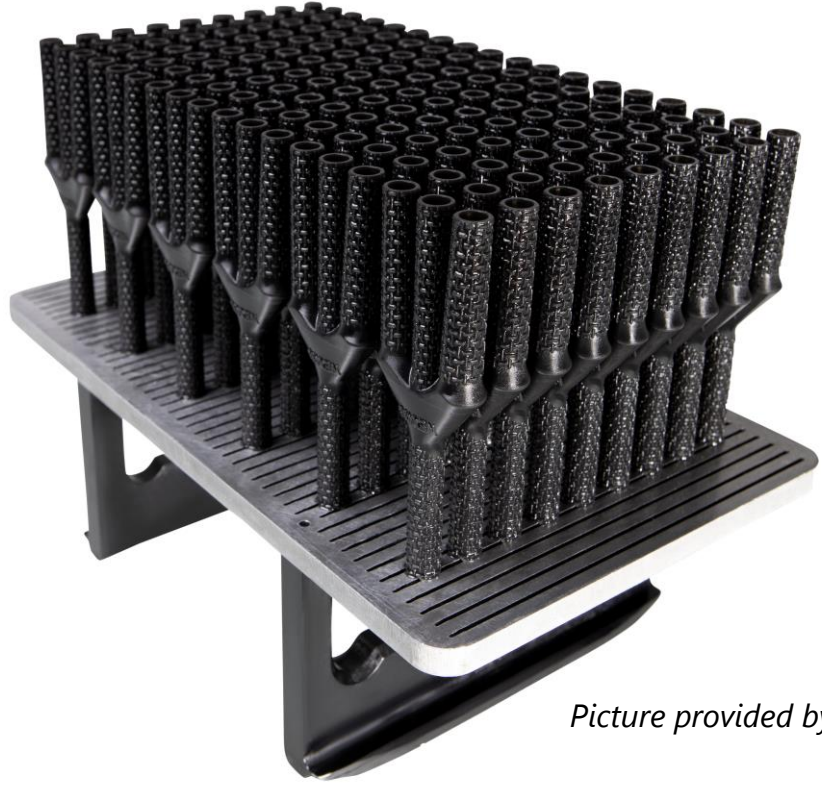


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Picture provided by Nexa3D

LOCTITE® 3D IND405™

HDT50 High Elongation

Photoplastic

Black, Clear

LOCTITE®

Henkel Corporation

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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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ELECTRICAL PROPERTIES

Electrical Properties	Measure	Method	Green	Post Processed
Volume Resistivity	$\Omega \cdot \text{cm}$	ASTM D257	-	2.75E +15 [1]
Surface Resistivity	Ω	ASTM D257	-	7.79E +15 [1]
Dielectric Strength	kV/mm	ASTM D149	-	24.9 [2]
AC Relative Permittivity (Dielectric Constant) ^[3]				
at 50 Hz (XY)	none	ASTM D150	-	4.7
at 1 kHz (XY)	none	ASTM D150	-	4.2
at 1 MHz (XY)	none	ASTM D150	-	3.6
AC Loss Characteristic (Dissipation Factor) ^[3]				
at 50 Hz (XY)	none	ASTM D150	-	0.017
at 1 kHz (XY)	none	ASTM D150	-	0.014
at 1 MHz (XY)	none	ASTM D150	-	0.150

Internal Data Sources:

[1] FOR106272 [2] FOR106273 [3] FOR106274





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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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ELECTRICAL PROPERTIES

Electrical Properties	Measure	Method	Green	Post Processed
Volume Resistivity	$\Omega \cdot \text{cm}$	ASTM D257	-	8.55E +14 ^[1]
Surface Resistivity	Ω	ASTM D257	-	1.24E +15 ^[1]
Dielectric Strength	kV/mm	ASTM D149	-	27.4 ^[2]
AC Relative Permittivity (Dielectric Constant) ^[3]				
at 50 Hz (XY)	none	ASTM D150	-	4.4
at 1 kHz (XY)	none	ASTM D150	-	4.2
at 1 MHz (XY)	none	ASTM D150	-	3.8
AC Loss Characteristic (Dissipation Factor) ^[3]				
at 50 Hz (XY)	none	ASTM D150	-	0.025
at 1 kHz (XY)	none	ASTM D150	-	0.017
at 1 MHz (XY)	none	ASTM D150	-	0.428

Internal Data Sources:

[1] FOR106275 [2] FOR116477 [3] FOR106277





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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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Version 2022/06/22