Technical Data Sheet

LOCTITE® 648™

(TDS for the new formulation of LOCTITE® 648™) August 2013

PRODUCT DESCRIPTION

LOCTITE® 648™ provides the following product characteristics:

Technology	Acrylic
Chemical Type	Urethane methacrylate
Appearance (uncured)	Green liquid[LMS]
Fluorescence	Positive under UV light[LMS]
Components	One component - requires no mixing
Viscosity	Low
Cure	Anaerobic
Secondary Cure	Activator
Application	Retaining
Strength	High

This Technical Data Sheet is valid for LOCTITE® 648™ manufactured from the dates outlined in the "Manufacturing Date Reference" section.

LOCTITE® 648™ is designed for the bonding of cylindrical fitting parts. The product cures when confined in the absence of air between close fitting metal surfaces and prevents loosening and leakage from shock and vibration. Typical applications include holding gears and sprockets onto gearbox shafts and rotors on electric motor shafts . LOCTITE® 648™ provides robust curing performance. It not only works on active metals (e.g. mild steel) but also on passive substrates such as stainless steel and plated surfaces. The product offers high temperature performance and oil tolerance. It tolerates minor surface contaminations from various oils, such as cutting, lubrication, anti-corrosion and protection fluids.

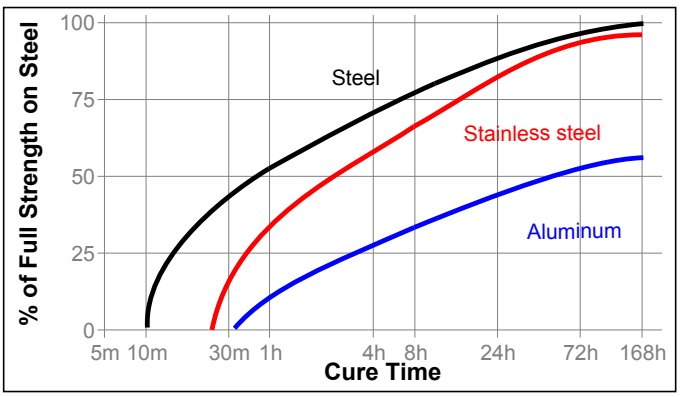
TYPICAL PROPERTIES OF UNCURED MATERIAL

Specific Gravity @ 25 °C	1.1
Viscosity, Brookfield - RVT, 25 °C, mPa·s (cP):	
Spindle 2, speed 20 rpm,	400 to 600[LMS]
Viscosity, Cone & Plate, 25 °C, mPa·s (cP):	
Shear rate 129 s^{-1}	400 to 600
Flash Point - See MSDS	

TYPICAL CURING PERFORMANCE

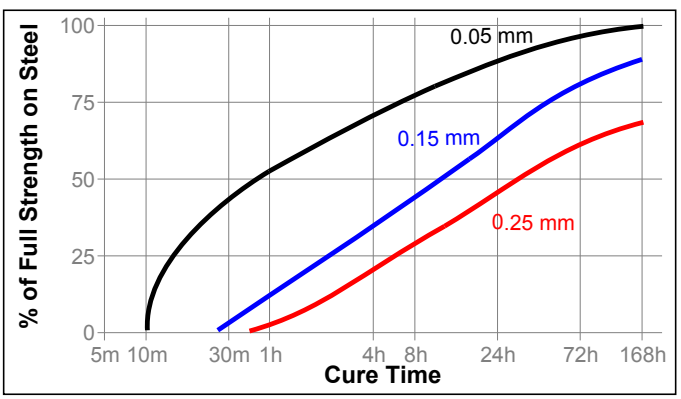
Cure Speed vs. Substrate

The rate of cure will depend on the substrate used. The graph below shows the shear strength developed with time on steel pins and collars compared to different materials and tested according to ISO 10123.

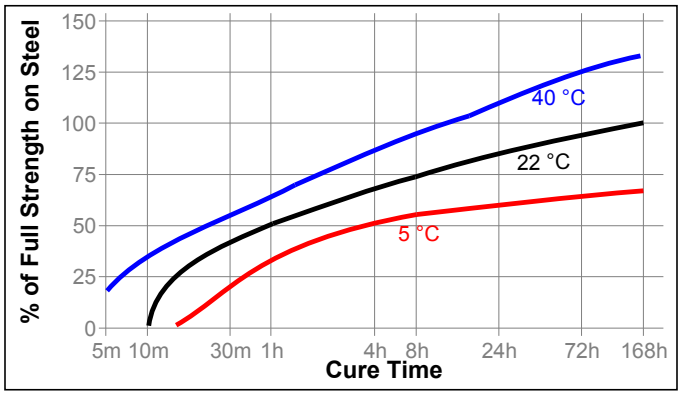


Cure Speed vs. Bond Gap

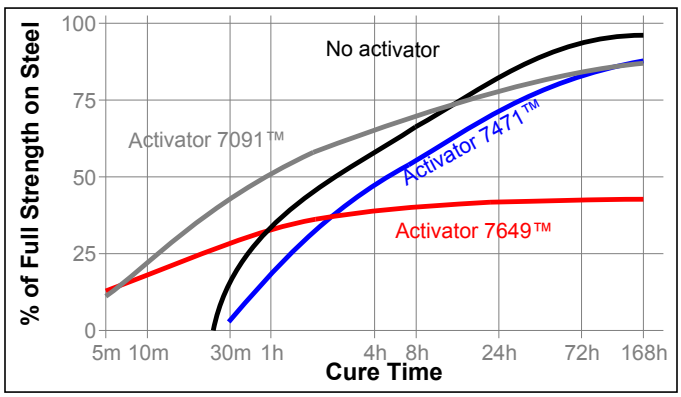
The rate of cure will depend on the bondline gap. The following graph shows shear strength developed with time on steel pins and collars at different controlled gaps and tested according to ISO 10123.



Cure Speed vs. Temperature
The rate of cure will depend on the temperature. The graph below shows the shear strength developed with time at different temperatures on steel pins and collars and tested according to ISO 10123.



Cure Speed vs. Activator
The graph below shows the shear strength developed with time on stainless steel pins and collars using Activator 7471™, 7649™ and 7091™ and tested according to ISO 10123.



TYPICAL PROPERTIES OF CURED MATERIAL

Physical Properties:

Glass Transition Temperature ISO 11359-2, °C	100
Coefficient of Thermal Expansion, ISO 11359-2 K^{-1}:	
Below Tg	93×10^{-06}
Above Tg	184×10^{-06}

TYPICAL PERFORMANCE OF CURED MATERIAL

Adhesive Properties

Cured for 15 minutes @ 22 °C
Compressive Shear Strength, ISO 10123:

Steel pins and collars	N/mm²	≥13.5[LMS]
	(psi)	(1,960)

Cured for 24 hours @ 22 °C
Compressive Shear Strength, ISO 10123:

Steel pins and collars	N/mm²	≥25[LMS]
	(psi)	(≥3,625)

Cured for 7 days @ 22 °C
Compressive Shear Strength, ISO 10123:

Steel pins and collars	N/mm²	31
	(psi)	(4,480)
Stainless Steel pins and collars	N/mm²	30
	(psi)	(4,350)
Aluminum pins and collars	N/mm²	18
	(psi)	(2,610)

Cured for 24 hours @ 22 °C
Breakaway Torque, ISO 10964:

M10 black oxide bolts and mild steel nuts	N·m	58
	(lb.in.)	(515)
3/8 x 16 steel nuts (grade 2) and bolts (grade 5)	N·m	32
	(lb.in.)	(285)

Prevail Torque, ISO 10964:

M10 black oxide bolts and mild steel nuts	N·m	40
	(lb.in.)	(355)
3/8 x 16 steel nuts (grade 2) and bolts (grade 5)	N·m	16
	(lb.in.)	(140)

Breakloose Torque, ISO 10964, Pre-torqued to 5 N·m:

3/8 x 16 steel nuts (grade 2) and bolts (grade 5)	N·m	29
	(lb.in.)	(255)

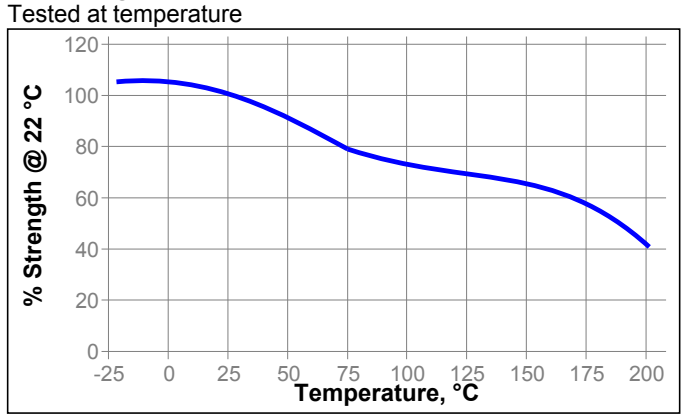
Prevail Torque, ISO 10964, Pre-torqued to 5 N·m:

3/8 x 16 steel nuts (grade 2) and bolts (grade 5)	N·m	29
	(lb.in.)	(255)

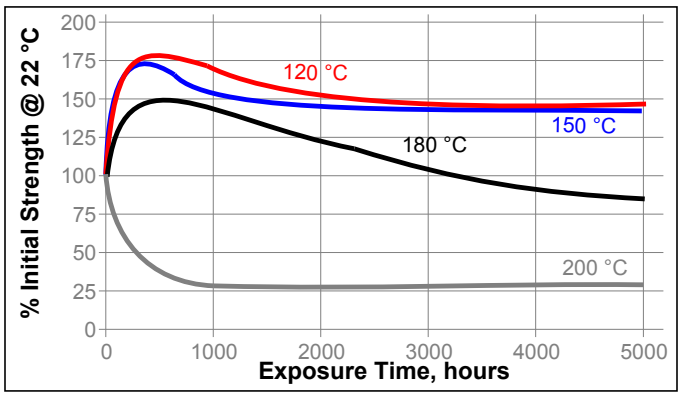
TYPICAL ENVIRONMENTAL RESISTANCE

Cured for 1 week @ 22 °C
Compressive Shear Strength, ISO 10123:
Steel pins and collars

Hot Strength
Tested at temperature



Heat Aging
Aged at temperature indicated and tested @ 22 °C



Chemical/Solvent Resistance
Aged under conditions indicated and tested @ 22 °C.

		% of initial strength			
Environment	**°C**	**500 h**	**1000 h**	**3000 h**	**5000 h**
Motor oil (5W40 -Synthetic)	125	170	165	150	145
Unleaded Petrol	22	130	130	110	105
Brake fluid	22	130	140	135	125
Water/glycol 50/50	87	85	80	80	80
Ethanol	22	130	130	125	120
Acetone	22	100	100	100	100
B100 Bio-Diesel	22	115	115	105	100
DEF (AdBlue®)	22	95	95	90	100

Stainless Steel pins and collars

		% of initial strength			
Environment	**°C**	**500 h**	**1000 h**	**3000 h**	**5000 h**
Sodium Hydroxide, 20%	22	115	105	95	90
Phosphoric Acid, 10%	22	75	60	40	35

GENERAL INFORMATION

This product is not recommended for use in pure oxygen and/or oxygen rich systems and should not be selected as a sealant for chlorine or other strong oxidizing materials.

For safe handling information on this product, consult the Material Safety Data Sheet (MSDS).

Where aqueous washing systems are used to clean the surfaces before bonding, it is important to check for compatibility of the washing solution with the adhesive. In some cases these aqueous washes can affect the cure and performance of the adhesive.

This product is not normally recommended for use on plastics (particularly thermoplastic materials where stress cracking of the plastic could result). Users are recommended to confirm compatibility of the product with such substrates.

Directions for use:

For Assembly

1. For best results, clean all surfaces (external and internal) with a LOCTITE® cleaning solvent and allow to dry.
2. To accelerate cure speed or where large gaps are present, use activator and allow to dry.
3. **For Slip Fitted Assemblies**, apply adhesive around the leading edge of the pin and the inside of the collar and use a rotating motion during assembly to ensure good coverage.
4. **For Press Fitted Assemblies**, apply adhesive thoroughly to both bond surfaces and assemble at high press on rates.
5. **For Shrink Fitted Assemblies,** the adhesive should be coated onto the part to produce a smooth, even film of material. If heating the hub for assembly, coat the pin. If the pin is to be cooled for assembly, coat the hub. If both heating and cooling is to be done, apply material to cooled part. Avoid condensation on cooled parts.
6. Parts should not be disturbed until sufficient handling strength is achieved.

For Disassembly

1. Remove with standard hand tools.
2. If needed, apply localized heat to the assembly to approximately 250 °C. Disassemble while hot.
3. If this temperature is not possible, heat as much as possible and use mechanical aids.

For Cleanup

1. Cured product can be removed with a combination of soaking in a Loctite solvent and mechanical abrasion such as a wire brush.

Loctite Material Specification[LMS]
LMS dated July 10, 2013. Test reports for each batch are available for the indicated properties. LMS test reports include selected QC test parameters considered appropriate to specifications for customer use. Additionally, comprehensive controls are in place to assure product quality and consistency. Special customer specification requirements may be coordinated through Henkel Quality.

Storage
Store product in the unopened container in a dry location. Storage information may be indicated on the product container labeling.
Optimal Storage: 8 °C to 21 °C. Storage below 8 °C or greater than 28 °C can adversely affect product properties. Material removed from containers may be contaminated during use. Do not return product to the original container. Henkel Corporation cannot assume responsibility for product which has been contaminated or stored under conditions other than those previously indicated. If additional information is required, please contact your local Technical Service Center or Customer Service Representative.

Conversions

(°C x 1.8) + 32 = °F
kV/mm x 25.4 = V/mil
mm / 25.4 = inches
µm / 25.4 = mil
N x 0.225 = lb
N/mm x 5.71 = lb/in
N/mm² x 145 = psi
MPa x 145 = psi
N·m x 8.851 = lb·in
N·m x 0.738 = lb·ft
N·mm x 0.142 = oz·in
mPa·s = cP

Manufacturing Date Reference

This Technical Data Sheet is valid for LOCTITE® 648™ manufactured from the dates below:

Made in:	**First manufacturing date**:
U.S.A.	September 2013
EU	Pending
China	August 2013
Brazil	November 2013
India	Pending

Disclaimer

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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Reference 2.2