

LOCTITE[®] 5713[™]

June 2007

PRODUCT DESCRIPTION

LOCTITE[®] 5713[™] provides the following product characteristics:

Technology	Silicone
Chemical Type	Silicone
Appearance, Resin (Component A)	White paste ^{LMS}
Appearance, Hardener (Component B)	Black paste ^{LMS}
Appearance (Mixture)	Black paste
Mix Ratio - Part A:Part B	1 : 1
Components	Two component - requires mixing
Viscosity	Medium, thixotropic
Cure	Heat cure
Application	FIP (Fuel Cell) Gasketing
Specific Benefit	Long Pot Life

LOCTITE[®] 5713[™] is a two component, heat curing, form in place (FIP) silicone designed for sealing Proton Exchange Membrane Fuel Cell (PEMFC) stacks. After mixing, the sealant's cure is inhibited to give extended working time. LOCTITE[®] 5713[™] formulation can be used to bond fuel cell components together. After curing, the bonded components can be compressed to form a gastight seal. LOCTITE[®] 5713[™] is a low ionic formulation that has been specially formulated to be compatible with the membrane electrode assemblies (MEA's).

TYPICAL PROPERTIES OF UNCURED MATERIAL

Part A:

Specific Gravity @ 25 °C	1.03
Flash Point - See SDS	
Solids/Non-Volatile Content, %	100
Viscosity, Cone & Plate, 25 °C, mPa·s (cP): Spindle CP20-2 Deg @ 12 s ⁻¹	115,000 to 155,000 ^{LMS}

Part B:

Specific Gravity @ 25 °C	1.06
Flash Point - See SDS	
Solids/Non-Volatile Content, %	100
Viscosity, Cone & Plate, 25 °C, mPa·s (cP): Spindle CP20-2 Deg @ 12 s ⁻¹	65,000 to 115,000 ^{LMS}

Mixed:

Specific Gravity @ 25 °C	1.05
Flash Point - See SDS	

TYPICAL CURING PERFORMANCE

Normal processing conditions will include sufficient exposure to heat to effectively cure the material. Cure time depends upon such factors as the mass of the material dispensed, the heat ramp up rate of the substrate and amount of airflow over the substrate. Minimum cure temperature profile for this product is 110°C. Minimum cure time is approximately 15 minutes.

Differential Scanning Calorimetry

Temperature Program from 25 to 200 °C at 10 °C/minute:

Curing Exotherm, J/g	4.6
Peak Maximum, °C	110

Working Life

Working life, hours @ 25 °C	24
-----------------------------	----

TYPICAL PROPERTIES OF CURED MATERIAL

Cured for 15 minutes @ 110 °C

Physical Properties:

Shore Hardness, ISO 868, Durometer A	28 to 38 ^{LMS}
Elongation, ISO 37, %	≥175 ^{LMS}
Tensile Strength, ISO 37	N/mm ² ≥1.7 ^{LMS} (psi) (≥250)
Tensile Modulus, ISO 37	N/mm ² 0.9 (psi) (136)

Tear Strength, ISO 34-1, Die C	N/mm (lb./in.)	5.8 (33)
Compression Set, ASTM D 395, Method B, %: Aged @ 75 °C for 70 hours	9	
Glass Transition Temperature (Tg), °C	-47.8	

TYPICAL ENVIRONMENTAL RESISTANCE

Typical Fluid Immersion Properties

Heat Aging

DI Water @ 90 °C for 1,000 hours:

Change in Durometer, Points (Initial = 31)	-5
Change in Tensile Strength, %	-16
Change in Tensile Modulus, %	-64
Change in Elongation, %	46

Water/Glycol @ 90 °C for 1,000 hours:

Change in Durometer, Points (Initial = 31)	-1
Change in Tensile Strength, %	-13
Change in Tensile Modulus, %	-60
Change in Elongation, %	40

Sulfuric Acid (pH 2) @ 90 °C for 1,000 hours:

Change in Durometer, Points (Initial = 31)	-2
Change in Tensile Strength, %	-19
Change in Tensile Modulus, %	-65
Change in Elongation, %	52

Methanol @ 60 °C for 1,000 hours:

Change in Durometer, Points (Initial = 31)	-1
Change in Tensile Strength, %	-16
Change in Tensile Modulus, %	-61
Change in Elongation, %	46

Air @ 90 °C for 1,000 hours:

Change in Durometer, Points (Initial = 31)	3
Change in Tensile Strength, %	-9
Change in Tensile Modulus, %	-51
Change in Elongation, %	19

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 Safety Data Sheet (SDS).

Directions for use:

- For best performance part surfaces should be clean and free of grease.
- Dispense LOCTITE® 5713™ in a 1:1 mix ratio utilizing the appropriate Henkel® cartridge dispenser and static mixing nozzle. Contact your local sales representative or technical service center for dispensing equipment needed per application.
- Excess material can be easily wiped away with non-polar solvents.
- It is recommended that this product be heat cured at 110 °C for 15 minutes.
- Actual cure schedule depends on mass and geometry of parts.

Loctite Material Specification^{LMS}

LMS dated March 19, 2007 (Part A) and LMS dated March 27, 2007 (Part B). 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 Loctite 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

$(^{\circ}\text{C} \times 1.8) + 32 = ^{\circ}\text{F}$
 $\text{kV/mm} \times 25.4 = \text{V/mil}$
 $\text{mm} / 25.4 = \text{inches}$
 $\mu\text{m} / 25.4 = \text{mil}$
 $\text{N} \times 0.225 = \text{lb}$
 $\text{N/mm} \times 5.71 = \text{lb/in}$
 $\text{N/mm}^2 \times 145 = \text{psi}$
 $\text{MPa} \times 145 = \text{psi}$
 $\text{N}\cdot\text{m} \times 8.851 = \text{lb}\cdot\text{in}$
 $\text{N}\cdot\text{m} \times 0.738 = \text{lb}\cdot\text{ft}$
 $\text{N}\cdot\text{mm} \times 0.142 = \text{oz}\cdot\text{in}$
 $\text{mPa}\cdot\text{s} = \text{cP}$

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.

Any liability in respect of the information in the Technical Data Sheet or any other written or oral recommendation(s) regarding the concerned product is excluded, except if otherwise explicitly agreed and except in relation to death or personal injury caused by our negligence and any liability under any applicable mandatory product liability law.

In case products are delivered by Henkel Belgium NV, Henkel Electronic Materials NV, Henkel Nederland BV, Henkel Technologies France SAS and Henkel France SA please additionally note the following:

In case Henkel would be nevertheless held liable, on whatever legal ground, Henkel's liability will in no event exceed the amount of the concerned delivery.

In case products are delivered by Henkel Colombiana, S.A.S. the following disclaimer is applicable:

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. 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.

Any liability in respect of the information in the Technical Data Sheet or any other written or oral recommendation(s) regarding the concerned product is excluded, except if otherwise explicitly agreed and except in relation to death or personal injury caused by our negligence and any liability under any applicable mandatory product liability law.

In case products are delivered by Henkel Corporation, Resin Technology Group, Inc., or Henkel Canada Corporation, the following disclaimer is applicable:

The data contained herein are furnished for information only and are believed to be reliable. We cannot assume responsibility for the results obtained by others over whose methods we have no control. It is the user's responsibility to determine suitability for the user's purpose of any production methods mentioned herein and to adopt such precautions as may be advisable for the protection of property and of persons against any hazards that may be involved in the handling and use thereof. In light of the foregoing, **Henkel Corporation specifically disclaims all warranties expressed or implied, including warranties of merchantability or fitness for a particular purpose, arising from sale or use of Henkel Corporation's products. Henkel Corporation specifically disclaims any liability for consequential or incidental damages of any kind, including lost profits.** The discussion herein of various processes or compositions is not to be interpreted as representation that they are free from domination of patents owned by others or as a license under any Henkel Corporation patents that may cover such processes or compositions. We recommend that each prospective user test his proposed application before repetitive use, using this data as a guide. This product may be covered by one or more United States or foreign patents or patent applications.

Trademark usage

Except as otherwise noted, all trademarks in this document are trademarks of Henkel Corporation in the U.S. and elsewhere. ® denotes a trademark registered in the U.S. Patent and Trademark Office.

Reference 0.1