Notes on interviews about Vacseal silicone leak closing compound

R. Weiss January 9, 2013

Summary Consulted with vacuum engineers and technicians at particle accelerators, in space science and the manufacturer about Vacseal. The following three questions were asked of each person contacted:

1) What is you experience with Vacseal?
2) Do you know about the longevity of a repair?
3) Have you measured the outgassing products with an RGA?

All consulted agreed that Vacseal was a useful way to fix small leaks, less than 10^{-4} torr liters/sec. Several warned against trying to close larger leaks since the Vacseal would flow into the vacuum system without hardening in the leak. No really hard information on the longevity was available except that no one could remember a leak once fixed opening again. One person guessed a lower limit of 7 years on a repair of a leaky weld on a stainless steel system. There was also no hard information on the residual gas except to note that one could see hydrocarbon peaks while Vacseal was injected into the leak and these attenuated once the compound cured. The measurement were carried out in a system with 10^{-11} torr pressure.

Jay Devereux Space Environment Lab 720-271-2719.
His father invented Vacseal while an employee of Ball Aerospace in Boulder Colorado and then after moving to NIST in Boulder he opened Space Environment Lab to make vacuum chambers and to market Vacseal. The compound has been in existence for the last 50 years. It is similar to other Silicone caulks such as RTV although it is less flexible and makes thinner layers than RTV. It has been used by Phillips to seal high voltage feedthroughs on large TV picture tubes. There is no outgassing information other than weight loss data shown at their website and in a compendium of outgassing data maintained by NASA Goddard. He reports that Wineland at NIST uses Vacseal on ceramic feedthroughs that began to leak on a system maintained at 10^{-11} torr.

Dan Dessau HEP at University of Colorado 303-492-1607
Recommends using the spray method of application rather than the liquid with a brush. He has experienced channel migration under brushed layers of Vacseal and strongly advises against indiscriminate application of the compound. He urges good degreasing and solvent cleaning of the surface to which the Vacseal is applied. He reports seeing the hydrocarbon peaks develop and then attenuate on an RGA at a pressure of 10^{-11} torr. He guesses that thin layers of the compound seal for at least 10 years even on bellows that are vibrating.

Fred Dylla now CEO of the APS at one time AVS president and Director of technology development at CEBAF 301-209-3131

Used Vacseal extensively at CEBAF especially on broken ceramic seals and thin bellows. Warned against using Vacseal on leaks larger than 10^{-4} torr liters/sec. Measured the outgassing as having two components one that attenuated quickly and another which was much slower but could be reduced by heating with a heatgun. Did not try to determine the amu. Found the seals to be reliable for years.

Marcy Stutzman CEBAF Director of Vacuum group 757-269-7013
Uses Vacseal to protect ceramic to metal seals on a vacuum system held at 10^{-12} torr. Suggested talking to Phil Adderley at CEBAF to learn more.

Phil Adderley CEBAF Vacuum technician 757-269-7200
Has had good experiences with Vacseal in fixing leaks in systems at 10^{-12} torr. The system is the electron source for the accelerator. The principal use he has found for Vacseal is on leaking ceramic feedthroughs which develop leaks in the 10^{-8} torr liter/sec range along hairline cracks between the ceramic and the metal. After application of the Vacseal the parts are baked to 250C. Some of the feedthroughs have been in service for 10 years and longer after the application of the Vacseal. He prefers using the spray rather then brushed application of the compound but tells of brushing on Vacseal to leaking magnets at Fermilab in the mid 1990's. He does not recommend indiscriminate application of Vacseal where one does not test whether the leak has been covered with helium after application and heating.

VACSEAL®

VACSEAL® is a silicone resin used primarily for sealing leaks in high and ultra high vacuum systems.

At 50°C the weight loss after 175 hours in vacuum is only 0.000005 Grams/cm², compared to 0.01 Grams/cm² for epoxy compounds. Residual gas analysis indicates no evidence of hydrocarbons or other contamination arising from VACSEAL® used on systems capable of attaining ultimate pressures of 1×10^{-12} torr.

VACSEAL® will seal leaks as large as 4 micron liters per second on systems under evacuation. The sealant will repair larger leaks if the system is at atmospheric pressure.

The vapor pressure of the sealant is highest when initially sprayed or painted on the system. The vapor pressure can be reduced to nearly that of most metals by simply curing with a modest amount of heat. Recommended cure times are 30 minutes at 200°C, 15 minutes at 250°C. Curing can also be effected at room temperature but requires a period of several days.

VACSEAL® is extremely useful as a cement for sealing all kinds of optical windows and CRT glass to wire feedthroughs. It will substantially reduce the IR reflectivity of metals and will produce higher emissivity levels for better heat transfer.

VACSEAL® has expansive application as an adhesive at cryogenic temperatures as well as good radiation resistance. The sealant's durability will survive the environment of space without adverse effect on the product or the spacecraft itself.

Available in both aerosol cans and bottles VACSEAL® can withstand repeated temperature cycling from liquid helium temperatures to 450°C over long intervals of time.

HIGH VACUUM LEAK SEALANT

Space Environment Laboratories

WEIGHT LOSS IN VACUUM BY SUBLIMATION

The curves in the graphs show the weight losses versus time at 50 and 100°C for several commonly used materials in vacuum. Samples were placed in a thermal chamber at a pressure of less than 5 x 10^{-6} torr and at the temperature indicated. The silicone resin used in VACSEAL had a lower weight loss in vacuum than any other material tested.

Indications of how well VACSEAL® can effect a permanent seal in vacuum systems has been demonstrated repeatedly on systems capable of attaining ultimate pressures of below 1 x 10^{-12} torr even after being baked at temperatures above 450 C.

STEADY STATE WEIGHT LOSS OF MATERIALS TESTED

VACSEAL (Silicone Resin)	1.6 x 10^{-8} grams/cm²/hr
EPOXY MOLDING COMPOUNDS	2.6 x 10^{-7} grams/cm²/hr
NYLONS & DELRINS	4.0 x 10^{-7} grams/cm²/hr
EPOXY (Room Temp. Cure)	6.4 x 10^{-7} grams/cm²/hr
WIRE INSULATION	1.0 x 10^{-5} grams/cm²/hr
SILICONE RUBBER (RTV)	1.0 x 10^{-4} grams/cm²/hr

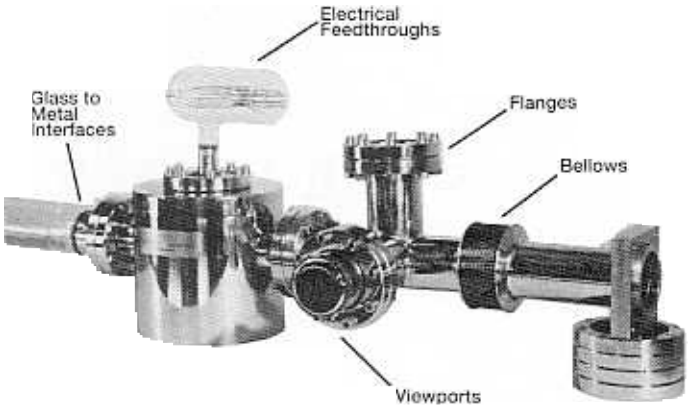
APPLICATION

Prior to using the sealant, surface dirt should be removed from the suspected area. Any hydrocarbon solvent is recommended for removal of greasy surface dirt. New systems can be sprayed or painted directly.

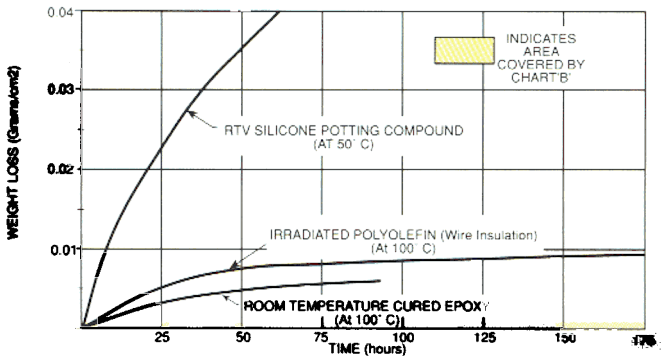
REMOVAL

In event it is desirable to remove the sealant, cured sealant is easily removed with any acetate, ketone, or ester solvent. The uncured sealant can be removed by wiping with any standard hydrocarbon solvent.

TYPICAL USES



Vacseal eliminates leaks in both metal and glass components of ultra high vacuum systems. Its superior electrical resistivity makes it extremely useful for making permanent repairs in all types of glass vacuum gauge tubes and preventing the flow of gasses through faulty seals around electrodes.



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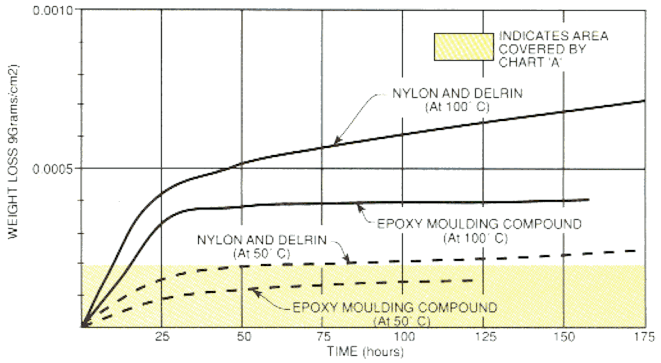

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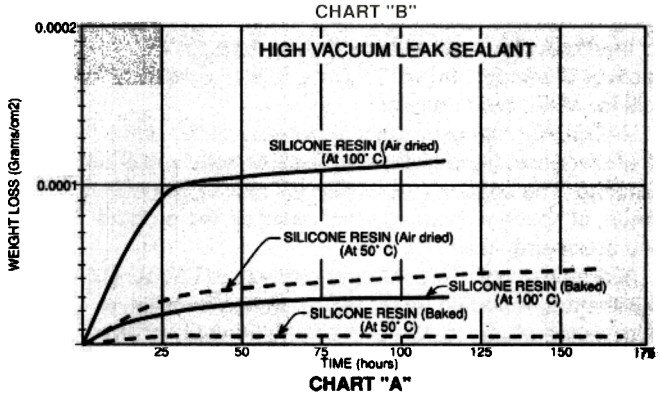


CHART "A"

Optimum Use Of Specifications
Thorough testing should be independently done for satisfactory performance.

For Ordering Information
Call or Fax:

Space Environment Laboratories

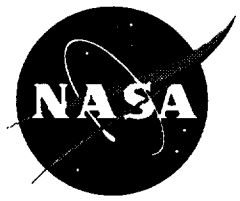
Post Office Box 1061
Boulder, Colorado 80306
Telephone (303) 443-4090

NASA Reference Publication 1124 Revision 4

June 1997

Outgassing Data for Selecting Spacecraft Materials

Neil A. Walter
John J. Scialdone
Goddard Space Flight Center
Greenbelt, Maryland



National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771
1997

TABLE OF CONTENTS

GLOSSARY

TML	Total Mass Loss
CVCM	Collected Volatile Condensable Material
WVR	Water Vapor Regained
BW	By Weight
PBW	Parts By Weight
BV	By Volume
/S	Denotes tape applied to a screen
/R	Denotes tape applied to a ring
/F	Denotes tape applied to a pre-weighed foil
A/B AS 10/1	Denotes ratio of two components, A & B
DEVOL	Devolatilized, or stripped

MATERIAL	DATA REFERENCE	MFR CODE	%TML	%CVCM	%WVR	CURE TIME	CURE TEMP	ATMOS	APPLICATION
TH 1006 SILICONE	GSFC2251	LNP	0.71	0.15		10M	116	AIR	SEAT
						2H	149	AIR	
						4H	204	AIR	
						16H	246	AIR	
THERMACOTE 250 THERMAL JOINT CPND	GSFC3698	THE	0.09	0.02					SEALANT
TI-R-300 INSULATION - FIRED	GSFC6960	TCC	3.68	0.16	0.00				INSULATION
TI-R-300 INSULATION - UNFIRED	GSFC6995	TCC	2.09	0.20	0.36				INSULATION
TORR SEAL A/B AS 1/1 BV	GSFC0981	VAR	0.84	0.00		24H	25	AIR	ADH SEALANT
TORR SEAL A/B AS 2/1 PBW WHITE	GSC19427	VAR	1.09	0.01	0.20	497H	125	AIR	SEALANT
TORR SEAL A/B AS 2/1 PBW WHITE PN 953-0001	GSC19282	VAR	1.82	0.00	0.17	2H	60	AIR	SEALANT
TORR SEAL A/B AS EQUAL LENGTHS FROM TUBES	GSC20091	VAR	0.92	0.01	0.17	24H	25	AIR	SEALANT
TORR SEAL A/B AS EQUAL LENGTHS FROM TUBES	GSC20094	VAR	0.88	0.01	0.18	1.5H	60	AIR	SEALANT
TUBING-SILICONE-RED GRADE 60 CL2 SPEC ZZR765	GSFC4718	MET	0.75	0.26					TUBING
TUBING-SILICONE-RED GRADE 60 CL2 SPEC ZZR765	GSFC4766	MET	0.09	0.04		24H	166	AIR	TUBING
TURCON 99 BLACK TFE/MOS2	GSC19625	SHA	0.03	0.01	0.01				RING SEAL
TUREL T BLACK FLUOROCARBON MIL R83485 TYPE 1	GSC19627	SHA	0.31	0.01	0.21				RING SEAL
TYGOTHANE POLYURETHANE TUBING	GSFC4598	NPC	0.44	0.19					TUBING
UDRI-3 ACRYLIC COPOLYMER/GRAPHITE/CARBON BLACK	GSC14794	GEV	0.58	0.03	0.19				DAMPER
ULTEM 2200 BROWN MOLD CPND FIBER REINFORCED	GSC17806	GEC	0.42	0.01	0.30				MOLD CPND
UV-5010 CLEAR URETHANE UV CURED	GSC16241	HYS	10.62	0.03	0.99				SEALANT
V-700075/BENZOYL PEROXIDE AS 100/1 BW	GSFC1705	RES	0.47	0.01		10M	93	AIR	TUBE
VACSEAL SILICONE LEAK SEALER	GSFC0743	SEL	3.52	0.70		7D	25	AIR	SEALANT
VACSEAL SILICONE LEAK SEALER	GSFC0747	SEL	2.02	0.40		24H	65	AIR	SEALANT
VACSEAL SILICONE LEAK SEALER	GSFC0751	SEL	1.48	0.45		24H	100	AIR	SEALANT
VACSEAL VS-301-A SILICONE (RE-RUN OF GSC21633)	GSC21703	SEL	0.42	0.29	0.01	24H	60	AIR	SEALANT
						24H	125	E-7	
VACSEAL VS-301-A SILICONE LEAK SEALANT AEROLSOL/F	GSC21633	SEL	2.44	0.93	0.02	24H	60	AIR	SEALANT
VACSEAL VS-301-B SILICONE (RE-RUN OF GSC21635)	GSC21706	SEL	1.08	0.55	0.01	24H	60	AIR	SEALANT
						24H	125	E-7	
VACSEAL VS-301-B SILICONE LEAK SEALANT BRUSH COAT/F	GSC21635	SEL	4.32	2.17	0.05	24H	60	AIR	SEALANT
VALCOR 0 RING - RTV 75	GSFC0042	DCC	0.25	0.09					0 RING
VITON 4900 BLACK GENERAL PURPOSE 70 DURO	GSC19168	DUP	0.68	0.04	0.18				GASKET
VITON 4912 BLACK MIL R-83248 TYPE 2 CLASS 1 75 DURO	GSC19171	DUP	0.15	0.01	0.10				GASKET
VITON A	GSFC2071	DUP	0.21	0.02					SEAL
VITON A O RING NAS 1593-012	GSFC2434	DUP	0.21	0.02					O RING
VITON B	GSFC4382	AGI	0.89	0.00					GROMMET
VITON B DUPONT	GSFC1696	DUP	0.86	0.04					SEAL
VITON C HOSE	GSFC2422	DUP	0.30	0.03					TUBING
VITON IMPREGNATED DACRON DUPONT 84-001	GSFC2511	DUP	0.85	0.09					DAMPER
VITON V14 BLACK BATCH 64135 CARBON BLACK	GSC14362	FEM	0.17	0.01	0.11				SEAL
VITON V31 WHITE BATCH 50592 ZNO	GSC14364	FEM	0.46	0.05	0.16				SEAL
VITON V31 WHITE BATCH 50592 ZNO	GSC14366	FEM	0.22	0.01	0.15				SEAL
WASHER BROWN SPONGE RUBBER SILICONE AMS 3195	GSC11261	CHR	0.50	0.19	0.01				WASHER
WASHER POLYPHENYLENE SULFIDE 40% GLASS FILLED	GSC10362	THE	0.08	0.01	0.03				WASHER
XLN-647 A/B AS 1/1 PBW IVORY EPOXY	GSC19866	MEC	1.03	0.02	0.34	7D	25	AIR	SEALANT

Material Safety Data Sheet

VACSEAL® High Vacuum Leak Sealant (Liquid)

Last Revision Date
July 30, 2010

Section 1: Product / Company Identification

1.1	**Product name:**	**Vacseal High Vacuum Leak Sealant**
1.2	**Chemical Classification:**	**Silicone resin**
1.3	**Company Details:**	**Manufacturer / Supplier** **Vacseal INC.** **PO Box 1061** **Boulder, Colorado 80306** **USA**
	Telephone:	**303-443-4909**

Emergency phone numbers:
Contact CHEMTREC 24 Hour Emergency
Worldwide phone :(703)-527-3887
Toll-free phone :(800)-424-9300 USA only

Section 2: Composition / Information on Ingredients

2.1	**Chemical characterization:**	**Silicone Solution**
2.2	**Physical Form:**	**Liquid - Resin Solids 20% by weight**
2.3	**Color**	**Colorless to pale yellow**
2.4	**Use**	**Sealing Leaks in high and ultra high vacuum systems**

2.5 Hazardous Ingredients*:

Chemical Name	CAS No.	% (w/w)
Trichloroethylene	79-01-6	30-60
Xylene	1330-20-7	15-30
Ethylbenzene	100-41-4	5-<15

Section 3: Hazard Identification

3.1 Overall Hazard classification: Combustible
Irritant
Harmful

3.2 Hazard Information:

Health Rating: 2 – Moderate (Poison)
Flammability Rating: 1 – Slight
Reactivity Rating: 1 – Slight
Contact Rating: 3 – Severe
Lab Protective Equipment: Goggles & Shield, Lab Coat, Vent Hood, Proper Gloves.
Storage Color Code: Blue (Health)

3.3 Route of Exposure: Skin Contact and Accidental Ingestion

3.4 Possible Health Effects:

Acute

Eyes: Vapor may cause eye irritation. Direct contact may Cause sever irritation.

Skin: May Cause moderate irritation.

Inhalation: Vapor may irritate nose and throat. Overexposure by inhalation may cause drowsiness, dizziness, confusion or loss of coordination.

Chronic

Skin: Overexposure may injure internally if absorbed. Prolonged exposure may irritate seriously.

Inhalation: Overexposure by inhalation may injure the following organs: Blood; Lungs, Liver, Kidneys, Nervous System.

Ingestion: Repeated ingestion or swallowing large amounts may injure internally.

3.5 Signs and symptoms of Overexposure: Vapor exposure may cause drowsiness and irritate throat. Overexposure may cause dizziness, confusion or loss of coordination.

Section 4: First Aid Measures

4.1 Eyes: Flush with water 15 minutes Get medical attention.

4.2 Skin: Wipe off and wash thoroughly with soap and water or waterless cleanser. Get medical attention if irritation develops or persists.

4.3 Inhalation: Remove to fresh air. Get medical attention if ill effects develop or persist.

4.4 Ingestion: Get medical attention immediately. Do not induce vomiting.

Section 5: Fire Fighting Measures

5.1 **Flammability:** Not Flammable in air at temperatures up to 100 degrees centigrade, however, can become combustible with elevated temperature and / or pressure in the presence of an ignition source.

5.2	**Flash Point**	Not Determined
5.3	**Autoignition Temperature**	Not Determined
5.4	**Lower Flammability Limit**	Not Determined
5.5	**Upper Flammability Limit**	Not Determined

5.6 Hazardous Properties: Exposure to strong oxidizing agents can cause fire or explosion. Reacts violently with oxidizing agents can cause file when in contact with open flame or excessive heat. Irritates eyes, mucous membranes or skin, and may cause burning. Narcotic, or its vapor is narcotic. Toxic, or its vapor is toxic

5.7 Extinguishing Media:
Dry Chemical, water fog, foam, carbon dioxide, water.

5.8 Special Firefighting Procedure:
Wear self-contained breathing apparatus due to thermal decomposition of products. Protective clothing should be worn.

5.9 Hazardous Combustion Products:
Carbon oxides and traces of incompletely burned carbon compounds. Silicon dioxide. Metal oxides. Formaldehyde

5.10 Unsuitable Extinguishing Media: None established

Section 6: Accidental Release Measures

6.1 Personal Precautions:
Avoid Skin and eye contact; avoid breathing vapor, mist, dust or fumes keep container closed. Do not take internally

6.2 Environmental Precautions:
Prevent from spreading or entering into drains, ditches of rivers by using sand earth or other appropriate barriers

6.3 Spill Response:
Remove all sources of ignition and wear protective Equipment. Use absorbent material to collect and contain for salvage or disposal. Use chemical worker goggles and gloves. Use respiratory protection unless exhaust ventilation is adequate or air sample data exposures are within TLV and PEL guidelines. Remove contaminated clothing and shoes as soon as practical and clean before reuse.

Section 7: Handling and Storage

7.1 Handling Precautions:

Use with adequate ventilation. Traces of benzene (carcinogen) may form if heated in air above 149 degrees centigrade. Provide ventilation to control vapor exposure within inhalation guidelines when handling at elevated temperatures. Avoid skin and eye contact. Avoid breathing vapor. Exercise good industrial hygiene practice. Wash after handling, especially before eating, drinking or smoking.

7.2 Storage Conditions:

Keep container closed and away form heat. Do not store near flame or other source of ignition.

Section 8: Exposure Controls / Personal Protection

8.1 Industrial Hygiene Standards:

Ingredients	CAS No.	Exposure Limits
Trichloroethlene	79-01-6	OSHA PEL 100 ppm (TWA) ACGIH TLV 50 ppm (TWA) 100 ppm (STEL)
Xylene	1330-20-7	OSHA PEL 100 ppm (TWA) ACGIH TLV 100 ppm (TWA) 150 ppm (STEL)
Ethylbenzene	100-41-4	OSHA PEL 100 ppm (TWA) ACGIH TLV 100 ppm (TWA) 125 ppm (STEL)

8.2 Engineering Controls:

Local ventilation – recommended
General Ventilation - recommended

8.3 Personal Protective Equipment:

Respiratory:

Use appropriate respiratory (organic Vapor/Dust/Mist) protection unless adequate local exhaust ventilation is provided or air sampling data show exposure is within exposure guidelines.

Eye: Use Chemical worker's goggles.

Skin: Use protective clothing Chemical gloves and long sleeves.

Hygiene Measures:

Wash at mealtime and end of shift. Contaminated clothing and shoes should be removed as soon as practical and thoroughly cleaned before reuse.

Section 9: Physical and Chemical Properties

9.1	**Physical Form**	Liquid
9.2	**Color**	Colorless to pale yellow
9.3	**Odor**	Solvent Odor
9.4	**pH**	Not determined
9.5	**Solubility in water**	Not determined
9.6	**Boiling point**	> 100 degrees centigrade
9.7	**Melting point**	Not determined
9.8	**Flash Point**	Not determined
9.9	**Autoignition temp**	Not determined
9.10	**Explosive properties**	No
9.11	**Oxidizing properties**	No
9.12	**Vapor Pressure @ 25 C**	Not determined
9.13	**Specific Gravity**	1.010
9.14	**Octanol/water partition coefficient**	Not determined
9.15	**Vapor Density (air=1)**	Not determined
9.16	**Viscosity**	105 cSt
9.17	**Molecular Weight**	Not determined

Section 10: Stability and Reactivity

10.1 Stability: **Stable**

10.2 Reactivity:

Conditions to avoid:	None
Materials to Avoid:	Oxidizing material can cause a reaction.
Hazardous Decomposition:	Carbon oxides and traces of incompletely burned carbon compounds
Hazardous Polymerization:	Does not occur.
Products:	Silicone dioxide. Metal oxides Formaldehyde

Section 11: Toxicological Information

11.1	**Possible health effects**	**Refer to section 3.4**
11.2	**Sensitizing Effects**	None Known
11.3	**Mutagenic Effects**	None Known
11.4	**Reproductive Effects**	None Known
11.5	**Carcinogenic Effects**	None Known
11.6	**Other Health Hazard**	No Known applicable information

Section 12: Ecological Information

12.1 Environmental Fate and Distribution

Organic solvents may evaporate into the atmosphere, where they degrade. Siloxanes are removed from water by sedimentation or binding to sewage sludge. In soil siloxanes are degraded.

12.2 Environmental Effects:

No adverse effects on aquatic organisms are predicted
Bioaccmulation: Potential to bioaccumulate

12.3 Fate and effects in Waste Water Treatment Plants:

No adverse effects on bacterial are predicted. The siloxanes in this product do not contribute to the BOD. The organic solvents in the product are poorly biodegradable.

Section 13: Disposal Considerations

13.1 Product Disposal: Dispose of in accordance with regulations.
13.2 Package Disposal: Dispose of in accordance with regulations.

Section 14: Transport Information

14.1 Proper Shipping Name:	Silicone resin solution
14.2 DOT Hazard Class:	Non-Regulated
14.3 UN/NA ID:	Not Regulated
14.4 Packing Group:	Not Applicable
14.5 Labels:	Not Regulated
14.6 NAER Guidebook:	Not Regulated
14.7 DOT Status:	Not Regulated

Section 15: Regulatory Information

15.1 Chemical Inventories:

TSCA: All chemical substances in this material are included on or exempted from listing on the TSCA inventory.

15.2 TCSA 12 (b): no

15.3 SARA: 311/312 Acute: yes, Chronic: yes, Fire: no, Pressure: no, Reactivity: no

15.4 California Prop. 65:

This product contains an ingredient known by the State of California to cause cancer or reproductive damage -
79-01-6 Trichloroethylene 100 ppm 50 ppm STEL 100 ppm.

Section 16: Other Information

This information is offered in good faith as typical values and not as a product specification. No warranties express or implied is here by made.
The recommended industrial hygiene and safe handling procedures are believed to be generally acceptable. However, each user should review these recommendations in the specific context of the intended use and determine whether they are appropriate.
****

Material Safety Data Sheet

VACSEAL® High Vacuum Leak Sealant (Aerosol)

Last Revision Date
July 30, 2010

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5.5	**Upper Flammability Limit**	Not Determined

5.6 Hazardous Properties: Cylinders may rupture, explode or become a projectile under fire conditions.
Exposure to strong oxidizing agents can cause fire or explosion. Reacts violently with oxidizing agents can cause fire when in contact with open flame or excessive heat. Irritates eyes, mucous membranes or skin, and may cause burning. Narcotic, or its vapor is narcotic. Toxic, or its vapor is toxic.

5.7 Extinguishing Media:
Dry Chemical, water fog, foam, carbon dioxide, water.

5.8 Special Firefighting Procedure:
Wear self-contained breathing apparatus due to thermal decomposition of products. Protective clothing should be worn.

5.9 Hazardous Combustion Products:
Carbon oxides and traces of incompletely burned carbon compounds. Silicon dioxide. Metal oxides. Formaldehyde

5.10 Unsuitable Extinguishing Media: None established

Section 6: Accidental Release Measures

6.1 Personal Precautions:
Avoid Skin and eye contact; avoid breathing vapor, mist, dust or fumes keep container closed. Do not take internally

6.2 Environmental Precautions:
Prevent from spreading or entering into drains, ditches of rivers by using sand earth or other appropriate barriers

6.3 Spill Response:
Remove all sources of ignition and wear protective Equipment. Use absorbent material to collect and contain for salvage or disposal. Use chemical worker goggles and gloves. Use respiratory protection unless exhaust ventilation is adequate or air sample data exposures are within TLV and PEL guidelines. Remove contaminated clothing and shoes as soon as practical and clean before reuse.

Section 7: Handling and Storage

7.1 Handling Precautions:

Use with adequate ventilation. Traces of benzene (carcinogen) may form if heated in air above 149 degrees centigrade. Provide ventilation to control vapor exposure within inhalation guidelines when handling at elevated temperatures. Avoid skin and eye contact. Avoid breathing vapor. Exercise good industrial hygiene practice. Wash after handling, especially before eating, drinking or smoking.

7.2 Storage Conditions:

Keep container closed and away form heat. Do not store near flame or other source of ignition.

Section 8: Exposure Controls / Personal Protection

8.1 Industrial Hygiene Standards:

Ingredients	CAS No.	Exposure Limits
Trichloroethlene	79-01-6	OSHA PEL 100 ppm 8 Hr (TWA) ACGIH TLV 50 ppm 8 Hr (TWA) 100 ppm (STEL)
Dichloromethane	75-09-2	OSHA PEL 25 ppm 8 Hr (TWA) ACGIH TLV 50 ppm 8 Hr (TWA) 125 ppm (STEL)
Xylene	1330-20-7	OSHA PEL 100 ppm 8 Hr (TWA) ACGIH TLV 100 ppm 8 Hr (TWA) 150 ppm (STEL)
Ethylbenzene	100-41-4	OSHA PEL 100 ppm 8 Hr (TWA) ACGIH TLV 100 ppm 8 Hr (TWA) 125 ppm (STEL)

8.2 Engineering Controls:

Local ventilation – recommended
General Ventilation - recommended

8.3 Personal Protective Equipment:

Respiratory:

Use appropriate respiratory (organic Vapor/Dust/Mist) protection unless adequate local exhaust ventilation is provided or air sampling data show exposure is within exposure guidelines.

Eye: Use Chemical worker's goggles.
Skin: Use protective clothing Chemical gloves and long sleeves.
Hygiene Measures:

Wash at mealtime and end of shift. Contaminated clothing and shoes should be removed as soon as practical and thoroughly cleaned before reuse.

Section 9: Physical and Chemical Properties

9.1	**Physical Form**	Liquid
9.2	**Color**	Colorless to pale yellow
9.3	**Odor**	Solvent Odor
9.4	**pH**	Not determined
9.5	**Solubility in water**	Not determined
9.6	**Boiling point**	> 100 degrees centigrade
9.7	**Melting point**	Not determined
9.8	**Flash Point**	Not determined
9.9	**Autoignition temp**	Not determined
9.10	**Explosive properties**	No
9.11	**Oxidizing properties**	No
9.12	**Vapor Pressure @ 25 C**	Not determined
9.13	**Specific Gravity**	1.010
9.14	**Octanol/water partition coefficient**	Not determined
9.15	**Vapor Density (air=1)**	Not determined
9.16	**Viscosity**	105 cSt
9.17	**Molecular Weight**	Not determined

Section 10: Stability and Reactivity

10.1 Stability: **Stable**

10.2 Reactivity:

Conditions to avoid:	None
Materials to Avoid:	Oxidizing material can cause a reaction.
Hazardous Decomposition:	Carbon oxides and traces of incompletely burned carbon compounds
Hazardous Polymerization:	Does not occur.
Products:	Silicone dioxide. Metal oxides Formaldehyde

Section 11: Toxicological Information

11.1	**Possible health effects**	**Refer to section 3.4**
11.2	**Sensitizing Effects**	None Known
11.3	**Mutagenic Effects**	None Known
11.4	**Reproductive Effects**	None Known
11.5	**Carcinogenic Effects**	None Known
11.6	**Other Health Hazard**	No Known applicable information

Section 12: Ecological Information

12.1 Environmental Fate and Distribution

Organic solvents may evaporate into the atmosphere, where they degrade. Siloxanes are removed from water by sedimentation or binding to sewage sludge. In soil siloxanes are degraded.

12.2 Environmental Effects:

No adverse effects on aquatic organisms are predicted
Bioaccmulation: Potential to bioaccumulate

12.3 Fate and effects in Waste Water Treatment Plants:

No adverse effects on bacterial are predicted. The siloxanes in this product do not contribute to the BOD. The organic solvents in the product are poorly biodegradable.

Section 13: Disposal Considerations

13.1 Product Disposal: Dispose of in accordance with regulations.
13.2 Package Disposal: Dispose of in accordance with regulations.

Section 14: Transport Information

14.1 Proper Shipping Name:	Silicone resin solution
14.2 DOT Hazard Class:	Non-Regulated
14.3 UN/NA ID:	Not Regulated
14.4 Packing Group:	Not Applicable
14.5 Labels:	Not Regulated
14.6 NAER Guidebook:	Not Regulated
14.7 DOT Status:	Not Regulated

Section 15: Regulatory Information

15.1 Chemical Inventories:

TSCA: All chemical substances in this material are included on or exempted from listing on the TSCA inventory.

15.2 TCSA 12 (b): no

15.3 SARA: 311/312 Acute: yes, Chronic: yes, Fire: no, Pressure: no, Reactivity: no

15.4 California Prop. 65:

This product contains an ingredient known by the State of California to cause cancer or reproductive damage -
79-01-6 Trichloroethylene 100 ppm 50 ppm STEL 100 ppm.

Section 16: Other Information

This information is offered in good faith as typical values and not as a product specification. No warranties express or implied is here by made.
The recommended industrial hygiene and safe handling procedures are believed to be generally acceptable. However, each user should review these recommendations in the specific context of the intended use and determine whether they are appropriate.
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