CRAFCO INC
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Evaluation of Silicone Sealant Resistance to Airfield Fluids

Purpose and Background:

Silicone sealants are used to seal and protect the joints in Portland Cement Concrete (PCC) pavements. Silicone sealants have been used in airfield PCC pavement joints since the 1980s and today represent the most widely used joint sealants at airfields. Factors to consider for successful airfield application include: resistance to ultraviolet light, wide temperature flexibility, cyclic movement capability, jet blast resistant and fuel/oil resistance.

There are a number of fuel/oil fluids used at airfields that are not used on highway PCC pavements. While the fluids, particularly jet fuel, cause the sealant to swell, the swelling is temporary. The spills are normally cleaned up quickly and/or the fluids are volatile and dissipate quickly. According to the Federal Aviation Administration (FAA), "silicone sealant is not degraded by contact with jet fuel. Some swelling of the materials will normally occur but it will return to its original shape, upon evaporation of the fuel without loss of bond."[1,4]

The Crafco RoadSaver Silicone Sealants conform to the specifications for low modulus silicone for many highway departments, federal agencies and the FAA. This product also meets and exceeds all requirements of ASTM D5893 "Standard Specification for Cold-Applied Single Component, Chemically Curing Silicone Sealant for Portland Cement Concrete Pavements."

Crafco RoadSaver Silicone sealants reported on here were subjected to contact with a variety of fluids found in airfields and tests that represent airfield conditions. According to the FAA, "the sealant's strength characteristics are less important than its ability to withstand joint movement and maintain adhesion".[4] Therefore the tests within ASTM C719 were used because they are thought to be an accurate depiction of actual expansion and contraction of PCC joints under airfield conditions.

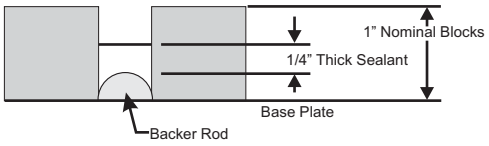
Sample and Test Fluid Descriptions:

Sealants –
- ☐ Crafco RoadSaver Non-Sag Silicone Sealant, Part Number 34902
- ☐ Crafco RoadSaver Self-Leveling Silicone Sealant, Part Number 34903

Test Fluids –
- ☐ Jet Fuel A (Jet A)
- ☐ Skydrol 500B-4 Hydraulic Fluid
- ☐ 50% Glycol / 50% H2O
- ☐ Hydraulic Fluid

Test Specimens –
- ☐ Crafco Concrete Test Blocks: 1″ x 1″ x 3″ (2.5 cm x 2.5 cm x 7.6 cm)
- ☐ Specimen Construction with Backer Rod (See Figures 1 and 2).
  - Sealant cured 21 days at 77°F/50% Relative Humidity.
- ☐ Specimen Preparation:
  - ½″ (1.3 cm) Teflon spacers sealed to ends of sealant and backer rod using Permatex Form-A-Gasket Sealant. (See Figure 3)
  - Forma-A-Gasket allowed to dry 2 days before start of fluid test.

Figure 1 - Jet Fuel Resistance Test Specimen Configuration



Note: Backer Rod ½"DIA., Rod Cut to Fit ½"Gap

Figure 2 - RoadSaver Silicone Non-Sag Test Specimen

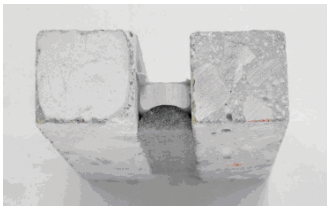
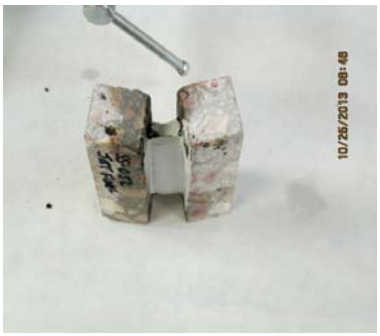


Figure 3 - RoadSaver Silicone Non-Sag Test Specimen - During Fluid Test

Figure 4 -
RoadSaver Silicone Non-Sag Test Specimen - After Fluid Test



Procedure:

The sealant is placed in the Test Specimen Configuration (Figure 1). After the specimen has cured for 21 days, the thickness of the sealant was measured at the center. The recess in each test specimen was filled with a test fluid to a height level with the top of the test blocks. Test fluid levels remained close to the top of the test blocks during the course of the exposure and did not need to be replenished. The test specimens were inspected every 15-20 minutes for a total of 2 hours of exposure. The test fluids were then drained. The Form-A-Gasket/Teflon seals and backer rods were removed. The thickness of the sealant was measured again. The sealant specimens were blotted dry and stood on end in ambient lab conditions for three days after which they were subjected to 10 cycles of - 50%/+100% compression/extension as described in ASTM C719.

Kerosene-based fuel, like Jet A, was selected as a test fluid because it represents the most common type of fuel used commercially within the US and rest of the world. Kerosene fuels include Jet A, Jet A-1, JP-5 and JP-8.

Results and Observations:

The Crafco RoadSaver Silicone sealants were subjected to a variety of fluids found in airfields. Visual inspections of the test specimens during the course of the fluid exposure did not indicate sealant swelling. When measured, the sealants did swell, as shown by the thickness measurement data in Table 1. All test specimens returned to the original dimensions after air drying (Table 2). No adhesion, cohesion or bonding loss was observed in any of the test specimens after the 10 compression/extension cycles.

After reviewing the factors for successful airfield application of silicone sealants, Crafco RoadSaver Silicone sealants are effective treatments to seal and protect Portland Cement Concrete joints at airfields

- ✓ Resistant to ultraviolet light
- ✓ Wide temperature flexibility
- ✓ Cycle movement capability
- ✓ Jet blast resistant
- ✓ Fuel/oil resistance

Crafco RoadSaver Silicone has been used at airfields for decades. A study was completed in 2013 that evaluated thirteen different sealants at Fairchild Air Force Base. Crafco RoadSaver Silicone Self-Leveling was the only silicone sealant within the test group that achieved more than 21 years of service life (Table 3).[5]

Table 1: Specimen Thickness Change After Fluid Exposure

Fluid	RoadSaver Silicone Non-Sag	RoadSaver Silicone Self-Leveling
Jet Fuel A	+8%	+12%
Skydrol 500B-4	+4%	+2%
Hydraulic Fluid	+2%	+2%
50% Glycol/50% H2O	<+1%	+1%

Table 2: Specimen Thickness Change From Original After Drying

Fluid	RoadSaver Silicone Non-Sag	RoadSaver Silicone Self-Leveling
Jet Fuel A	NONE	NONE
Skydrol 500	NONE	NONE
Hydraulic Fluid	NONE	NONE
50% Glycol/50% H2O	NONE	NONE

Table 3: Silicone Sealant Failure By Years Of Service Life At Fairchild Air Force Base[5,6]

	Average Total Failure By Years Of Service Life		
Product	5 Years	10 Years	21 Years
Crafco RoadSaver Silicone SL	1%	16%	18%
Competitor A	2%	14%	31% *
Competitor B	1%	28% *	35% *
Competitor C	1%	20%	
Competitor D	10%	23%	
Competitor E	8%	35% *	
Competitor F	22%	53% *	

Based on LTPP Pavement Maintenance (FHWA-RD-99-143) the service life is the time required for 25% of joint length to develop failure, these materials were in the range for replacement.

References:

1. Engineering Technical Letter 02-8: "Silicone Joint Sealant Specification for Airfield Pavements." HQ AFCESA/CESC, Tyndall AFB, FL, September 5, 2002.
2. ASTM D5893 "Standard Specification for Cold-Applied Single
3. ASTM C719, "Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)."
4. Federal Aviation Administration, Engineering Brief #36, Silicone Joint Sealants, 1986.
5. Lynch, Larry N., Chehovits, James G., Luders, David G., and Belangie, Michael. "Twenty One Year Field Performance of Joint Resealing Project at Fairchild AFB." Transportation Research Record: Journal of the Transportation Research Board, Volume 2361, 2013.
6. Lynch, Larry N., Chehovits, James G., and Luders, David G. "Ten-Year Field Performance Evaluation of Joint Resealing Project." Transportation Research Record: Journal of the Transportation Research Board, Volume 1795, 2002.

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