THERM-A-FORM™ CIP35 Test Report

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Executive Summary

THERM-A-FORM™ CIP35 is a highly reliable, 2-component, cure-in-place, dispensable 3.5 W/m-K thermally conductive material.

This document outlines the examination of the thermal reliability of this silicone-based gap filler after being subjected to long-term environmental aging.

The thermal performance of THERM-A-FORM™ CIP35 was examined after being subjected to multiple environmental stress tests. The thermal impedance of the aged samples did not experience a significant increase after any of the treatments studied.

1.0 Introduction

The purpose of the document is to explain the mechanical and environmental tests and the corresponding measurements that were performed on samples of thermally conductive gap filler THERM-A-FORM CIP35.

The samples were tested for thermal impedance and compression as a factor of pressure. The measurements were taken initially and after environmental stressing.

It is worth noting that the exact impedance value of the reliability fixture is not representative of the impedance value of the thermal interface material itself, but it can be used to measure changes to thermal performance over time.

2.0 Test Procedure

2.1. Sample Preparation

THERM-A-FORM CIP35 samples were prepared by dispensing from 300cc cartridges.

For the compression/deflection testing, the dispensed compounds were thickness controlled to be 0.250" with a drawbar, cut to 0.5" diameter discs, and cured at 150°C for 30 minutes before aging.

For the thermal impedance testing, the dispensed compounds were thickness controlled to 0.100" with a drawbar, cut to 1.3" diameter discs, and cured at 150°C for 30 minutes before aging.

2.2. Thermal Impedance Testing

Three samples were tested at 50°C and 20 PSI (0.138 MPa) at each aging condition, per ASTM D5470.

2.3. Compression Deflection Testing

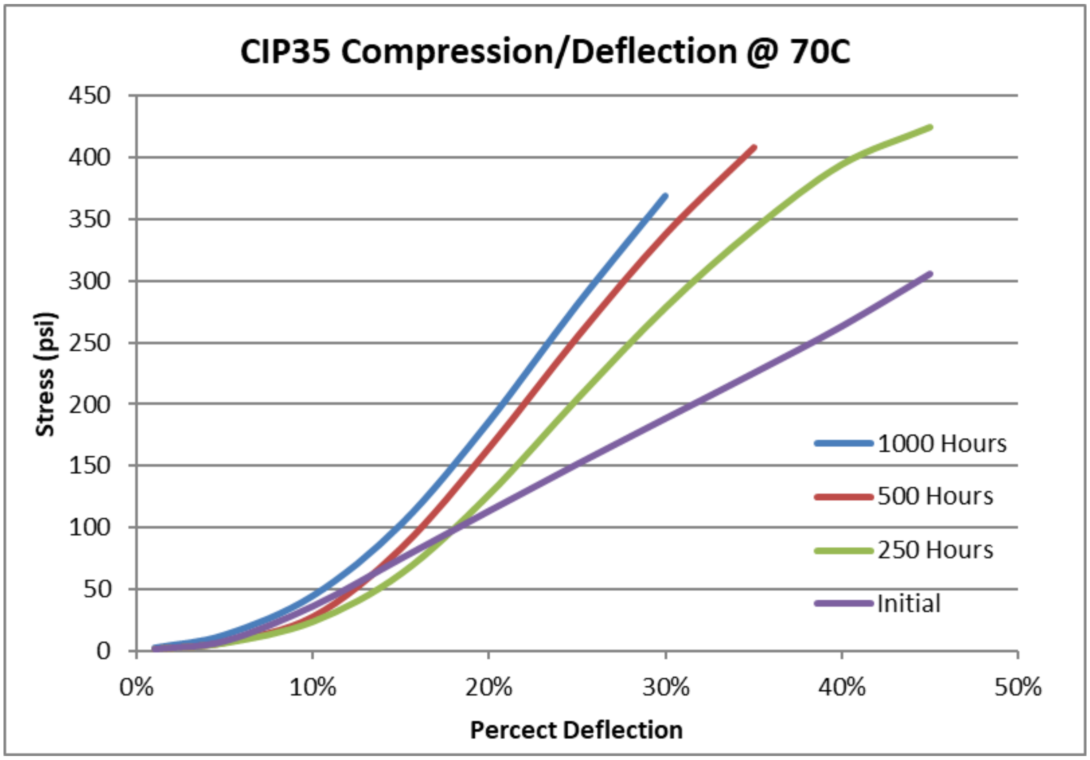
Samples were tested in a laboratory environment on a Texture Analyzer per ASTM C165. Three samples were tested at each aging condition. Samples were tested at 0.025 inches/min (0.01 mm/sec) up to 80% deflection or 50kg - the limit of the load cell.

2.4. NASA Outgassing

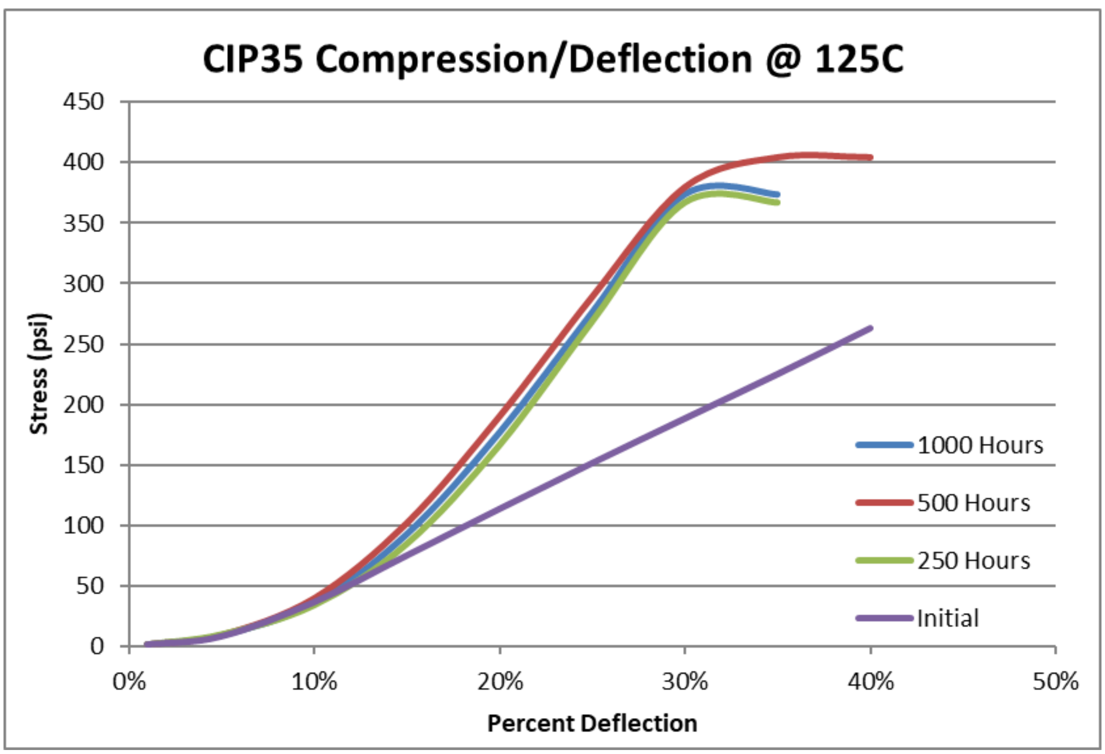
Samples were sent to an independent outside laboratory and tested for volatility analysis per ASTM E595.

3.0 Results

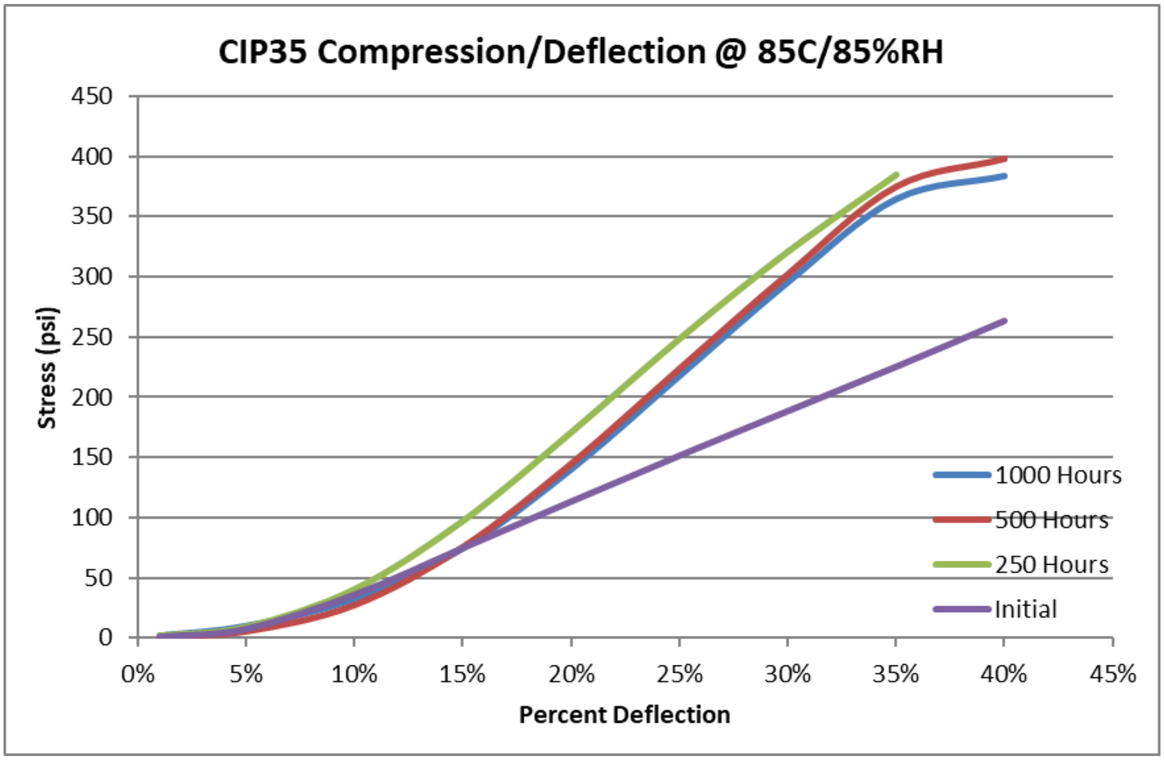
3.1. Compression Deflection After Aging at 70°C: 250 mil thickness



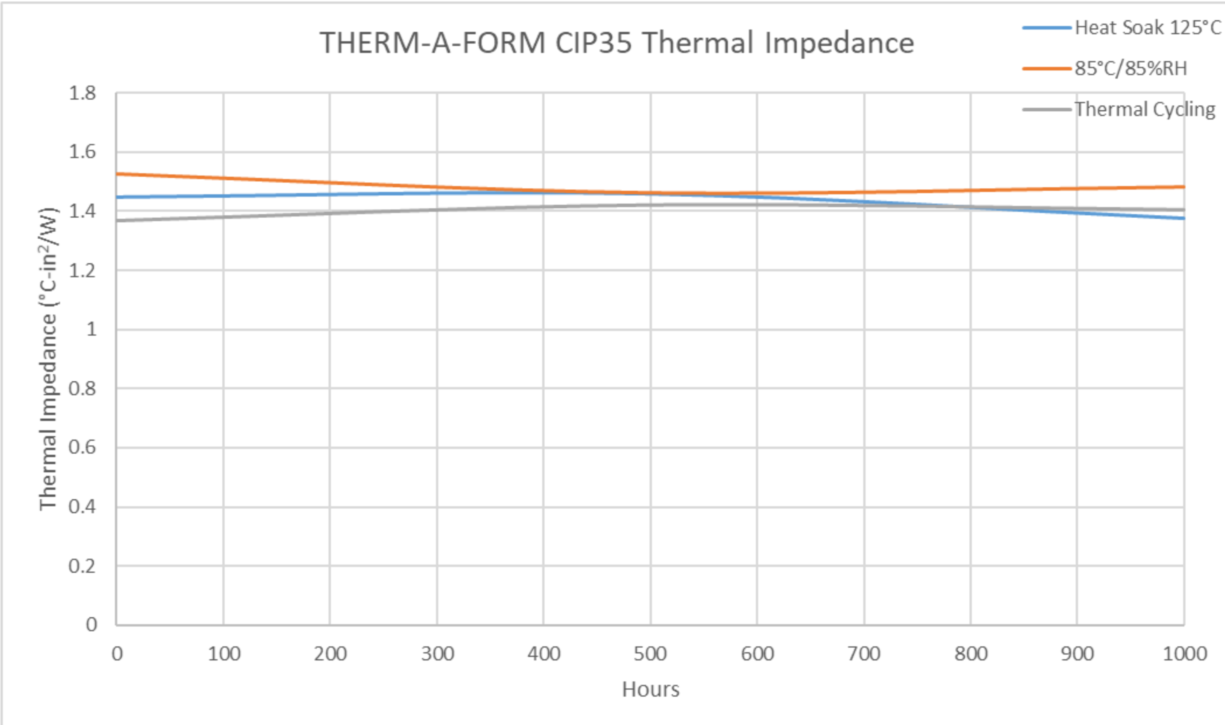
3.2. Compression Deflection After Aging at 125°C: 250 mil thickness



3.3. Compression Deflection After Aging at 85°C/85%RH: 250 mil thickness



3.4. Thermal Impedance After Aging: 100 mil thickness



Environment	Initial TI (°C-in^2/W)	500 Hours TI (°C-in^2/W)	% Change from Initial	1000 Hours TI (°C-in^2/W)	% Change from Initial
Heat Soak 125°C	1.45	1.46	1%	1.38	-5%
85°C/85%RH	1.53	1.46	-4%	1.48	-3%
Thermal Cycling	1.37	1.42	4%	1.41	3%

3.5. NASA Outgassing

The National Aeronautics & Space Administration (NASA) criteria for low-volatility materials limits the total mass loss (TML) to 1.0% and collected volatile condensable material (CVCM) to 0.10%.

Outgassing Results	
% Total mass loss	0.22
% CVCM	0.06

4.0 Conclusion

To summarize the above results, THERM-A-FORM™ CIP35 is highly reliable after long-term aging in multiple environments.

The mean impedance values after heat soak and heat and humidity aging saw a decrease of 5% and 3%, respectively - indicating an improvement in thermal performance. For thermal cycling aging, there was a minor increase of 3%.

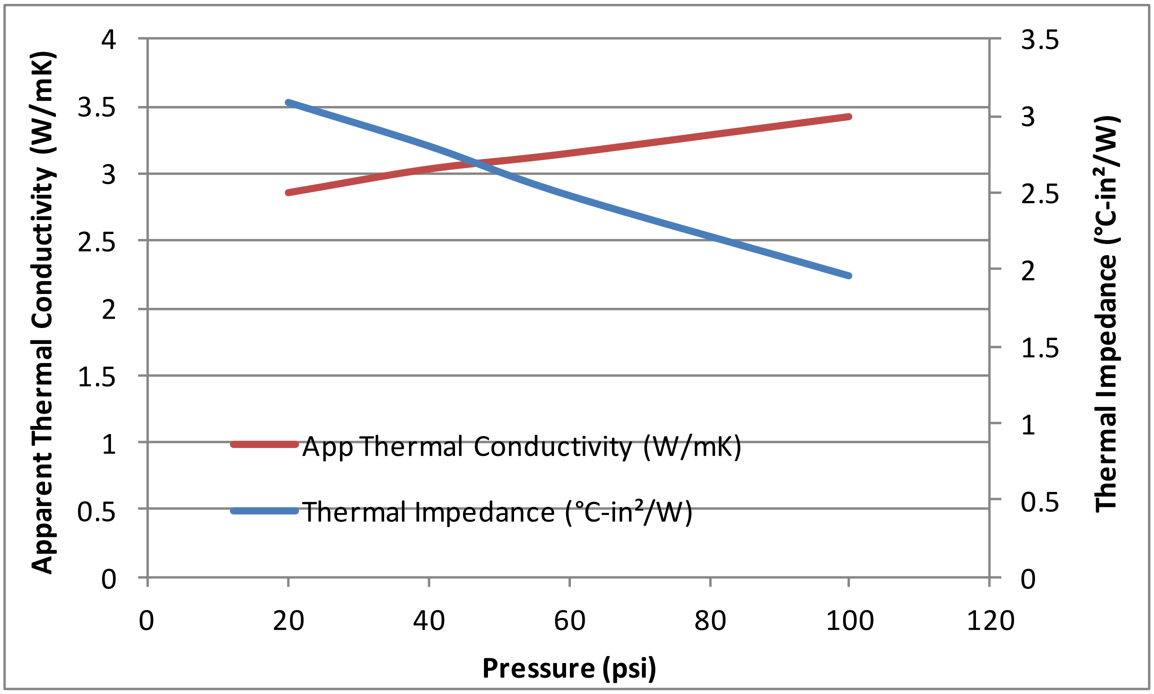
The compression/deflection curves saw minimal increases, within the recommended compression range, after experiencing heat soak, heat and humidity, and thermal cycling aging.

In addition, CIP35's outgassing results of 0.22% and 0.06% for TML and CVCM, respectively, pass the NASA outgassing criteria for low-volatility materials.

The results of this study provide evidence that CIP35 maintains reliability after long-term aging.

Appendix: Thermal Properties vs. Pressure

250 mil CIP-250



20 mil CIP-250