FOAM CONTROL IN LOW TEMPERATURE EV COOLANTS

Low Temperature Defoamer for Coolant Systems Case Study

Introduction

As electric vehicle (EV) adoption continues to accelerate, coolant system requirements are evolving alongside engine technology. Traditional defoamers were developed for combustion engines and are typically evaluated under high temperature conditions, most commonly at 88 °C using ASTM 1881 test methods. However, EV engines operate at significantly lower temperatures, often closer to ambient conditions, creating new performance expectations for foam control additives.

Many defoamers designed for combustion engines struggle to perform consistently at these lower temperatures, leading to excessive foaming, slower foam collapse, and unreliable system performance. As a result, there is a growing market need for defoamers that deliver effective foam control across a broader temperature range while maintaining stability and clarity in coolant media.

Hydrite evaluated two experimental defoamer technologies engineered to perform reliably in both EV and traditional combustion engine coolant systems, offering a single solution capable of meeting the demands of today's changing automotive landscape.

Challenge

Developing a defoamer suitable for EV coolant systems presented several technical challenges:

- **Testing constraints:** Performance evaluation needed to align with ASTM 1881, a method traditionally optimized for high temperature combustion engine applications.
- **Low temperature performance:** Unlike combustion engines, EV systems require effective foam control at approximately 25 °C, where many conventional defoamers underperform.
- **Wide temperature range:** Achieving consistent defoaming performance across both low and high temperatures introduces formulation and stability challenges.
- **Coolant compatibility:** Defoamers must not discolor coolant media or create haze, which could negatively impact system appearance and perceived quality.

These challenges required a solution that could balance performance, stability, and aesthetics across diverse operating conditions.

Results

Bench trials were conducted using ASTM 1881 at both standard high temperature (88 °C) and low temperature (25 °C) conditions. All defoamers were dosed at 0.02% in a 33% coolant media and evaluated based on foam height at 300 seconds and foam collapse time. Two experimental defoamer samples were compared against a blank and Patcote® 492, a product designed for traditional combustion engines.

Coolant Media Sample 1

		Blank	Patcote 492	Patcote 480	Sample Trial 2
88 °C	Foam at 300 sec (mL)	40	30	15	15
	Foam Drop (sec)	4	4	0.2	0.2
25 °C	Initial Foam at 300 sec (mL)	185	320	35	20
	Initial Foam Drop (sec)	26	72	2	1

Coolant Media Sample 2

		Blank	Patcote 492	Patcote 480	Sample Trial 2
88 °C	Foam at 300 sec (mL)	270	253	20	65
	Foam Drop (sec)	11	9	0.6	3
25 °C	Initial Foam at 300 sec (mL)	345	155	78	145
	Initial Foam Drop (sec)	34	12	7	13

Across both coolant media samples, **Patcote® 480 and Sample Trial 2 consistently demonstrated improved foam control compared to the traditional combustion engine defoamer,** particularly at lower temperatures. The experimental samples produced significantly lower foam volumes at 25 °C and achieved faster foam collapse times, without sacrificing high temperature effectiveness.

Value Created

Hydrite's experimental defoamer technologies deliver effective foam control at both low and high temperatures, offering a versatile solution for modern coolant formulations.

By providing consistent performance across a wide temperature range and maintaining coolant clarity, these defoamers address a key challenge facing the evolving automotive market, supporting current needs while preparing for future engine technologies.

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