



Cosmetic wand-package testing under temperature and altitude stress

ARE Labs evaluated an anonymized cosmetic serum wand package in two separate experiments: a climate-storage study of 210 units spanning 226 hours and a simulated-altitude study of 54 units. Elevated temperature produced the main package-function findings. At 60 °C, all 42 evaluated units had bent wands and wipers that were displaced or stuck during opening. The altitude report recorded no observed exterior or thread leakage, but an inconsistency in the internal-visual record limits a broader pass claim.

Study purpose and design

The work separated temperature-related formulation and applicator behavior from leakage risk under reduced pressure for three anonymized package variants.

Climate storage used 14 units per variant at each of -30, 5, 23, 40, and 60 °C in a study spanning 226 hours, with immediate and 4-hour room-temperature observations at seven timepoints. Altitude exposure used six units per variant at each of 18,000, 26,000, and 40,000 ft simulated elevation, split equally between immediate and 4-hour observations after a 15-minute dwell.

Equipment used in this study

Equipment	Role in the measurement
Five controlled-temperature environments	Maintained climate conditions at -30, 5, 23, 40, and 60 °C
Sealed vacuum chamber and rotary-vane pump	Produced the three reduced-pressure altitude conditions
Calibrated analytical balance	Measured unit mass before and after exposure

Methods in brief

Climate allocation. The climate experiment included 210 units, with 70 assigned to each variant. At each temperature, 14 units per variant were observed at seven timepoints. At every timepoint, one unit was evaluated immediately and one after four hours at room temperature.

Package observations. Units were weighed and inspected for exterior or thread residue, internal appearance, cap and wand behavior, brush appearance, accumulation, crystallization, and wiper seating. Evaluators applied a deliberately strict threshold to the accumulation scale.

Altitude allocation. The altitude experiment included 54 units. At each elevation, six units per variant were exposed close to horizontal. Three were inspected immediately, and three were inspected after four hours at room temperature and pressure.



Selected results from two separate experiments

Maximum climate-study losses are listed by anonymized variant. The altitude rows show the mean change and sample standard deviation for the six units in each variant/elevation combination.

Experiment / condition (total units)	Variant A	Variant B	Variant C
Climate: -30 and 5 °C (42 at each)	0 mg max	0 mg max	0 mg max
Climate: 23 °C (42)	15 mg max	15 mg max	15 mg max
Climate: 40 °C (42)	93 mg max; 46 mg excluding anomalous unit	52 mg max	51 mg max
Climate: 60 °C (42)	88 mg max	95 mg max	90 mg max
Altitude: 18,000 ft (18)	0.167 ± 0.408 mg	0.667 ± 0.816 mg	0.500 ± 0.548 mg
Altitude: 26,000 ft (18)	0.333 ± 0.516 mg	0.333 ± 0.516 mg	0.667 ± 0.516 mg
Altitude: 40,000 ft (18)	0.833 ± 0.753 mg	0.500 ± 0.548 mg	0.833 ± 0.753 mg

At 60 °C, all 42 evaluated units had bent wands and wipers that were displaced or stuck during opening. The narrative reports a 1.5-5.5° bend range; displayed individual values span 1.8-5.5°.

Three abnormalities existed before climate exposure. The 40 °C unit later photographed with dried or crystallized thread residue already had exterior/thread residue before testing; the image does not establish a new storage-caused leak. The cause of elevated-temperature mass loss was not determined.

The altitude report recorded no observed exterior or cap-thread leakage. Individual sheets mark a bottom viewing window as cloudy while the summary reports a moving or visible bubble, so the conclusion is limited to the supported leakage and inspection outcomes.

What the two experiments show

For this anonymized product-package configuration, elevated temperature produced a stronger package-function signal than the reduced-pressure exposures tested. The immediate and four-hour observations also separated temporary freezing after -30 °C removal from recovery after a room-temperature hold.

Interpretation limits

Results apply to the tested variants, units, conditions, and observations. They do not establish a universal threshold, determine the cause of mass loss, or resolve the disclosed source-record differences. Identifying details and labeled photographs are omitted. This two-page summary does not replace either of the two detailed source reports.

Scope an environmental package study

Before agreeing to the protocol, define the product-package system, temperature or pressure conditions, unit allocation, recovery timing, inspection criteria, and the decisions the evidence must support.

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