



Home Innovation
RESEARCH LABS™

Reproducibility and Repeatability Study – ASTM B117-18

January 16, 2020

Scope

This paper describes the quality assurance (QA) measures that are used to commission and operate the ASTM B117 Salt Fog Chamber at Home Innovation Research Labs (HI). The QA measures are based on conformity to the Standard's operating conditions and protocol for evaluation of corrosive conditions.

Background

ASTM B117 Standard Practice for Operating Salt Spray (Fog) is an American Society for Testing and Materials standard that is used to establish the normal operating parameters of a salt fog apparatus and to provide a means for standardization and comparison between laboratories. This standard is the basis upon which conditioning of samples is conducted for later evaluation of corrosion or other physical effects by various methods. Visual comparison and mass loss measurements are often the basis of evaluations.

The Standard requires control of the following:

- Fog atomization collection rate: 1.0 - 2.0 ml/hour
- Cabinet internal temperature 35 +/- 2 °C
- pH range: 6.5 - 7.2
- Salt concentration: 5 +/- 1%

ASTM B117 provides a method to compare the operation of a salt fog chamber by applying *Annex X3 – Evaluation of Corrosive Conditions*. Metal test panels are specified for exposure durations in the salt fog device and their mass losses are observed for comparison to the Standard's repeatability and reproducibility statistics. Two panels are used for exposure durations of 48, 96, and 168 hours.

This protocol was adopted by Home Innovation Research Labs as a QA measure to demonstrate conformity with other ASTM B117 devices.

Reproducibility Study Results

The following data is our QA study of conformity to reproducibility criteria based on the ASTM B117-18, Annex X3 protocol:

Study Date: December 2019

Salt Spray chamber used: Ascott S1000 iP, S/N 3279, Calibrated 09/12/2019

Panels used: UNS G10080 steel plates 76 x 127 x 0.8 mm

Comparison Data source: ASTM B117-11 Annex X3.8 Precision and Bias – Steel Panel Test

Table 1. ASTM Reproducibility Study (QP1 Panel Set)

Time (h)	ASTM Average Mass Loss (g)	ASTM S_R , Standard Deviation (g)	ASTM R (g)	ASTM C_v , Coefficient of Variation (%)
48	0.8170	0.0947	0.2652	11.58
96	1.5347	0.2019	0.5653	14.02
168	2.5996	0.3255	0.9114	12.52

Table 2. HI Panel Results

Time (h)	HI Panel 1 Mass Loss (g)	HI Panel 2 Mass Loss (g)
48	0.82	0.80
96	1.76	1.59
168	2.83	2.60

Table 3. ASTM vs HI Mass Loss Reproducibility Results

Time (h)	HI Average Mass Loss (g)	ASTM Average Mass Loss (g)	Passing Range (based on ASTM values, Mass \pm R)		Result
			Min (g)	Max (g)	
48	0.81	0.8170	0.5518	1.0822	Pass
96	1.68	1.5347	0.9694	2.100	Pass
168	2.72	2.5996	1.6882	3.511	Pass

Table 4. ASTM vs HI Coefficient of Variation Reproducibility Results

Time (h)	HI Average Mass Loss (g)	HI S_R , Standard Deviation (g)	HI C_v , Coefficient of Variation (%)	Passing Range (based on ASTM values)	Result
48	0.81	0.01	1.30	≤ 11.58	Pass
96	1.68	0.08	5.00	≤ 14.02	Pass
168	2.72	0.12	4.32	≤ 12.52	Pass

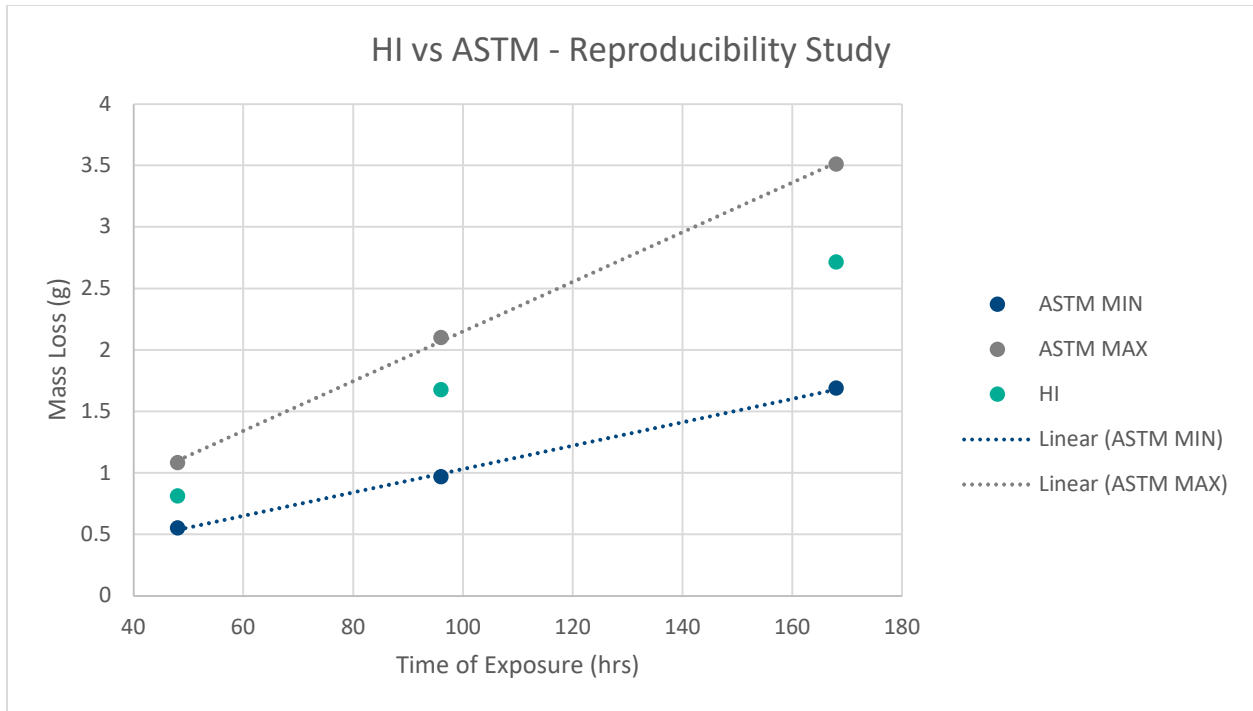


Figure 1. HI vs ASTM – Reproducibility Study

Repeatability Study Results

The following data is our QA study of conformity to repeatability criteria based on the ASTM B117-18, Annex X3 protocol:

Study Date: December 2019

Salt Spray chamber used: Ascott S1000 iP, S/N 3279, Calibrated 09/12/2019

Panels used: UNS G10080 steel plates 76 x 127 x 0.8 mm

Comparison Data source: ASTM B117-11 Annex X3.8 Precision and Bias - Steel Panel Test

Table 5. ASTM Repeatability Study (QP1 Panel Set)

Time (h)	ASTM Average Mass Loss (g)	ASTM S_r , Standard Deviation (g)	ASTM r (g)	C_v , Coefficient of Variation (%)
48	0.8170	0.0588	0.1646	7.20
96	1.5347	0.1048	0.2934	7.28
168	2.5996	0.2498	0.6994	9.61

Table 6. ASTM vs HI Mass Loss Repeatability Results

Time (h)	HI Average Mass Loss (g)	ASTM Average Mass Loss (g)	Passing Range (based on ASTM values, Mass ± r)		Result
			Min (g)	Max (g)	
48	0.81	0.8170	0.6524	0.9816	Pass
96	1.68	1.5347	1.2413	1.8281	Pass
168	2.72	2.5996	1.9002	3.299	Pass

Table 7. ASTM vs HI Coefficient of Variation Repeatability Results

Time (h)	HI Average Mass Loss (g)	HI S _r , Standard Deviation (g)	HI C _v , Coefficient of Variation (%)	Passing Range (based on ASTM values)	Result
48	0.81	0.01	1.30	≤7.20	Pass
96	1.68	0.08	5.00	≤7.28	Pass
168	2.72	0.12	4.32	≤9.61	Pass

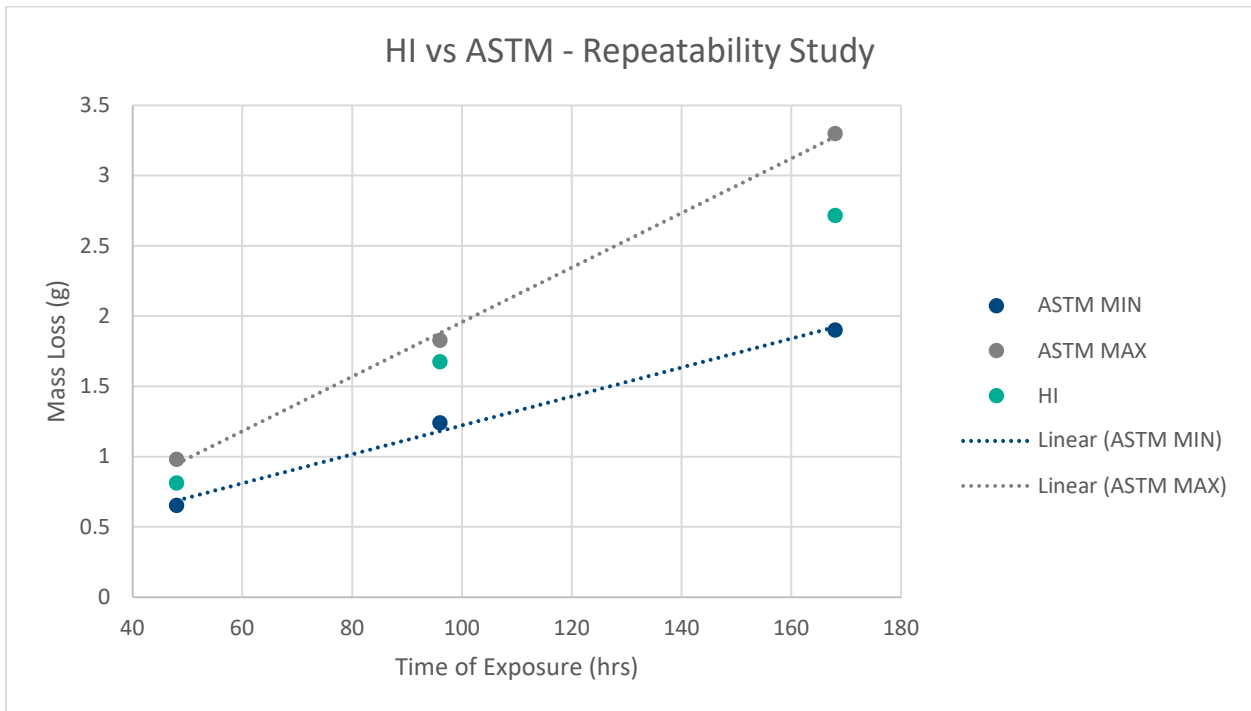


Figure 2. HI vs ASTM – Repeatability Study

Discussion

A pair of panels were tested in accordance with the ASTM B117-18 standard. Following testing, the collected data were analyzed to determine repeatability and reproducibility statistics in comparison to the interlaboratory study conducted by ASTM. For the purposes of the comparison, ASTM data from material QP1 was used, as that material was tested by the most laboratories. Home Innovation acceptance criteria were bounded by the results of that study.

Figures 1 and 2 graphically show that repeatability and reproducibility results are well within the bounds established by the ASTM interlaboratory testing.

Conclusion

The Home Innovation Research Lab's results were found to be within the repeatability and reproducibility ranges provided by ASTM B117-18.