Element Materials Technology Denver-Longmont A.K.A. NTS Labs, LLC
Test Report for Environmental/Dynamics Testing of the KST7250 and KST3601

Prepared For
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Revision History

Rev.	Description	Issue Date
0	Initial Release	06/20/2024
1	Corrected Test Result	06/26/2024

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1.0 Introduction

This document presents the test procedures used and the results obtained during the performance of an Environmental/Dynamics test program at Element Materials Technology Denver-Longmont (hereafter referred to as "Element"). The test program was conducted to assess the ability of the specified Equipment Under Test (EUT) to successfully satisfy the requirements defined in the test specification.

2.0 References

The following references listed below form a part of this document to the extent specified herein.

- Test Specification: See Table 5.0-1
- KS Technologies, LLC Purchase Order EMT-2415-01, dated 04/08/2024
- Element Quotation OP0651495, dated 12/11/2023
- ISO/IEC 17025:2017(E) *General Requirements for the Competence of Testing and Calibration Laboratories,* dated 11/2017

3.0 Product Selection and Description

KS Technologies, LLC selected and provided the following test sample(s) to be used as the Equipment Under Test.

Table 3.0-1: Product Identification – Equipment Under Test (EUT)

Item	Qty.	Name/Description	Part Number	Serial Number
1	1	KST7250	KST7250	000003
2	1	KST3601	KST3601	000583
3	1	KST7250	KST7250	000004
4	1	KST3601	KST3601	000259
5	1	KST7250	KST7250	000001
6	1	KST3601	KST3601	000495
7	1	KST7250	KST7250	000005
8	1	KST3601	KST3601	000589

3.1 Security Classification

Non-classified

4.0 General Test Requirements

4.1 Test Equipment

The instrumentation used in the performance of these tests is periodically calibrated and standardized within manufacturer's rated accuracies and are traceable to the National Institute of Standards and Technology. The calibration procedures and practices are in accordance with ISO 17025:2017. Certification of calibration is on file subject to inspection by authorized personnel.

5.0 Test Description and Results

Table 5.0-1: Summary of Test Information & Results

Section	Test	Specification	Test Facility	Test Date	Part #	Serial #	Test Result
5.1	Dust (IP-6x)	IEC 60529	Longmont	05/31/2024 - 06/03/2024	KST7250 KST3601	000001, 000495	No visual damage noted
5.2	Water Spray (IP-x5)	IEC 60529	Longmont	05/31/2024	KST7250 KST3601	000004, 000259	No visual damage noted
5.3	Immersion (IP-x7)	IEC 60529	Longmont	05/31/2024	KST7250 KST3601	000003, 000583	No visual damage noted
5.4	Drop	MIL-STD-810G & IEC 60068-2-31	Longmont	06/06/2024 - 06/17/2024	KST7250 KST3601	000005, 000589	Visual damage noted. Customer Determination

5.1 Dust (IP-6x)

5.1.1 Test Procedure

IEC 60529

5.1.2 Test Result

The EUT showed no visual damage noted after the test was completed.

5.1.3 Test Datasheets

Test Log			
MJO No: PR182906	**Customer: KS Technologies**	**Test Specification: IEC 60529**	**Test Performed: IP-6x**

Date	Time	Log Entry	Tech
5/31/2024	1445	**No visible evidence of damage before testing.**	CS
		IP Designation: IP-6x Enclosure Category: 1 – Air pressure reduced within the enclosure	CS
		Dust: 2 kg of talcum powder per cubic meter of the test chamber volume	CS
5/31/24	1450	Sample KST7250 was affixed with a hose fitting to allow for pulling a vacuum on the internal cavity of the sample.	CS
5/31/24	1455	Sample was set up within the dust chamber.	CS
5/31/24	1500	Per the IEC specification, the target flow for the test shall be 0.97 to 1.45 liters per minute.	CS
5/31/24	1510	The chamber was sealed. A vacuum of 2kPA within the sample was achieved without reaching the target flow. Additionally, no measurable flow was achieved, therefore the test duration was set at 8 hours.	CS
5/31/24	1511	Began the 8-hour exposure	CS
6/3/24	0715	The 8-hour exposure was completed. Opened the chamber, cleared away all the dust from the sample, and removed it from the chamber	CS
6/3/24	0720	Opened the sample and performed a visual inspection of the sample	CS
6/3/24	0735	No evidence of dust ingress was observed. Results meet the passing criteria for IP-6x	CS
			CS
6/3/24	0810	Sample KST3601 was affixed with a hose fitting to allow for pulling a vacuum on the internal cavity of the sample.	CS
6/3/24	0813	Sample was set up within the dust chamber.	CS
6/3/24	0813	Per the IEC specification, the target flow for the test shall be 0.97 to 1.45 liters per minute.	CS
6/3/24	0815	The chamber was sealed. The targeted flow was achieved so the test duration was set to 2 hours.	CS
6/3/24	0822	Began the 2-hour exposure	CS
6/3/24	1025	The 2-hour exposure was completed. Opened the chamber, cleared away all the dust from the sample, and removed it from the chamber	CS
6/3/24	1030	Opened the sample and performed a visual inspection of the sample	CS
6/3/24	1045	No evidence of dust ingress was observed. Results meet the passing criteria for IP-6x	CS
6/3/24	1100	Test complete, no visual damage	CS

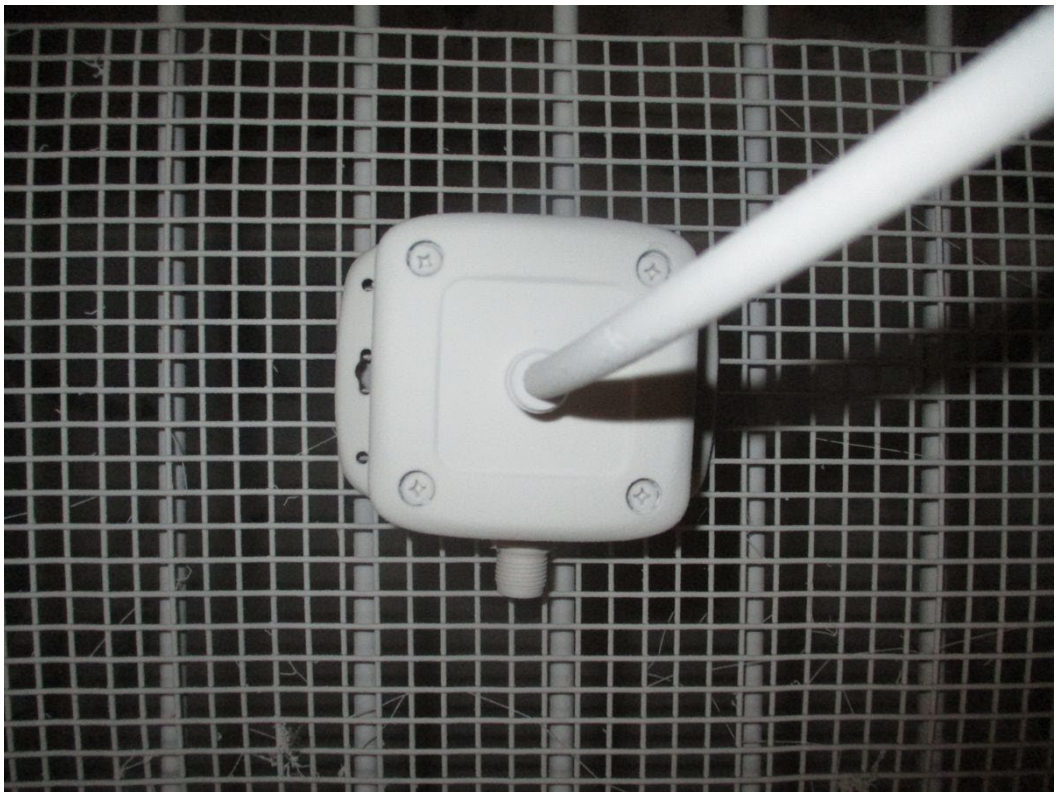
5.1.4 Test Photographs

Pre- Exposure

SN-000001_Pre- Exposure

SN-000001_Post Exposure

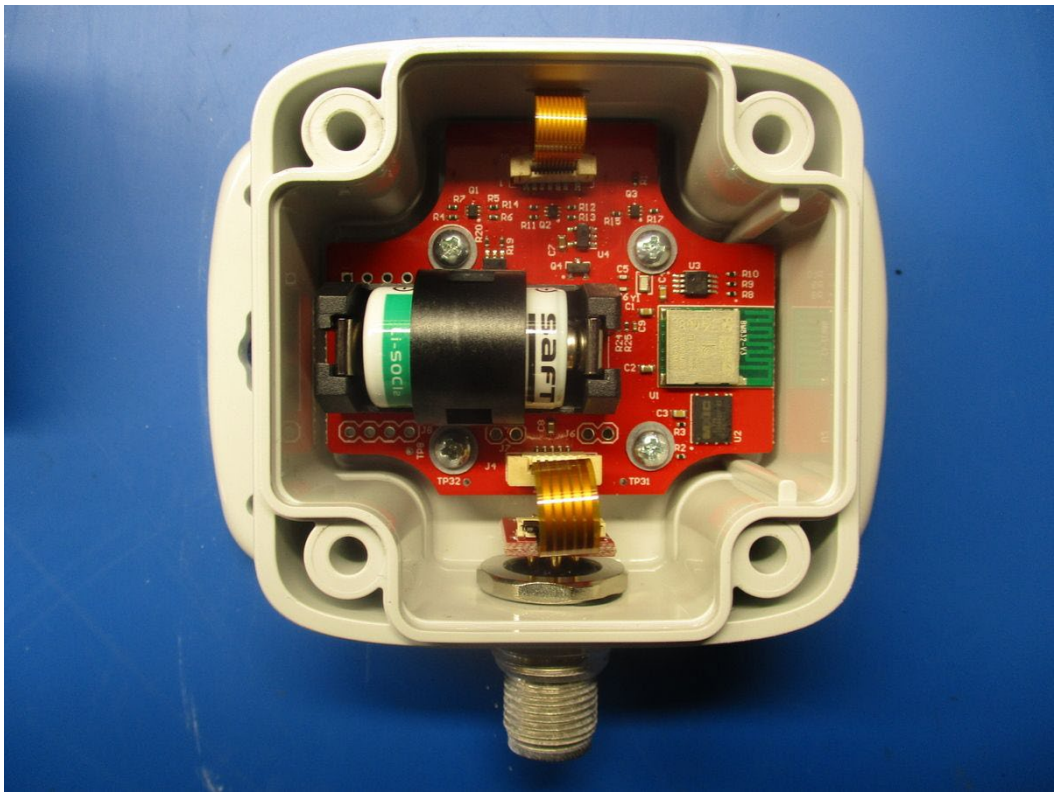
SN-000001_Post Exposure



SN-000001_Post Exposure

SN-000001_Post Exposure

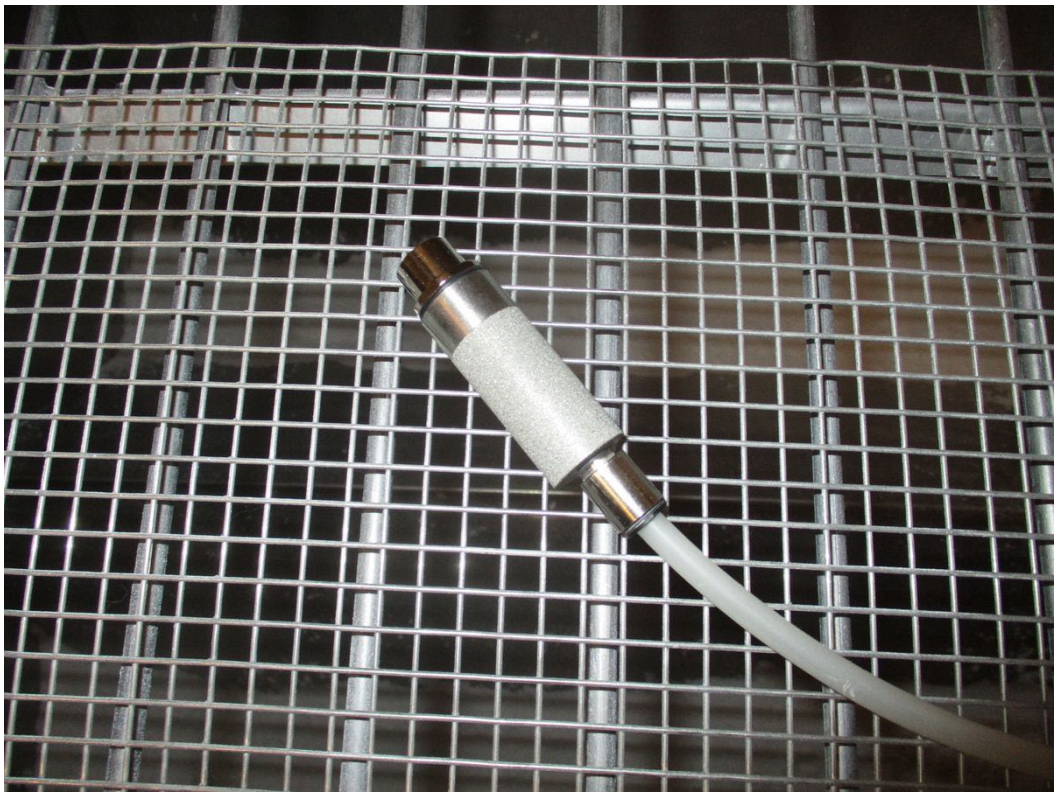
SN-000001_Post Exposure



SN-000001_Post Exposure

SN-000001_Post Exposure

SN-000495_Pre- Exposure



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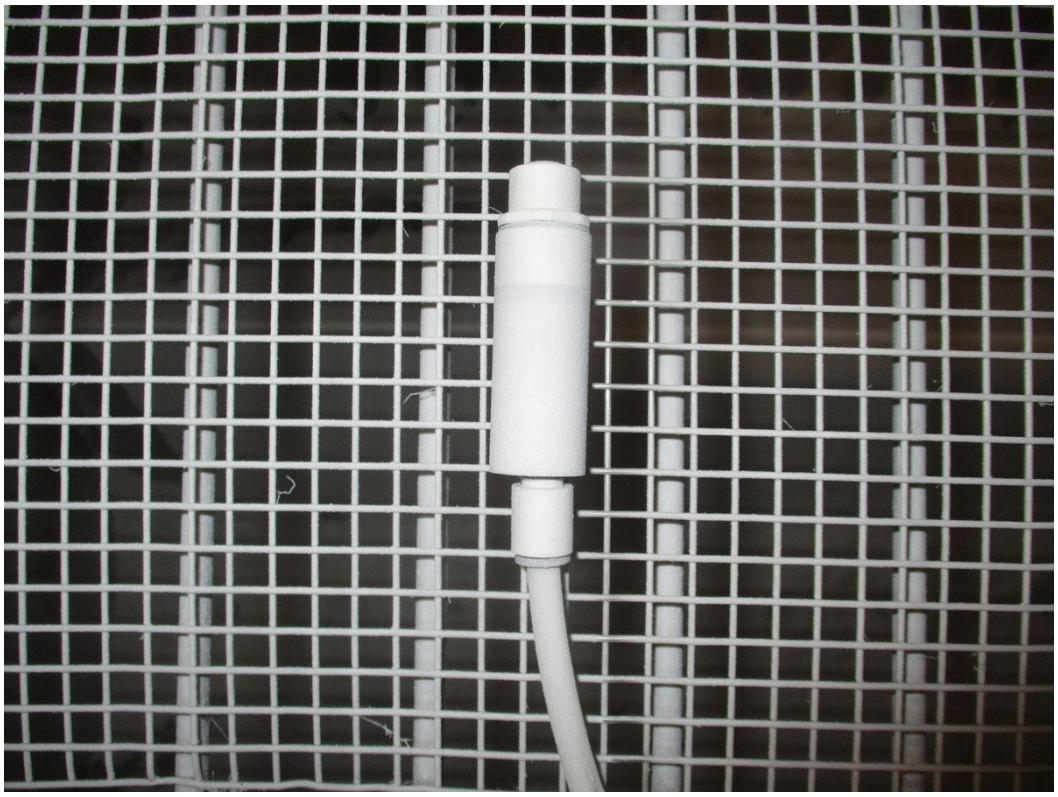

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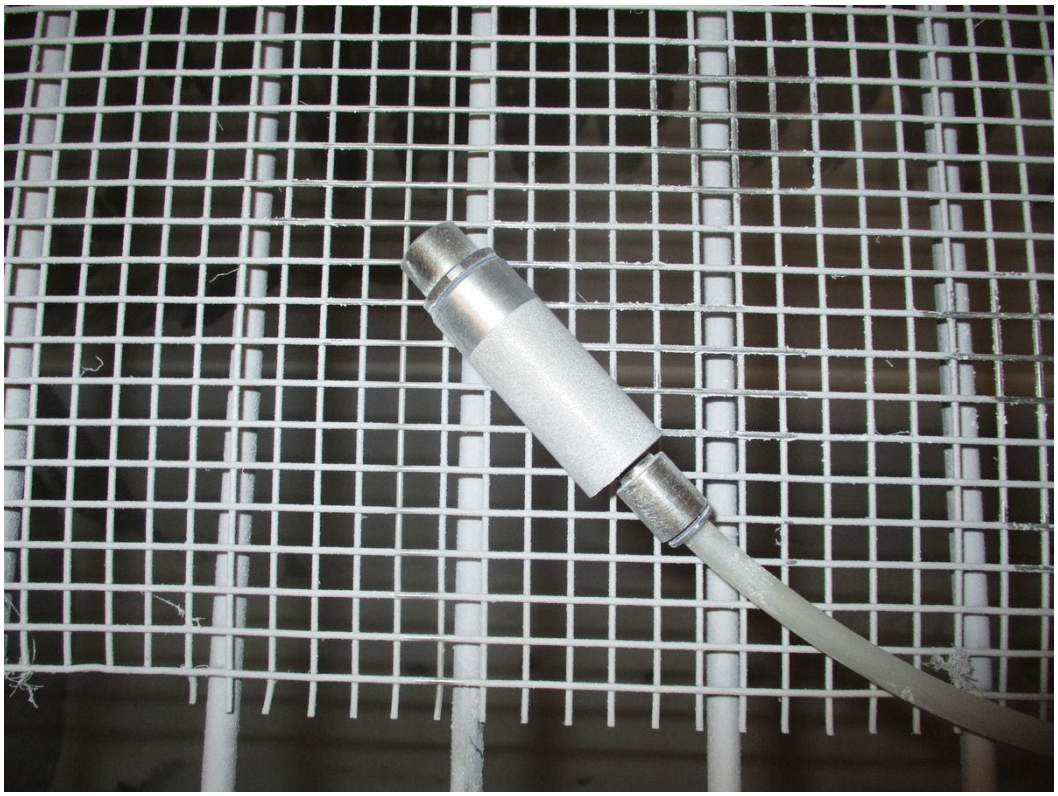

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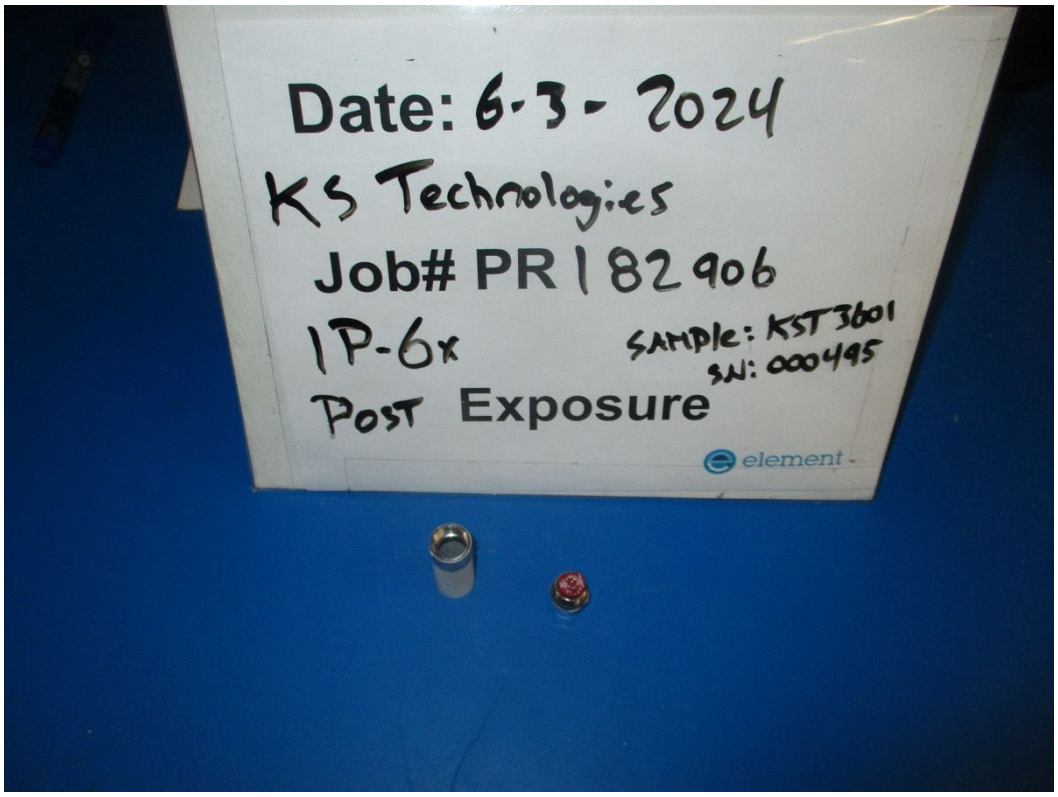


SN-000495_Post Exposure

SN-000495_Post Exposure

5.1.5 Test Equipment List

Table 5.1-1: First Characteristic Numeral 6 Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC080871	Chamber (Dust, Settling)	Thermotron	D27	08/15/2023	NCR
WC061711	Scale (Digital)	Accutek	W-8250-50B	09/05/2023	09/05/2024
WC084362	Gauge (Vacuum)	Dwyer Instruments	2000-10KPA	06/22/2023	06/22/2024
WC084363	Meter (Flow)	Dwyer Instruments	RMA-11	06/12/2023	06/12/2024

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

5.2 Water Spray (IP-x5)

5.2.1 Test Procedure

IEC 60529

5.2.2 Test Result

The EUT showed no visual damage noted after the test was completed.

5.2.3 Test Datasheets

Test Log			
MJO No: PR182906	**Customer: KS Technologies**	**Test Specification: IEC 60529**	**Test Performed: IP-x5**

Date	Time	Log Entry	Tech
5/31/2024	1215	**No visible evidence of damage before testing.**	CS
		IP Design: IP-x5	CS
		Test Means: Water jet hose nozzle - 6.3 mm diameter	CS
		Water flow rate: 12.5 l/min	CS
		Duration: 1 min/m at least 3 min	CS
		Distance from nozzle to enclosure surface: Between 2.5 m and 3 m	CS
		Water Temperature: The water temperature does not differ from that of the specimen by more than 5 K.	CS
5/31/24	1220	Sample temperatures were within 5 K of the water temperature	CS
5/31/24	1225	Setup sample KST7250	CS
5/31/24	1230	Test was executed on 5 sides of sample KST7250 for a total duration of 3 minutes	CS
5/31/24	1240	Sample was inspected for signs of water intrusion. No water intrusion was found within the sample	CS
5/31/24	1315	Setup sample KST3601	CS
5/31/24	1319	Test was executed on sample KST3601 for a total duration of 3 minutes. Sample was rotated during exposure	CS
5/31/24	1325	Sample was inspected for signs of water intrusion. No water intrusion was found within the sample	CS
5/31/24	1340	Test complete, no visual damage	CS

5.2.4 Test Photographs

Pre- Exposure

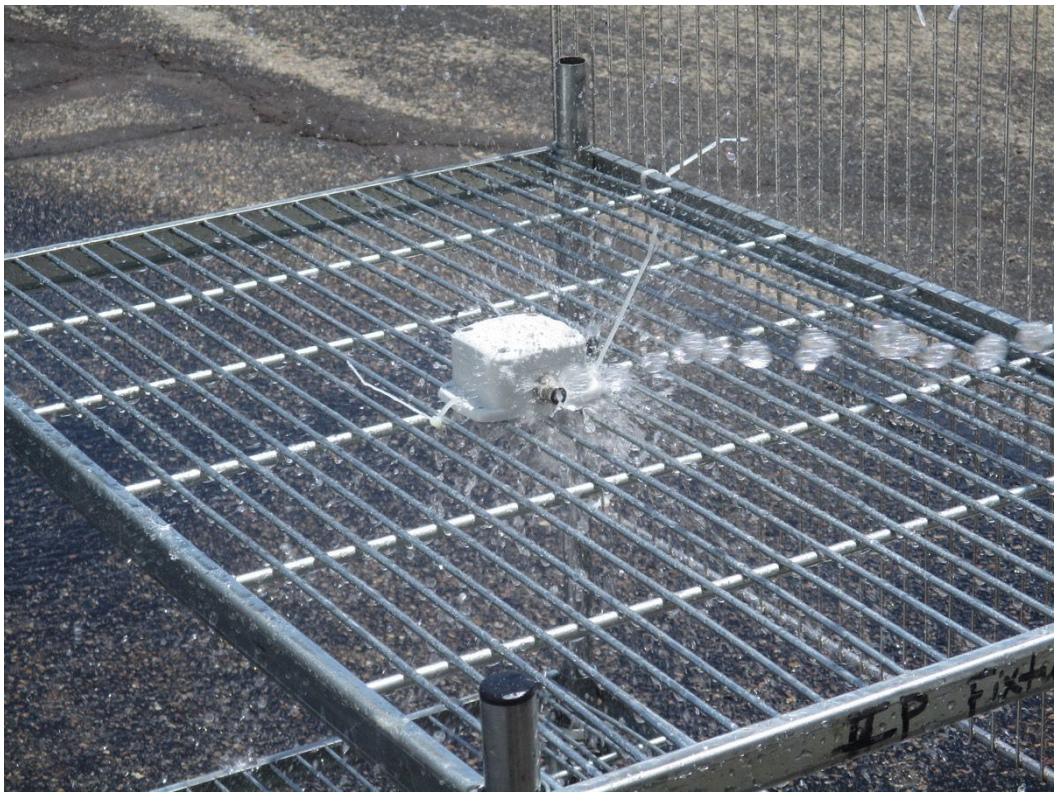
Pre- Exposure

SN-000004_Pre- Exposure

SN-000004_Exposure

SN-000004_Exposure

SN-000004_Exposure



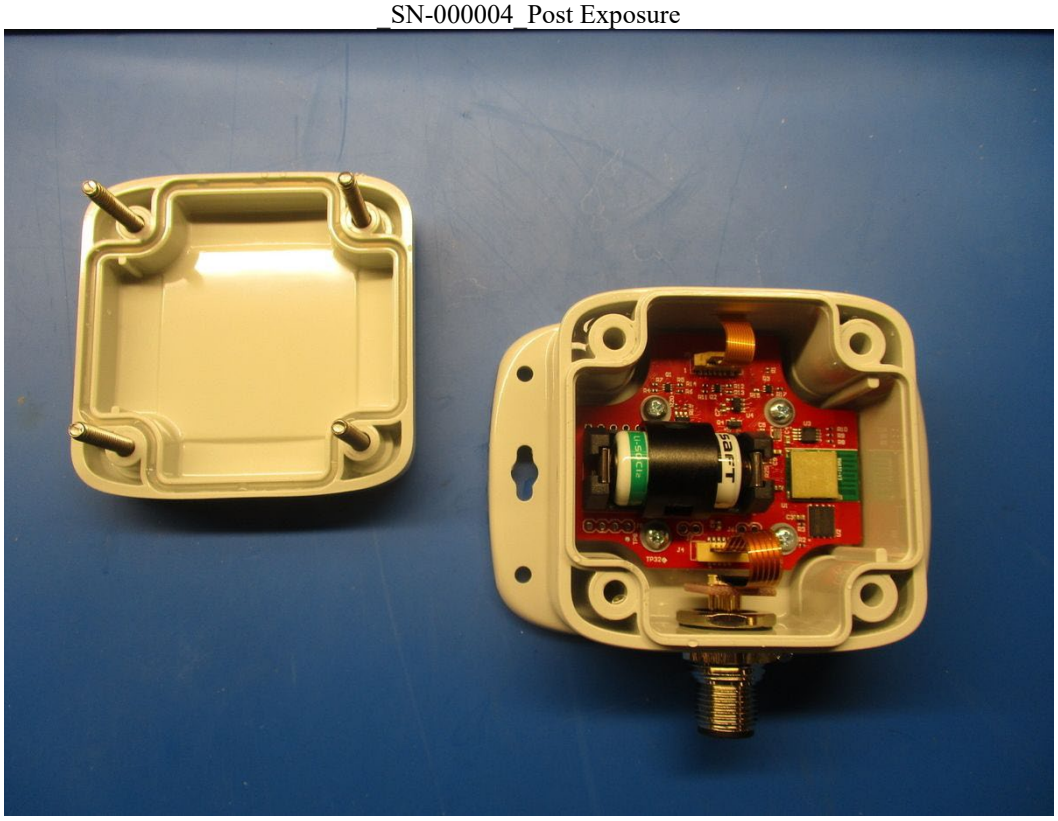
SN-000004_Exposure

SN-000004_Exposure

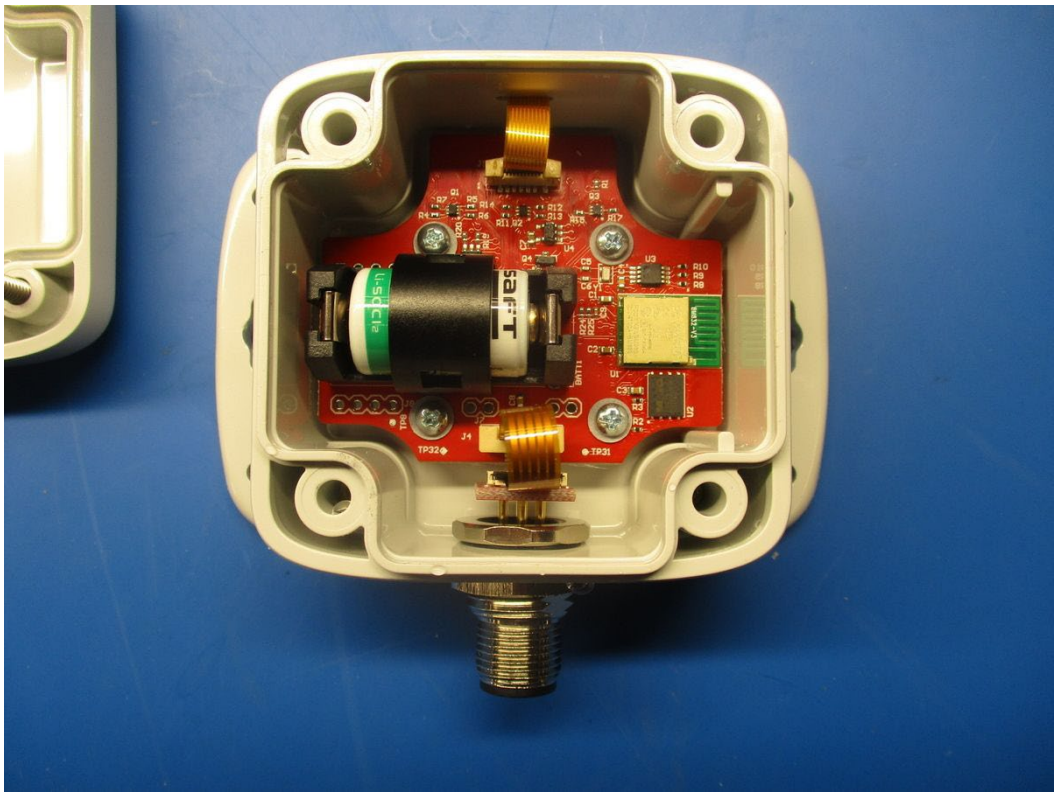
SN-000004_Post Exposure

SN-000004_Post Exposure

_SN-000004_Post Exposure



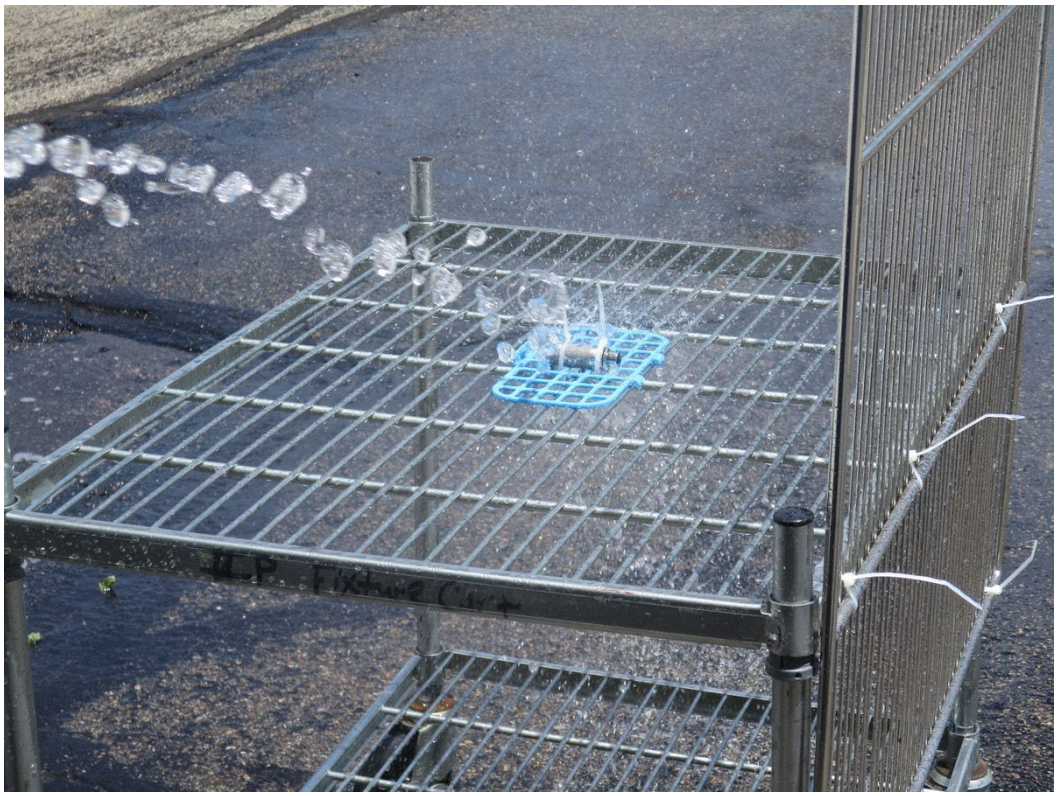
SN-000004_Post Exposure



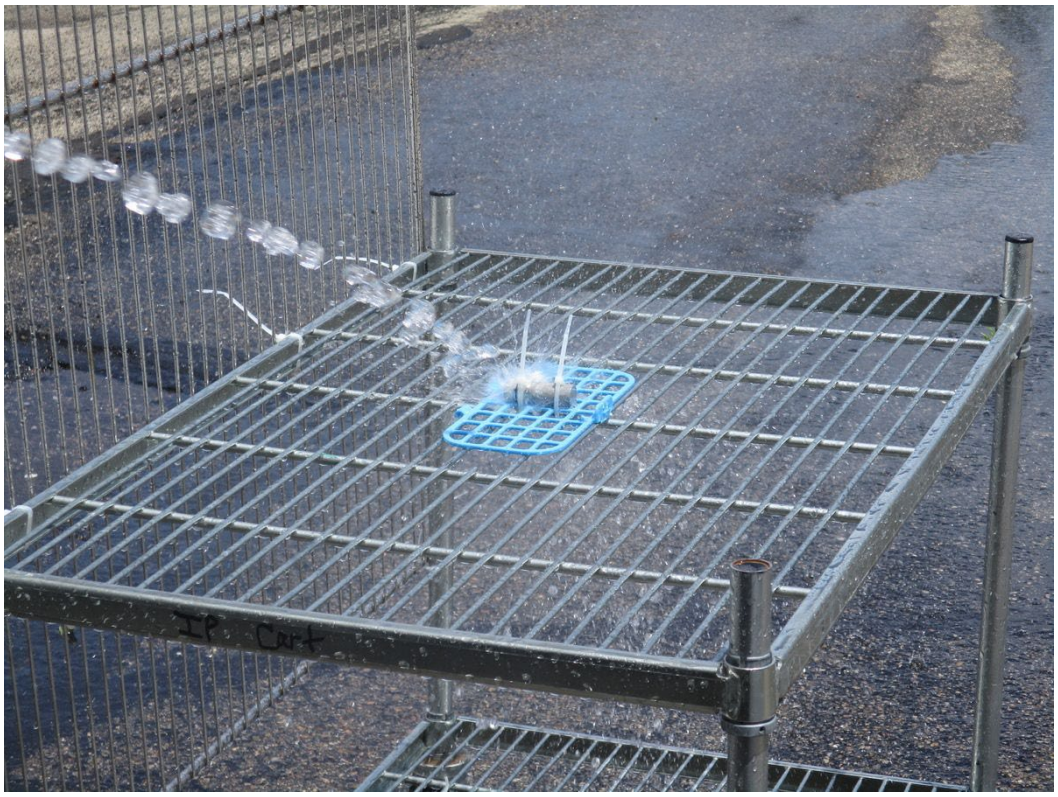
SN-000004_Post Exposure

SN-000259_Pre Exposure

SN-000259_Exposure



SN-000259_Exposure

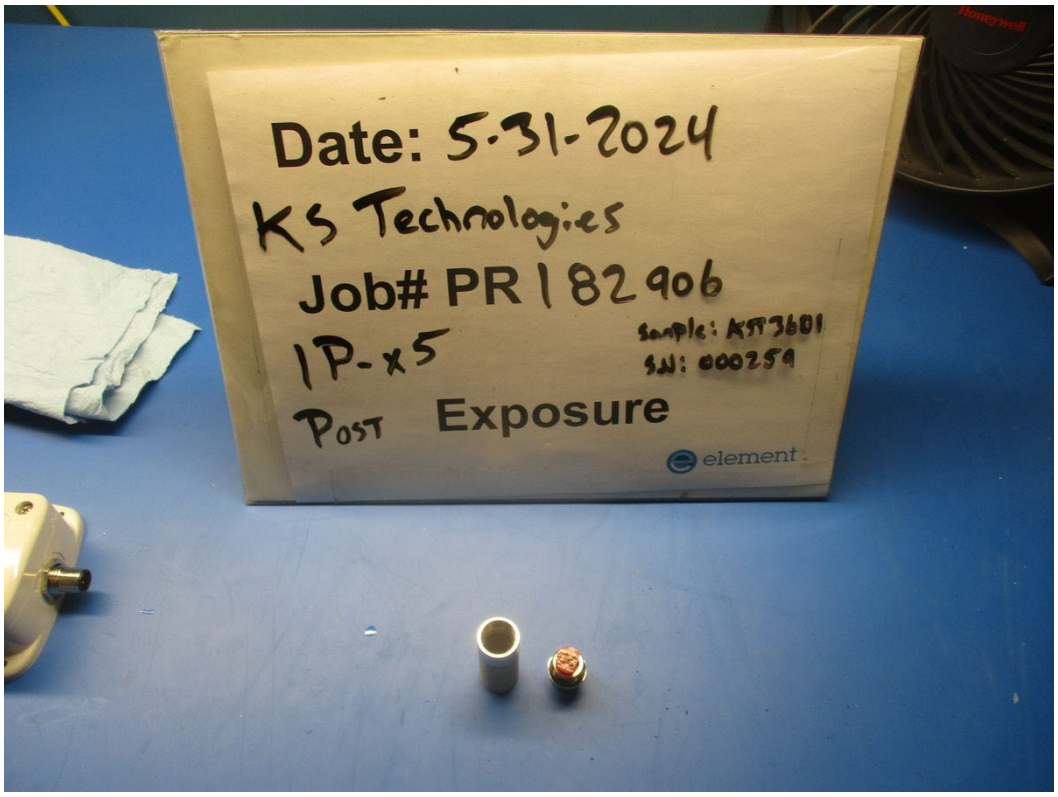


SN-000259_Exposure

SN-000259_Exposure

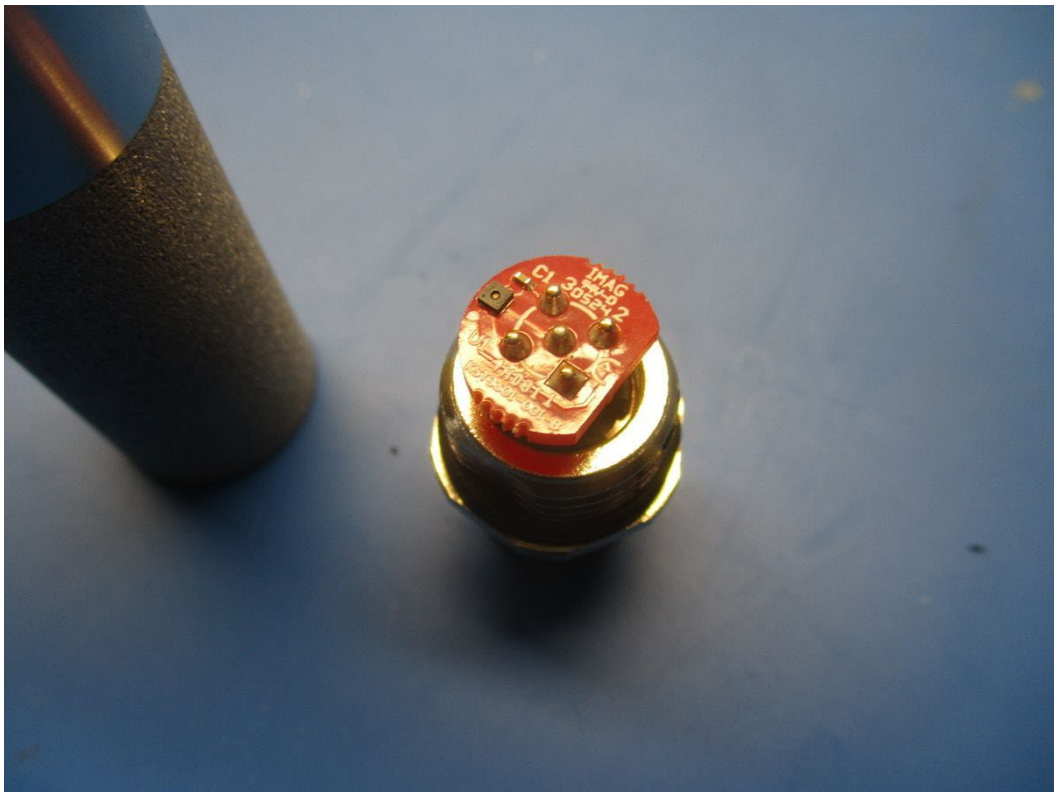
SN-000259_Post Exposure

SN-000259_Post Exposure



SN-000259_Post Exposure

SN-000259_Post Exposure



SN-000259_Post Exposure

5.2.5 Test Equipment List

Table 5.2-1: Second Characteristic Numeral 5 Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC084243	Nozzle (Spray)	Element	Nozzle	NCR	NCR
WC084353	Tank (Water)	Element	Water Tank	NCR	NCR
WC061417	Calibrator (Thermocouple)	Omega Engineering	CL27	11/02/2023	11/02/2024
WC080932	Stopwatch (Digital)	Digi	94460-28	03/21/2024	03/21/2025
WC084240	Measurement Tools (Tape Measure)	Stanley	33-726	06/20/2022	06/19/2024

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

5.3 Immersion (IP-x7)

5.3.1 Test Procedure

IEC 60529

5.3.2 Test Result

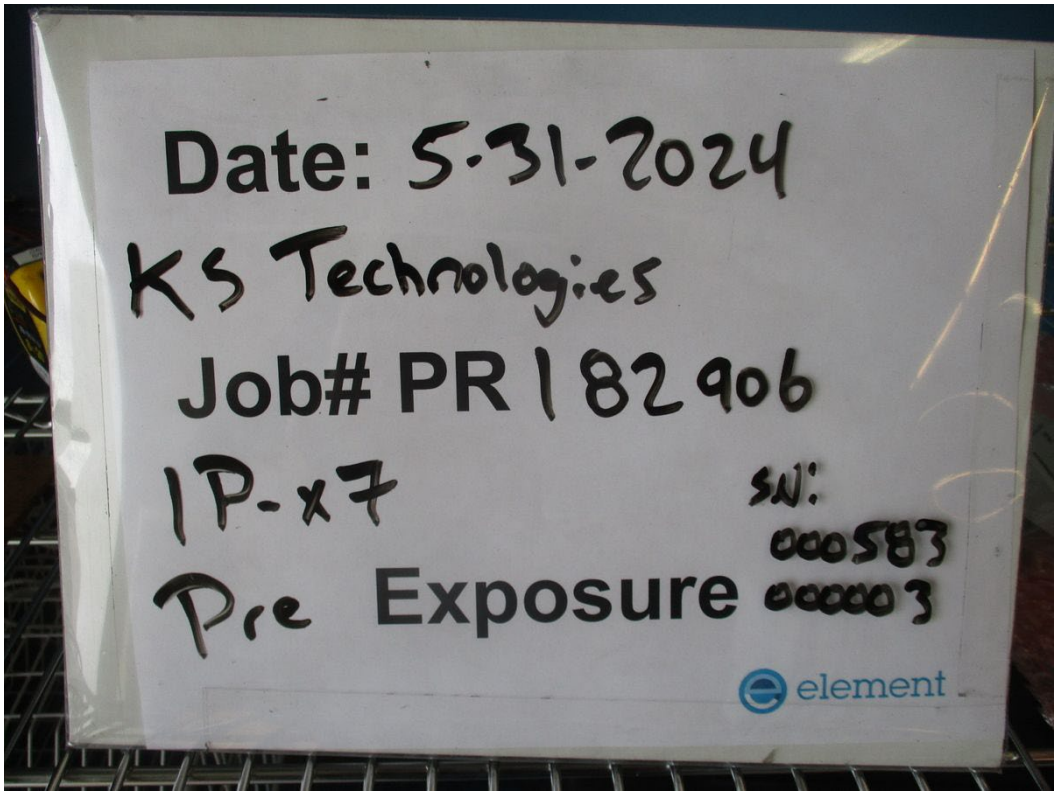
The EUT showed no visual damage noted after the test was completed.

5.3.3 Test Datasheets

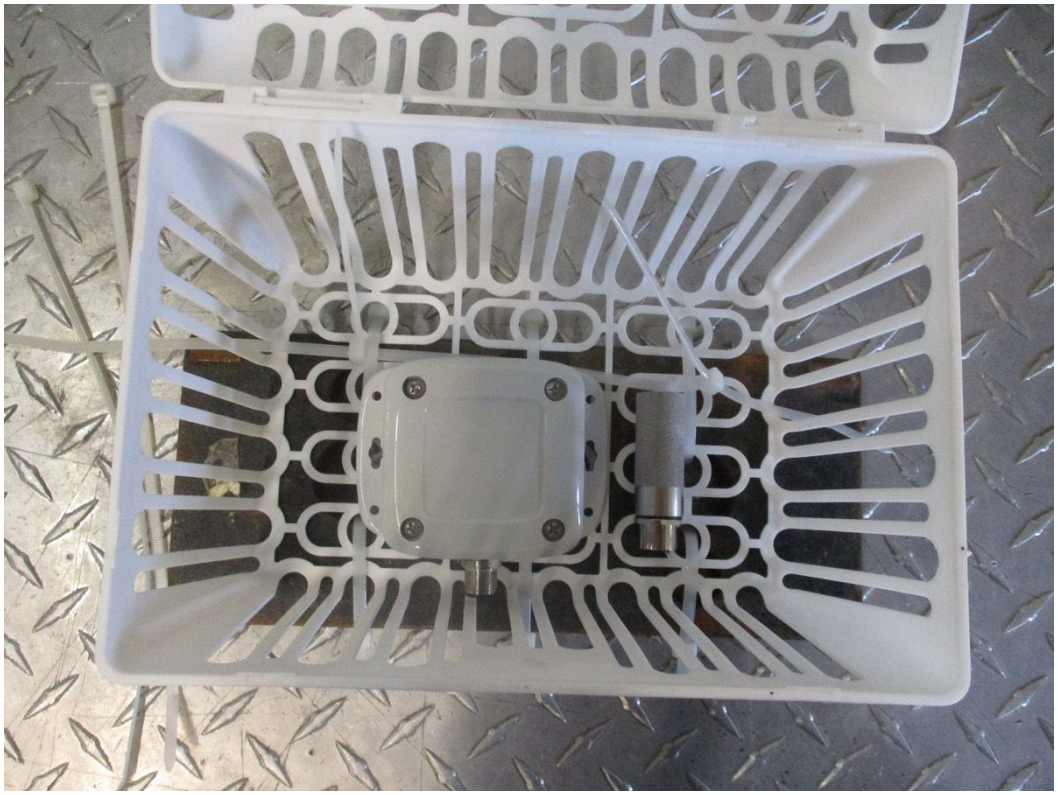
Test Log			
MJO No: PR182906	**Customer: KS Technologies**	**Test Specification: IEC 60529**	**Test Performed: IP-x7**

Date	Time	Log Entry	Tech
5/31/2021	1020	**No visible evidence of damage before testing.**	CS
		IP Designation: IP-x7	CS
		Test Means: Immersion tank water-level on enclosure 0.15 m above top, 1 m above bottom	CS
		Water Temperature: The water temperature does not differ from that of the specimen by more than 5 K	CS
		Test Duration: 30 minutes	CS
5/31/24	1025	Sample temperatures were within 5 K of the water temperature	CS
5/31/24	1027	Samples were placed inside of a cage with a rope that measures out to 1 meter	CS
5/31/24	1032	Samples were then exposed to water immersion at 1 meter for a duration of 30 minutes	CS
5/31/24	1102	Samples have completed water immersion exposure	CS
5/31/24	1105	Samples were inspected for signs of water intrusion. No water intrusion was found within the samples	CS
5/31/24	1120	Test complete, no visual damage	CS

5.3.4 Test Photographs



SN-000003, 000583_Pre- Exposure



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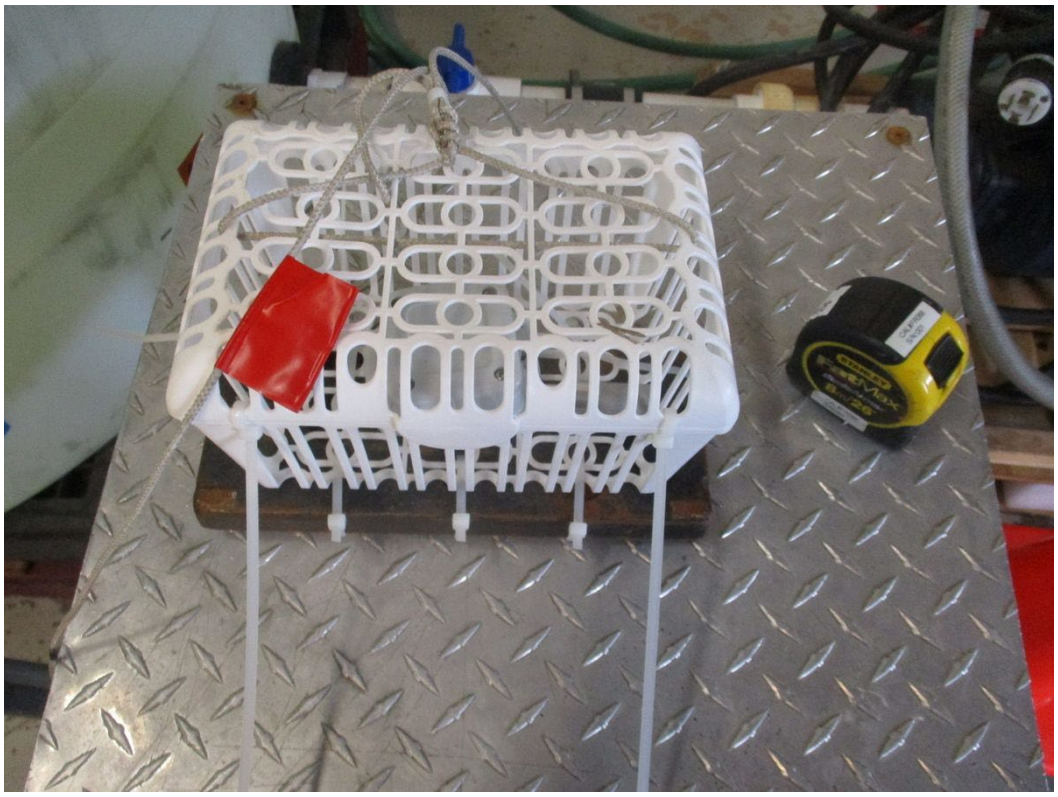

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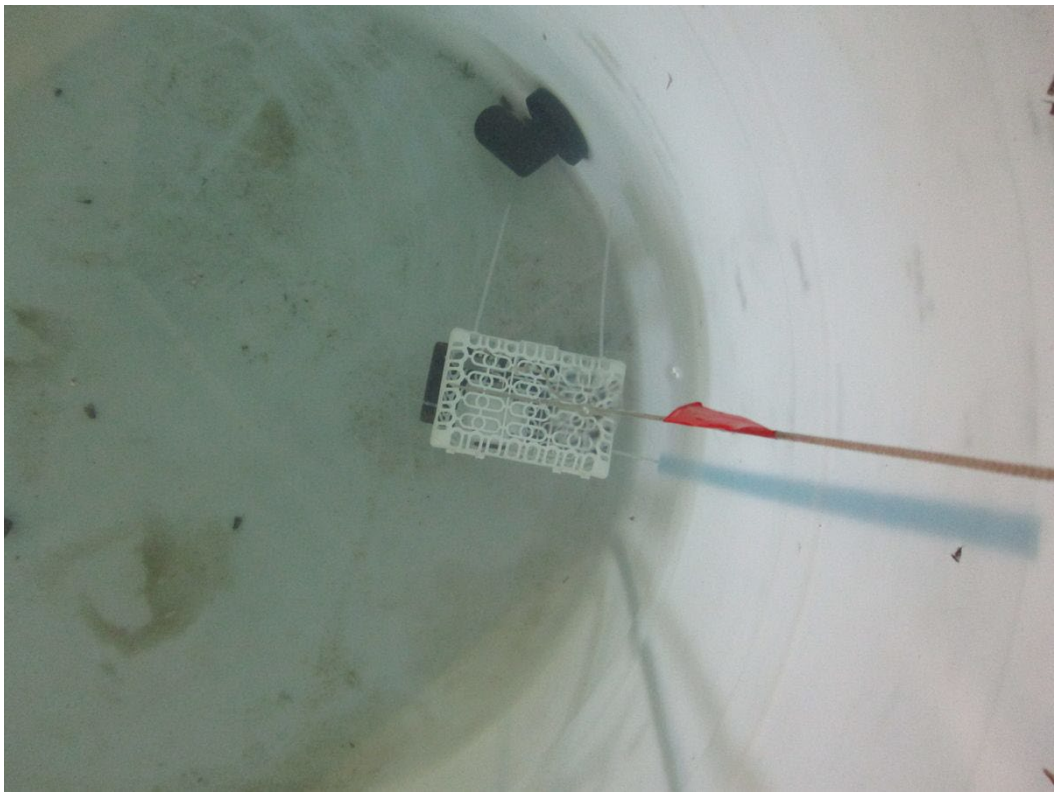
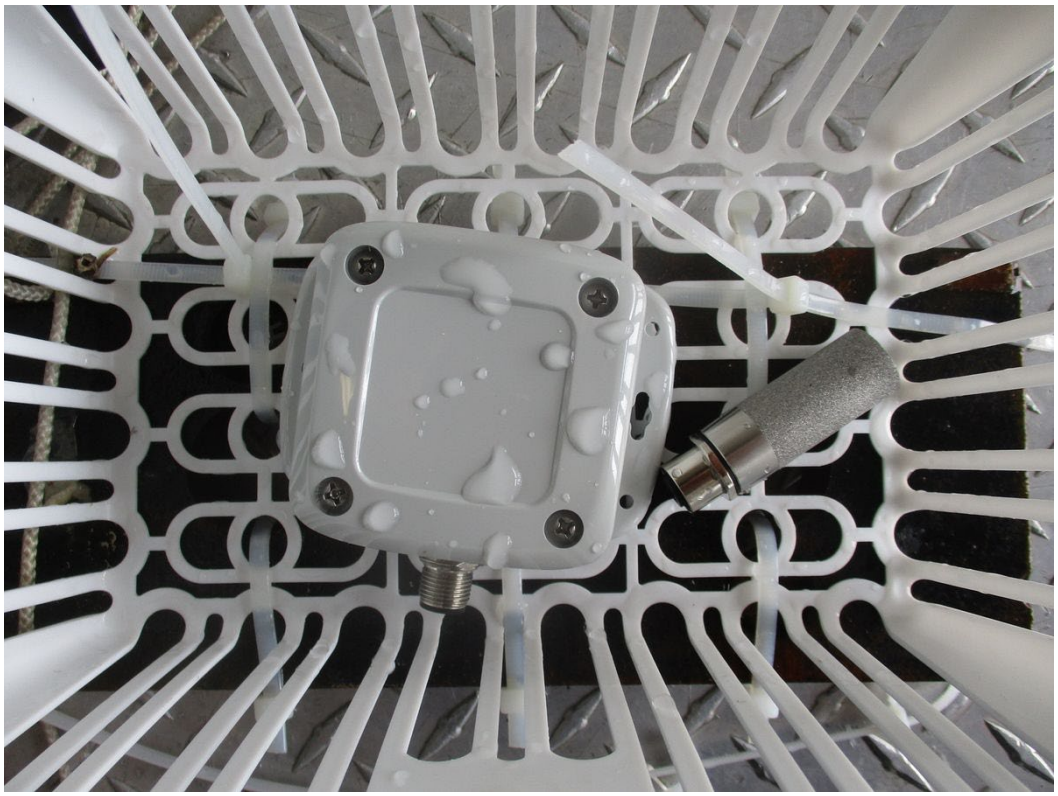


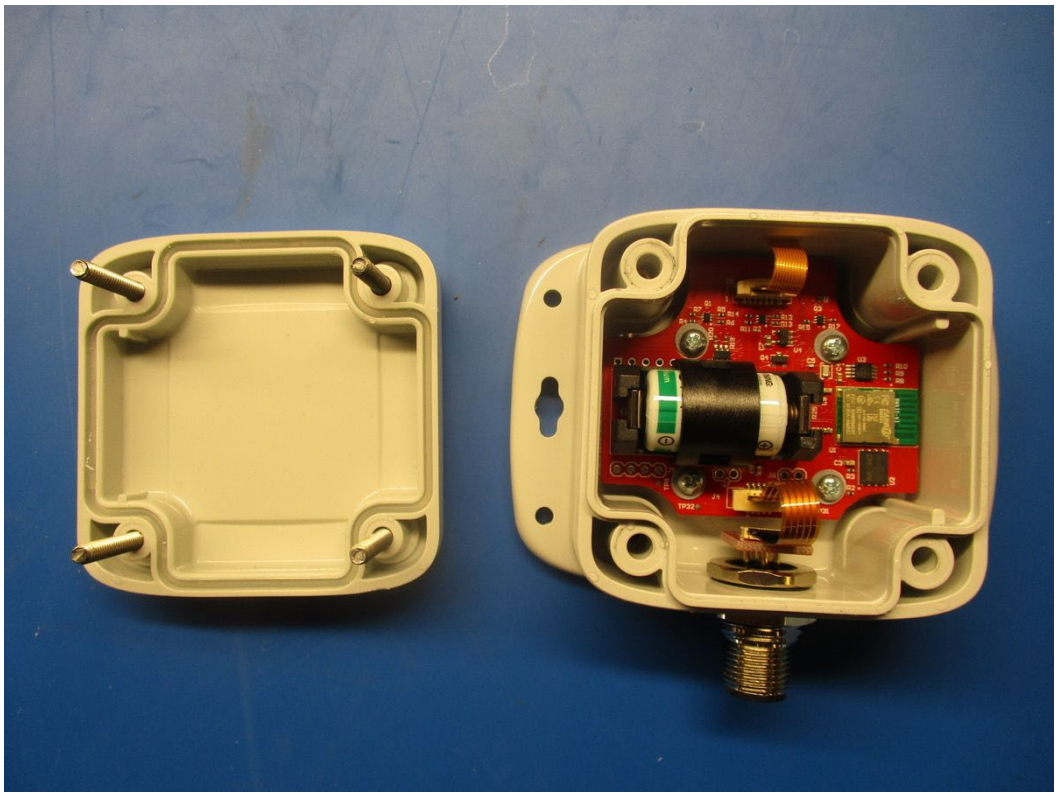
SN-000003, 000583_Exposure

SN-000003, 000583_Exposure

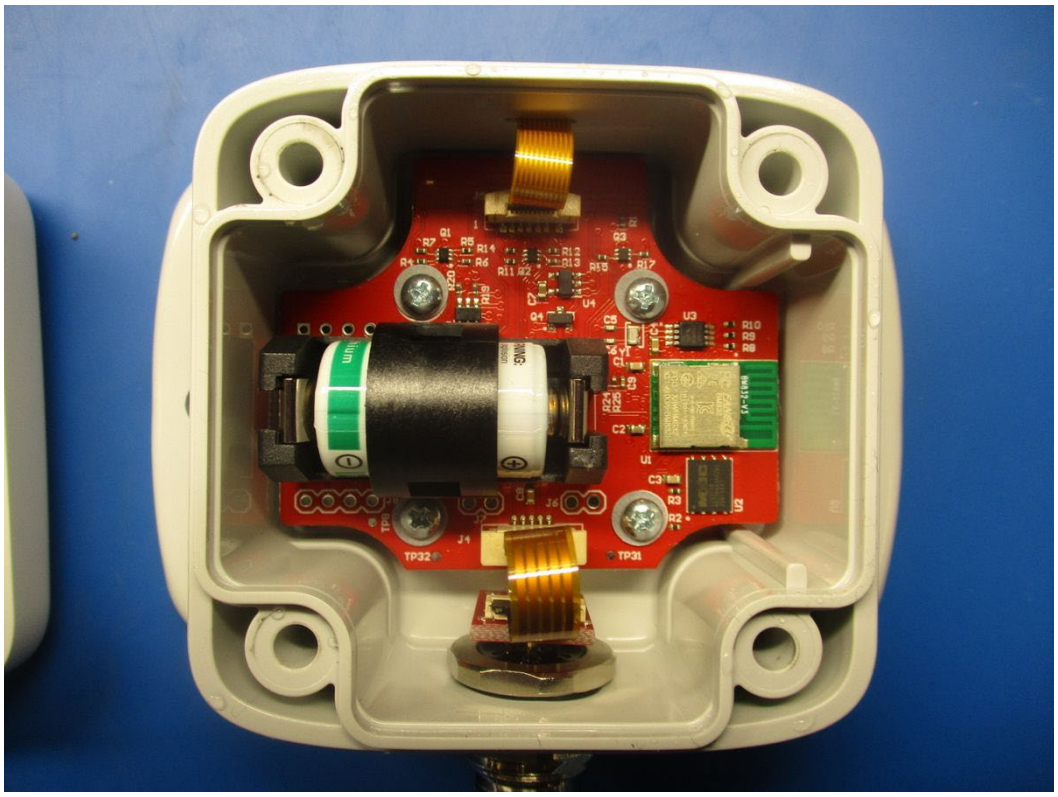


SN-000003, 000583_Post Exposure

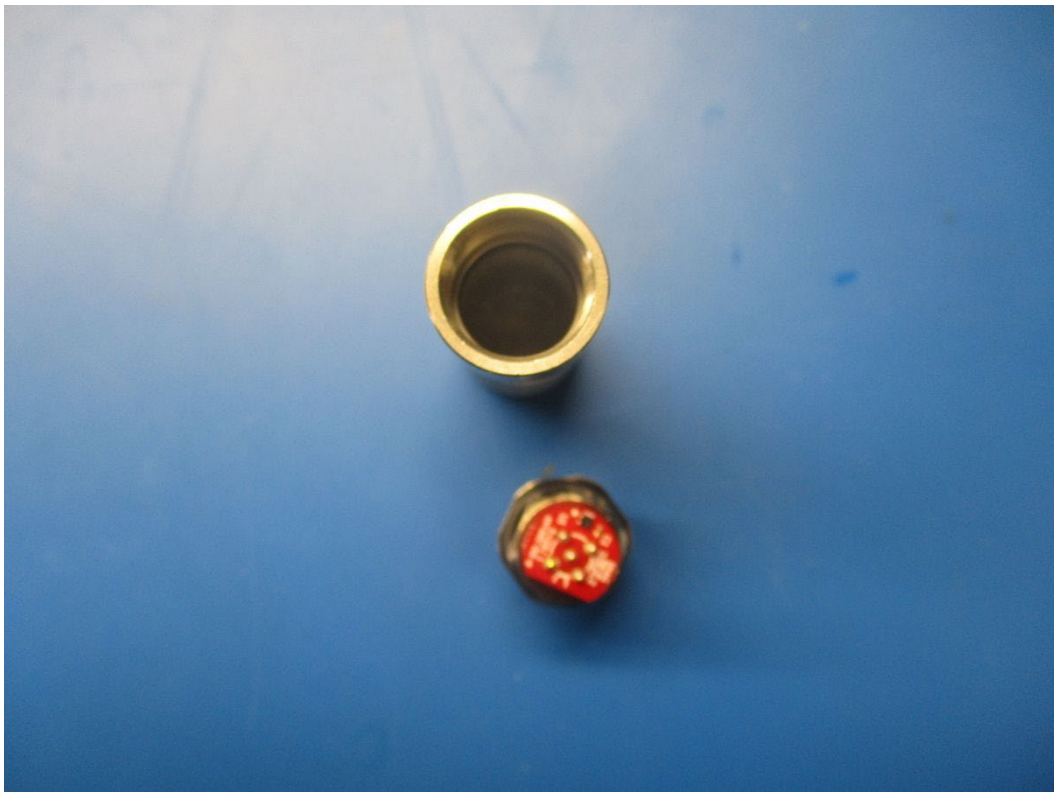
SN-000003_Post Exposure



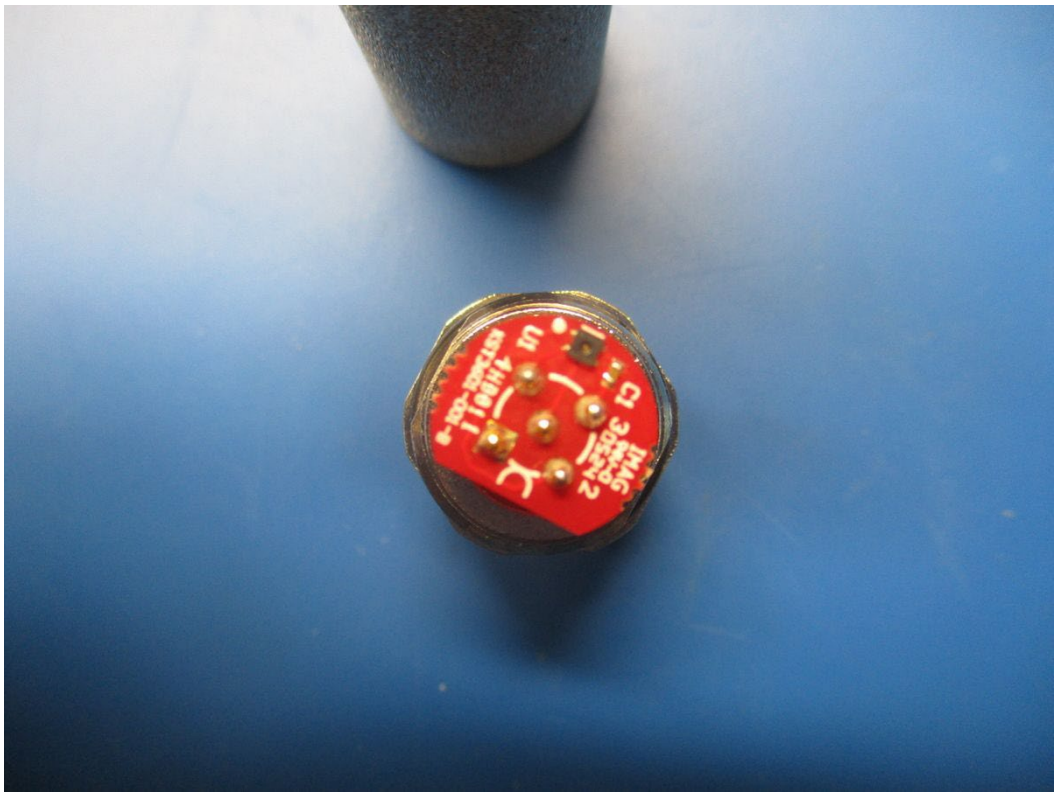
SN-000003_Post Exposure



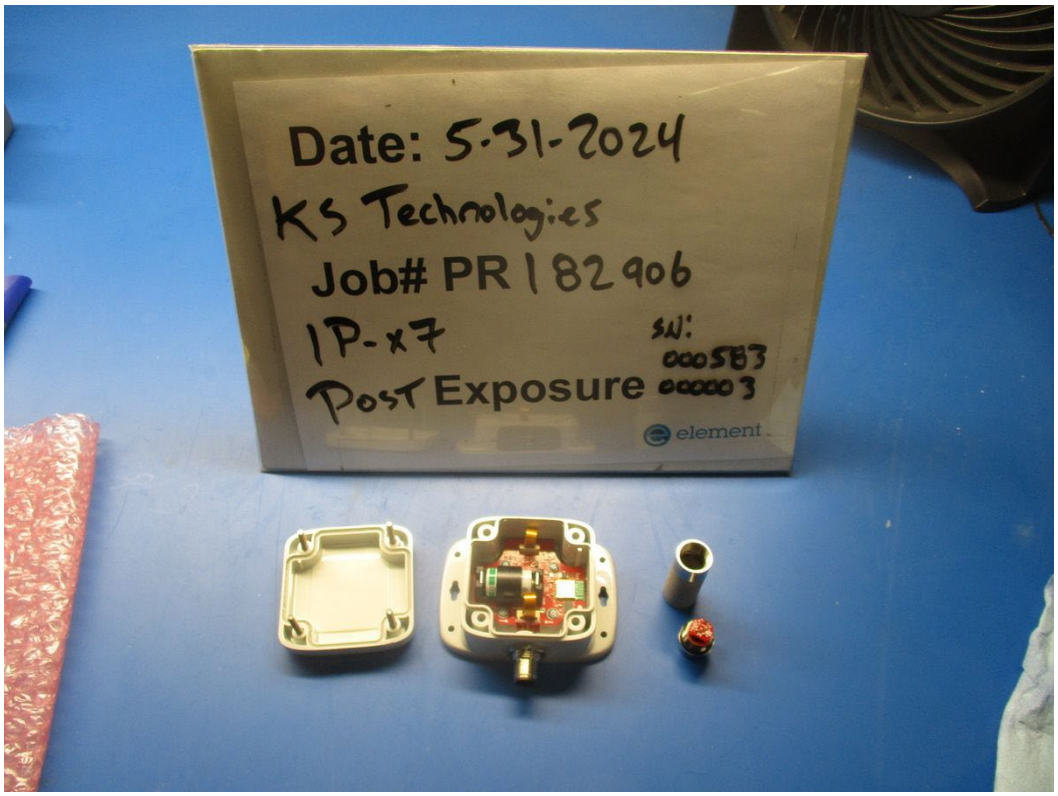
SN-000003_Post Exposure



SN-000583_Post Exposure



SN-000583_Post Exposure



SN-000003, 000583_Post Exposure

5.3.5 Test Equipment List

Table 5.3-1: Second Characteristic Numeral 7 Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC084353	Tank (Water)	Element	Water Tank	NCR	NCR
WC061417	Calibrator (Thermocouple)	Omega Engineering	CL27	11/02/2023	11/02/2024
WC080932	Stopwatch (Digital)	Digi	94460-28	03/21/2024	03/21/2025
WC084240	Measurement Tools (Tape Measure)	Stanley	33-726	06/20/2022	06/19/2024

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

5.4 Drop

5.4.1 Test Procedure

MIL-STD-810G & IEC 60068-2-31

5.4.2 Test Result

The EUT showed visual damage noted after the test was completed. The EUT's results will be determined by KS Technologies, LLC.

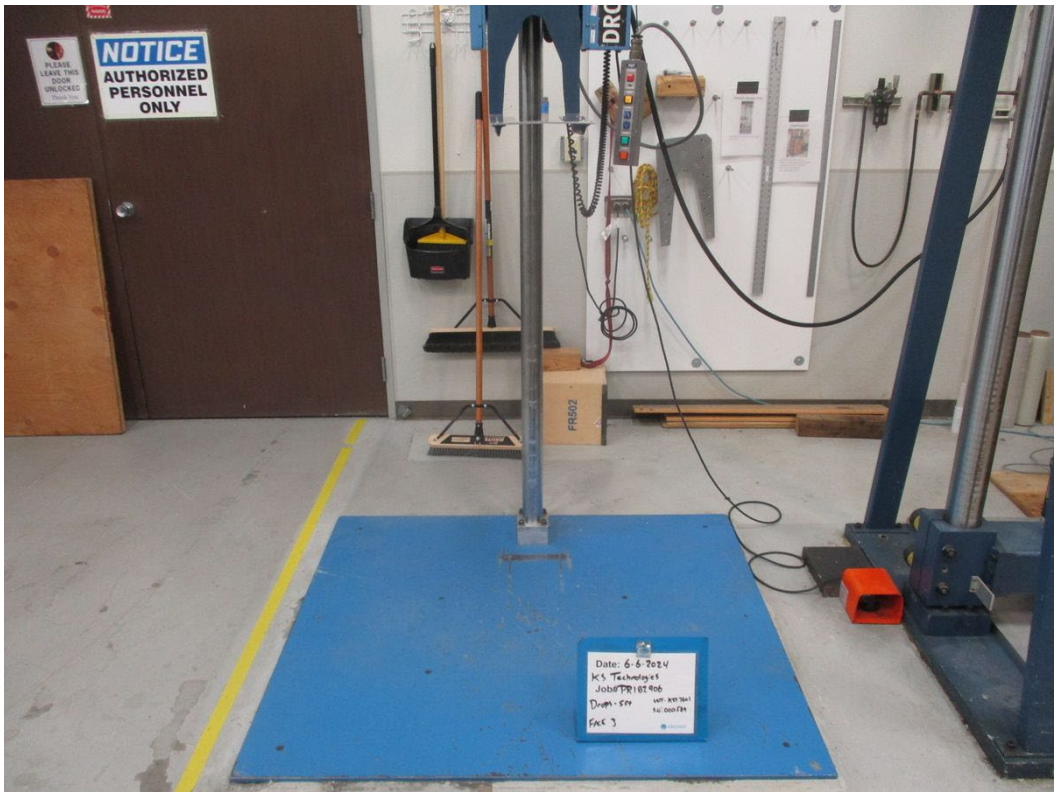
5.4.3 Test Datasheets

Start Date: 6/6/24		End Date: 6/17/24		KS Technologies	Project No: PR182906	
Test Engineer: Cam Storey				Customer Witness: N/A	Temp: 72F Humidity: 54%	
Date	**Time**	**Axis**	**Plot No.**	**Serial No.**	**Remarks**	**Initials**
6/6/24					UUT will be dropped from a height of 5 feet on to a piece of steel backed by concrete. Swing Arm Drop tester will be used for height reference and UUT will be allowed to freefall	CS
	1620				Setup KST3601 on Swing Arm Drop Tester #7	CS
	1622	Face 3	Drop 1	000589	Perform a Drop on Face 3 (Opposite from connector end) from a height of 5 feet	CS
	1623	Face 2	Drop 2	000589	Perform a Drop on Face 2 from a height of 5 feet	CS
					After the drop on Face 2 the UUT showed signs of denting on the connector end	CS
	1624	Face 4	Drop 3	000589	Perform a Drop on Face 4 from a height of 5 feet	CS
					After the drop on Face 4 the UUT showed signs of denting on the connector end	CS
	1626	Edge 6-3	Drop 4	000589	Perform a Drop on Edge 6-3 from a height of 5 feet	CS
	1627	Edge 4-3	Drop 5	000589	Perform a Drop on Edge 4-3 from a height of 5 feet	CS
					After the drop on Edge 4-3 the UUT showed signs of denting on the connector end	CS
					UUT will be dropped from a height of 1000 mm on to a piece of steel backed by concrete. Swing Arm Drop tester will be used for height reference and UUT will be allowed to freefall	CS
6/17/2024	1428	Face 3	Drop 1	000005	Perform a drop from a height of 1000 mm on Face 3	CS
	1429	Face 2	Drop 2	000005	Perform a drop from a height of 1000 mm on Face 2	CS
	1430	Face 1	Drop 3	000005	Perform a drop from a height of 1000 mm on Face 1	CS
	1431	Face 6	Drop 4	000005	Perform a drop from a height of 1000 mm on Face 6	CS
	1432	Face 5	Drop 5	000005	Perform a drop from a height of 1000 mm on Face 5	CS
	1434	Face 4	Drop 6	000005	Perform a drop from a height of 1000 mm on Face 4	CS
	1435	Face 3	Drop 7	000005	Perform a drop from a height of 1000 mm on Face 3	CS
	1436	Face 2	Drop 8	000005	Perform a drop from a height of 1000 mm on Face 2	CS
	1436	Face 1	Drop 9	000005	Perform a drop from a height of 1000 mm on Face 1	CS
	1437	Face 6	Drop 10	000005	Perform a drop from a height of 1000 mm on Face 6	CS
	1437	Face 5	Drop 11	000005	Perform a drop from a height of 1000 mm on Face 5	CS
	1438	Face 4	Drop 12	000005	Perform a drop from a height of 1000 mm on Face 4	CS
					Test complete, connector end showed signs of damage after the drop testing. Customer to make final determination of test results	CS

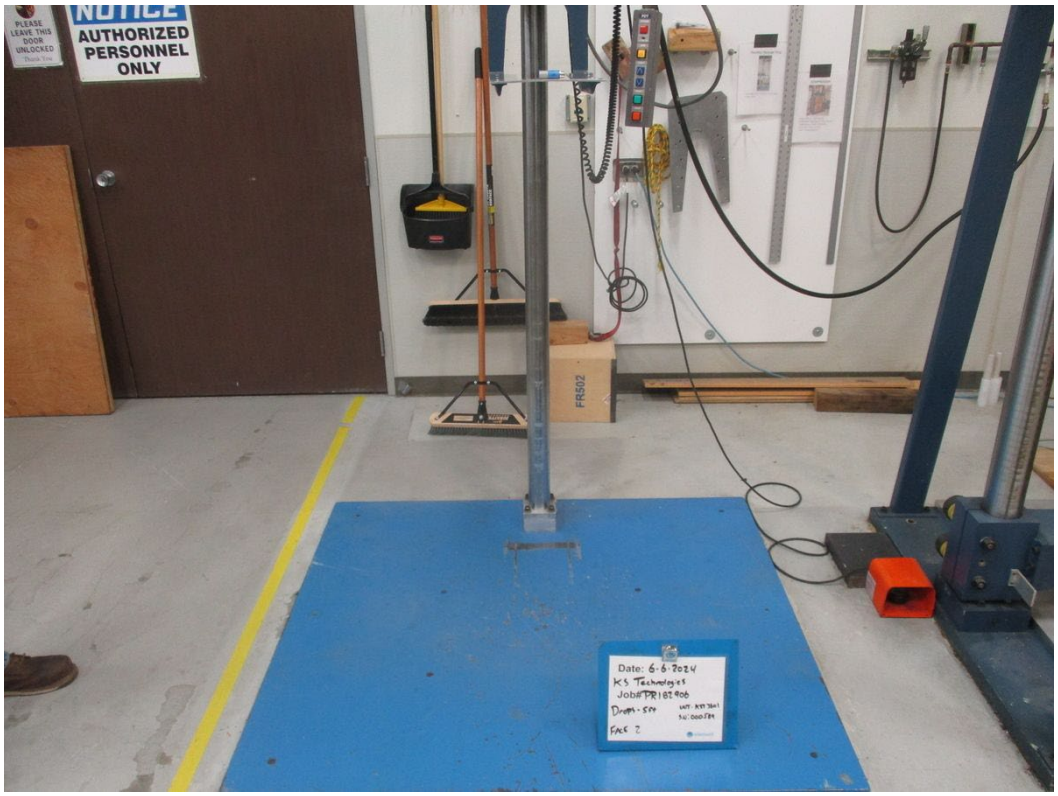
5.4.4 Test Photographs

Height

_Height



SN-000589_Drops_Face 3

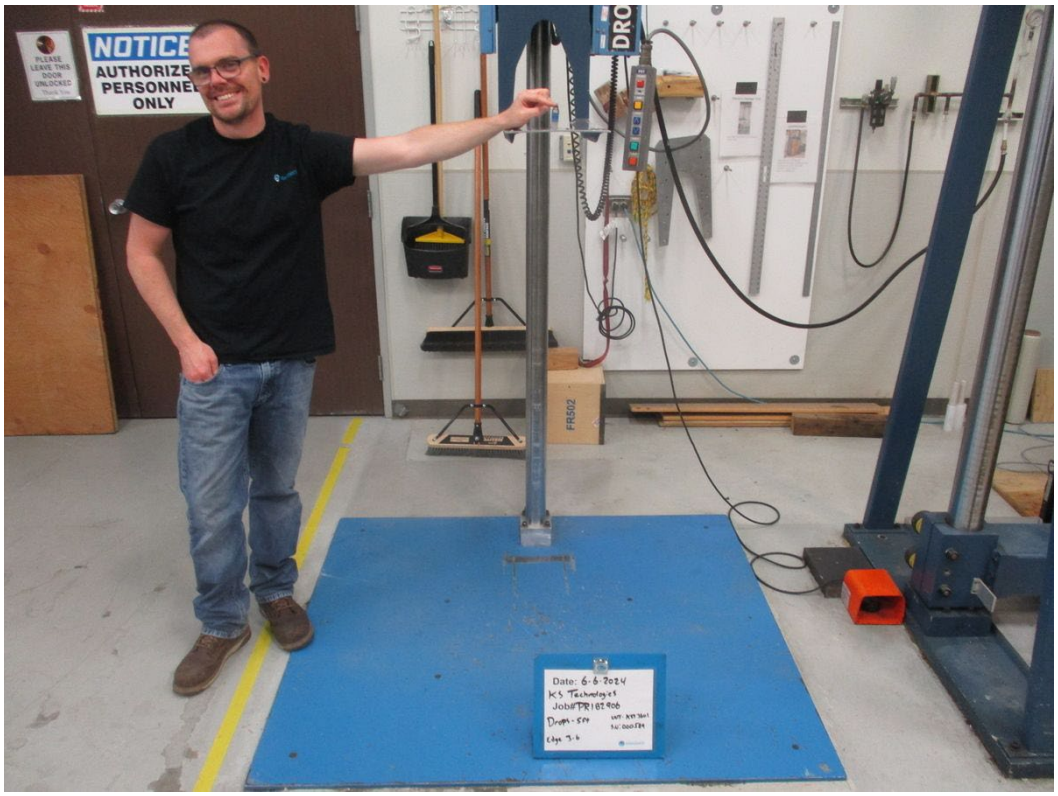


SN-000589_Drops_Face 2

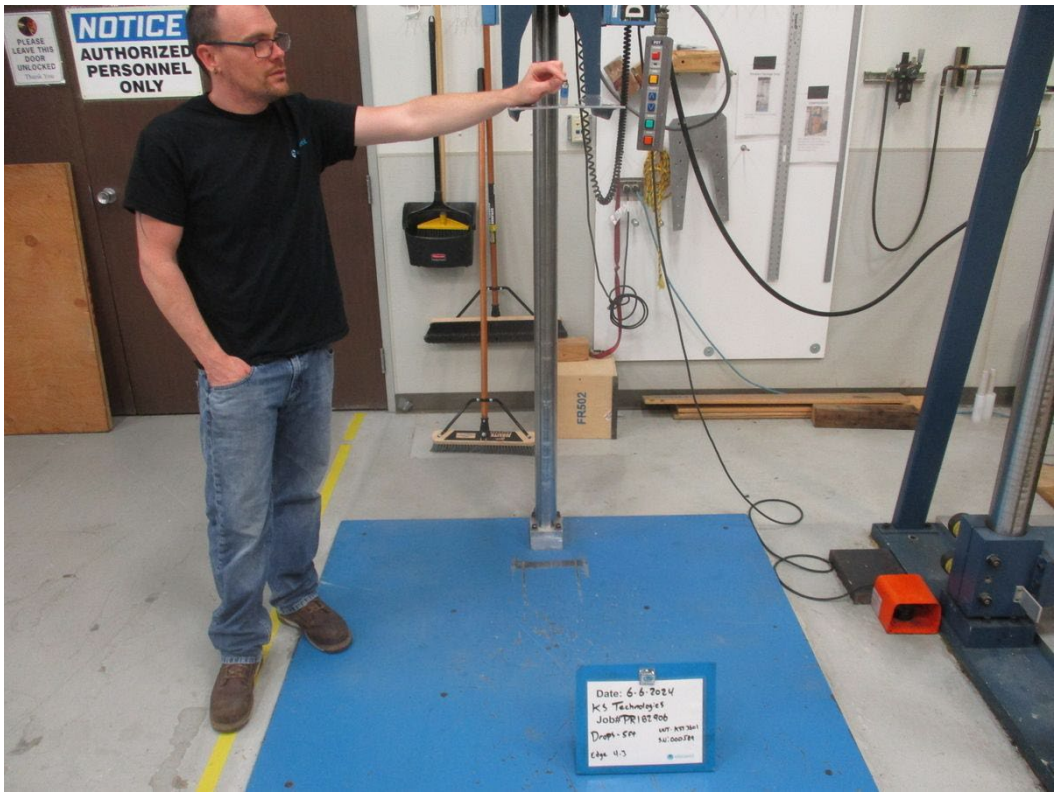
SN-000589_Drops_Face 3_Post Exposure

SN-000589_Drops_Face 4

SN-000589_Drops_Face 4_Post Exposure

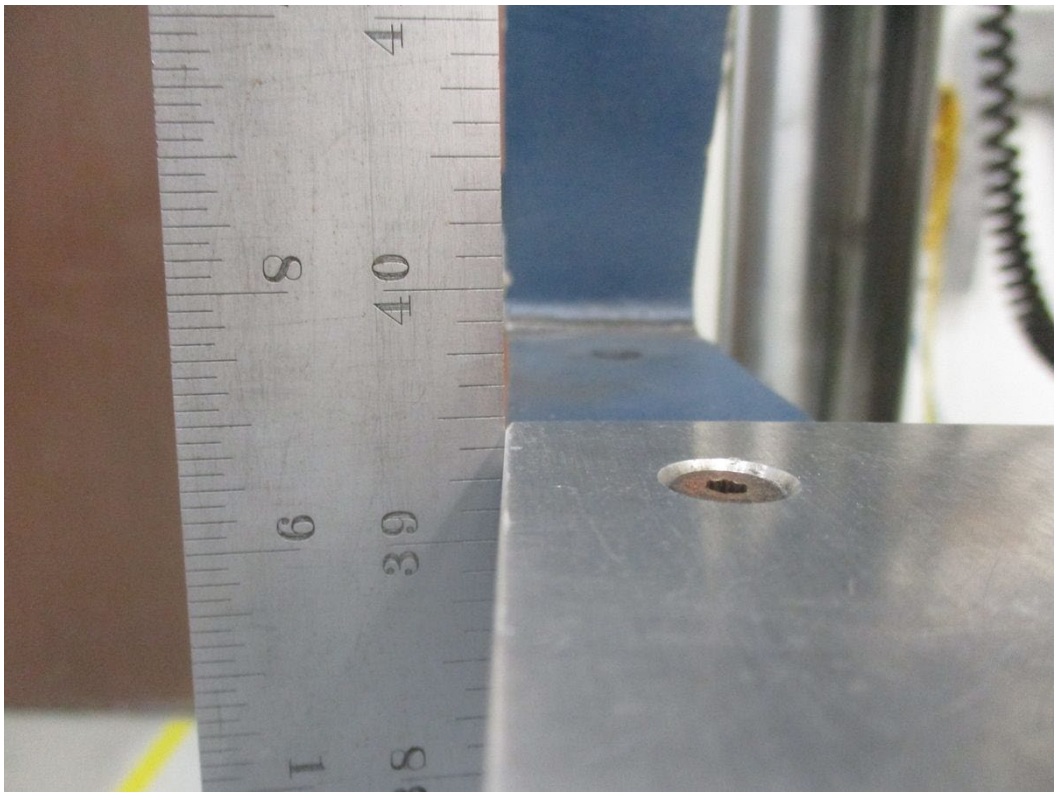


SN-000589_Drops_Edge 3-6

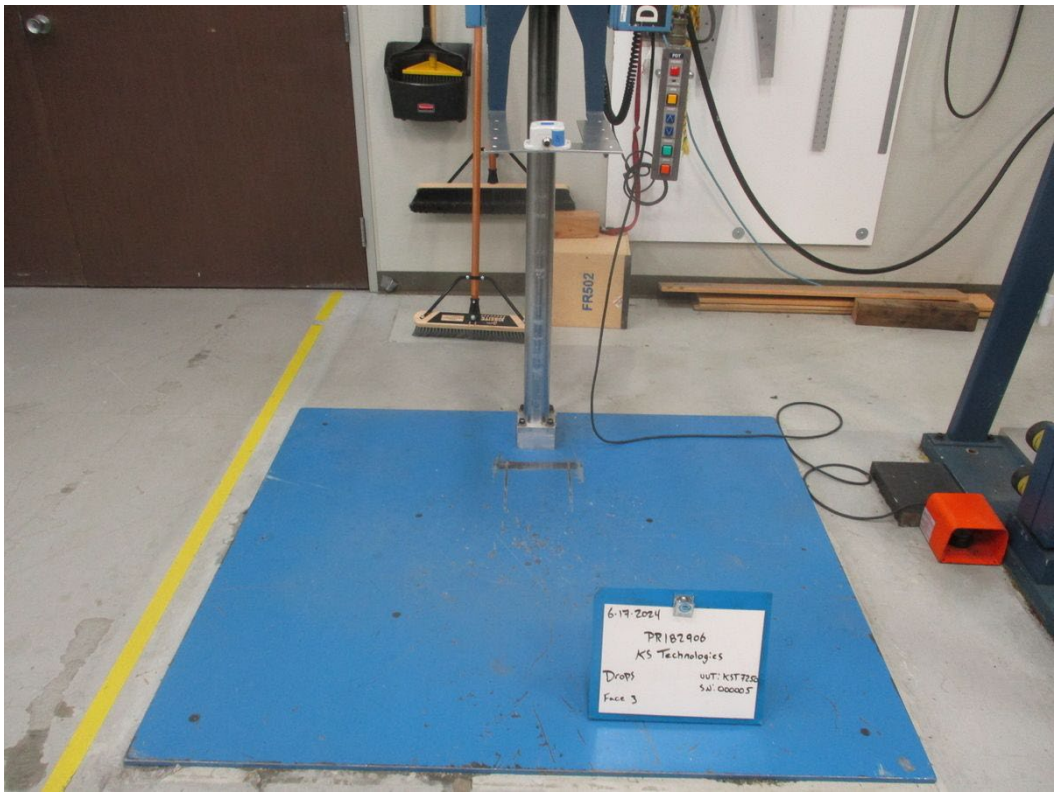


SN-000589_Drops_Edge 4-3

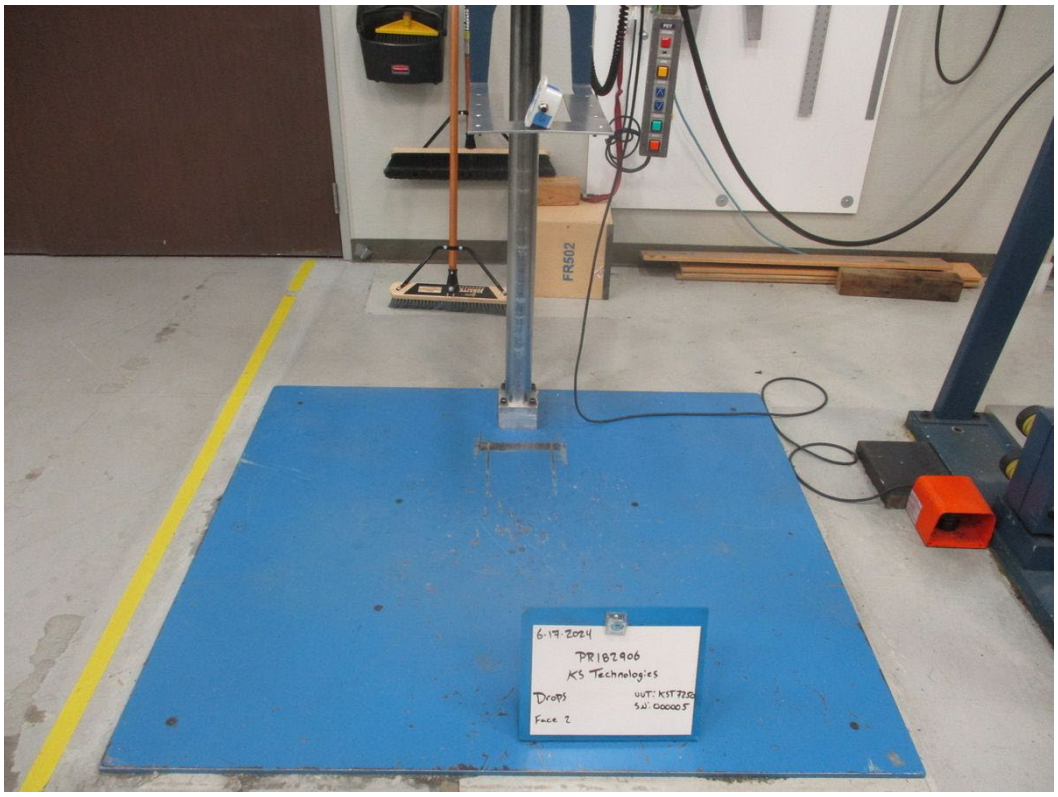
SN-000589_Drops_Edge 4-3_Post Exposure



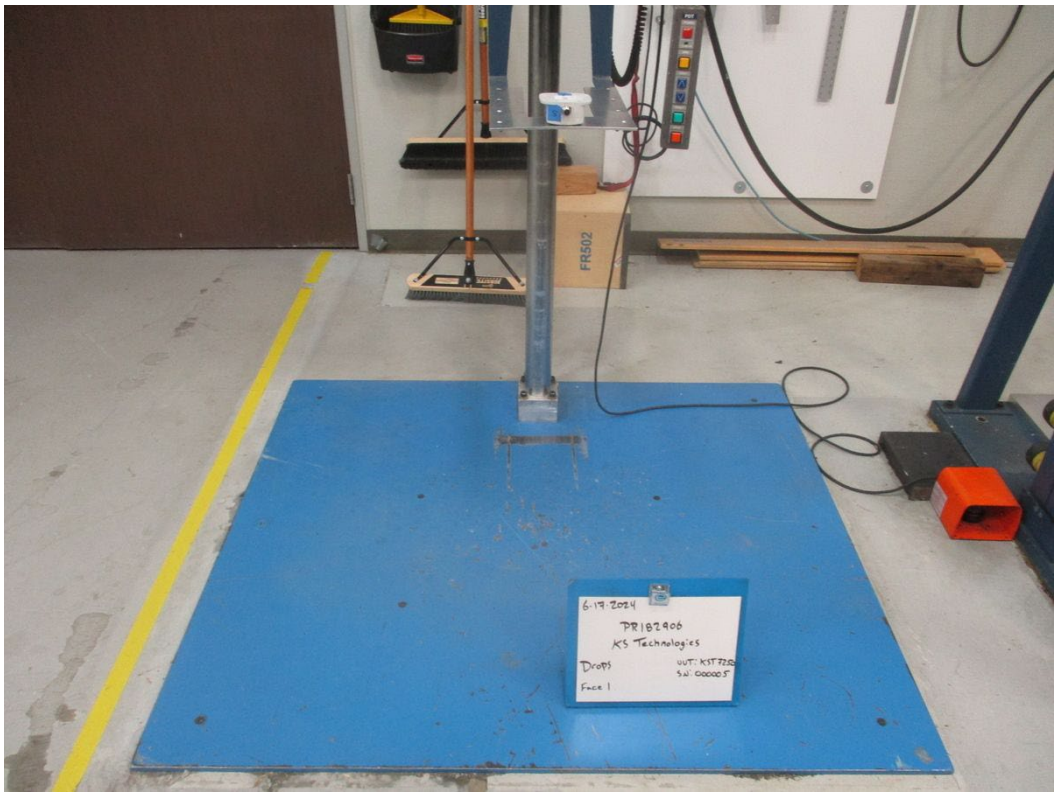
1000 mm Height



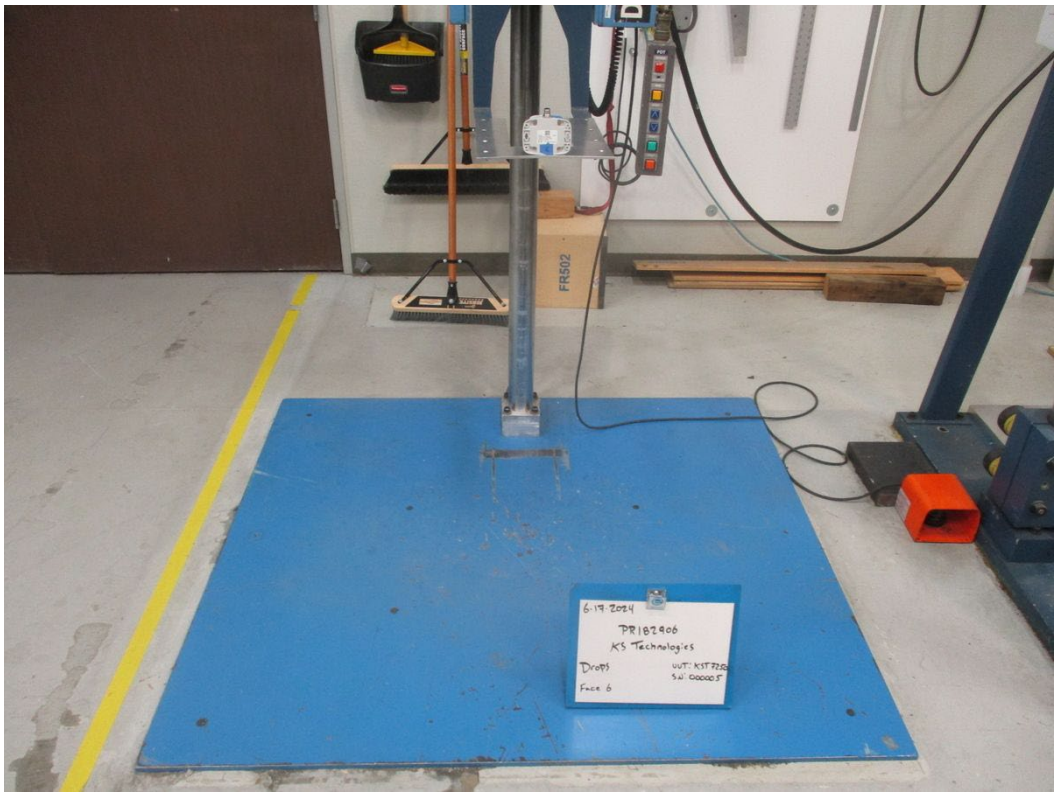
SN-000005_Drops_Face 3



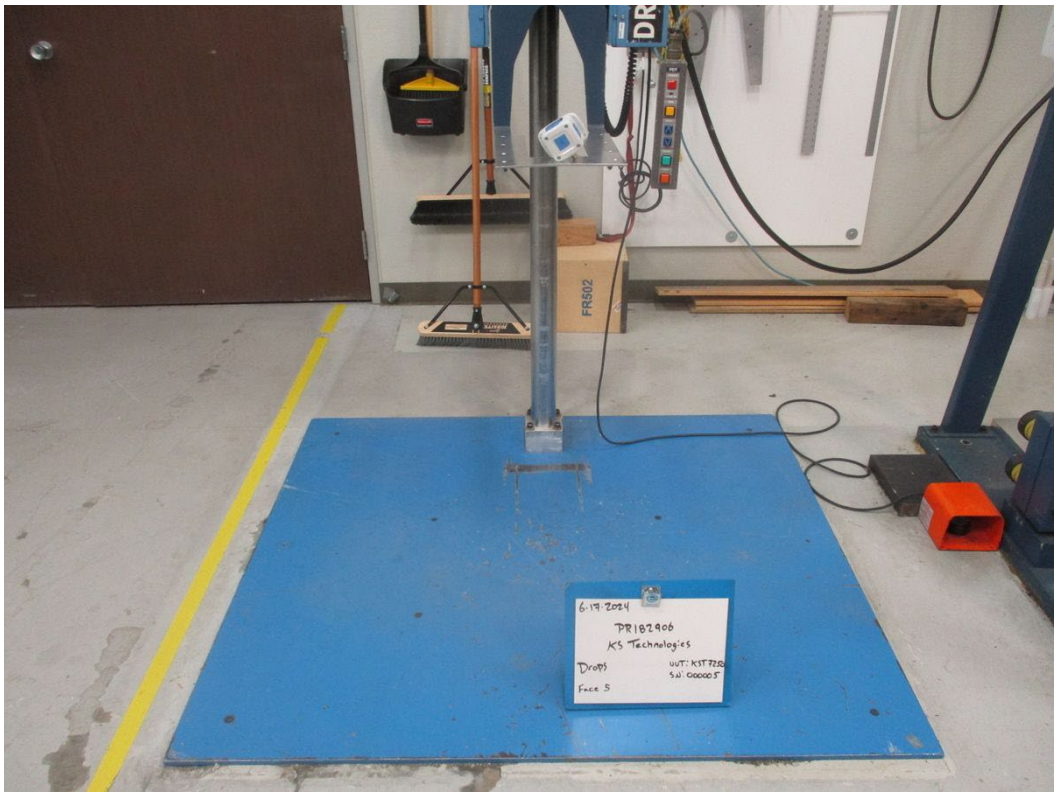
SN-000005_Drops_Face 2



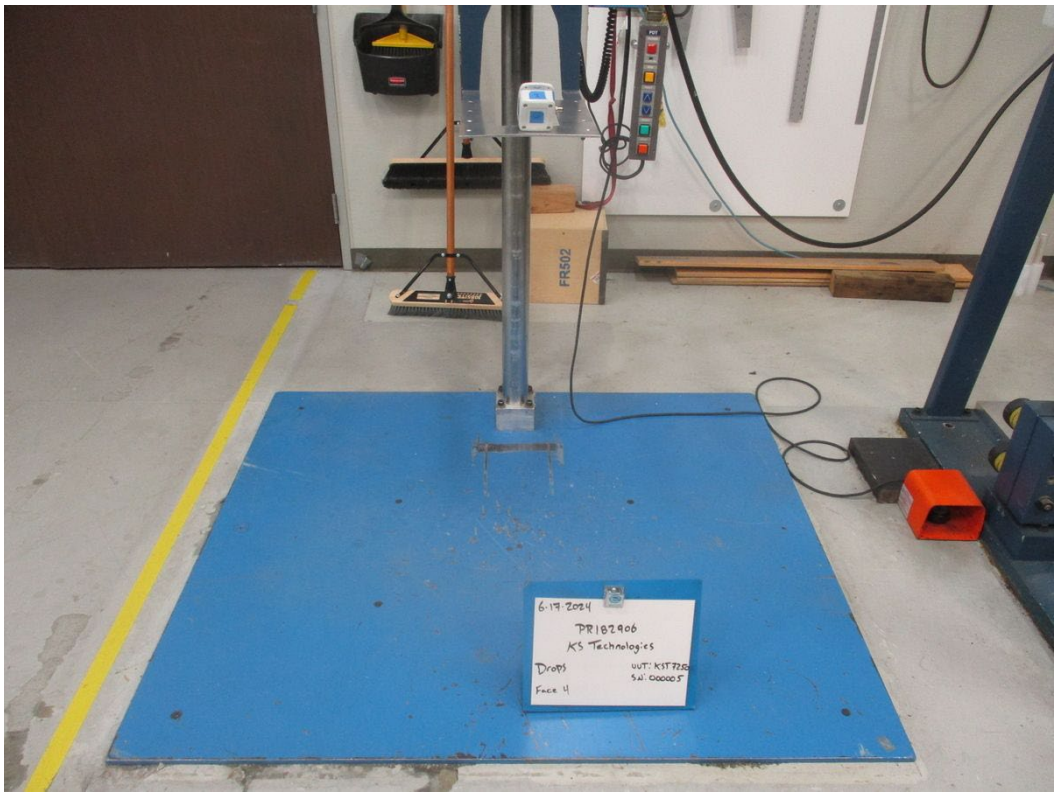
SN-000005_Drops_Face 1



SN-000005_Drops_Face 6



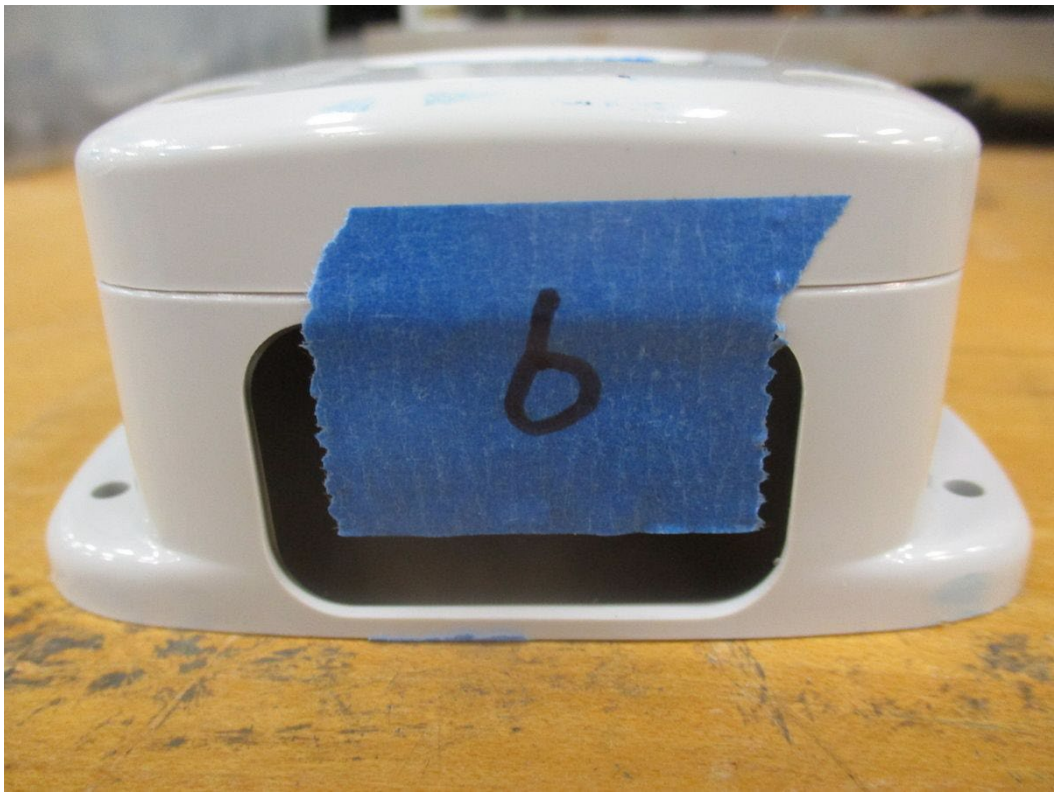
SN-000005_Drops_Face 5



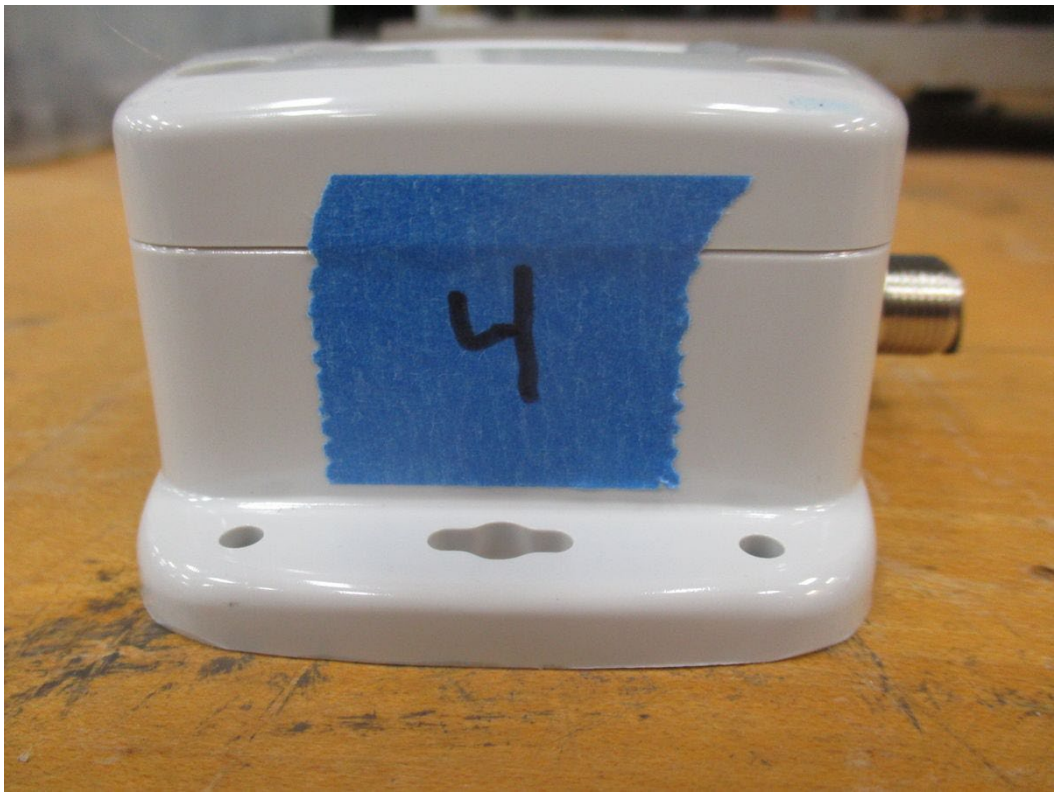
SN-000005_Drops_Face 4

SN-000005_Drops_Post Exposure

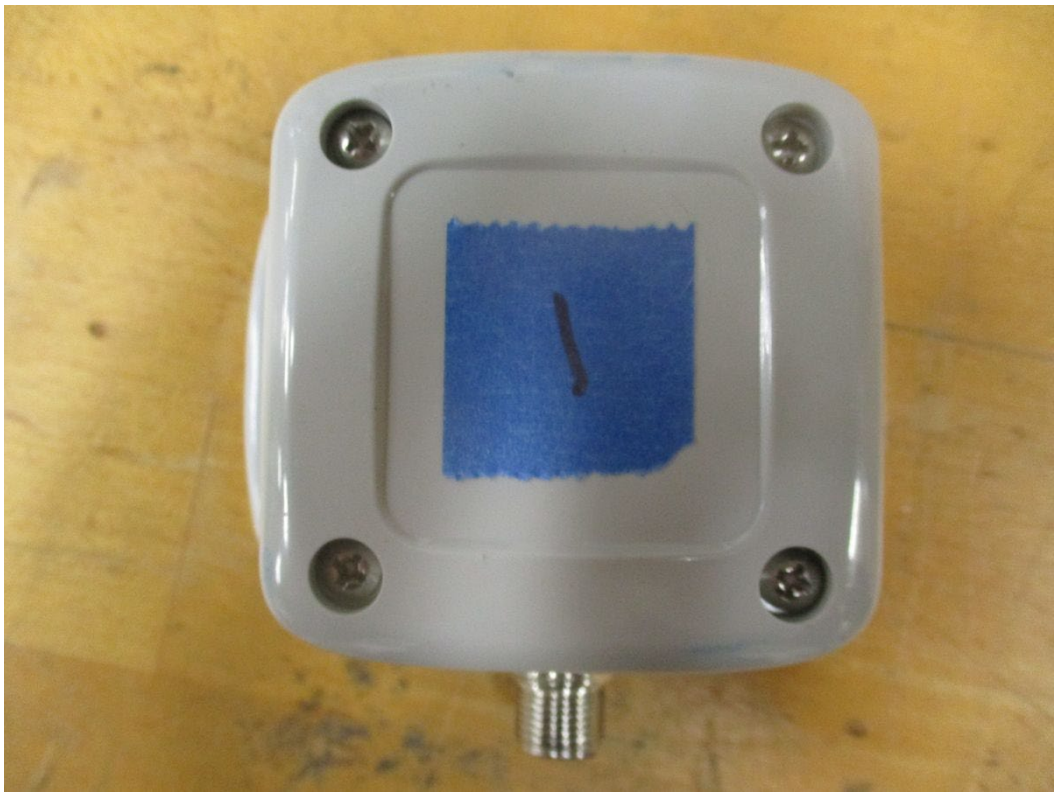
SN-000005_Drops_Post Exposure



SN-000005_Drops_Post Exposure



SN-000005_Drops_Post Exposure



SN-000005_Drops_Post Exposure

SN-000005_Drops_Post Exposure

5.4.5 Test Equipment List

Table 5.4-1: Drop Test Equipment List

Asset Number	Asset Type	Manufacturer	Model	Calibrated	Due
WC061449	Tower (Drop)	Lansmont	PDT56	NCR	NCR
WC061709	Probe (Temperature/Humidity)	Extech Instruments	EA20	11/03/2023	11/03/2024
WC078485	Measurement Tools (Ruler)	Starrett	C604R	NCR	NCR

Calibration Abbreviations
CAL: Calibration
NCR: No Calibration Required

End of Test Report