



Testing of Exposed Sensors

Ebtron, Inc.

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USA

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Chemir Job #V1FRR379

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TESTING SUMMARY FOR Ebtron, Inc.

September 16, 2015

TESTING METHOD NAME AND NUMBER

V1FRR379 The objective is to test sensor design by exposing 10 sensors to hydrochloric acid vapors and submerging 10 sensors in a saltwater bath for 30 days. The pass/fail criteria will be based on voltage readings taken from the saltwater bath test sensors and resistance readings from the acid vapor test sensors. Sensor failure will be indicated by a reading of 10.0VDC on the heated(H) thermistor and 0.0VDC on the temperature(T) thermistor for the saltwater test sensors. Sensor failure will be indicated by an open loop(OL) reading on the multi meter for either thermistor of the acid vapor test sensors. The initial readings will be taken once test setup is complete and again after 30 days of exposure.

RESULTS

SAMPLE PREPARATION

The sample was prepared for analysis using the following approaches:

- 10 sensors were exposed to a salt water solution, equivalent to seawater, for 30 days
- 10 sensors were exposed to hydrochloric acid vapors for 30 days

TESTING METHOD

Saltwater Test

The as-received test sensors were submerged in a saltwater solution equivalent to seawater. Initial voltage readings of both the heated (H) thermistors and temperature (T) thermistors of each sensor were taken using client provided equipment, GTC116 Type A transmitter. After 30 days of continuous exposure, the readings were taken again using same method. Results are in Table 1 below.

Table 1. Salt Water Submersion results

SENSOR ID	INITIAL (75.4F)		30 DAYS (71.0F)		Δ VALUE		SERIAL NUMBERS	
	H (VDC)	T (VDC)	H (VDC)	T (VDC)	ΔH (VDC)	ΔT (VDC)	H	T
1	6.623	3.851	6.862	3.746	+0.239	-0.105	11333850	21219579
2	6.560	3.905	6.775	3.802	+0.215	-0.103	11333851	21219580
3	6.870	3.790	7.104	3.680	+0.234	-0.110	11333852	21219581
4	6.499	3.656	6.721	3.541	+0.222	-0.115	11333853	21219582
5	6.989	3.727	7.221	3.612	+0.232	-0.115	11333854	21219583
6	6.926	3.754	7.160	3.639	+0.234	-0.115	11333845	21219574
7	6.538	3.610	6.733	3.485	+0.195	-0.125	11333846	21219575
8	6.872	3.810	7.109	3.698	+0.237	-0.112	11333847	21219576
9	6.762	3.800	6.901	3.688	+0.139	-0.112	11333848	21219577
10	6.750	3.746	6.980	3.632	+0.230	-0.114	11333849	21219578

Acid Vapor Test

The as-received sensors were placed in a sealed container over hydrochloric acid diluted to appropriate level, 1 part acid to 10 parts water with blue and white wire leads exposed for measurement. Initial resistance readings were taken using a multi meter with range set to 20k Ω for the heated (H) thermistors and 200k Ω for the temperature (T) thermistors. After 30 days of continuous exposure, the readings were taken again using same method. Results are in Table 2 below.

Table 2. Acid Fuming exposure results

SENSOR ID	INITIAL (75.4F)		30 DAYS (71.0F)		Δ VALUE		SERIAL NUMBERS	
	H (k Ω)	T (k Ω)	H (k Ω)	T (k Ω)	Δ H (k Ω)	Δ T (k Ω)	H	T
1	1.22	92.40	1.31	101.60	+0.09	+9.20	11333855	21219584
2	0.89	96.70	0.98	110.00	+0.09	+13.30	11333860	21219589
3	0.92	95.90	1.02	110.90	+0.10	+15.00	11333858	21219587
4	0.92	104.00	1.03	120.60	+0.11	+16.60	11333861	21219590
5	0.99	110.30	1.04	125.30	+0.05	+15.00	11333856	21219585
6	0.99	93.60	1.12	109.00	+0.13	+15.40	11333864	21219593
7	0.98	95.90	1.08	108.00	+0.10	+12.10	11333859	21219588
8	0.93	86.90	1.03	97.70	+0.10	+10.80	11333857	21219583
9	0.92	92.40	1.03	105.00	+0.11	+12.50	11333863	21219592
10	1.16	96.70	1.30	114.00	+0.14	+16.10	11333862	21219595

CONCLUSION

Based on the pass/fail criteria defined in the objective, the as-received test sensors had a 100% survival rate in both the saltwater and acid vapor tests. . The differences between initial and 30 day readings reflect changes in resistance of thermistors due to difference in room temperature at time readings were taken.

SAMPLE LOG-IN

SAMPLE NUMBER	DESCRIPTION
S1	Sensors for Salt Test—5 Sensors (PN:610-1665) per Cable Cable 1
S2	Sensors for Salt Test—5 Sensors (PN:610-1665) per Cable Cable 2
S3	GTC116 Type *A*
S4	Sensors (PN:610-1665) for Acid Test 10 each

Please remember we dispose of samples 30 days after the date of this Executive Summary unless instructed otherwise.

ATTACHMENTS

Attachment 1 Photos of Exposure setup

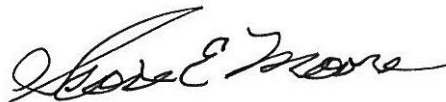
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