



A Method of Estimating Product Field Failure Rate from the Results of HALT – HALTPlus™

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ASTR 2008 Oct 1 – Oct 3, Portland, Oregon

HALTPlus 1
July 17, 2008





How many of us have wanted to use HALT
data to estimate AFR as we were?

- Told it couldn't be done...
- Frustrated by the lack of data...
- Don't have the bandwidth to develop a model...
- **XXX**

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 **The Situation** 

How to Prepare to Estimate a Product's Field Failure Rate from HALT Data

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 **Assumptions & Requirements** 

- ◆ **Must complete at least one HALT:**
 - Need a sample size of at least four units
 - All issues are corrected up to guard band limits (beyond preferably)
 - Corrective actions are verified in HALT
 - The HALT process must be as defined in the book HALT, HASS, and HASS Explained
 - Need the Operational Limits from HALT
- ◆ **Access to MTBF estimate**
- ◆ **Correlation between field and HALT stresses**
 - Three acceleration models are used, linear, exponential, and quadratic.
- ◆ **Excel based model**
 - Available on the web since the end of the summer – for a fee (naturally).

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CPMT **The Benefits** **ASTR 2008**

- ◆ Eliminate prolonged life tests – save product cost, space, and effort.
- ◆ Quickly & accurately estimate field failure rate.
- ◆ Customer satisfaction.

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CPMT **Linear Acceleration** **ASTR 2008**


Accelerated Time Scale

Field Use Time Scale


Time

Two other acceleration models are used in the estimation formula.

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Comparison of Field Results to Estimate



Products:	Calculated		HALT Results			Spec	MM Weight	Est AFR % HALT Only	Field AFR, %	Return Rate, %
	MTBF	AFR, %	Hot	Cold	Vib					
Control Panel	415,000	2.1	130	-80	28	5	10	0.22		
Residential Inverter	175,800	5.0	100	-60	28	6	10	0.45		1.18
Truck Inverter	143,600	6.1	102	-67	20	6	10	0.85	0.30	0.60
RV Inverter	342,100	2.6	100	-30	31	2	4	0.50		6.23
Residential Inverter	275,000	3.2	110	-60	17	6	10	0.60	0.30	4.80
RV Inverter	157,100	5.6	90	-60	21	2	2	0.67		9.50
Marine Inverter	192,500	4.6	90	-60	13	2	5	1.93		9.90
RV Inverter	106,800	8.2	100	-50	13	2	10	1.48		10.94
Programmable PS	616,200	1.4	110	-70	19	3	5	0.92		
Residential Inverter	233,700	3.8	100	-70	17	6	10	0.64	0.30	4.80
RV Inverter	56,800		80	-35	17	2	6	3.24		
Truck Inverter	109,500	8.0	105	-35	14	6	10	2.57		10.14
Energy Monitor	67,200	13.0	90	-50	40	1	2	0.41		
Apex 3k2p	186,300	4.7				3	5			
Ovation 2760			100	-61	22	3	5			
Ovation 35162						3	5			
mount 3156320-003	79,600	11.0				3	5			
Pinnacle II 400/440			100	-50		3	5			
SolAR	56,700	15.5	85	-40	30	6	10	2.10		
Printer			80	-50		1	2			1.4

Table is placeholder only - real data to follow

Results are from power, telecommunications, commercial, xxx, and xxx industries.

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Table Clarification



Products – Generic product type.

Calculated MTBF – Estimated by Telcordia SR-332, Issue 1, Parts Stress Method.

AFR – Annual Failure Rate from MTBF.

HALT Results – Product limitation from HALT.

Spec – Lookup value of the product's published specs.



Weight – Lookup value of spec guard band.

Est AFR% – Calculated AFR from formula.

Field AFR – Actual field AFR after HALT.

Return Rate, % – Product return rate with failed units.


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Work Remaining



- ◆ More data from others:
 - HALT results
 - Estimated MTBF
 - Field failure number
 - Type of product, i.e., internet server, etc.
- ◆ Confidence limits
- ◆ Include effects of HASS
- ◆ Patent grant

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Conclusions



- ◆ The methodology works very well
- ◆ Would like more data – would you like to help?