



**DESIGN RELIABILITY VERIFICATION REPORT**

<b>Date Released</b>	June 23, 2016	<b>Reference Number</b>	RE-PH15/200B
<b>Model No.</b>	73-936-0024 (iHP Module)	<b>Manufacturing Site</b>	Laguna
<b>Product Spec Rev</b>	Rev.06	<b>Product Spec Release Date</b>	05-07-2015
<b>BOM Release Date</b>	10/15/2015	<b>Schematic Rev</b>	A
<b>Sample Size</b>	See page 4	<b>Product Rev</b>	DVT

	<b>Name/s</b>	<b>Signature</b>	<b>Date</b>
<b>Issued by</b>	Napoleon N. Lanto		06/23/2016
<b>Approved by</b>	Jet Bautista		06/23/2016
<b>Circulation</b>	<b>Team</b>	<b>Name/s</b>	
	Design Team EW-01	(EE) Ricardo Roldan, Louie Cuevas (ME) Jonathan Cudal, Angelito Hatol	
	Design Management	Nonoy Neri, Peter Fernandes	
	Program Management	Rowena Legaspi, Dan Soliman, Scott Ireland	
	Reliability Engineering	Jet Bautista, Lito Baldo, Reggie Quinto, MP John Lau	

<b>Revision Control</b>		
<b>Revision</b>	<b>Change History</b>	<b>Date</b>
A	First Release	11/29/2015
B	Updated section 1.3.1 test remark to pass Updated section 2.1 test remark to survived Added attachment 73-936-0024 DVT WCSA rev A.xlsx in Appendix	06/23/2016

**Proprietary Information**

The information contained in this document is the property of ARTESYN EMBEDDED TECHNOLOGIES. Except as specifically requested in writing by ARTESYN EMBEDDED TECHNOLOGIES, the holder of this document: (1) shall keep all information contained herein confidential and shall protect same in whole or in part from disclosure and dissemination to all third parties and (2) shall use same for operating and maintenance purposes only.

**REPORT CONTENTS**

**Test Result Summary and Conclusion .....3**  
**References:.....4**  
**TEST DETAILS.....5**  
**1.0 Reliability Test.....5**  
    1.1 ELECTROLYTIC CAPACITOR LIFE ESTIMATION .....5  
    1.2 OPTO-COUPLER CTR MARGIN CALCULATION .....6  
    1.3 COMPONENT STRESS ANALYSIS .....7  
        1.3.1 *Thermal Stress Measurement* .....7  
        1.3.2 *Electrical Stress Measurement* .....8  
**2.0 Robustness Test .....9**  
    2.1 HIGH TEMPERATURE STRESS TEST (HTST).....9  
**Appendix .....10**

**Test Result Summary and Conclusion**

TEST	DRV Result
	(P-Pass / F-Fail / NR-Not Required)
<b>1.0 Reliability Test</b>	
1.1 Electrolytic Capacitor Life Prediction	P
1.2 Opto-coupler CTR Margin Calculation	P
1.3 Component Stress Analysis (DSA / WCSA)	
1.3.1 Thermal Stress Measurement	P
1.3.2 Electrical Stress Measurement	P
<b>2.0 Robustness Test</b>	
2.1 High Temperature Stress Test (HTST)	Survive
<b>3.0 Appendix</b>	

<b>Test Report Conclusion</b>	This product had completed the DRV tests as outlined in this report. Based on the test results depicted in this report, the product passed the DRV test.
-------------------------------	--

**References:**

1. Product Specifications: iHP Product Specifcation rev 06 Draft Rev.06
2. DRV Test Plan No. QAP-1146/PH
3. Design Derating Requirements [920-000114](#)
4. Design Reliability Verification [920-000095](#)
5. Schematic Diagram [710-021500-0001](#) Rev.A
6. PCB Artwork P/N's: [509-021501-0002](#) Rev.A

**SAMPLE UNIT SUMMARY**

Sample Unit #	Serial #	Date Code	Firmware	Product Revision
1	Unit 1	n/a	2.11	DVT
2	Unit 2	n/a	2.11	DVT
3	Unit 3	n/a	2.11	DVT

**TEST DETAILS**

**1.0 Reliability Test**

**1.1 Electrolytic Capacitor Life Estimation**

<b>Reference Document</b>		Reliability Test Instruction 920-000098		
<b>Test Location</b>		RE Eastwood		
<b>Test Conditions</b>	Input Voltage	380-480	Volts	
	Output Power	2880	Watts	
	Loading Conditions	24V/120A		
	Ambient Temp	30	°C	
	Cooling	Forced Air		
<b>Test Equipment</b>	Description	Model No.	Equip No.	Calibration Due Date
	Chroma	63203	QAE-573	9/29/2016
	Tektronix Oscilloscope	DPO 5034B	QAE-587	6/8/2016
	TTI DMM	1705	QAE-391	8/27/2016
	Chroma	62150H-1000S	QAE-533	9/15/2016
	ESPEC Chamber	PSL-2K	QAE-231	4/15/2016
<b>Test Sample</b>	Serial Nos.	Sample 1, Sample 2		
	Date Code	See page 4		
<b>Product Useful Life / Cap Life Expectancy</b>		87,600	Hours	
<b>Test Results</b>	All Electrolytic capacitor meets life expectancy			
<b>Test Remarks</b>	Based on above test results, calculated E-cap prediction result meets Life Expectancy requirement. See E-cap Life calculation data on Appendix.			

## 1.2 Opto-coupler CTR Margin Calculation

<b>Reference Document</b>		Reliability Test Instruction 920-000098		
<b>Test Location</b>		RE Eastwood		
<b>Test Conditions</b>	Input Voltage	342Vac	Volts	
	Output Power	2880	Watts	
	Loading Conditions	24V/120.0A		
	Ambient Temp	50	°C	
	Cooling	Forced Air		
<b>Test Equipment</b>	Description	Model No.	Equip No.	Calibration Due Date
	Chroma	63203	QAE-573	9/29/2016
	Tektronix Oscilloscope	DPO 5034B	QAE-587	6/8/2016
	TTI DMM	1705	QAE-391	8/27/2016
	Chroma	62150H-1000S	QAE-533	9/15/2016
	ESPEC Chamber	PSL-2K	QAE-231	4/15/2016
<b>Test Sample</b>	Serial Nos.	Sample 1, Sample 2		
	Date Code	See page 4		
<b>Product Useful Life</b>		10	Years	
<b>Test Results</b>	Opto coupler U809 has the lowest CTR margin of 488.08%			
	Refer to the attachment at the appendix section for details.			
<b>Test Remarks</b>	Passed			

### 1.3 Component Stress Analysis

#### 1.3.1 Thermal Stress Measurement

<b>Reference Document</b>		Reliability Test Instruction 920-000098		
<b>Test Location</b>		RE Eastwood		
<b>Test Conditions</b>	Input Voltage	342-519Vac	Volts	
	Output Power	2880	Watts	
	Loading Condition	24V/120A		
	Ambient Temp	50	°C	
	Cooling	Forced Air		
<b>Test Equipment</b>	Description	Model No.	Equipment No.	Calibration Due Date
	Chroma	63203	QAE-573	9/29/2016
	ESPEC Chamber	PSL-2K	QAE-231	4/15/2016
	TTI DMM	1705	QAE-391	8/27/2016
	Chroma	62150H-1000S	QAE-533	9/15/2016
<b>Test Sample</b>	Serial Nos.	Sample 1, Sample 2		
	Date Code	See page 4		
<b>Test Results</b>	<p>The sample unit latches at 342Vac 50°C Ambient. These were highlighted to Design Engineers. <a href="#">Refer to Bugzilla issue 18308</a></p> <p>DE Corrective Actions Are:</p> <ul style="list-style-type: none"> <li>- Rail_Imbalance protection circuit is now separated from the OCP circuit.</li> <li>- Code was updated to avoid mistriggering of protection during high temp condition.</li> <li>- PCB respin on the control board was performed to improved the grounding of the circuits to minimize signal noises.</li> </ul> <p>See <a href="#">73-936-0024 DVT WCSA rev A.xlsx</a> for thermal verification.</p>			
<b>Test Remarks</b>	<p>Based on the above test results, the product <b>passed</b> the Thermal Derating CSA / Worst-Case CSA. See CSA test data on Appendix.</p>			

### 1.3.2 Electrical Stress Measurement

<b>Reference Document</b>		Reliability Test Instruction 920-000098		
<b>Test Location</b>		RE Eastwood		
<b>Test Conditions</b>	Input Voltage	400Vdc	Volts	
	Output Power	2880	Watts	
	Loading Condition	24V/120A		
	Ambient Temp	25	°C	
	Cooling	Forced Air		
<b>Test Equipment</b>	Description	Model No.	Equipment No.	Calibration Due Date
	Chroma	63203	QAE-573	9/29/2016
	Tektronix Oscilloscope	DPO 5034B	QAE-587	6/8/2016
	TTI DMM	1705	QAE-391	8/27/2016
	Chroma	62150H-1000S	QAE-533	9/15/2016
<b>Test Sample</b>	Serial Nos.	Sample 1, Sample 2		
	Date Code	See page 4		
<b>Test Results</b>	All components are found within Artesyn Component Electrical Derating Requirement.			
<b>Test Remarks</b>	Based on the above test results, the product passed the Electrical Derating CSA / Worst-Case CSA. See CSA test data on Appendix.			



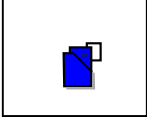
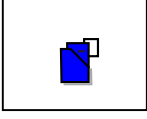


## 2.0 Robustness Test

### 2.1 High Temperature Stress Test (HTST)

<b>Reference Document</b>		Robustness Test Instruction 920-000099-0000		
<b>Test Location</b>		RE Eastwood		
<b>Test Conditions</b>	Input Voltage	400Vdc (4days)	Volts	
	Output Power	2880	Watts	
	Ambient Temperature	50+15+10	°C	
	Cooling	Forced Air by system box (Fan 19.8cfm)		
<b>Test Equipment</b>	Description	Model No.	Equipment No.	Calibration Due Date
	Chroma DC source	62150H-1000S	QAE-538	9/14/2016
	Chroma E-load	63203	TM15-170	3/6/2016
	ESPEC Chamber	PSL-2K	QAE-231	4/14/2016
<b>Test Sample</b>	Serial No.	Sample 3		
	Date Code	See page 4		
<b>1.) Load Cycling Test</b>	Output Loading	Min Load	0	A
		Full Load	62.5	A
	Cycling Sequence	16 hours FL, 8 hours ML		
	Duration	96 hours		
<b>2.) Output Short Circuit Test</b>	Input Line	On all the time		
	Output	ML then, short output to common, repeat 10X.		
<b>Test Results</b>	<p>The unit was able to operate beyond 70°C even after OTP was disabled.</p> <p>DE Corrective Actions Are:</p> <ul style="list-style-type: none"> <li>- Rail_Imbalance protection circuit is now separated from the OCP circuit.</li> <li>- Code was updated to avoid mistriggering of protection during high temp condition.</li> <li>- PCB respin on the control board was performed to improved the grounding of the circuits to minimize signal noises.</li> </ul>			
<b>Failure Analysis (Yes/NR)</b>	NA			
<b>Test remarks</b>	Based on above test results, sample unit survived HTST.			

**Appendix**

Attachment	Revision	File Name
	Rev A	73-936-0024 E-cap Life Calculator Rev15.1.xls
	Rev A	73-936-0024 DVT DSA @ 50°C rev A.xlsx
	Rev A	73-936-0024 DVT Opto CTR Calculation.xls
	Rev A	73-936-0024 DVT WCSA rev A.xlsx