

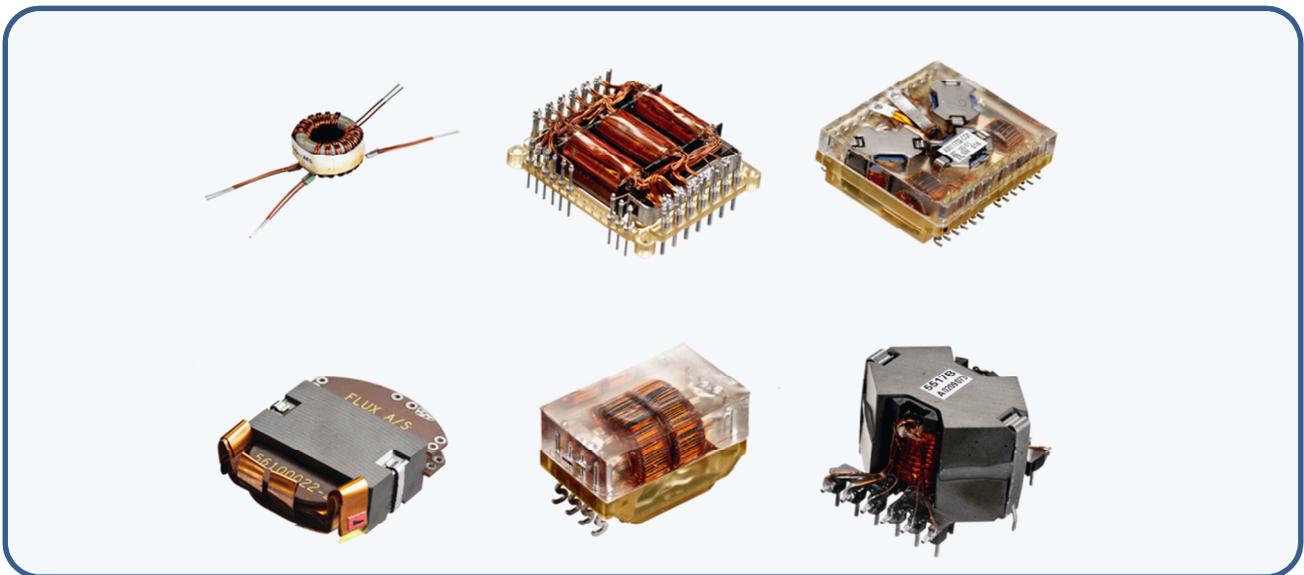
Qualification Test Procedure: **Various Topologies**

Document: 08690244

Issue: 1

Date: 28th August 2013

Page: 1 of 36



Author

Michael D. Simpson

Sales Manager (Space)

Lars A. Gregersen

© Flux A/S

This document contains information proprietary to Flux A/S. The information, whether in form of text, schematics, tables, drawings or illustrations, must not be duplicated or used for purpose other than evaluation, or disclosed outside the recipient company or organisation without the prior, written permission of Flux A/S.



DOCUMENT CHANGE LOG

Change No.	Date	Initiator	Pages Affected	Short Description of Change
Issue 1	28-08-13	-	-	Initial Issue



TABLE OF CONTENTS

1. INTRODUCTION 4

2. REFERENCE DOCUMENTS 4

3. SAMPLES DEFINITION 4

 3.1 Range of component families for testing 4

 3.1.1 Flux SMT 4

 3.1.2 Flux Platform 4

 3.1.3 Flux IM..... 4

 3.2 Qualification of transformers and inductors based on similarity 5

 3.3 Manufacturing and screening of samples 6

 3.4 Range of materials for Qualification Testing 7

 3.5 Range of processes for Qualification Testing 8

 3.6 Retention of qualification status 9

4. QUALIFICATION TESTING 9

 4.1 Chart III – Qualification test level.....10

 4.2 Test Facilities.....11

 4.3 Compliance towards MIL-PRF-2711

5. TEST RESULTS..... 12

 5.1 Presentation of results12

 5.2 Test Report matrix13

 5.3 Vibration and Mechanical Shock14

 5.3.1 Random Vibration14

 5.3.2 Mechanical Shock 500G.....14

 5.3.3 Mechanical Shock 100G.....15

 5.4 Moisture Test.....16

 5.4.1 One cycle16

 5.4.2 Full Test16

 5.5 Internal Examination (DPA)17

 5.5.1 Q1 – 1411800417

 5.5.2 Q2 – 1413800618

 5.5.3 Q3 – 1413800719

 5.5.4 Q4 – 1412800120

 5.5.5 Q5 – 12311047-2-B.....21

 5.5.6 Q6 – 14280036-2-B.....22

 5.6 Observations and Observation on testing23

 5.7 Minor Nonconformances23

 5.8 Critical Failures23

6. CONCLUSION 23



1. INTRODUCTION

This document details the results of the Qualification testing of Flux A/S units detailed in Section 3.1. All testing was performed in accordance with FT 08690231 ^(RD1).

2. REFERENCE DOCUMENTS

Ref.	Document	Title
RD1	FT 08690231-1	Qualification Test Procedure
RD2	MIL-PRF-27	General Specification for Transformers and Inductors
RD3	MIL-STD-202	Test Method Standards – Electronic and Electrical Component Parts
RD4	MIL-STD-981	Design, Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Applications
RD5	FT 08690019	Process Identification Document
RD6	FT 08711502	Screening Test Procedure for Transformers and Inductors
RD7	FT 08783001	Nonconforming Product
RD8	ECSS-Q-ST-70-08	Manual soldering of high-reliability electrical connections
RD9	FT 08690027	Declared Materials List
RD10	FT 08690028	Declared Processes List

3. SAMPLES DEFINITION

3.1 Range of component families for testing

The magnetic components covered by this lot acceptance test procedure are:

3.1.1 Flux SMT

Sample	Flux Part No	Description Specification		Quantity
Q1	14118004	Flyback 150kHz TASF	CRE_TAS 12_004 / rev 2	4
Q2	14138006	QFE Gate Transformer R13 30kHz SMD	CRE_ASP 12_012 / rev 1	4
Q3	14138007	A0014610 Toroid in F6 House	TBD	4
Q4	14128001	Current Sense Transformer	07524436A1	4

3.1.2 Flux Platform

Sample	Flux Part No	Description	Specification	Quantity
Q5	12311047-2-B	QFE DM Choke 300µH 5A	QFE DM Choke 300µH 5A	4

3.1.3 Flux IM

Sample	Flux Part No	Description	Specification	Quantity
Q6	14280036-2-B	IM2 EPC QFE 63W 25-38V	CRE_ASP 11_020 / rev 2	6

A number of samples representing the above-mentioned topology will be tested. The range of sizes and variants within each topology, covered by this qualification, is defined in the rules of similarity given in paragraph 3.2.



3.2 Qualification of transformers and inductors based on similarity

Flux has tailored the requirements of MIL-STD 981^(RD3). Similarity is judged against a family of qualified devices, rather than a single device

Only inductors and/or transformers that have passed qualification inspection shall be used as reference devices for establishing qualification by similarity.

Inductors or transformers deemed to be qualified on the basis of similarity shall be manufactured at the same production facility utilising the same processes as the reference device.

A similar device is an inductor or transformer that meets the following conditions when compared to the reference device(s)

Clause	C	PC	Comments
a) Same or lower operating temperature	✓		Family of devices will qualified from - 55 ° C to + 125 °C, actual operating parameters will be determined by the end user
b) Same or lower operating frequency and the same or lower operating power.	✓		Device will operate with a Flux specified range, actual operating parameters will be determined by the end user.
c) Same or lower ambient temperature.	✓		Family of devices will be qualified from - 55 ° C to + 125 °C, actual ambient temperature will be determined by the end user
d) To be used at an atmospheric pressure of the same or lower altitude.	✓		Family of devices will be qualified at atmospheric pressure, actual altitude will be determined by the end user.
e) To be used at the same or lower operating voltages and the same or lower dielectric stress per mil of same insulation.	✓		Device will operate with a Flux specified range, actual operating parameters will be determined by the end user
f) Same or lower shock and vibration requirements.	✓		
g) Same or greater life time expectancy.	✓		
h) Same or lower temperature class.	✓		
i) Same family as defined in 4.2 thru 4.7.	✓		
j) Same grade as defined in the applicable military specifications.	✓		
k) Same type of external and internal mounting, same type of case construction with nominal wall thickness within 25 percent when a case is used, same shape, and same termination (pin or hook terminals).	✓		
l) Linear envelope dimensions neither greater than 150 percent nor less than 70 percent of the corresponding dimensions. The total volume of envelope not to exceed 250 percent.	✓		150 / 70 % of linear dimensions, total volume not typically calculated (theoretical max if all three dimensions 150% = 337,5%). Volume will be calculated where all 3 dimension exceed 100%.
m) Same or greater wire size (cross-sectional area), and the same wire coating material for corresponding windings.	✓		
n) Same processing material and specification for case, finish and marking.	✓		
o) Same processing material and composition for potting, insulation (tapes and films), impregnation, staking and filling.	✓		
p) Same material composition, characteristic and coating for the ferrite and MMP core, same shape, and the same manufacturer.		✓	Grouped by core type, manufacturer and size
q) Same bobbin material and characteristics.	✓		
r) Same solder composition and welding.	✓		
s) Same construction and material for the terminals. For terminals of the same dimensions therequired terminal strength requirements to be the same or lower.	✓		

Table 3-2 Rules of similarity



3.3 Manufacturing and screening of samples

The components will be manufactured at Flux facilities



3.4 Range of materials for Qualification Testing

Material	DML Ref	Qualification Sample					
		Q1	Q2	Q3	Q4	Q5	Q6
Aluminium - AA6082-T6/T651	01.001					✓	
BRASS MS58. Plated with 2,5 µm Ni and 5 µm Sn90Pb10 by manufacturer	02.005						✓
Cu-ETP (surface treated Sn60Pb40: 5-10µm)	02.010	✓	✓	✓	✓		
STAINLESS SPRING STEEL, AISI 301	06.008						✓
Tin Solder Wire - Sn63 Pb37	07.001	✓	✓	✓	✓		✓
Tin Solder Bar - Sn60 Pb40	07.002	✓	✓	✓	✓	✓	✓
Toroid Core, MPP	08.002	✓					
Ferrite Core - Polyester or Nylon Coated	08.012		✓	✓	✓		
Toroid Core HIFLUX	08.023					✓	
Ferro Magnetic Oxide PC40	08.024						✓
Scotchweld 2216	10.001	✓	✓	✓	✓	✓	✓
Polyester Label / Acrylic Adhesive	11.001	✓	✓	✓	✓		✓
3M Tape 1205	11.003	✓	✓	✓	✓	✓	✓
Temp Lace, Polyester w synthetic rubber finish	11.006					✓	
CF1-135 Primer	14.001	✓	✓	✓	✓		
Ultem 1010R-7101	15.005	✓	✓	✓	✓		✓
Ultem 1000-100 natural	15.006						✓
Elkosil - Silicone Rubber Tube	16.002	✓	✓	✓	✓		
CV2500 - Silicone 2 part	16.004	✓	✓	✓	✓		✓
Polyesterimide Enamelled copper Wire	19.003	✓	✓	✓	✓		✓
Copper Wire - Polyurethane Polymide Enamelled	19.004					✓	
Glass micropearls 0.1mm	20.001	✓	✓	✓	✓		✓
Aerosil 200	20.005	✓	✓	✓	✓		✓
Stycast 2850FT	20.007					✓	
Catalyst 11 (for use with Stycast)	20.008					✓	



3.5 Range of processes for Qualification Testing

Processes	DPL Ref	Qualification Sample					
		Q1	Q2	Q3	Q4	Q5	Q6
Bonding with EC2216	FT.01.002	✓	✓	✓	✓	✓	✓
Impregnation with CV2500 or MAPSIL QS1123	FT.03.001 & FT.03.002	✓	✓	✓	✓		✓
Stripping	FT.07.001 to FT.07.004	✓	✓	✓	✓	✓	✓
Winding	FT.07.006						✓
Wire winding	FT.07.007	✓	✓	✓	✓	✓	
Soldering	FT.08.001	✓	✓	✓	✓		✓
Pretinning	FT.09.002	✓	✓	✓	✓	✓	✓
Destressing of carrier	FT.13.002						✓
Assembly and bonding of cores Bonding to socket	FT.14.001						✓
Insertion of pins	FT.14.002						✓
Modification of coilformer	FT.14.003						✓
Bending and insertion of L pins	FT.14.004	✓	✓	✓	✓		
Marking & serialisation	FT.15.001	✓	✓	✓	✓	✓	✓
Grinding of cores	FT.16.001						✓
MIP	FT.17.002	✓	✓	✓	✓	✓	✓
Housing Assembly	FT.16.004	✓	✓	✓	✓		
Potting with Stycast	FT.16.005					✓	
Screening test	FT.17.004	✓	✓	✓	✓	✓	✓
Manufacturing test	FT.17.005	✓	✓	✓	✓	✓	✓
Material inspection	FT.17.006	✓	✓	✓	✓	✓	✓
Visual Inspection	FT.17.007	✓	✓	✓	✓	✓	✓
Final inspection	FT.17.008	✓	✓	✓	✓	✓	✓



3.6 Retention of qualification status

There is a conflict between the retention periods stated in MIL-PRF-27^(RD2) and MIL-STD-981^(RD4). For purposes of this specification, MIL-PRF-27^(RD2) holds precedence

Qualification status is valid for a period of sixty months from the date of initial qualification (start of testing date), provided that during this period the topology using the same materials and processes, has been manufactured at least once each successive twelve month period.

4. QUALIFICATION TESTING

Qualification is performed based upon MIL-PRF-27^(RD2) Table V (Qualification Inspection)

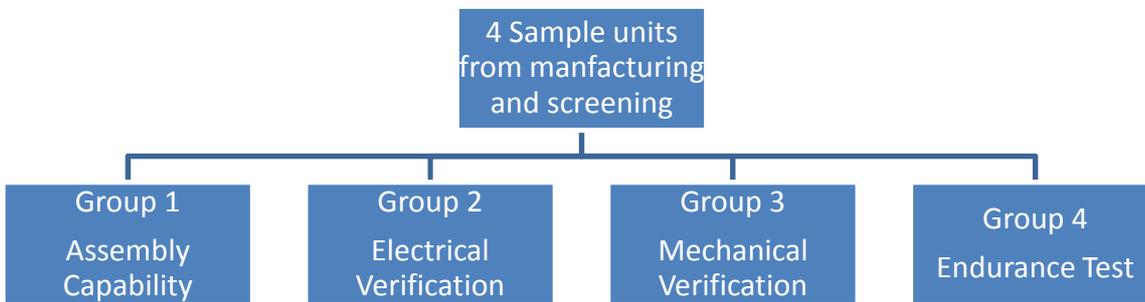


Table 4-1 Test Sub-groups



4.1 Chart III – Qualification test level

Flux has reduced the sample size used for qualification purposes to 4.

Group and Test		Sample				Method (Paragraph)	Requirement (Paragraph)
		1&5	2&6	3	4		
Group 1	Screening	✓	✓	✓	✓	RD6	
	Solderability	✓	✓	✓	✓	5.6.1	5.6.2
	Visual Inspection	✓	✓	✓	✓	ECSS-Q-ST-70-08	
Group 2	Terminal Strength	✓	✓	✓	✓	5.8.1	5.8.2
	Visual Inspection	✓	✓	✓	✓	ECSS-Q-ST-70-08	
	Dielectric Withstanding Voltage (at atmospheric pressure)	✓	✓	✓	✓	5.5.1	5.5.2
	Electrical characteristics (room temperature)	✓	✓	✓	✓	5.2.1	5.2.2
	Mounting on PCB and Fixture	✓	✓	✓	✓	ECSS-Q-ST-70-08	
	Visual Inspection	✓	✓	✓	✓	ECSS-Q-ST-70-08	
	Electrical characteristics (inductance)	✓	✓	✓	✓	5.2.1	5.2.2
Group 3	Vibration	✓	✓			5.9.1	5.9.2
	Mechanical Shock	✓	✓			5.10.1	5.10.2
	Visual Inspection	✓	✓			ECSS-Q-ST-70-08	
	Electrical characteristics (inductance)	✓	✓			5.2.1	5.2.2
	Dielectric withstanding voltage (At reduced voltage)	✓	✓			5.5.1	5.5.2
	Winding continuity	✓	✓			ECSS-Q-ST-70-08	
	Thermal shock	✓	✓			5.4.1	5.4.2
	Winding continuity	✓	✓			RD6	
	Immersion	✓	✓			N/A	
	Moisture resistance	✓	✓			5.11.1	5.11.2
	Overload	✓	✓			5.12.1	5.12.2
	Dielectric withstanding voltage (At reduced voltage)	✓	✓			5.5.1	5.5.2
	Insulation resistance	✓	✓			RD6	
	Winding continuity	✓	✓			RD6	
	Visual and mechanical examination	✓	✓			5.3.1	5.3.2
	Electrical characteristics	✓	✓			5.2.1	5.2.2
	Visual and Mechanical Examination (DPA)	✓	✓ (1)			RD3	
	Group 4	Life test			✓	✓	5.13.1
Dielectric withstanding voltage (At reduced voltage)				✓	✓	5.5.1	5.5.2
Insulation resistance				✓	✓	RD6	
Visual and mechanical examination				✓	✓	5.3.1	5.3.2
Electrical characteristics				✓	✓	5.2.1	5.2.2
Sample Size = 4(6)						Failures Allowed = 0	

Table 4-2 Test Flow

Note 1: Although not required, an additional sample of Q1, Q2, Q3 and Q4 were subjected to DPA.



4.2 Test Facilities

All testing was performed at Flux facilities at Asnaes, and Delta facilities in Horsholm, Denmark.

4.3 Compliance towards MIL-PRF-27

Compliance between table 4-2 and MIL-PRF-27^(RD2) requirements for grade 5 transformers and inductors, is given in table 4-3:

Test or Inspection	C / NC	Test / Doc	Notes
Solderability	C	T	Soldering Iron method
Resistance to solvents	C	D	Resistance to solvent known for all materials
Resistance to soldering heat	C	T	Part of solderability test
Terminal strength	C	T	
Dielectric withstanding voltage (At atm. pressure)	C	T	
Dielectric withstanding voltage (At bar pressure)	NC	-	Not performed due to excessive cost. Test is not required as part of MIL-STD-981 group B inspection.
Induced voltage	C	T	Only for machine wound components
Insulation resistance	C	T	
Electrical characteristics	C	T	
Temperature rise	NC	-	Component performance not relevant for process qualification.
Corona discharge	N/A	-	All components operate below 100V/mil
Salt spray	NC	-	No components are subjected to salty environment
Vibration	C	T	
Shock	C	T	Test conditions E used
Dielectric withstanding voltage (At reduced voltage)	C	T	
Induced voltage	C	T	Only for machine wound components
Winding continuity	C	T	
Thermal shock (10 cycles)	C	T	25 cycles performed
Winding continuity	C	T	
Immersion	NC	-	No components are subjected to wet environment
Moisture resistance	C	T	Test performed without polarisation, no load, excl. vibration
Overload	C	T	
Dielectric withstanding voltage (At reduced voltage)	C	T	
Induced voltage	C	T	Only for machine wound components
Insulation resistance	C	T	
Winding continuity	C	T	
Visual and mechanical examination	C	T	
Electrical characteristics	C	T	
Flammability	C	D	Flammability data used
Visual and Mechanical examination (Internal)	C	T	
Life test	C	T	
Dielectric withstanding voltage (At reduced voltage)	C	T	
Insulation resistance	C	T	
Visual and mechanical examination	C	T	
Electrical characteristics	C	T	
Fungus	C	-	All materials used are fungus resistant

Table 4-3 Compliance Matrix



5. TEST RESULTS

5.1 Presentation of results

The results are presented and summarised in paragraph 5.2, any remarks relevant to the test campaign are detailed in paragraphs 5.4 and 5.5 for minor and critical observations respectively.



5.2 Test Report matrix

Group and Test		Q1				Q2				Q3				Q4				Q5				Q6			
		038	041	039	042	046	044	406 409	411 412	021	024	022	025	001	004	002	005	138	139	140	141	156 158	157 159	160	161
Group 1	Screening	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Solderability	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Visual Inspection	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Group 2	Terminal Strength	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	N/A	N/A	N/A	N/A	✓	✓	✓	✓	
	Visual Inspection	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Dielectric Withstanding Voltage (at atmospheric pressure)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Electrical characteristics (room temperature)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Mounting on PCB and Fixture	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Visual Inspection	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Electrical characteristics (inductance)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Group 3	Vibration	✓	✓			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		
	Mechanical Shock	✓	✓			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		
	Visual Inspection	✓	✓			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		
	Electrical characteristics (inductance)	✓	✓			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		
	Dielectric withstanding voltage (At reduced voltage)	✓	✓			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		
	Winding continuity	✓	✓			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		
	Thermal shock	✓	✓			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		
	Winding continuity	N/A	N/A			N/A	N/A			N/A	N/A			N/A	N/A			N/A	N/A			N/A	N/A		
	Immersion	N/A	N/A			N/A	N/A			N/A	N/A			N/A	N/A			N/A	N/A			N/A	N/A		
	Moisture resistance	✓	✓			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		
	Overload	✓	✓			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		
	Dielectric withstanding voltage (At reduced voltage)	✓	✓			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		
	Insulation resistance	✓	✓			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		
	Winding continuity	✓	✓			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		
	Visual and mechanical examination	✓	✓			✓	✓			✓	✓			✓	✓			✓	✓			✓	✗	✓	✗
	Electrical characteristics	✓	✓			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		
	Visual and Mechanical Examination (DPA)	✓	✓			✓	✓			✓	✓			✓	✓			✓				✓	✗		
Group 4	Life test			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		✓	✓	
	Dielectric withstanding voltage (At reduced voltage)			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		✓	✓	
	Insulation resistance			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		✓	✓	
	Visual and mechanical examination			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		✓	✓	
	Electrical characteristics			✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		✓	✓	

Pass

Passed with comments
See section 5.7

Fail
See section 5.8

This test is required,
however it is Not
Applicable for this part type

In accordance with Test
procedure this test is not
required for this S/N

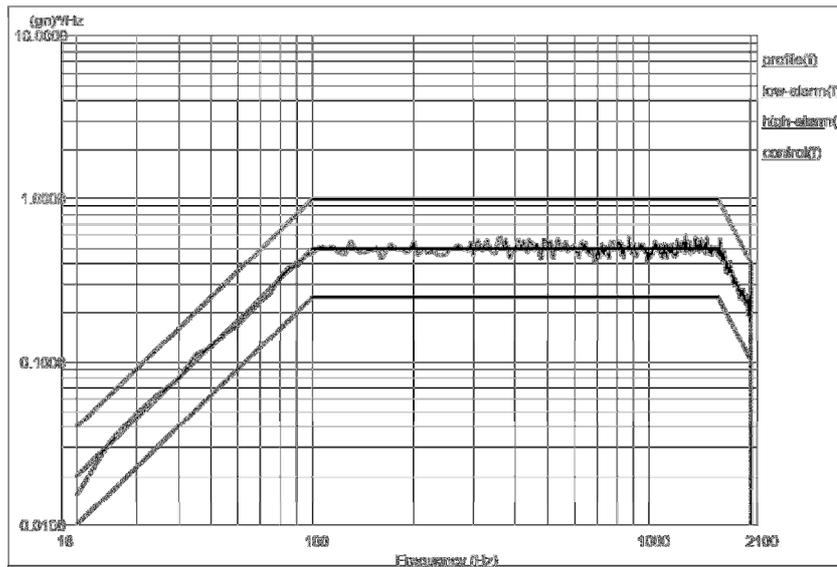


5.3 Vibration and Mechanical Shock

Vibration and Mechanical shock was performed at Delta

5.3.1 Random Vibration

This was performed on all units from subgroup 3



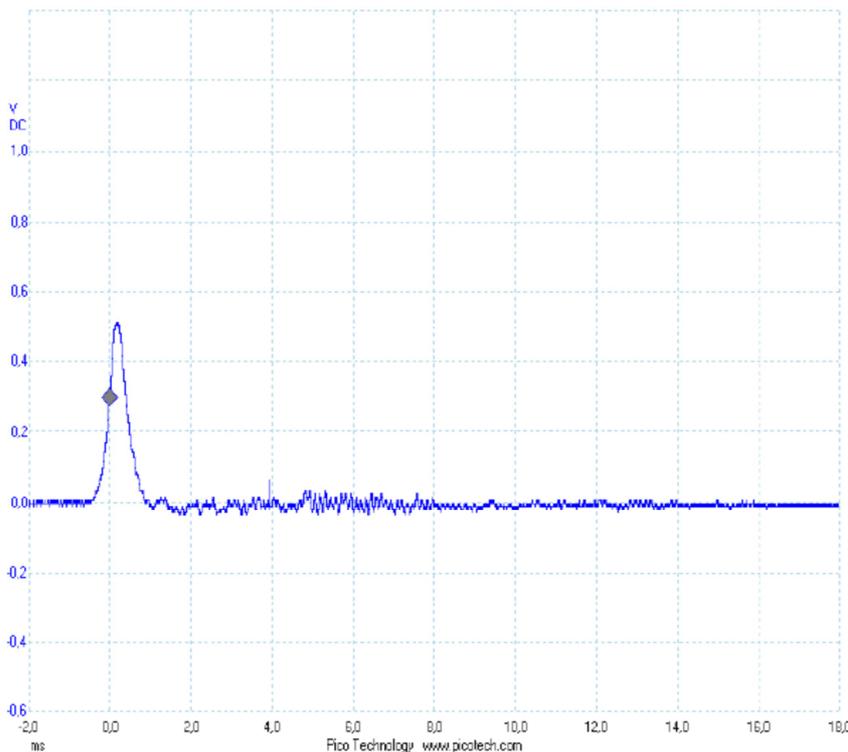
Vibration

Recorded PSD
from run 1.

30 g_{rms}, 5 min.

5.3.2 Mechanical Shock 500G

This was performed on all units from subgroup 3 except Q6 S/N 158 and 159



Shock 500g

Recorded
shock pulse

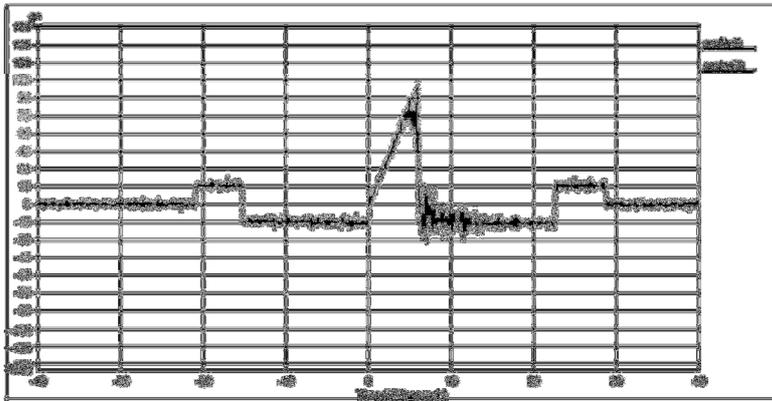
1 mV/g verti-
cally.

500 g, 1 ms



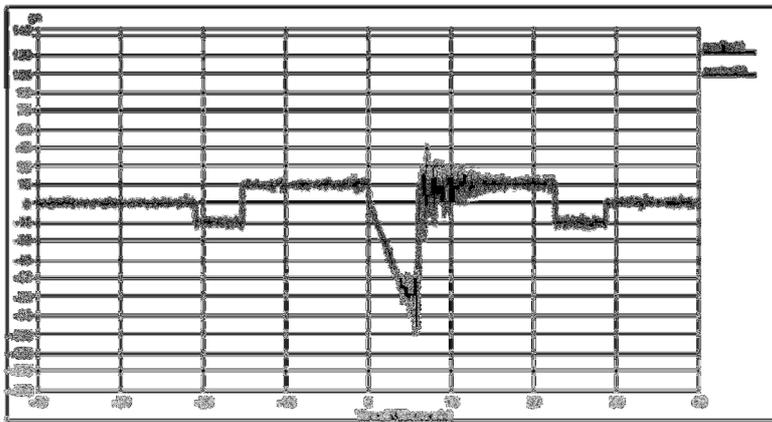
5.3.3 Mechanical Shock 100G

This testing was performed on Q6 samples S/N 158 and 159 only.



Sawtooth shock

In each axis,
 3 shocks in positive direction
 100g, 6ms

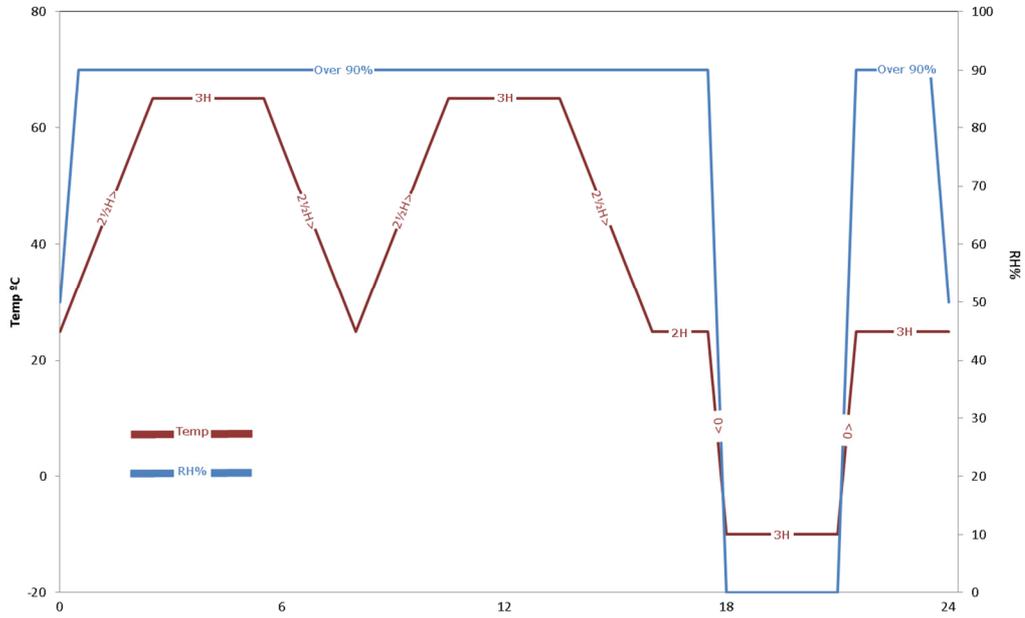


-and 3 shocks in the negative direction.

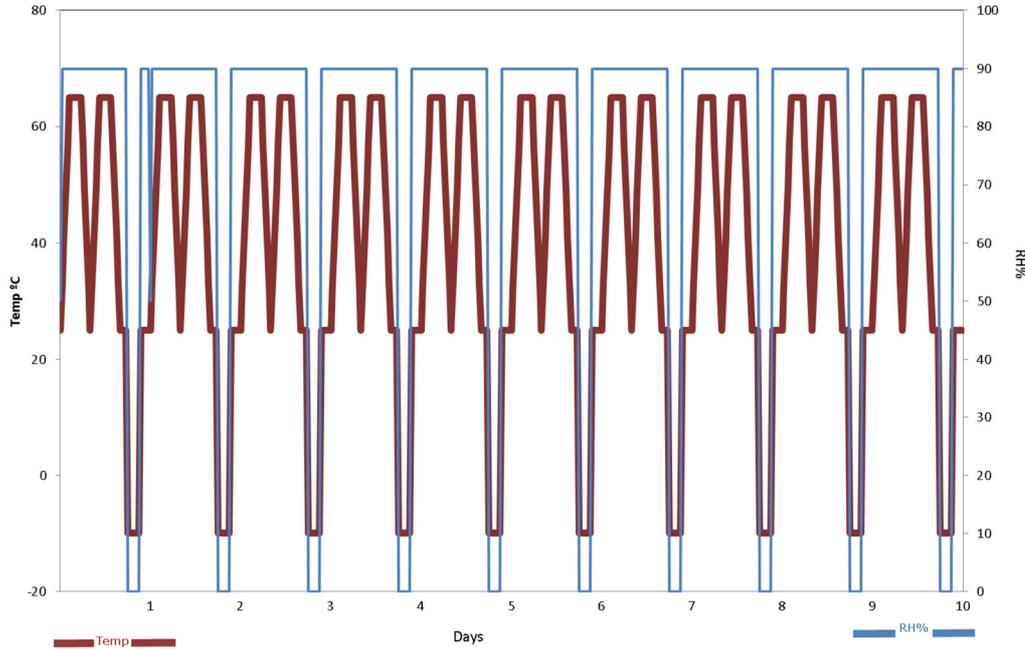


5.4 Moisture Test

5.4.1 One cycle



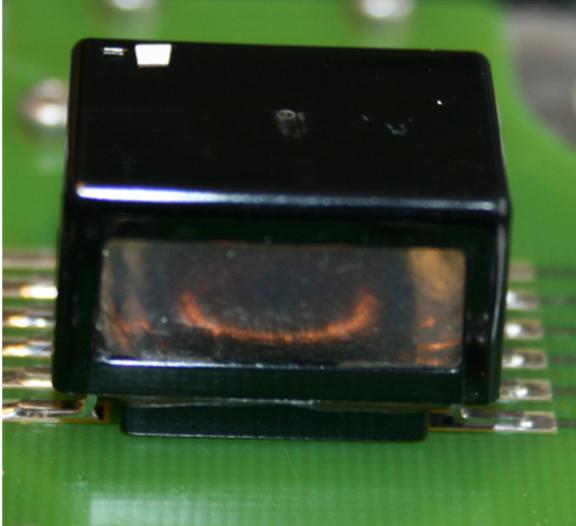
5.4.2 Full Test



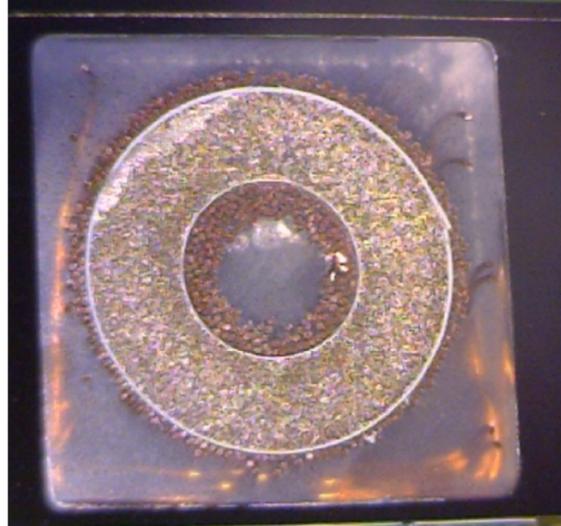
5.5 Internal Examination (DPA)

5.5.1 Q1 - 14118004

External Examination



Internal Examination

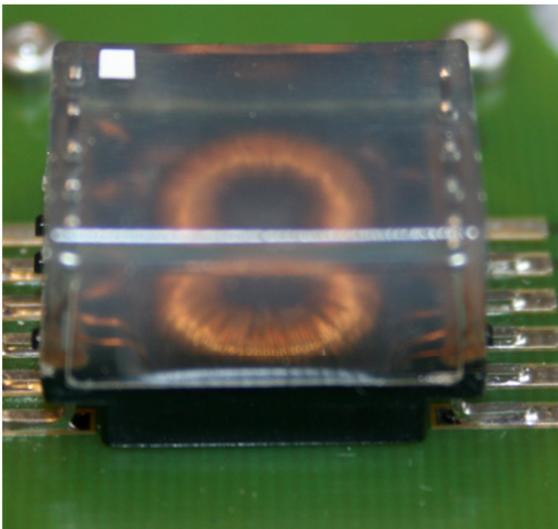


Comments:

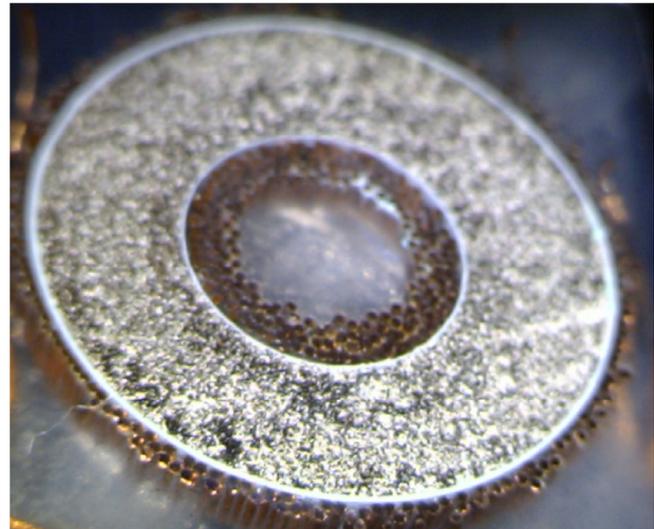
Serial Number 038, this unit is with full housing. The core material show apparent signs of 'pitting' on the surface of the cut section.

This is typical of Hiflux and other powder based cores when sectioned and polished

External Examination



Internal Examination



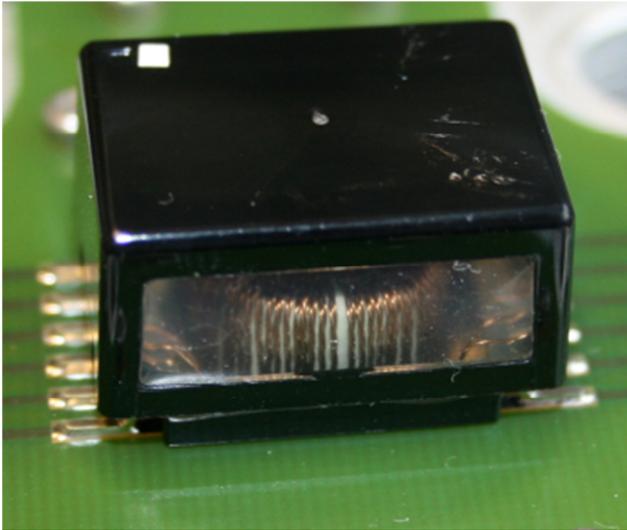
Comments:

Serial Number 041, this unit is without the upper housing. The core material show apparent signs of 'pitting' on the surface of the cut section.

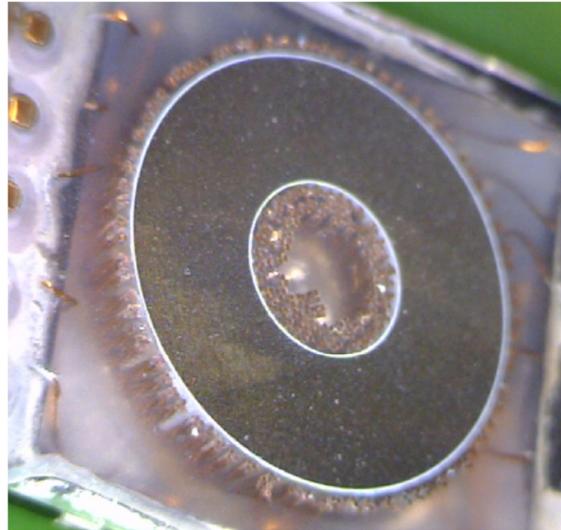
This is typical of Hiflux and other powder based cores when sectioned and polished

5.5.2 Q2 – 14138006

External Examination

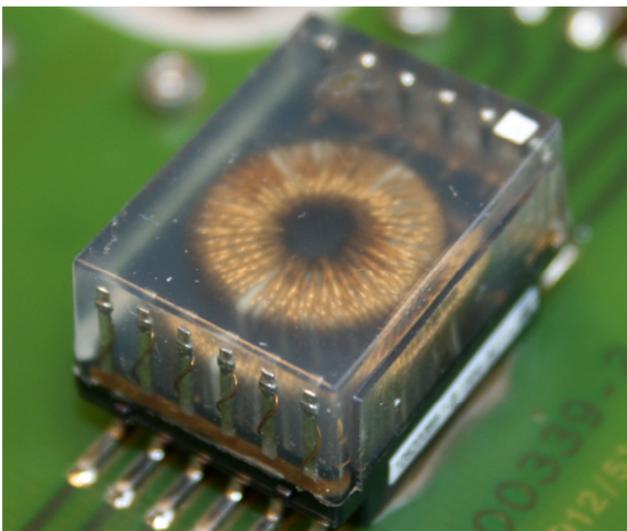


Internal Examination

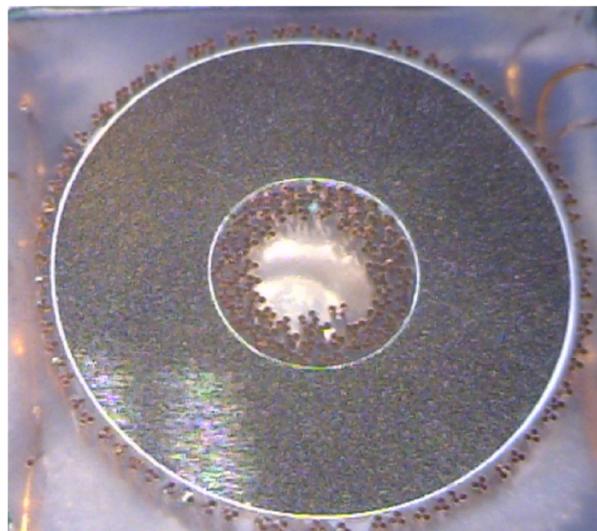


Comments:
Serial Number 046, this unit is with full housing

External Examination



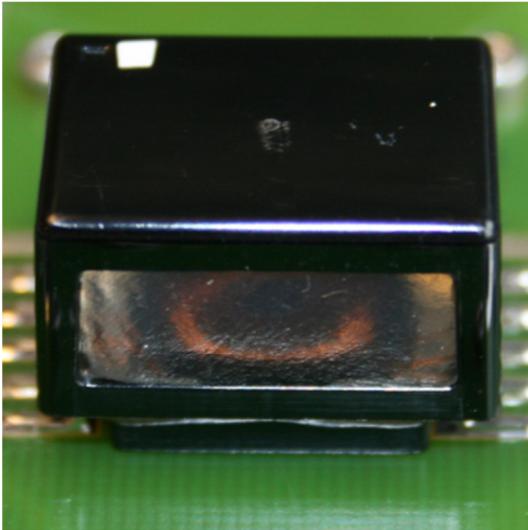
Internal Examination



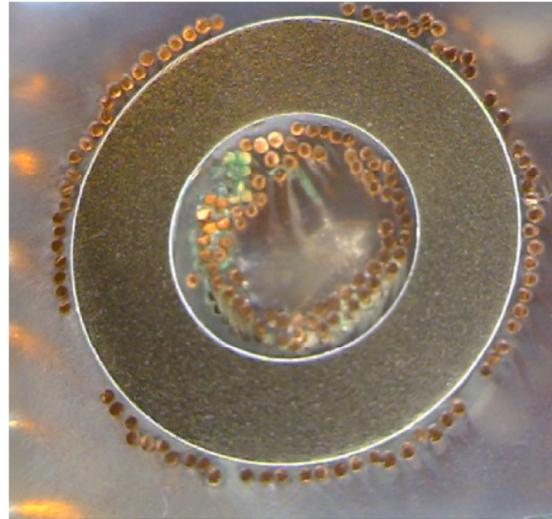
Comments:
Serial Number 044, this unit is without the upper housing

5.5.3 Q3 – 14138007

External Examination

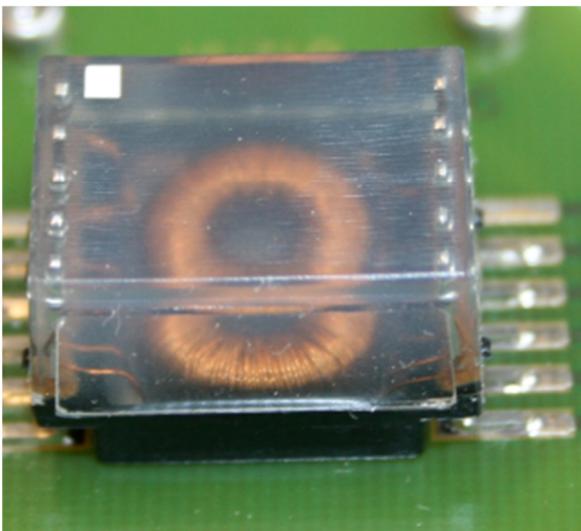


Internal Examination

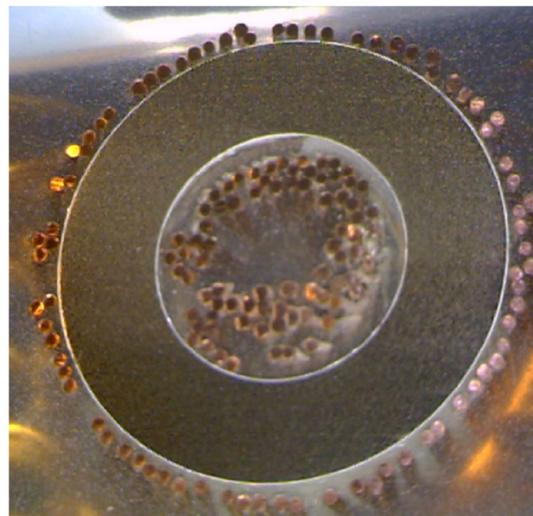


Comments:
Serial Number 021, this unit is with full housing

External Examination



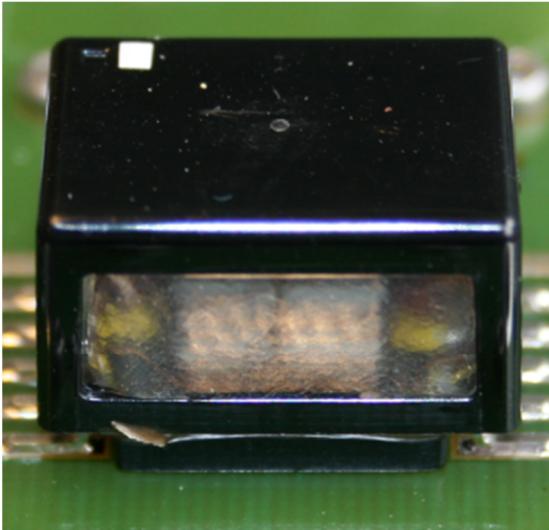
Internal Examination



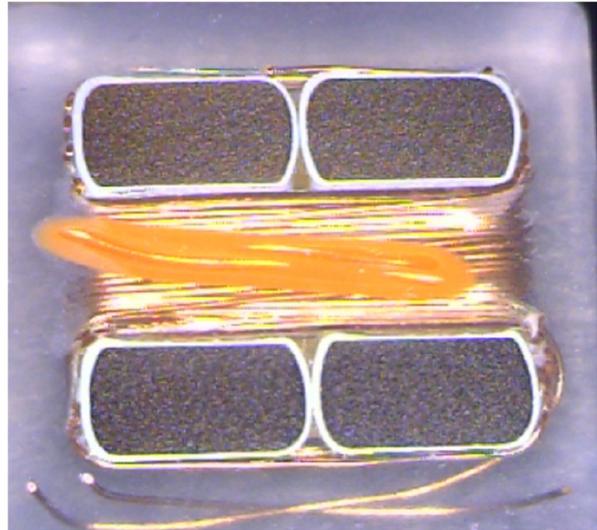
Comments:
Serial Number 024, this unit is without the upper housing

5.5.4 Q4 - 14128001

External Examination

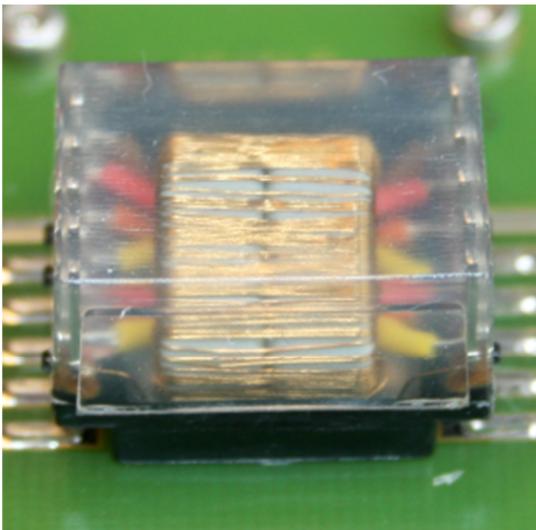


Internal Examination

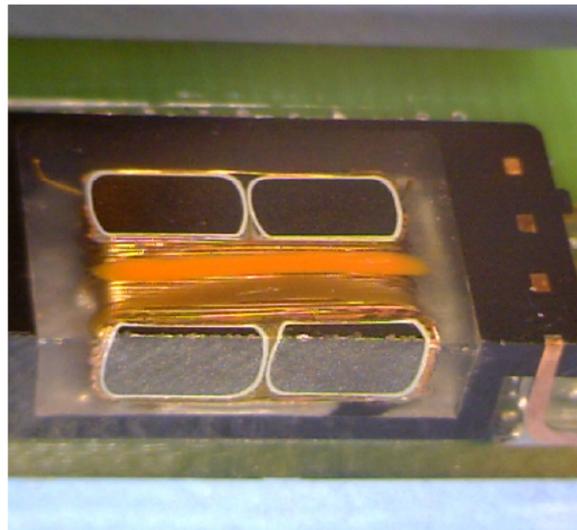


Comments:
Serial Number 001, this unit is with full housing

External Examination

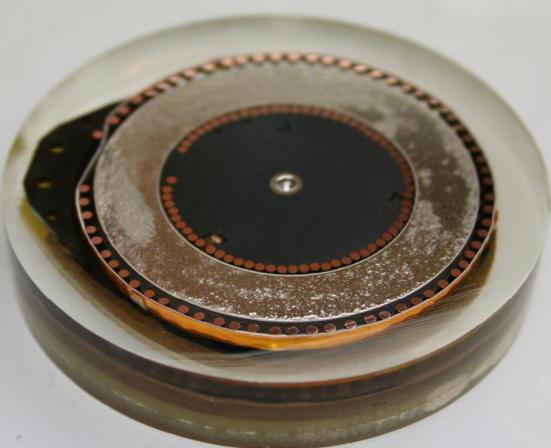
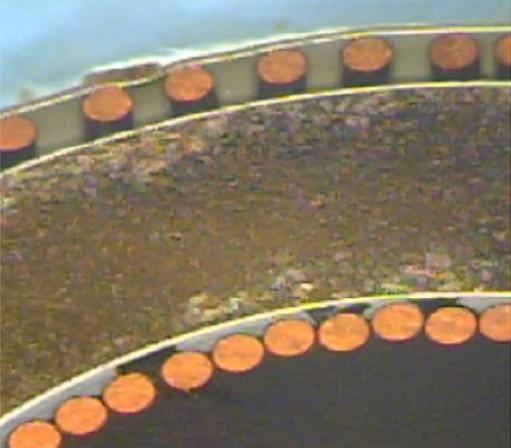
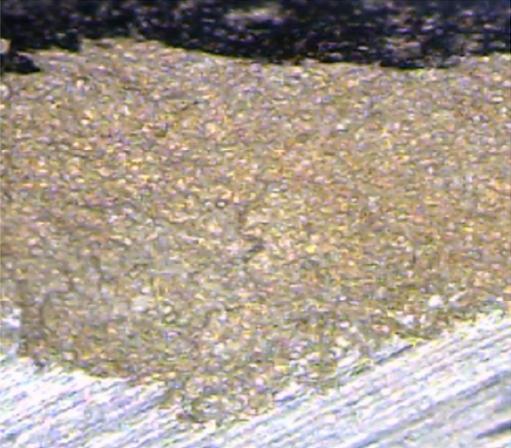


Internal Examination



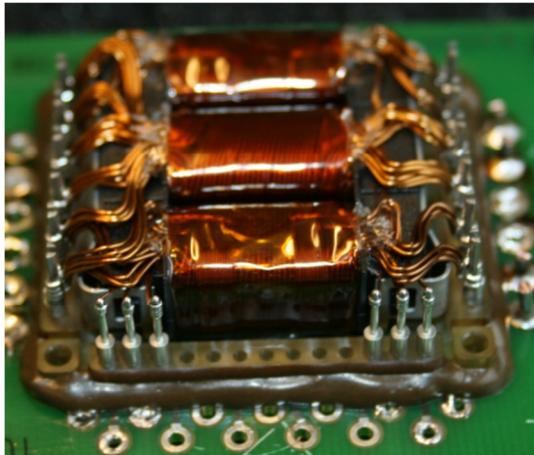
Comments:
Serial Number 004, this unit is without the upper housing. Cross sections were performed through 2 axis

5.5.5 Q5 – 12311047-2-B

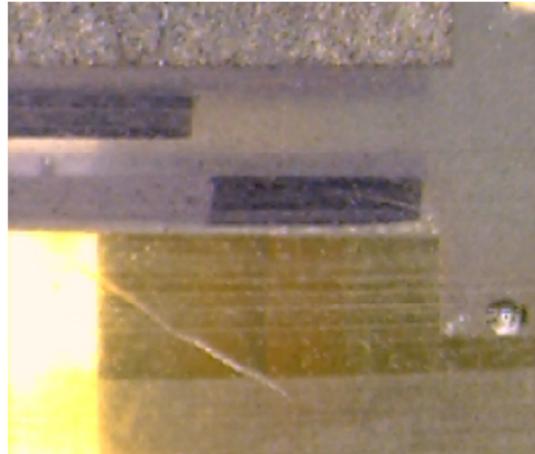
External Examination	Internal Examination
<p>a)</p>  <p>c)</p> 	<p>b)</p>  <p>d)</p> 
<p>Comments: Serial Number 138, In photos b & c the core material show apparent signs of 'pitting' on the surface of the cut section . This is typical of Hiflux and other powder based cores when sectioned and polished. Photo (d) shows the core material in its normal form.</p>	

5.5.6 Q6 – 14280036-2-B

External Examination



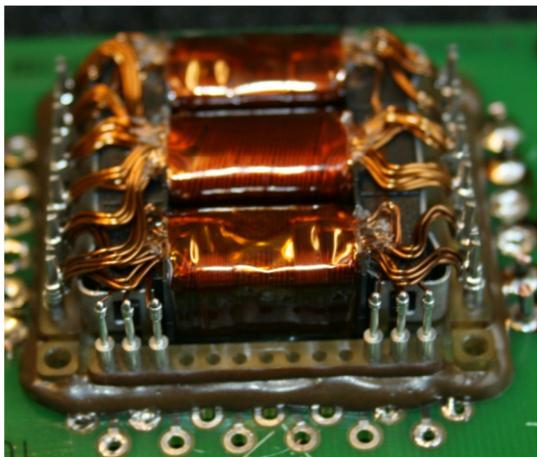
Internal Examination



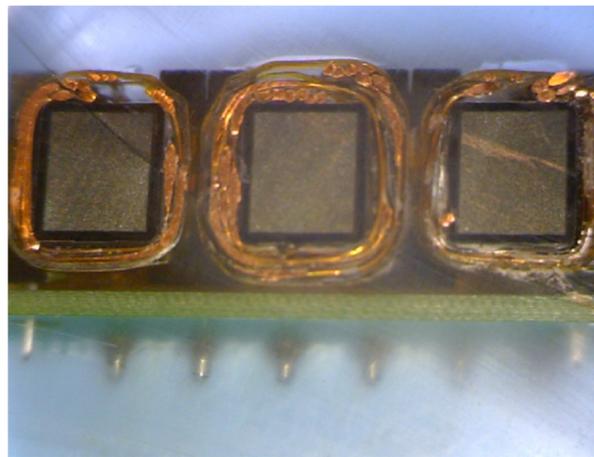
Comments:

Serial Number 156, this unit was subjected to 500G mechanical shock. The DPA showed that the physical damage to the spool-former where glued to the platform.

External Examination



Internal Examination



Comments:

Serial Number 158, this unit was subjected to 100G mechanical shock



5.6 Observations and Observation on testing

1. Rather than the normal terminal strength test, housings with L-pins inserted and filled with CV2500 as used in units Q1 to Q4 were tested to destruction. The pins held to between 30N and 40N before the pins came free from the base.
2. In order to protect the schedule, due to chamber availability the moisture test was performed earlier in the test sequence. See the test sheets for details.
3. The internal examination (DPA) of Q1 S/N 038 & S/N 041 revealed 'pitting' of the core material. Despite this, the unit showed no drop off in electrical performance. This appearance is consistent with that previously seen on MPP and Hiflux cores and is inherent with powder based cores
4. The internal examination (DPA) of Q5 S/N 138 revealed 'pitting' of the core material. Despite this, the unit showed no drop off in electrical performance. This appearance is consistent with that previously seen on MPP and Hiflux cores and is inherent with powder based cores

5.7 Minor Nonconformances

1. From the information observed during the screening testing of Q4 units, the lower inductance was lowered from 31 to 29mh

5.8 Critical Failures

1. Visual examination showed that Q6 S/N 156 the spool-former had broken where glued to the platform and on S/N 157 the spool-former has separated slightly from the glue fixing in to the platform. This had no impact on the electrical performance of these units. S/N 156 is was subjected to DPA, an additional cut through the plane of this separation was made. This showed clear separation of the spool-former from the platform. Both of these units were subjected to 500G mechanical shock. The fault was not present in the units tested at 100G mechanical shock.

6. CONCLUSION

All units are deemed to have passed qualification as defined in FT 08690231^(RD1), with the caveat that the Intergrated Magnetics (IM) are passed to 100G mechanical shock only.



Annex 1 – Test Sheets



TEST	Solderability	Visual Inspection	Terminal Strength	Visual Inspection	DWV	Electrical Characteristics		Mount on PCB & Fixture	Visual Inspection	Photo
						Inductance μ H	Insul MOhm			
CONDITIONS	08690229 5.6	ECSS-Q-ST-70-08	08690229 5.8	ECSS-Q-ST-70-08	V=500 5 secs	V=0,050V f=30kHz	V=500	ECSS-Q-ST-70-08	ECSS-Q-ST-70-08	
LIMITS						Max: 65.1 Min: 53.3	Min: 5000			
S/N 038 Lidded	✓	✓	Similarity Test Performed. Pins passed to >30N	✓	✓	59.4	✓	✓	✓	✓
S/N 041 Unlidded	✓	✓		✓	✓	59.4	✓	✓	✓	✓
S/N 039 Lidded	✓	✓		✓	✓	59.5	✓	✓	✓	✓
S/N 042 Unlidded	✓	✓		✓	✓	59.6	✓	✓	✓	✓

TEST	Electrical Characteristics		Vibration	Mechanical Shock	Visual Inspection	Electrical Characteristics		DWV	Thermal Shock	Winding Continuity
	Inductance μ H	Insul MOhm				Inductance μ H	Insul MOhm			
CONDITIONS	V=0,050V f=30kHz	V=500	08690229 5.9	08690229 5.10	ECSS-Q-ST-70-08	V=0,050V f=30kHz	V=500	V=375 5 secs	08690229 5.4	08711502
LIMITS	Max: 65.1 Min: 53.3	Min: 5000	Performed at Delta	Performed at Delta 500G		Max: 65.1 Min: 53.3	Min: 5000			
S/N 038 Lidded	59.4	✓	✓	✓	✓	59.3	✓	✓	✓	N/A
S/N 041 Unlidded	59.4	✓	✓	✓	✓	59.3	✓	✓	✓	N/A
S/N 039 Lidded	59.6	✓								
S/N 042 Unlidded	59.5	✓								



Q1 - 14118004-1-B (continued)

TEST	Moisture Resistance	Overload	DWV	Insulation Resistance	Winding Continuity	Visual Inspection	Electrical Characteristics		DPA	Life Test
							Inductance μ H	Insul MOhm		
CONDITIONS	08690229 5.11	08690229 5.12	V=375 5 secs	08711502	08711502	08690229 5.3	V=0,050V f=30kHz	V=500	MIL-STD-202	08690229 5.13
LIMITS							Max: 65.1			
							Min: 53.3	Min: 5000		
S/N 038 Lidded	✓	✓	✓	✓	✓	✓	59.6	✓	✓	
S/N 041 Unlidded	✓	✓	✓	✓	✓	✓	59.6	✓	✓	
S/N 039 Lidded										✓
S/N 042 Unlidded										✓

TEST	DWV	Insulation Resistance	Visual Inspection	Electrical Characteristics		Visual Inspection
				Inductance μ H	Insul MOhm	
CONDITIONS	V=375 5 secs	08711502	08690229 5.3	V=0,050V f=30kHz	V=500	ECSS-Q-ST-70-08
LIMITS				Max: 65.1		
				Min: 53.3	Min: 5000	
S/N 038 Lidded						
S/N 041 Unlidded						
S/N 039 Lidded	✓	✓	✓	59.5	✓	✓
S/N 042 Unlidded	✓	✓	✓	59.6	✓	✓



TEST	Solderability	Visual Inspection	Terminal Strength	Visual Inspection	DWV	Electrical Characteristics		Mount on PCB & Fixture	Visual Inspection	Photo
						Inductance mH N2	Insul MOhm			
CONDITIONS	08690229 5.6	ECSS-Q-ST-70-08	08690229 5.8	ECSS-Q-ST-70-08	V=500 5 secs	V=0,250V f=30kHz	V=500	ECSS-Q-ST-70-08	ECSS-Q-ST-70-08	
LIMITS						Max: 11.28 Min: 6.768	Min: 5000			
S/N 044 Unlidded	✓	✓	Similarity Test Performed. Pins passed to >30N	✓	✓	10.27	✓	✓	✓	✓
S/N 046 Lidded	✓	✓		✓	✓	10.30	✓	✓	✓	✓
S/N 406 Lidded	✓	✓		✓	✓	10.94	✓	✓	✓	✓
S/N 411 Unlidded	✓	✓		✓	✓	10.77	✓	✓	✓	✓
S/N 409 Lidded	✓	✓		✓	✓	10.62	✓	✓	✓	✓
S/N 412 Unlidded	✓	✓		✓	✓	10.75	✓	✓	✓	✓

TEST	Electrical Characteristics		Vibration	Mechanical Shock	Visual Inspection	Electrical Characteristics		DWV	Thermal Shock	Winding Continuity
	Inductance mH N2	Insul MOhm				Inductance mH N2	Insul MOhm			
CONDITIONS	V=0,250V f=30kHz	V=500	08690229 5.9	08690229 5.10	ECSS-Q-ST-70-08	V=0,250V f=30kHz	V=500	V=375 5 secs	08690229 5.4	08711502
LIMITS	Max: 11.28 Min: 6.768	Min: 5000	Performed at Delta	Performed at Delta 500G		Max: 11.28 Min: 6.768	Min: 5000			
S/N 044 nLidded	10.32	✓	✓	✓	✓	10.67	✓	✓	✓	N/A
S/N 046 Lidded	10.31	✓	✓	✓	✓	10.81	✓	✓	✓	N/A
S/N 406 Lidded	10.60	✓								
S/N 411 Unlidded	10.23	✓								
S/N 409 Lidded	10.15	✓								
S/N 412 Unlidded	10.22	✓								



Q2 -14138006-1-B (continued)

TEST	Moisture Resistance	Overload	DWV	Insulation Resistance	Winding Continuity	Visual Inspection	Electrical Characteristics		DPA	Life Test
							Inductance mH N2	Insul MOhm		
CONDITIONS	08690229 5.11	08690229 5.12	V=375 5 secs	08711502	08711502	08690229 5.3	V=0,250V f=30kHz	V=500	MIL-STD-202	08690229 5.13
LIMITS							Max: 11.28			
							Min: 6.768	Min: 5000		
S/N 044 Unlidded	✓	✓	✓	✓	✓	✓	10.55	✓	✓	
S/N 046 Lidded	✓	✓	✓	✓	✓	✓	10.61	✓	✓	
S/N 406 Lidded										✓
S/N 411 Unlidded										✓
S/N 409 Lidded										✓
S/N 412 Unlidded										✓

TEST	DWV	Insulation Resistance	Visual Inspection	Electrical Characteristics		Visual Inspection
				Inductance mH N2	Insul MOhm	
CONDITIONS	V=375 5 secs	08711502	08690229 5.3	V=0,250V f=30kHz	V=500	ECSS-Q-ST-70-08
LIMITS				Max: 11.28		
				Min: 6.768	Min: 5000	
S/N 044 Unlidded						
S/N 046 Lidded						
S/N 406 Lidded	✓	✓	✓	10.83	✓	✓
S/N 411 Unlidded	✓	✓	✓	10.58	✓	✓
S/N 409 Lidded	✓	✓	✓	10.56	✓	✓
S/N 412 Unlidded	✓	✓	✓	10.28	✓	✓



TEST	Solderability	Visual Inspection	Terminal Strength	Visual Inspection	DWV	Electrical Characteristics			Mount on PCB & Fixture	Visual Inspection	Photo
						Inductance μ H N1	Inductance μ H N2	Inductance μ H N3			
CONDITIONS	08690229 5.6	ECSS-Q-ST-70-08	08690229 5.8	ECSS-Q-ST-70-08	V=500 5 secs	V=10mV f=10kHz	V=10mV f=10kHz	V=10mV f=10kHz	ECSS-Q-ST-70-08	ECSS-Q-ST-70-08	
LIMITS						Max: 84.8 Min: 50.8	Max: 84.8 Min: 50.8	Max: 54.3 Min: 32.5			
S/N 021 Lidded	✓	✓	Similarity Test Performed. Pins passed to >30N	✓	✓	57.9	57.8	37.3	✓	✓	✓
S/N 024 Unlidded	✓	✓		✓	✓	62.2	62.1	40.1	✓	✓	✓
S/N 022 Lidded	✓	✓		✓	✓	61.6	61.6	39.6	✓	✓	✓
S/N 025 Unlidded	✓	✓		✓	✓	64.5	64.4	41.5	✓	✓	✓

TEST	Electrical Characteristics			Vibration	Mechanical Shock	Visual Inspection	Electrical Characteristics			DWV
	Inductance μ H N1	Inductance μ H N2	Inductance μ H N3				Inductance μ H N1	Inductance μ H N2	Inductance μ H N3	
CONDITIONS	V=10mV f=10kHz	V=10mV f=10kHz	V=10mV f=10kHz	08690229 5.9	08690229 5.10	ECSS-Q-ST-70-08	V=10mV f=10kHz	V=10mV f=10kHz	V=10mV f=10kHz	V=375 5 secs
LIMITS	Max: 84.8 Min: 50.8	Max: 84.8 Min: 50.8	Max: 54.3 Min: 32.5	Performed at Delta	Performed at Delta 500G		Max: 84.8 Min: 50.8	Max: 84.8 Min: 50.8	Max: 54.3 Min: 32.5	
S/N 021 Lidded	56.4	56.4	36.0	✓	✓	✓	59.4	59.4	38.1	✓
S/N 024 Unlidded	61.2	61.2	39.2	✓	✓	✓	63.2	63.3	40.5	✓
S/N 022 Lidded	60.5	60.5	38.7							
S/N 025 Unlidded	63.4	63.4	40.6							



Q3 - 14138007-1-B (continued)

TEST	Thermal Shock	Winding Continuity	Moisture Resistance	Overload	DWV	Insulation Resistance	Winding Continuity	Visual Inspection	Electrical Characteristics		
									Inductance μ H N1	Inductance μ H N2	Inductance μ H N3
CONDITIONS	08690229 5.4	08711502	08690229 5.11	08690229 5.12	V=375 5 secs	08711502	08711502	08690229 5.3	V=10mV f=10kHz	V=10mV f=10kHz	V=10mV f=10kHz
LIMITS									Max: 84.8	Max: 84.8	Max: 54.3
									Min: 50.8	Min: 50.8	Min: 32.5
S/N 021 Lidded	✓	N/A	✓	✓	✓	✓	✓	✓	59.1	59.1	37.8
S/N 024 Unlidded	✓	N/A	✓	✓	✓	✓	✓	✓	63.7	63.7	40.8
S/N 022 Lidded											
S/N 025 Unlidded											

TEST	DPA	Life Test	Visual Inspection	DWV	Insulation Resistance	Visual Inspection	Electrical Characteristics			Visual Inspection
							Inductance μ H N1	Inductance μ H N2	Inductance μ H N3	
CONDITIONS	MIL-STD-202	08690229 5.13	ECSS-Q-ST-70-08	V=375 5 secs	08711502	08690229 5.3	V=10mV f=10kHz	V=10mV f=10kHz	V=10mV f=10kHz	ECSS-Q-ST-70-08
LIMITS							Max: 84.8	Max: 84.8	Max: 54.3	
							Min: 50.8	Min: 50.8	Min: Min:	
S/N 021 Lidded	✓									
S/N 024 Unlidded	✓									
S/N 022 Lidded		✓	✓	✓	✓	✓	62.9	63.9	40.3	✓
S/N 025 Unlidded		✓	✓	✓	✓	✓	67.1	67.0	43.0	✓



TEST	Solderability	Visual Inspection	Terminal Strength	Visual Inspection	DWV	Electrical Characteristics		Mount on PCB & Fixture	Visual Inspection	Photo
						Inductance mH N5	Insul MOhm			
CONDITIONS	08690229 5.6	ECSS-Q-ST-70-08	08690229 5.8	ECSS-Q-ST-70-08	V=500 5 secs	V=250mV f=10kHz	V=500	ECSS-Q-ST-70-08	ECSS-Q-ST-70-08	
LIMITS						Max: 49.0 Min: 28.0	Min: 5000			
S/N 001 Lidded	✓	✓	Similarity Test Performed. Pins passed to >30N	✓	✓	31.5	✓	✓	✓	✓
S/N 004 Unlidded	✓	✓		✓	✓	32.5	✓	✓	✓	✓
S/N 002 Lidded	✓	✓		✓	✓	29.8	✓	✓	✓	✓
S/N 005 Unlidded	✓	✓		✓	✓	30.7	✓	✓	✓	✓

TEST	Electrical Characteristics		Vibration	Mechanical Shock	Visual Inspection	Electrical Characteristics		DWV	Thermal Shock	Winding Continuity
	Inductance mH N5	Insul MOhm				Inductance mH N5	Insul MOhm			
CONDITIONS	V=250mV f=10kHz	V=500	08690229 5.9	08690229 5.10	ECSS-Q-ST-70-08	V=250mV f=10kHz	V=500	V=375 5 secs	08690229 5.4	08711502
LIMITS	Max: 49.0 Min: 28.0	Min: 5000	Performed at Delta	Performed at Delta 500G		Max: 49.0 Min: 28.0	Min: 5000			
S/N 001 Lidded	29.0	✓	✓	✓	✓	31.3	✓	✓	✓	N/A
S/N 004 Unlidded	29.6	✓	✓	✓	✓	31.9	✓	✓	✓	N/A
S/N 002 Lidded	27.1	✓								
S/N 005 Unlidded	28.5	✓								



Q4 -14128001-1-B (continued)

TEST	Moisture Resistance	Overload	DWV	Insulation Resistance	Winding Continuity	Visual Inspection	Electrical Characteristics		DPA	Life Test
							Inductance mH N5	Insul MOhm		
CONDITIONS	08690229 5.11	08690229 5.12	V=375 5 secs	08711502	08711502	08690229 5.3	V=250mV f=10kHz	V=500	MIL-STD-202	08690229 5.13
LIMITS							Max: 49.0			
							Min: 28.0	Min: 5000		
S/N 001 Lidded	✓	✓	✓	✓	✓	✓	28.9	✓	✓	
S/N 004 Unlidded	✓	✓	✓	✓	✓	✓	29.2	✓	✓	
S/N 002 Lidded										✓
S/N 005 Unlidded										✓

TEST	DWV	Insulation Resistance	Visual Inspection	Electrical Characteristics		Visual Inspection
				Inductance mH N5	Insul MOhm	
CONDITIONS	V=375 5 secs	08711502	08690229 5.3	V=250mV f=10kHz	V=500	ECSS-Q-ST-70-08
LIMITS				Max: 49.0		
				Min: 28.0	Min: 5000	
S/N 001 Lidded						
S/N 004 Unlidded						
S/N 002 Lidded	✓	✓	✓	28.5	✓	✓
S/N 005 Unlidded	✓	✓	✓	30.3	✓	✓



TEST	Solderability	Visual Inspection	Terminal Strength	Visual Inspection	DWV	Electrical Characteristics		Mount on PCB & Fixture	Visual Inspection	Photo
						Inductance μ H	Insul MOhm			
CONDITIONS	08690229 5.6	ECSS-Q-ST-70-08	08690229 5.8	ECSS-Q-ST-70-08	V=500 5 secs	V=0,250V f=100kHz	V=500	ECSS-Q-ST-70-08	ECSS-Q-ST-70-08	
LIMITS						Max: 483.9 Min: 396.0	Min: 5000			
S/N 138	✓	✓	N/A	✓	✓	444.4	✓	✓	✓	✓
S/N 139	✓	✓		✓	✓	446.0	✓	✓	✓	✓
S/N 140	✓	✓		✓	✓	432.0	✓	✓	✓	✓
S/N 141	✓	✓		✓	✓	444.4	✓	✓	✓	✓

TEST	Electrical Characteristics		Vibration	Mechanical Shock	Visual Inspection	Electrical Characteristics		DWV	Thermal Shock	Winding Continuity
	Inductance μ H	Insul MOhm				Inductance μ H	Insul MOhm			
CONDITIONS	V=0,250V f=100kHz	V=500	08690229 5.9	08690229 5.10	ECSS-Q-ST-70-08	V=0,250V f=100kHz	V=500	V=375 5 secs	08690229 5.4	08711502
LIMITS	Max: 483.9 Min: 396.0	Min: 5000	Performed at Delta	Performed at Delta 500G		Max: 483.9 Min: 396.0	Min: 5000			
S/N 138	443.5	✓	✓	✓	✓	445.2	✓	✓	✓	N/A
S/N 139	446.1	✓	✓	✓	✓	447.8	✓	✓	✓	N/A
S/N 140	430.4	✓								
S/N 141	444.5	✓								



Q5 - 12311047-2-B (continued)

TEST	Moisture Resistance	Overload	DWV	Insulation Resistance	Winding Continuity	Visual Inspection	Electrical Characteristics		DPA	Life Test
							Inductance μ H	Insul MOhm		
CONDITIONS	08690229 5.11	08690229 5.12	V=375 5 secs	08711502	08711502	08690229 5.3	V=0,250V f=100kHz	V=500	MIL-STD-202	08690229 5.13
LIMITS							Max: 483.9			
							Min: 396.0	Min: 5000		
S/N 138	✓	✓	✓	✓	✓	✓	418.4	✓	Pending	
S/N 139	✓	✓	✓	✓	✓	✓	407.4	✓		
S/N 140										✓
S/N 141										✓

TEST	DWV	Insulation Resistance	Visual Inspection	Electrical Characteristics		Visual Inspection
				Inductance μ H	Insul MOhm	
CONDITIONS	V=375 5 secs	08711502	08690229 5.3	V=0,250V f=100kHz	V=500	ECSS-Q-ST-70-08
LIMITS				Max: 483.9		
				Min: 396.0	Min: 5000	
S/N 138						
S/N 139						
S/N 140	✓	✓	✓	427.2	✓	✓
S/N 141	✓	✓	✓	439.8	✓	✓



Q6 - 14280036-2-B

TEST	Solderability	Visual Inspection	Terminal Strength	Visual Inspection	DWV	Electrical Characteristics			Mount on PCB & Fixture	Visual Inspection	Photo
						Inductance μ H LA2	Inductance μ H LB2	Inductance μ H LC2			
CONDITIONS	08690229 5.6	ECSS-Q-ST-70-08	08690229 5.8	ECSS-Q-ST-70-08	V=500 5 secs	V=0,030V f=100kHz	V=0,030V f=100kHz	V=0,030V f=100kHz	ECSS-Q-ST-70-08	ECSS-Q-ST-70-08	
LIMITS						Max: 10.75 Min: 9.73	Max: 22.55 Min: 16.61	Max: 10.75 Min: 9.73			
S/N 156	✓	✓	✓	✓	✓	10.12	20.37	10.16	✓	✓	✓
S/N 157	✓	✓	✓	✓	✓	9.89	20.31	10.08	✓	✓	✓
S/N 158	✓	✓	✓	✓	✓	10.01	20.51	10.17	✓	✓	✓
S/N 159	✓	✓	✓	✓	✓	9.99	20.05	10.05	✓	✓	✓
S/N 160	✓	✓	✓	✓	✓	10.17	20.49	10.09	✓	✓	✓
S/N 161	✓	✓	✓	✓	✓	9.98	20.24	10.09	✓	✓	✓

TEST	Electrical Characteristics			Vibration	Mechanical Shock	Visual Inspection	Electrical Characteristics			DWV
	Inductance μ H LA2	Inductance μ H LB2	Inductance μ H LC2				Inductance μ H LA2	Inductance μ H LB2	Inductance μ H LC2	
CONDITIONS	V=0.030V f=100kHz	V=0.030V f=100kHz	V=0.030V f=100kHz	08690229 5.9	08690229 5.10	ECSS-Q-ST-70-08	V=0.030V f=100kHz	V=0.030V f=100kHz	V=0.030V f=100kHz	V=375 5 secs
LIMITS	Max: 10.75 Min: 9.73	Max: 22.55 Min: 16.61	Max: 10.75 Min: 9.73	Performed at Delta	Performed at Delta (See Below)		Max: 10.75 Min: 9.73	Max: 22.55 Min: 16.61	Max: 10.75 Min: 9.73	
S/N 156	10.24	19.97	10.23	✓	✓ @500G	✓	10.19	20.38	10,29	✓
S/N 157	10.03	19.98	10.14	✓	✓ @500G	✓	9.91	20.31	10,16	✓
S/N 158	10.15	20.00	10.23	✓	✓ @100G	✓	10.04	19.98	10,19	✓
S/N 159	10.14	19.58	10.14	✓	✓ @100G	✓	9.98	19.61	10,06	✓
S/N 160	10.30	20.21	10.19							
S/N 161	10.09	19.98	10.18							



Q6 - 14280036-2-B (continued)

TEST	Thermal Shock	Winding Continuity	Moisture Resistance	Overload	DWV	Insulation Resistance	Winding Continuity	Visual Inspection	Electrical Characteristics		
									Inductance μ H LA2	Inductance μ H LB2	Inductance μ H LC2
CONDITIONS	08690229 5.4	08711502	08690229 5.11	08690229 5.12	V=375 5 secs	08711502	08711502	08690229 5.3	V=0.030V f=100kHz	V=0.030V f=100kHz	V=0.030V f=100kHz
LIMITS									Max: 10.75 Min: 9.73	Max: 22.55 Min: 16.61	Max: 10.75 Min: 9.73
S/N 156	✓	N/A	✓	✓	✓	✓	✓	See Section 5.8	10.23	20.40	10.29
S/N 157	✓	N/A	✓	✓	✓	✓	✓	See Section 5.8	10.02	20.26	10.11
S/N 158	✓	N/A	✓	✓	✓	✓	✓	✓	10.15	20.20	10.24
S/N 159	✓	N/A	✓	✓	✓	✓	✓	✓	10.07	19.76	10.12
S/N 160											
S/N 161											

TEST	DPA	Life Test	Visual Inspection	DWV	Insulation Resistance	Visual Inspection	Electrical Characteristics			Visual Inspection
							Inductance μ H LA2	Inductance μ H LB2	Inductance μ H LC2	
CONDITIONS	MIL-STD-202	08690229 5.13	ECSS-Q-ST-70-08	V=375 5 secs	08711502	08690229 5.3	V=0.030V f=100kHz	V=0.030V f=100kHz	V=0.030V f=100kHz	ECSS-Q-ST-70-08
LIMITS							Max: 10.75 Min: 9.73	Max: 10.75 Min: 9.73	Max: 10.75 Min: 9.73	
S/N 156	See Section 5.8									
S/N 157										
S/N 158	✓									
S/N 159										
S/N 160		✓	✓	✓	✓	✓	10.22	20.06	10.12	✓
S/N 161		✓	✓	✓	✓	✓	10.05	19.79	10.08	✓