

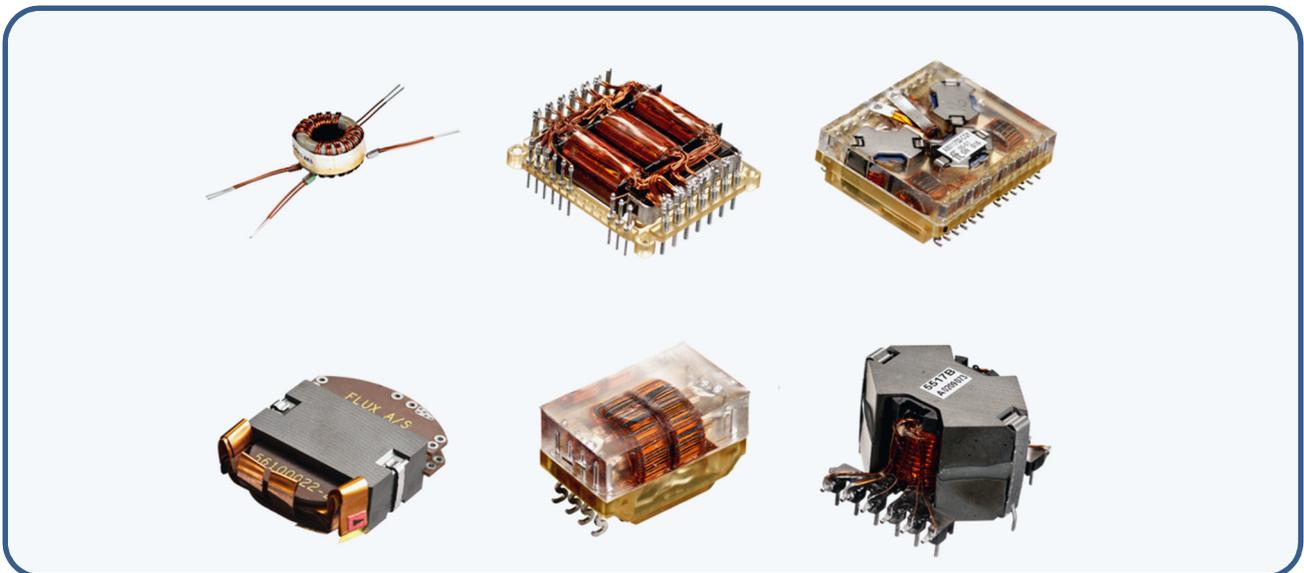
Test Report: **Qualification, Periodic Testing and LOT Validation**

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Page: 1 of 40

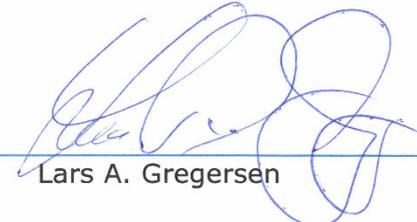


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1. INTRODUCTION

This document report the status for Qualification Testing of Magnetic topologies listed in section 3.1 in accordance with 3201/013. The testing is performed as an extension of the Technology Domain of the Flux A/S Technology Flow Approval

All testing is performed in accordance with FT08699016 ^(RD8)

2. REFERENCE DOCUMENTS

Ref.	Document	Title
RD1	3201	Generic Specification: Coils, RF and Power, Fixed (Inductors and Transformers)
RD2	3201/13	Detail Specification: Customised Magnetics
RD3	MIL-STD-202	Test Method Standards - Electronic and Electrical Component Parts
RD4	FT08711502	Screen Testing
RD5	FT08699003	Declared Materials List
RD6	FT08699004	Declared Processes List
RD7	FT08699015	Technology Flow
RD8	FT08699016	Qualification, Periodic Testing and LOT validation

3. SAMPLES DEFINITION

3.1 Range of component families for testing

These parts will be defined as per the individual test program:

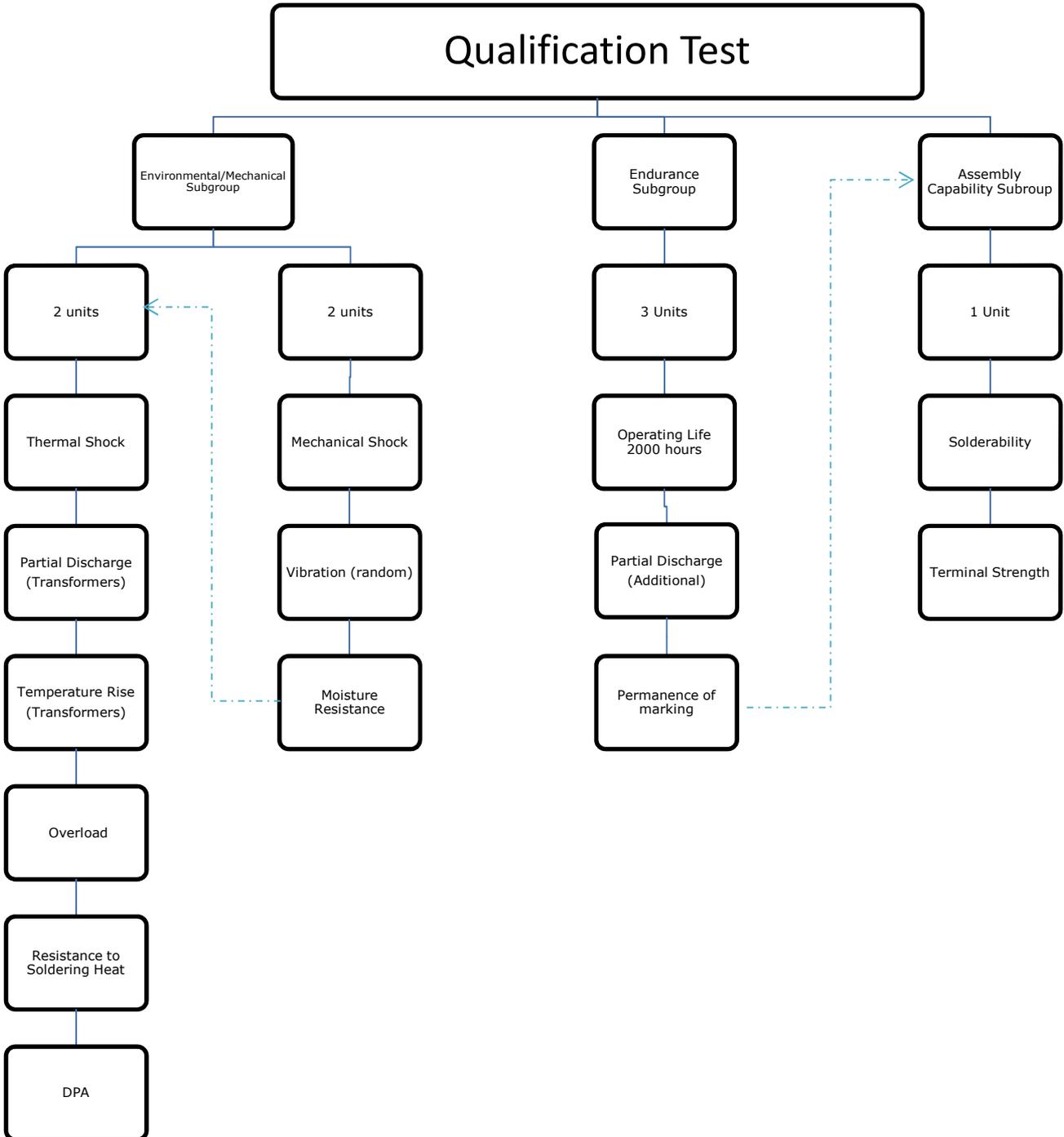
Evaluation Sample	Flux Part No	Description	Quantity
QS1	12413001-1	ESA 5Kw Inductor	5
QS2	14413001-1	ESA 5Kw Transformer	5
QS3	12781001-1	Encapsulated power inductor	5
QS4	12781007-1	Encapsulated power inductor	5
QS5	12311067-1	Toroid Inductor	5
QS6	12169002-1	T17 CMC	5
QS7	12189001-1	EFD Inductor	5

Table 3-1 Test samples



4. LOT ACCEPTANCE TESTING

4.1 Original subgroups





4.2 Test Matrix

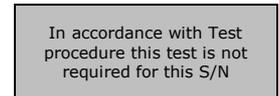
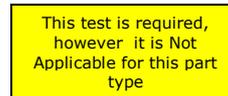
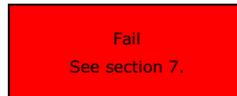
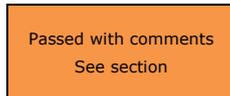
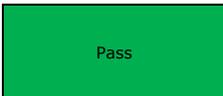
4.2.1 Samples QS1 & QS2

Test performed based the requirements of ESCC 3201/013. In order to reduce the number of units and increase the stringency of the testing, the same units will be used for both columns of the Environmental/Mechanical Groups. Additionally the unit in the Assembly Capability subgroup will be selected from the Endurance subgroup. This Testing is destructive and the samples are not suitable for flight use.

Group and Test		12413001-1					14413001-1				
		001	002	004	005	006	015	017	018	019	020
Life Test	Life Test			✓	✓	✓			✓	✓	✓
	Partial Discharge (High Power Transformers only)								✓	✓	✓
	Permanence of marking			✓	✓	✓			✓	✓	✓
Solderability	Solderability			No Terminals					No Terminals		
	Terminal Strength			No Terminals					No Terminals		
Mechanical Shock	Mechanical Shock	✓	✓				✓	✓			
	Random Vibration	✓	✓				✓	✓			
	Moisture Resistance	✓	✓				✓	✓			
Thermal Shock	Thermal Shock	✓	✓				✓	✓			
	Partial Discharge (High Power Transformers only)	Inductor					✓	✓			
	Temperature Rise (Transformers only)						✓				
	Overload	✓	✓				✓				
	Resistance to Soldering Heat	No Terminals	No Terminals				No Terminals				
	DPA	✓					✓				

Sample Size = 5

Key:





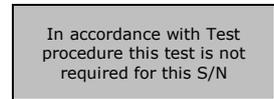
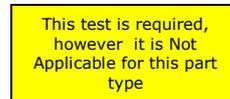
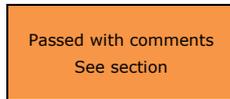
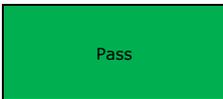
4.2.2 Samples QS3 & QS4

Test performed based the requirements of ESCC 3201/013. In order to reduce the number of units and increase the stringency of the testing, the same units will be used for both columns of the Environmental/Mechanical Groups. Additionally the unit in the Assembly Capability subgroup will be selected from the Endurance subgroup. This Testing is destructive and the samples are not suitable for flight use.

Group and Test		12781001-1					12781007-1				
		009	010	001	002	003	006	009	001	002	003
Life Test	Life Test			✓	✓	✓			✓	✓	✓
	Partial Discharge (High Power Transformers only)										
	Permanence of marking			✓	✓	✓			✓	✓	✓
Solderability	Solderability			✓					✓		
	Terminal Strength			Flying Leads					Flying Leads		
Mechanical Shock	Mechanical Shock	✓	✓				✓	✓			
	Random Vibration	✓	✓				✓	✓			
	Moisture Resistance	✓	✓				✓	✓			
Thermal Shock	Thermal Shock	✓	✓				✓	✓			
	Partial Discharge (High Power Transformers only)	Inductor					Inductor				
	Temperature Rise (Transformers only)	Inductor					Inductor				
	Overload	✓	✓				✓	✓			
	Resistance to Soldering Heat	✓	✓				✓	✓			
	DPA	✓					✓				

Sample Size = 5

Key:





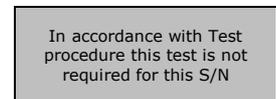
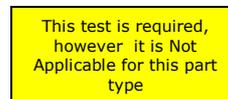
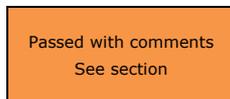
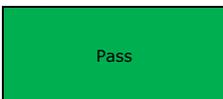
4.2.3 Samples QS5 & QS6

Test performed based the requirements of ESCC 3201/013. In order to reduce the number of units and increase the stringency of the testing, the same units will be used for both columns of the Environmental/Mechanical Groups. Additionally the unit in the Assembly Capability subgroup will be selected from the Endurance subgroup. This Testing is destructive and the samples are not suitable for flight use.

Group and Test		12311067-1					12169002-1				
		001	002	003	004	005	001	002	003	004	005
Life Test	Life Test			✓	✓	✓			✓	✓	✓
	Partial Discharge (High Power Transformers only)			Inductor					Inductor		
	Permanence of marking			✓	✓	✓			✓	✓	✓
Solderability	Solderability			✓					✓		
	Terminal Strength			Flying Leads					Flying Leads		
Mechanical Shock	Mechanical Shock	✓	✓				✓	✓			
	Random Vibration	✓	✓				✓	✓			
	Moisture Resistance	✓	✓				✓	✓			
Thermal Shock	Thermal Shock	✓	✓				✓	✓			
	Partial Discharge (High Power Transformers only)	Inductor					Inductor				
	Temperature Rise (Transformers only)										
	Overload	✓	✓				✓	✓			
	Resistance to Soldering Heat	✓	✓				✓	✓			
	DPA	✓					✓				

Sample Size = 5

Key:





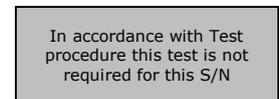
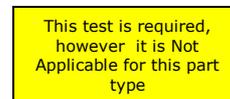
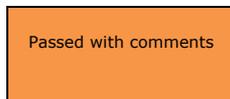
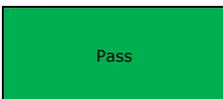
4.2.4 Samples QS7

Test performed based the requirements of ESCC 3201/013. In order to reduce the number of units and increase the stringency of the testing, the same units will be used for both columns of the Environmental/Mechanical Groups. Additionally the unit in the Assembly Capability subgroup will be selected from the Endurance subgroup. This Testing is destructive and the samples are not suitable for flight use.

Group and Test		12189001-1				
		001	002	003	004	005
Life Test	Life Test			✓	✓	✓
	Partial Discharge (High Power Transformers only)			Inductor		
	Permanence of marking			✓	✓	✓
Solderability	Solderability			✓		
	Terminal Strength			✓		
Mechanical Shock	Mechanical Shock	✓	✓			
	Random Vibration	✓	✓			
	Moisture Resistance	✓	✓			
Thermal Shock	Thermal Shock	✓	✓			
	Partial Discharge (High Power Transformers only)	Inductor				
	Temperature Rise (Transformers only)					
	Overload	✓	✓			
	Resistance to Soldering Heat	✓	✓			
	DPA	✓				

Sample Size = 5

Key:





4.3 Test facilities

All testing was performed at FLUX facilities, Asnaes; and Force's facilities in Horsholm, Denmark.

5. TEST METHODS AND REQUIREMENTS

5.1 Screening

Screening was performed in accordance with FT08711502, prior to the start of Qualification, Periodic and LOT Validation Testing testing.

5.2 Visual inspection

5.2.1 Visual inspection method

Visual inspection shall be aided by magnification appropriate to the size of inspection item, between 4x to 10x magnifications. Additional magnification shall be used to resolve suspected anomalies or defects.

5.2.2 Visual inspection requirements

5.2.2.1 External

The components shall be examined to verify that the materials, external design and construction, physical dimensions, marking and workmanship are in accordance with the requirements defined in the relevant procedures and the reference documents given in section 2 of this procedure

5.2.2.2 Post-test

No more than 10% of the surface shall have pooling, flaking, chipping, cracking, crazing or other impairment of the protective coating. There shall be no leakage of the filling material, no evidence of other physical damage, such as cracks, bursting, or bulging of the case or corrosion affecting the mechanical or electrical operation of the samples.

5.3 Solderability

Solderability shall be performed on samples with PCB terminals. Solderability is not applicable for flying leads.

5.3.1 Solderability method

Solderability shall be tested by the "Soldering iron method", specified in MIL-STD-202, method 208. By using the "Soldering iron method" no separate test for resistance to soldering heat will be performed, and the purpose of this test will be:

- a) Qualification of the component resistance to heat when soldered with a soldering iron.
- b) Qualification of the solderability of the component terminals.

Practical test method to be applied:

- Minimum two of each type of terminals shall be tested
- A standard soldering iron shall be used. Tip temperature shall be 320 °C +/- 10 °C
- Solder alloy shall be Sn63Pb37 and flux shall be type RMA.
- The solder tip shall be held on the middle of the terminal for 2 Sec +/- 0,5 sec
- Solder iron tip shall be calibrated to reach 280°C on the calibration wire in 2 sec



5.3.2 Solderability requirements

The pins shall be visually inspected. Any termination that has less than 5% of the examination area dewetted, nonwetted or with pinholes will be accepted. Inspection is in accordance with MIL-STD-202 ^(RD2), method 208.

5.4 Terminal strength

Up to a maximum of 4 identical terminals per sample are to be subjected to terminal strength testing. Terminal strength is not applicable for flying leads.

5.4.1 Terminal strength method

Terminal Strength: Unless otherwise specified in the Magnetic Sheet for the component under test, the Terminal Strength shall be tested as specified in Para. 8.17 of ESCC 3201.

5.4.2 Terminal strength requirements

There shall be no evidence of loosening or rupturing of terminals, or other mechanical damage.

5.5 Induced voltage

5.5.1 Induced voltage method

Wound toroids manufactured on a winding machine shall be subjected to a voltage sufficient to cause twice the rated voltage across any winding or 300V for wires <0.250mm and 500V for wires \geq 0.250mm whichever is greater

This test will be performed as surge test with 10 pulses.

5.5.2 Induced voltage requirements

During this test the magnetic device shall be inspected for evidence of continuous arcing, flashover, breakdown of insulation, and abrupt changes in the input current. Means shall be provided to indicate fluctuations of input current.



5.6 Dielectric withstanding voltage

5.6.1 Dielectric withstanding voltage method

The dielectric withstanding voltage test, serves to determine whether insulating materials and spacing between different parts in the magnetic component are adequate.

The test consists of the application of an AC voltage higher than rated voltage for a specific time between mutually insulated portions of a component part or between insulated portions and ground.

The test shall be applied between each winding and shield, and all of the other windings and shields connected to the core (if accessible). Alternatively the test shall be applied between each winding and shield, and each of the other windings, shields and core (if accessible).

Atmospheric pressure applies

<i>Voltage</i>	500 V rms.
<i>Max. Current</i>	0.10 mA ± 0.02 mA
<i>Ramp Time</i>	<i>Max. 1 s</i>
<i>Dwell Time</i>	<i>Min. 60 s for qualification</i> <i>Min. 5 s for validation</i>
<i>Frequency</i>	50 Hz

5.6.2 Dielectric withstanding voltage requirements

During and post test the magnetic device shall be inspected for evidence of arcing, flashover, breakdown of insulation, and damage.

5.7 Electrical characteristics

5.7.1 Electrical charateristics test method

The applicable electrical measurements as specified in the detail specification, shall be measured in accordance with FT08711502 and as agreed in the baseline for each part.

5.7.2 Electrical charactristics requirements

The measured electrical characteristics shall fall within the limits specified in the detail specification, including any formally agreed deviation. Drift shall be calculated with reference to the first measurement after production screening

5.8 Permanence of marking

5.8.1 Permanence of marking method

Components shall be tested using the methods detailed MIL-STD-202,method 215.

The following shall reply:

- The marked portion of the components shall be brushed.
- The solvents tested shall be:
 - Demineralized water
 - 2-propanol



5.8.2 Permanence of marking requirements

There shall be no evidence of mechanical damage and the markings shall remain legible. The paint or exterior finish shall not soften, peel, or show other signs of deterioration.

5.9 Vibration

MIL-PRF-27^(RD1) states that MIL-STD-202^(RD2) method 201 or 204 be used. Flux feels that these two options form an unrealistic scenario, therefore we elected to increase the vibration testing and use method 214. The purpose of which is:

'This test is conducted for the purpose of determining the ability of the component parts to withstand the dynamic stress exerted by random vibration applied between upper and lower frequency limits to simulate the vibration experienced in various service field environments'

5.9.1 Vibration test method

The components shall be mounted on a PCB and a vibration fixture and exposed to random vibration according to MIL-STD-202^(RD2), method 214, condition H.

Test conditions are as follows: random vibration

- Vibration level: 30 g rms.
- Duration: 5 minutes per axis.
- Level applied to fixture.

Axis	Frequency Range (Hz)	Level	G rms. Acceleration	Duration per axis
X,Y,Z	20 -100	+ 6 dB/oct	30	300 sec.
	100-1600	0.5 g ² /Hz		
	1600-2000	- 12 dB/oct		

Table 5-3 Vibration test level

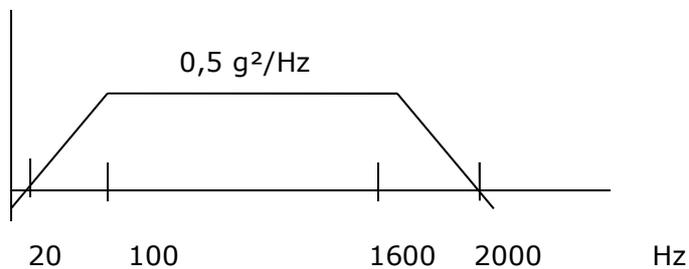


Figure 9-4 Vibration test PSD spectrum



5.9.2 Vibration test requirements

There shall be no evidence of physical damage in accordance with MIL-PRF-27^(RD1), section 4.7.16. Visual inspection shall be performed after vibration testing.

5.10 Mechanical shock

5.10.1 Mechanical shock method

The components shall be mounted on a PCB and a vibration fixture. The components shall be exposed to three shocks in each direction of the three perpendicular axes.

For Qualification Testing, and Periodic Testing for renewal of qualification after lapse: test condition: D (half sine, 500g, 1ms) shall apply.

For Periodic Testing for extension of qualification: test condition I (sawtooth, 100g, 6ms) shall apply.

5.11 Life test

5.11.1 Life test method

Operating Life: Unless otherwise specified, shall be replaced by either Passive Life or Operating Life, as specified in the magnetic sheet for the component under test, as follows:

5.11.1.1 Passive life

MIL-STD-202, Method 108 with the following details:

- Mounting: the components shall be mounted on racks or on a PCB
- Duration:
 - 2000 (+48 -0) hours for Qualification Testing, and Periodic Testing for renewal of qualification after lapse.
 - 1000 (+48 -0) hours for Periodic Testing for extension of qualification Ambient test temperature: maximum operating temperature as specified in Maximum Ratings
- Operating conditions: Non-operating
- Data points:

Intermediate and End-Point Electrical Measurements shall be performed as specified in the Magnetic Sheet for the component under test at 0, and 1000/2000 hours. If drift values are specified, the drift shall always be related to the 0-hour measurement.

The components shall be stabilised at ambient room conditions for a minimum of 30 minutes after removal from the test chamber, prior to the performance of measurements.

On completion of testing, the components shall be visually examined. There shall be no evidence of any damage.

5.11.1.2 Operating life

MIL-STD-202, Method 108 with the following details:

- Mounting: the components shall be mounted on racks or on a PCB
- Duration:
 - 2000 (+48 -0) hours for Qualification Testing, and Periodic Testing for renewal of qualification after lapse.
 - 1000 (+48 -0) hours for Periodic Testing for extension of qualification.
- Operating conditions: 5 ON/OFF cycles/week as follows:
 - Cycles 1 to 4: ON for 20 hours: operating at maximum operating temperature as



specified in Maximum Ratings, plus OFF for 3 hours: non-operating at $T_{amb} = +22 \pm 3^{\circ}\text{C}$

followed by:

- Cycle 5: ON for 68 hours: operating at maximum operating temperature as specified in Maximum Ratings, plus OFF for 3 hours: non-operating at $T_{amb} = +22 \pm 3^{\circ}\text{C}$

During ON periods, unless otherwise specified in the Magnetic Sheet for the component under test, the component with all normally loaded secondaries loaded with their specified impedances, shall be loaded with 100% rated power as specified in the Magnetic Sheet for the component under test.

- Data Points:
Intermediate and End-Point Electrical Measurements shall be performed as specified in the Magnetic Sheet for the component under test at 0, 1000 and 2000 hours. If drift values are specified, the drift shall always be related to the 0-hour measurement.
The components shall be stabilised at ambient room conditions for a minimum of 30 minutes after removal from the test chamber, prior to the performance of measurements.

5.11.2 Life test requirements

On completion of testing, the components shall be visually examined. There shall be no evidence of any damage.

5.12 Insulation resistance

5.12.1 Insulation resistance method

At specified voltage with insulation resistance (IR) of 7,500 megohms minimum.

5.12.2 Insulation resistance requirements

There shall not be any evidence of physical damage in accordance with MIL-PRF-27^(RD2).

5.13 Internal mechanical examination (Destructive physical analysis(DPA))

5.13.1 DPA method

Components are to be moulded into adequate material, and cut and polished. The cut planes shall include solderings if any, and the core. Multiple cutplanes may be necessary. The components are to be visually inspected, and photographed.

5.13.2 DPA requirements

There shall not be any evidence of physical damage of core, wires, coilformer, solderings, and insulation materials or impregnation material.



5.14 Partial discharge

Transformer only

5.14.1 Partial discharge Method

- a. Magnitude of test voltage: 533Vac peak
- b. Frequency: 50Hz
- c. Test duration: 10 minutes min (after ramp up / before ramp down)
- d. Background noise: <2pC
- e. Pressure: <2Pa
- f. Pass criteria: no pulse ($\geq 5\text{pC}$) during the test duration shall be observed

5.15 Moisture resistance

5.15.1 Moisture resistance method

Moisture resistance is to be performed by exposing the components to a number of temperature and humidity cycles as specified in MIL-STD-202^(RD2), method 106F. The components are not to be polarised or loaded during humidity cycles. Cycle steps 7a (-10°C conditioning) and 7b (vibration) are not applicable.

5.15.2 Moisture resistance requirements

There shall be no evidence of physical damage, or corrosion affecting the mechanical or electrical operation of the component, in accordance with MIL-PRF-27^(RD1), section 4.7.20.

5.16 Overload

5.16.1 Overload method

Overload test have been performed by applying operating conditions as specified for each component, with the following exceptions:

- Power is to be at 112% of nominal power
- Temperature: Increase 1 temperature class

The operating conditions were applied for at least 48h in accordance with in accordance with MIL-PRF-27^(RD1), section 6.11.

5.16.2 Overload requirements

There shall be no evidence of physical damage in accordance with MIL-PRF-27^(RD1), section 3.24.

5.17 Thermal shock

5.17.1 Thermal shock method

Thermal shock shall be performed using an environmental chamber. The following test conditions shall be used; if not otherwise specified in the Order Baseline Matrix.

Parameter	Requirement
Minimum temperature	- 55°C ±3°C
Maximum temperature	+120°C ±3°C
Transition temperature	Room Temperature
Dwell time at min. and max. temperature	30 min.



Parameter	Requirement
Dwell time at transition temperature	4 min.
Transfer time	< 5 min.
Number of cycles	100

The first five cycles shall run continuously. After five cycles, the test may be interrupted after the completion of any full cycle, and the components allowed to return to ambient room temperature before testing is resumed.

5.17.2 Thermal shock requirement

The components shall be examined for evidence of leakage and other visible damage according to MIL-PRF-27^(RD1) section 3.24.

5.18 Temperature rise

5.18.1 Temperature rise method

The temperature rise of components shall be determined by any suitable method, but preferably by the resistance-change method.

The device with all normally loaded secondaries loaded with their specified impedances, shall have their windings loaded with the rated currents and voltages at the minimum frequency specified in the Detail Specification. Forced-air circulation shall be shut off when the electrical conditions are applied.

5.18.2 Temperature rise requirement

The units shall be within the specified parameters.



6. TEST RESULTS

6.1 Presentation of results

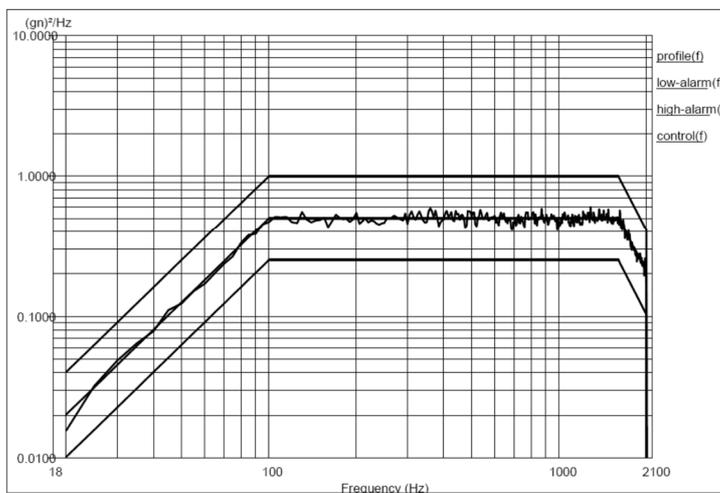
The results are presented and summarised in section 9, any remarks relevant to the test campaign are detailed in sections 10.5 through 10.7.

6.2 Vibration and Mechanical Shock

Vibration and Mechanical shock was performed at Delta all units passed without comments

6.2.1 Random Vibration

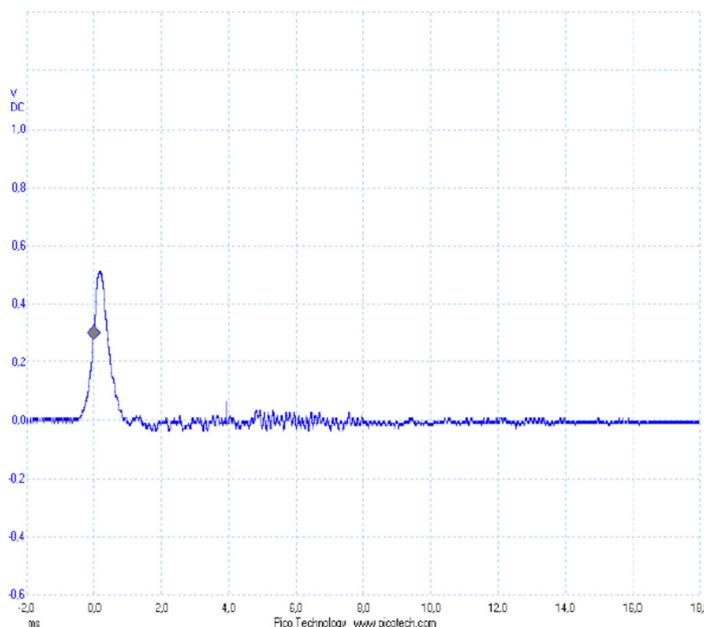
This was performed on all units from subgroup 3



Vibration

Recorded PSD from run 1.
30 g_{rms}, 5 min.

6.2.2 Mechanical Shock 500g



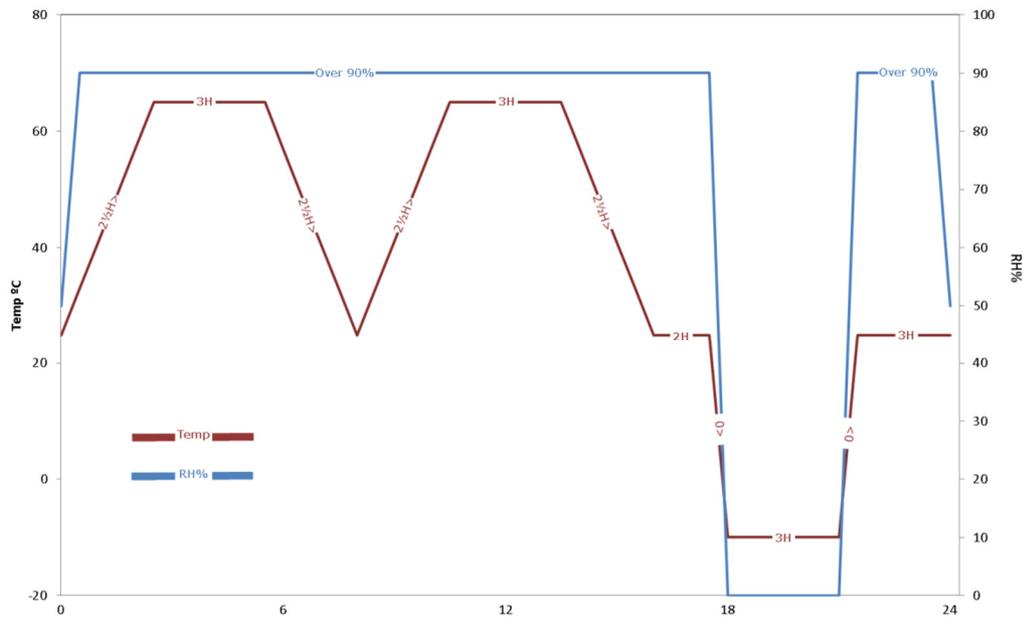
Shock 500g

Recorded shock pulse
1 mV/g vertically.
500 g, 1 ms

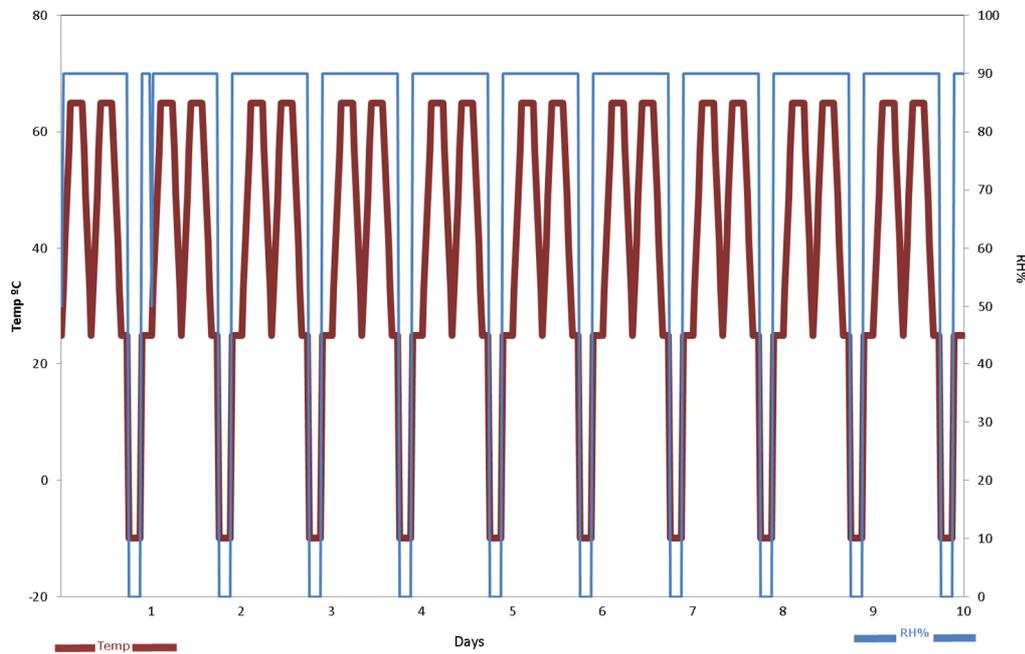


6.3 Moisture Test

6.3.1 One cycle

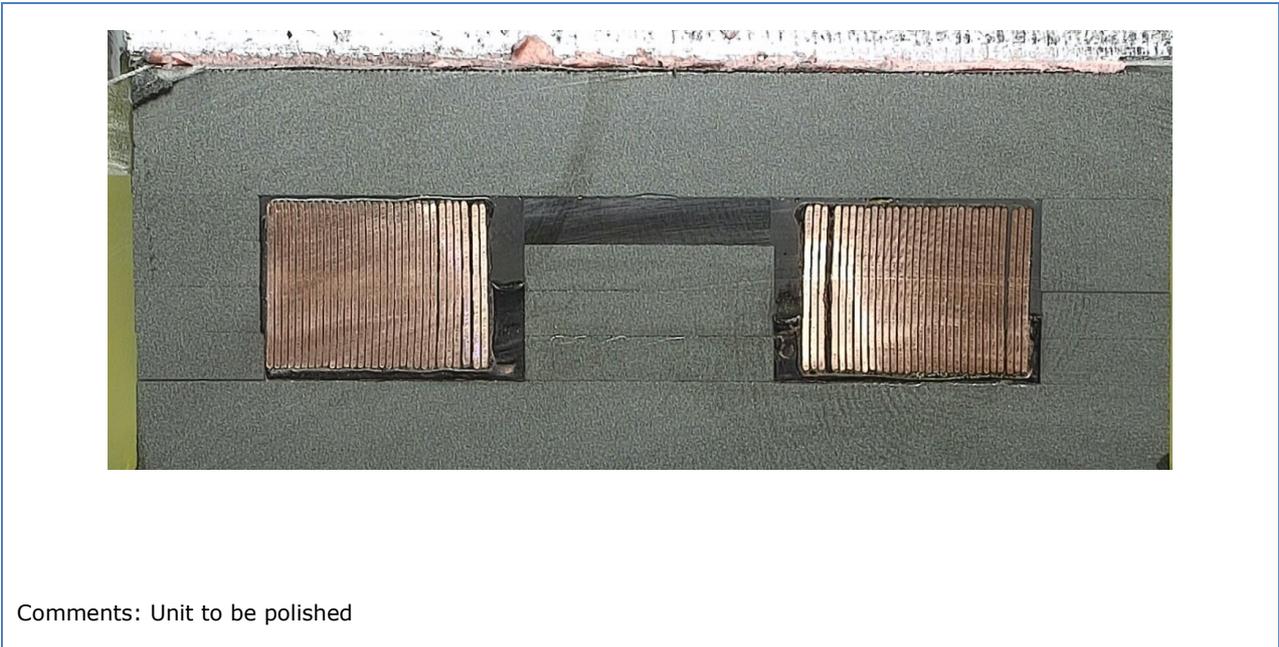


6.3.2 Full Test

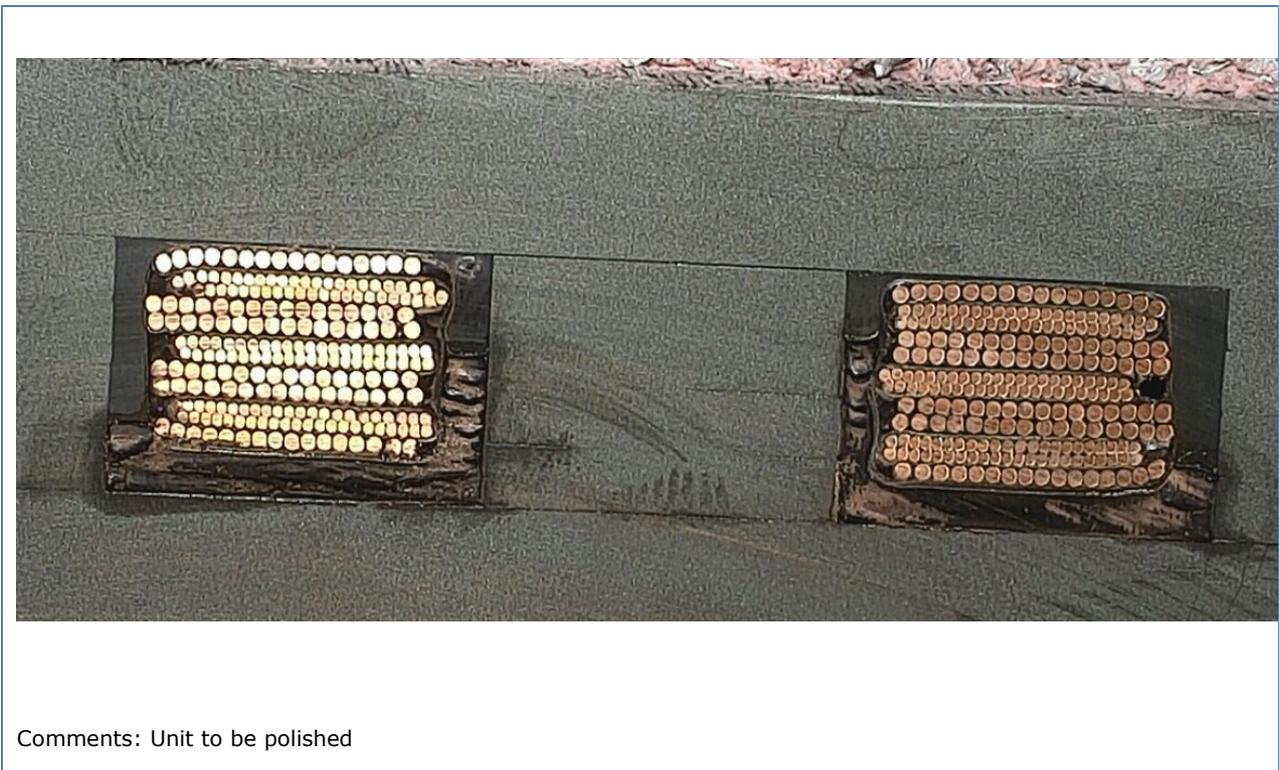


6.4 Internal Examination (DPA)

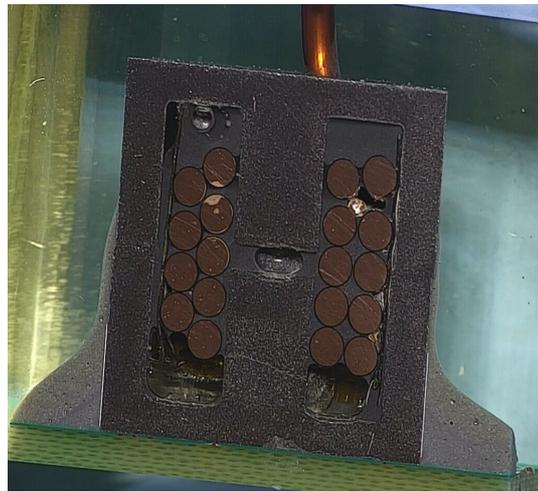
6.4.1 QS1 – 12413001-1 - S/N 001



6.4.2 QS2 – 14413001-1 - S/N 015



6.4.3 QS3 – 12780101-1 - S/N 009



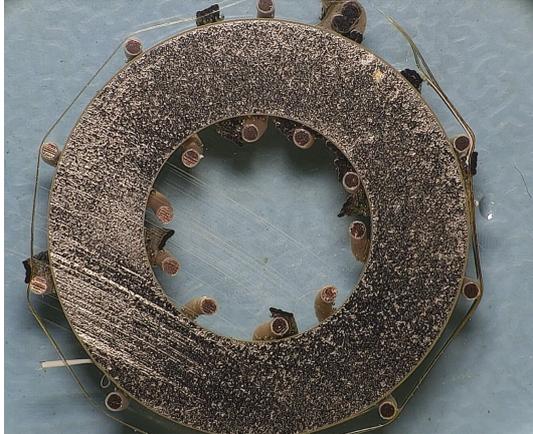
Comments: None

6.4.4 QS4 – 12780107-1 - S/N 006



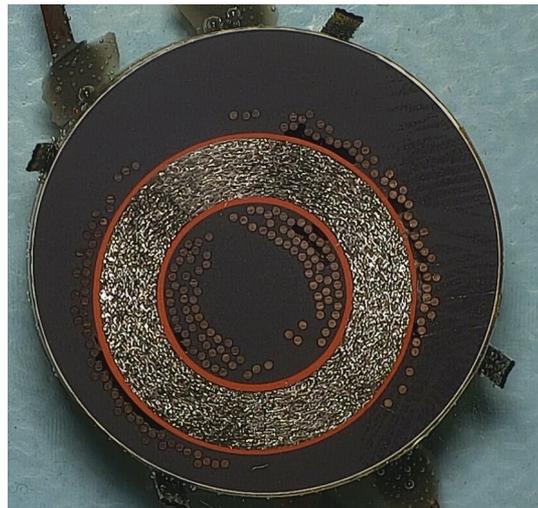
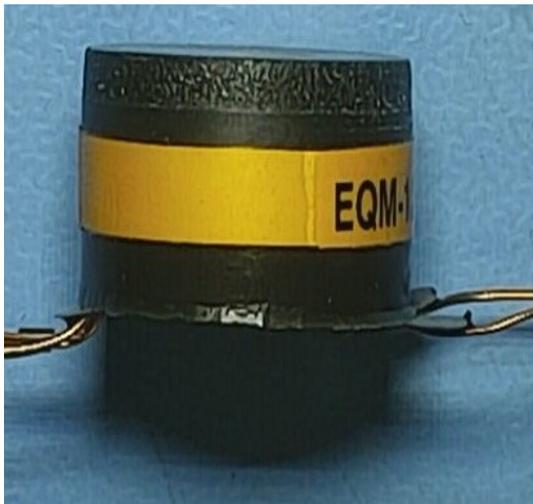
Comments: None

6.4.5 QS5 – 12311067-1 - S/N 001



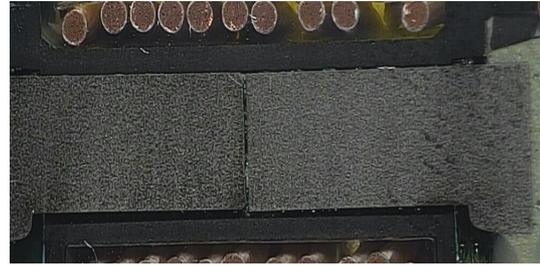
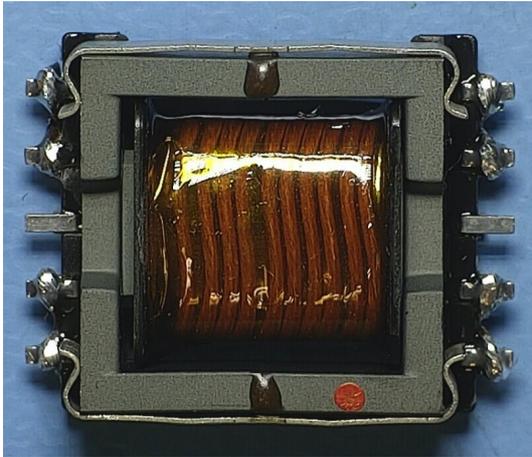
Comments: None

6.4.6 QS6 – 12169002-1 - S/N 001



Comments: None

6.4.7 QS7 - 12189001-1 - S/N 001



Comments: None

7. OBSERVATIONS AND OBSERVATIONS ON TESTING

None

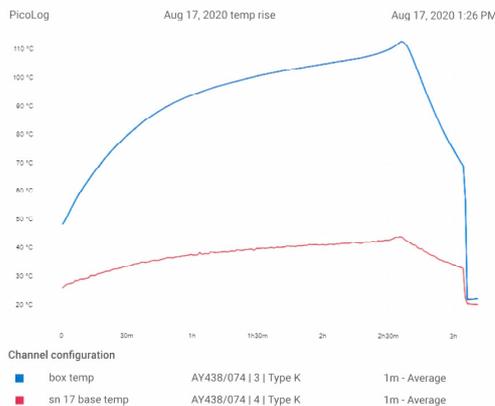
7.1 Minor Nonconformances

None

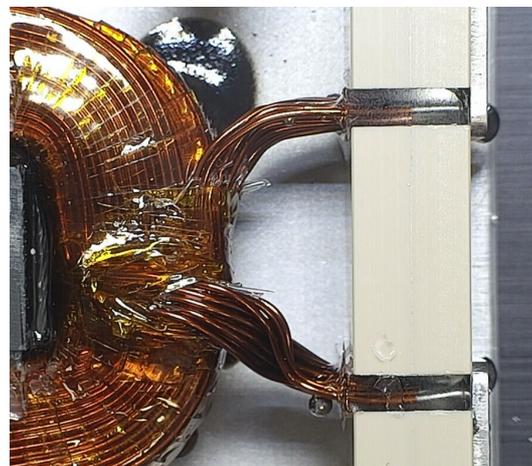
7.2 Critical Failures

7.2.1 Temperature Rise QS2 Serial Number 017

The temperature rise test on S/N 017 caused the unit to overheat and enter thermal runaway. The baseplate temperature was in excess of 110°C, with the internal temperature considerably higher. The Temperature lead to the melting of the solder, this indicates a temperature >183°C.



Temperature during temperature rise



Melting of solder

The unit is design to be used with active cooling to avoid overheating. Without some manner of dispersing the heat the unit will overheat.

The test cannot be performed on the manner prescribed by Flux’s Engineering. A new method should be devised which allows for a simulation of actual operating conditions including a cooled baseplate to dissipate heat.

8. CONCLUSION

The units have passed qualification as defined in FT08699016 (RD8)



9. TEST DATA

9.1 QS1 - 12413001-1

TEST	Electrical Characteristics		Mount on PCB & Fixture	Vibration	Mechanical Shock	Moisture Resistance	Electrical Characteristics		Thermal Shock	Temperature Rise
	Inductance μ H	Insul MOhm					Inductance μ H	Insul MOhm		
CONDITIONS	V=0.250V f=100kHz	V=500	ECSS-Q-ST-70-08	External Test		§ 5.15	V=0.250V f=100kHz	V=500	§ 5.17	§ 5.18
LIMITS	Max: 43,02			Force Report: 120-24835			Max: 43,02			
	Min: 38,92	Min: 5000					Min: 38,92			
S/N 001	From screening		✓	✓	✓	✓	33,37	✓	✓	N/A Inductor
S/N 002			✓	✓	✓	✓	32,55	✓	✓	
S/N 004										
S/N 005										
S/N 006										

TEST	Overload	Induced Voltage	DWV	Insulation Resistance	Electrical Characteristics		Visual Inspection	Resistance to soldering heat	DPA
					Inductance μ H	Insul MOhm			
CONDITIONS	§ 5.16	§ 5.5	V=500 AC 60 s	Surge Test	V=0.250V f=100kHz	V=500	ECSS-Q-ST-70-08	§ 5.3	§ 5.14
LIMITS					Max: 43,02				
					Min: 38,92	Min: 5000			
S/N 001	✓	✓	✓	✓	33,12	✓	✓		✓
S/N 002	✓	✓	✓	✓	32,34	✓	✓		
S/N 004									
S/N 005									
S/N 006									



TEST	Life Test	Permanence of Marking	Electrical Characteristics		Visual Inspection	Solderability	Terminal Strength	Visual Inspection
			Inductance μ H	Insul MOhm				
CONDITIONS	§ 5.11	§ 5.8	V=0.250V f=100kHz	V=500	§ 5.2	§ 5.3	§ 5.4	§ 5.2
LIMITS			Max: 43,02					
			Min: 38,92	Min: 5000				
S/N 001								
S/N 002								
S/N 004	✓	✓	32,15	✓	✓	Units are connected via connectors. No terminals	✓	
S/N 005	✓	✓	32,28	✓	✓		✓	
S/N 006	✓	✓	33,43	✓	✓		✓	



9.2 QS2 - 14413001-1

TEST	Electrical Characteristics		Mount on PCB & Fixture	Vibration	Mechanical Shock	Moisture Resistance	Electrical Characteristics		Thermal Shock	Partial Discharge	Temperature Rise
	Inductance μ H	Insul MOhm					Inductance μ H	Insul MOhm			
CONDITIONS	V=0.250V f=100kHz	V=500	ECSS-Q-ST-70-08	External Test		§ 5.15	V=0.250V f=100kHz	V=500	§ 5.17	§ 5.15	§ 5.18
LIMITS	Max: TBA			Force Report: 120-24835			Max: TBA				
	Min: TBA	Min: 5000					Min: TBA	Min: 5000			
S/N 015	From screening		✓	✓	✓	✓	55,7	✓	✓	✓	✓
S/N 017	From screening		✓	✓	✓	✓	63,5	✓	✓	✓	See Section 7
S/N 018											
S/N 019											
S/N 020											

TEST	Overload	Induced Voltage	DWV	Insulation Resistance	Electrical Characteristics		Visual Inspection	Resistance to soldering heat	DPA
					Inductance μ H	Insul MOhm			
CONDITIONS	§ 5.16	§ 5.5	V=500 AC 60 s	Surge Test	V=0.250V f=100kHz	V=500	ECSS-Q-ST-70-08	§ 5.3	§ 5.14
LIMITS					Max: TBA				
					Min: TBA	Min: 5000			
S/N 015	✓	✓	✓	✓	54,4	✓	✓		✓
S/N 017									
S/N 018									
S/N 019									
S/N 020									



TEST	Life Test	Permanence of Marking	Electrical Characteristics		Visual Inspection	Partial Discharge	Solderability	Terminal Strength	Visual Inspection
			Inductance μ H	Insul MOhm					
CONDITIONS	§ 5.11	§ 5.8	V=0.250V f=100kHz	V=500	§ 5.2	§ 5.15	§ 5.3	§ 5.4	§ 5.2
LIMITS			Max: TBA						
			Min: TBA	Min: 5000					
S/N 015									
S/N 017									
S/N 018	✓	✓	57,59	✓	✓	✓	Units are connected via connectors. No terminals	✓	
S/N 019	✓	✓	78,76	✓	✓	✓		✓	
S/N 020	✓	✓	63,49	✓	✓	✓		✓	



9.3 QS3 - 12780101-1

TEST	Electrical Characteristics		Mount on PCB & Fixture	Vibration	Mechanical Shock	Moisture Resistance	Electrical Characteristics		Thermal Shock	Temperature Rise
	Inductance μ H	Insul MOhm					Inductance μ H	Insul MOhm		
CONDITIONS	V=0.250V f=100kHz	V=500	ECSS-Q-ST-70-08	External Test		§ 5.15	V=0.250V f=100kHz	V=500	§ 5.17	§ 5.18
LIMITS	Max: TBA			Force Report: 120-24835			Max: TBA			
	Min: TBA	Min: 5000					Min: TBA			
S/N 009	From screening		✓	✓	✓	✓	1,62	✓	✓	N/A Inductor
S/N 010			✓	✓	✓	✓	1,62	✓	✓	
S/N 001										
S/N 002										
S/N 003										

TEST	Overload	Induced Voltage	DWV	Insulation Resistance	Electrical Characteristics		Visual Inspection	Resistance to soldering heat	DPA
					Inductance μ H	Insul MOhm			
CONDITIONS	§ 5.16	§ 5.5	V=500 AC 60 s	Surge Test	V=0.250V f=100kHz	V=500	ECSS-Q-ST-70-08	§ 5.3	§ 5.14
LIMITS					Max: TBA				
					Min: TBA	Min: 5000			
S/N 009	✓	✓	✓	✓	1,60	✓	✓	✓	✓
S/N 010	✓	✓	✓	✓	1,56	✓	✓	✓	
S/N 001									
S/N 002									
S/N 003									



TEST	Life Test	Permanence of Marking	Electrical Characteristics		Visual Inspection	Solderability	Terminal Strength	Visual Inspection
			Inductance μ H	Insul MOhm				
CONDITIONS	§ 5.11	§ 5.8	V=0.250V f=100kHz	V=500	§ 5.2	§ 5.3	§ 5.4	§ 5.2
LIMITS			Max: TBA					
			Min: TBA	Min: 5000				
S/N 009								
S/N 010								
S/N 001	✓	✓	1,60	✓	✓	✓	Flying Leads	✓
S/N 002	✓	✓	1,59	✓	✓			
S/N 003	✓	✓	1,39	✓	✓			



9.4 QS4 - 12780107-1

TEST	Electrical Characteristics		Mount on PCB & Fixture	Vibration	Mechanical Shock	Moisture Resistance	Electrical Characteristics		Thermal Shock	Temperature Rise
	Inductance μ H	Insul MOhm					Inductance μ H	Insul MOhm		
CONDITIONS	V=0.250V f=100kHz	V=500	ECSS-Q-ST-70-08	External Test		§ 5.15	V=0.250V f=100kHz	V=500	§ 5.17	§ 5.18
LIMITS	Max: 110,0			Force Report: 120-24835			Max: 110,0			
	Min: 90,0	Min: 5000					Min: 90,0			
S/N 006	From screening		✓	✓	✓	✓	91,6	✓	✓	N/A Inductor
S/N 009			✓	✓	✓	✓	92,3	✓	✓	
S/N 001										
S/N 002										
S/N 003										

TEST	Overload	Induced Voltage	DWV	Insulation Resistance	Electrical Characteristics		Visual Inspection	Resistance to soldering heat	DPA
					Inductance μ H	Insul MOhm			
CONDITIONS	§ 5.16	§ 5.5	V=500 AC 60 s	Surge Test	V=0.250V f=100kHz	V=500	ECSS-Q-ST-70-08	§ 5.3	§ 5.14
LIMITS					Max: 110,0				
					Min: 90,0	Min: 5000			
S/N 006	✓	✓	✓	✓	90,9	✓	✓	✓	✓
S/N 009	✓	✓	✓	✓	92,6	✓	✓	✓	
S/N 001									
S/N 002									
S/N 003									



TEST	Life Test	Permanence of Marking	Electrical Characteristics		Visual Inspection	Solderability	Terminal Strength	Visual Inspection
			Inductance μ H	Insul MOhm				
CONDITIONS	§ 5.11	§ 5.8	V=0.250V f=100kHz	V=500	§ 5.2	§ 5.3	§ 5.4	§ 5.2
LIMITS			Max: 110,0					
			Min: 90,0	Min: 5000				
S/N 006								
S/N 009								
S/N 001	✓	✓	91,0	✓	✓	✓	Flying Leads	✓
S/N 002	✓	✓	91,4	✓	✓			
S/N 003	✓	✓	92,2	✓	✓			



9.5 QS5 - 12311067-1

TEST	Electrical Characteristics		Mount on PCB & Fixture	Vibration	Mechanical Shock	Moisture Resistance	Electrical Characteristics		Thermal Shock	Temperature Rise
	Inductance μ H	Insul MOhm					Inductance μ H	Insul MOhm		
CONDITIONS	V=0.250V f=100kHz	V=500	ECSS-Q-ST-70-08	External Test		§ 5.15	V=0.250V f=100kHz	V=500	§ 5.17	§ 5.18
LIMITS	Max: 17,27			Force Report: 120-24835			Max: 17,27			
	Min: 14,13	Min: 5000					Min: 14,13			
S/N 001	From screening		✓	✓	✓	✓	15,75	✓	✓	N/A Inductor
S/N 002			✓	✓	✓	✓	15,54	✓	✓	
S/N 003										
S/N 004										
S/N 005										

TEST	Overload	Induced Voltage	DWV	Insulation Resistance	Electrical Characteristics		Visual Inspection	Resistance to soldering heat	DPA
					Inductance μ H	Insul MOhm			
CONDITIONS	§ 5.16	§ 5.5	V=500 AC 60 s	Surge Test	V=0.250V f=100kHz	V=500	ECSS-Q-ST-70-08	§ 5.3	§ 5.14
LIMITS					Max: 17,27				
					Min: 14,13	Min: 5000			
S/N 001	✓	✓	✓	✓	15,86	✓	✓	✓	
S/N 002	✓	✓	✓	✓	15,64	✓	✓	✓	
S/N 003									
S/N 004									
S/N 005									



TEST	Life Test	Permanence of Marking	Electrical Characteristics		Visual Inspection	Solderability	Terminal Strength	Visual Inspection
			Inductance μ H	Insul MOhm				
CONDITIONS	§ 5.11	§ 5.8	V=0.250V f=100kHz	V=500	§ 5.2	§ 5.3	§ 5.4	§ 5.2
LIMITS			Max: 17,27					
			Min: 14,13	Min: 5000				
S/N 001								
S/N 002								
S/N 003	✓	✓	15,62	✓	✓	✓	Flying Leads	✓
S/N 004	✓	✓	15,54	✓	✓			
S/N 005	✓	✓	15,67	✓	✓			



9.6 QS6 - 12169002-1

TEST	Electrical Characteristics		Mount on PCB & Fixture	Vibration	Mechanical Shock	Moisture Resistance	Electrical Characteristics		Thermal Shock	Temperature Rise
	Inductance μ H	Insul MOhm					Inductance μ H	Insul MOhm		
CONDITIONS	V=0.250V f=1kHz	V=500	ECSS-Q-ST-70-08	External Test		§ 5.15	V=0.250V f=1kHz	V=500	§ 5.17	§ 5.18
LIMITS	Max: 4,64			Force Report: 120-24835			Max: 4,64			
	Min: 2,32	Min: 5000					Min: 2,32			
S/N 001	From screening		✓	✓	✓	✓	3,62	✓	✓	N/A Inductor
S/N 002			✓	✓	✓	✓	3,85	✓	✓	
S/N 003										
S/N 004										
S/N 005										

TEST	Overload	Induced Voltage	DWV	Insulation Resistance	Electrical Characteristics		Visual Inspection	Resistance to soldering heat	DPA
					Inductance μ H	Insul MOhm			
CONDITIONS	§ 5.16	§ 5.5	V=500 AC 60 s	Surge Test	V=0.250V f=1kHz	V=500	ECSS-Q-ST-70-08	§ 5.3	§ 5.14
LIMITS					Max: 4,64				
					Min: 2,32	Min: 5000			
S/N 001	✓	✓	✓	✓	2,94	✓	✓	✓	✓
S/N 002	✓	✓	✓	✓	3,24	✓	✓	✓	
S/N 003									
S/N 004									
S/N 005									



TEST	Life Test	Permanence of Marking	Electrical Characteristics		Visual Inspection	Solderability	Terminal Strength	Visual Inspection
			Inductance μ H	Insul MOhm				
CONDITIONS	§ 5.11	§ 5.8	V=0.250V f=1kHz	V=500	§ 5.2	§ 5.3	§ 5.4	§ 5.2
LIMITS			Max: 4,64					
			Min: 2,32	Min: 5000				
S/N 001								
S/N 002								
S/N 003	✓	✓	2,93	✓	✓	✓	Flying Leads	✓
S/N 004	✓	✓	2,97	✓	✓			
S/N 005	✓	✓	2,87	✓	✓			



9.7 QS7 - 12189001-1

TEST	Electrical Characteristics		Mount on PCB & Fixture	Vibration	Mechanical Shock	Moisture Resistance	Electrical Characteristics		Thermal Shock	Temperature Rise
	Inductance μ H	Insul MOhm					Inductance μ H	Insul MOhm		
CONDITIONS	V=0.250V f=100kHz	V=500	ECSS-Q-ST-70-08	External Test		§ 5.15	V=0.250V f=100kHz	V=500	§ 5.17	§ 5.18
LIMITS	Max: 6,88			Force Report: 120-24835			Max: 6,88			
	Min: 5,63	Min: 5000					Min: 5,63			
S/N 001	From screening		✓	✓	✓	✓	5,64	✓	✓	N/A Inductor
S/N 002			✓	✓	✓	✓	5,85	✓	✓	
S/N 003										
S/N 004										
S/N 005										

TEST	Overload	Induced Voltage	DWV	Insulation Resistance	Electrical Characteristics		Visual Inspection	Resistance to soldering heat	DPA
					Inductance μ H	Insul MOhm			
CONDITIONS	§ 5.16	§ 5.5	V=500 AC 60 s	Surge Test	V=0.250V f=100kHz	V=500	ECSS-Q-ST-70-08	§ 5.3	§ 5.14
LIMITS					Max: 6,88				
					Min: 5,63	Min: 5000			
S/N 001	✓	✓	✓	✓	5,63	✓	✓	✓	✓
S/N 002	✓	✓	✓	✓	5,76	✓	✓	✓	
S/N 003									
S/N 004									
S/N 005									



TEST	Life Test	Permanence of Marking	Electrical Characteristics		Visual Inspection	Solderability	Terminal Strength	Visual Inspection
			Inductance μ H	Insul MOhm				
CONDITIONS	§ 5.11	§ 5.8	V=0.250V f=100kHz	V=500	§ 5.2	§ 5.3	§ 5.4	§ 5.2
LIMITS			Max: 6,88					
			Min: 5,63	Min: 5000				
S/N 001								
S/N 002								
S/N 003	✓	✓	6,16	✓	✓	✓	✓	✓
S/N 004	✓	✓	6,24	✓	✓			
S/N 005	✓	✓	6,28	✓	✓			