Generic Specification:

Magnetic Components for Space Applications

Document:	08690020	**Issue:**	10
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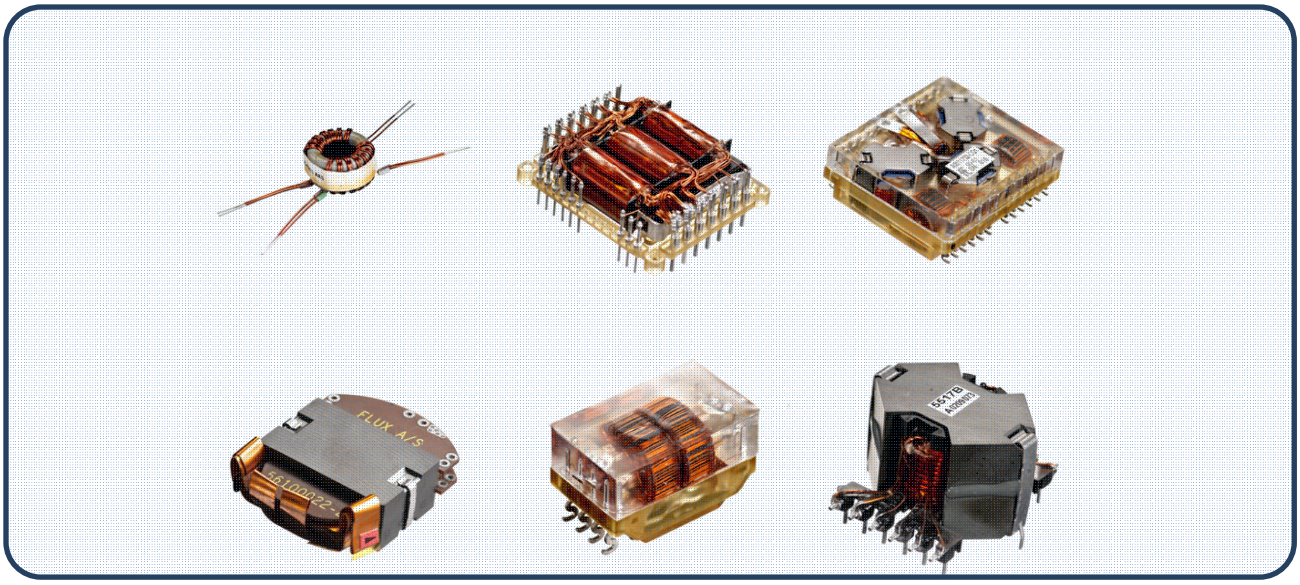

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DOCUMENT CHANGE LOG

Change No.	Date	Initiator	Pages Affected	Short Description of Change
Issue 6	25-01-15	MS	-	See previous edition for details
Issue 7	14-11-16	MS	-	Change to Address
				Section 3.1 Change to contact personnel
				Section 4.3.3 Addition of Temperature Rating
				Section 7.3.2 Change to sample size
				Section 9.8.1 Non-film method added
				Section 9.20.2 Change to operating life test
				Section 9.20.3 Addition of accelerated life test
Issue 8	15-05-17	MS		Throughout small clerical amendments Removal of reference to OBM
				Change of Parts submission warrant to Preliminary Design Review.
				Change of Feedback Report to Final Design Review
				Section 3.1 change to contact details
				Section 3.4 change to wording
				Section 3.6 addition of Class S
				Section 4.2.1 addition of Class S
				Section 4.2.2 addition of Class S
				Section 4.3.1 change to LOT reject and addition of Class S
				Section 4.3.2 addition of Class S
				Section 4.3.2.1 addition of Grade 4 & 6
				Section 5.5.1 change to wording
				Section 5.5.3 change to wording
				Section 6.2 addition of Class S
				Section 7.1 addition of Class S
				Section 7.3.6 change of wording
				Section 7.3.7 change of wording
				Section 7.3.9 new section
				Section 9 change of Leakage
				Section 9 change of wording
				Section 9.5.2 change of wording
				Section 9.8 addition of Class S
				Section 9.15 change of wording
				Section 9.18.1 change of conditions

DOCUMENT CHANGE LOG

Change No.	Date	Initiator	Pages Affected	Short Description of Change
Issue 9	22/08/22	MS	-	Section 9.20.1 change of conditions Section 9.20.1 addition of accelerated life test Section 9.25 change of wording Section 10.2 change of wording Section 10.3 change of wording Section 11.1 change of wording Section 11.3 change of wording Section 12 change of wording Various clerical amendments Section 3.1 change title Section 3.4.1 added. Section 4.4 modification of date code Section 5.6 change of wording Section 6.4 Addition Section 7.3 reference to ESCC 3201 Issue 5 Tables 9.1 Addition of Induced Voltage, change to drift Section 9.5 inclusion of Class S requirements. Section 9.6 Clarification of voltages Section 9.7 Removal of 'For machine wound toroids' Section 9.24 Addition of Insulation Resistance 10.2 Addition of Order Confirmation
Issue 10	28/02/23	MS	-	Section 4.4 Change to Colour code reference (removal of RD16)

TABLE OF CONTENTS

1. INTRODUCTION

FLUX's general operating practices and Work Instructions are controlled by our Quality Management System (QMS). This document summarises the general requirements for the procurement, inspection, test, delivery, and documentation requirements.

Additionally, it covers aspects relating to Lot Acceptance Testing (LAT), Qualification Testing and Qualification retention.

2. SCOPE

Applicable to all space components unless formally agreed otherwise.

3. REFERENCES AND TERMS

3.1 Contact Personnel

The key persons are:

Contact	Position	Reason for contact	Email
Lars A. Gregersen	COO Defence & Space	Contractual and Planning Issues	lag@FLUX.dk
Carl Aage Dahl Winther	QHSE Manager	Quality Issues	caw@FLUX.dk

Telephone contact is via the FLUX switchboard +45 59650089.

3.2 Reference Documents

These documents have been used to establish FLUX's generic baseline, as detailed herein.

Ref.	Document	Title
RD1	MIL-PRF-27	General Specification for Transformers and Inductors
RD2	MIL-STD-202	Test Method Standards – Electronic and Electrical Component Parts
RD3	MIL-STD-981	Design, Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Applications
RD4	ECSS-P-001	Abbreviations, Symbols and Units – Glossary of Terms
RD5	ECSS-Q-ST-10	Product Assurance Management
RD6	ECSS-Q-ST-10-09	Nonconformance Control System
RD7	ECSS-Q-ST-20	Quality Assurance
RD8	ECSS-Q-ST-70	Materials, mechanical parts and processes
RD9	ECSS-Q-ST-70-01	Contamination and Cleanliness Control
RD10	ECSS-Q-ST-70-02	Thermal Vacuum outgassing test for the screening of space materials
RD11	ECSS-Q-ST-70-08	Manual soldering of high-reliability electrical connections
RD12	ESCC 3201	Coils, RF and Power, Fixed
RD13	ESCC 23500	Requirements for Lead Materials and Finishes for Components for Space Applications
RD14	FT 08742201	FLUX Quality Manual
RD15	FT 08711502	Screening Test Procedure for Transformers and Inductors
RD16		N/A
RD17	MIL-STD-810	Test Method Standards – Test Method Standard for Environmental Engineering Considerations and Laboratory Tests
RD18	IEC 60317	Specifications for particular types of winding wires (family of documents)
RD19	AS9116:2015	Aerospace Series – Notice of Change (NOC)
RD20	ECSS-Q-ST-60-14C	Space Product Assurance – Relifing procedure – EEE components

3.3 Customer Specific Baseline

In addition to the generic baseline described herein, FLUX uses the following documents to establish customer specific baselines.

Ref.	Document	Title
GD1	FT 08690019	General - Process Identification Document (PID)
GD2	FT 08690027	Declared Materials List
GD3	FT 08690028	Declared Processes List

Additionally, a Quality Plan may be produced for each customer, highlighting their individual baseline and quality requirements.

3.4 Part Specific Baseline

The baseline for each part is then established using the detail specification, Preliminary Design Review and Final Design Review

Documents shall be used with the following order of precedence:

- Individual Part Baseline (including individual part specification, Preliminary Design Review (PDR), Final Design Review (FDR) and agreed Request For Deviations(RFD))
- Q-Plan
- Flux A/S Generic Specification*

*The FLUX Generic Specification may be substituted with a customer Generic Specification; however, a Statement of Compliance (SOC) from FLUX may be applied

Deviations from the formal baseline may be requested via the Purchase Order (PO). Once accepted by FLUX, these deviations will be used in lieu of the relevant parameter.

When an updated specification is received a new baseline shall be formally agreed.

3.4.1 Flux A/S Part Number

Flux A/S component identification is as follows

12345678-#-$

Ref.	Function	Designation and Description	
12	Part type	12	Chokes / Inductors
		14	Pulse / Transformers
		15	Data Transmission (Chokes, Inductors and Transformers)
		19	Assemblies
34(1)	Core Size(Ap)	Cores size is evaluated by core cross section area times winding area ($Ap = A_c * A_w\ [mm^4]$)	
5(1)	Type of terminations	0	Pin/ex-striplines
		1	Flying leads /striplines
		2	Open solder terminal
		3	Open pin terminal
		4	Potted pin
		5	Potted flying leads
		6	Closed solder terminal
		7	Closed pin terminal
		8	Potted SMD
		9	SMD
678		Sequential Numeric Value	
(2)**#**(3)	Part Revision	Sequential Numeric Value	
$	Flight Designation	Alpha Character (internal use)	

Note 1: Applies to custom magnetics up to and including a core size(Ap) of 50. Part numbers where the third and fourth digits are >50 are part of the Flux A/S catalogue and numbers 3 and 4 represent the part series and 5 is part of the sequential numeric value.

Note 2: The "-" between 8th digit and revision can be an ascending alphabetic letter indicating prototype revisions during design phase. When released the letter is replaced by "-". First prototype edition is labelled "A", second "B" and so forth. Revision number stays "1" after the letter.

Note 3:The part revision will change for matters of Fit, Form, Function affecting interchangeability and where Flux A/S deem necessary.

3.5 General terms, definitions, abbreviations, symbols and units

The terms, definitions, abbreviations, symbols and units specified in the ECSS-P-001(RD4) and the relevant Detail Specification shall apply.

3.6 FLUX terms

Term	Definition
Preliminary Design Review	Upon initial receipt of baseline documentation. FLUX will review the customer's specifications. Communication of the findings will be by way of a Preliminary Design Review (PDR). The PDR shall indicate the type and level of testing and FLUX's observations/recommendations as to the manufacturability of the part. The PDR shall be submitted to the customer for acceptance. If rejected by the customer, the PDR shall be up issued in line with the customer comments and resubmitted, this process will be repeated until an agreement can be reached. Upon acceptance of the PDR, it shall be applied to the formal baseline, until such time as the relevant specifications are updated.
Final Design Review	On first time productions and upon specification updates where significant design changes are required. FLUX will produce a Final Design Review for submission to the

Term	Definition
	customer. This report will detail observations on the production and any recommendations and action items to be applied to baseline for subsequent productions. Upon formal acceptance of the FDR, all recommendations and action items (unless formally instructed otherwise) will be applied to the baseline, until such time as the relevant specifications are updated.
Production LOT	A Production Lot refers to a group of components, which are: • Defined by a single design or component number • Produced in a production run by means of the same production processes, the same tools and machinery, and the same manufacturing, test, and quality controls All components in the same lot shall have the same lot date code. Additionally for Class S the following shall also apply: • Materials used in the manufacture of the part shall be from a single lot and traceable to the lot • All single process operations shall not be changed during processing of the lot.
Class B (taken from RD3)	Class B parts are for use in noncritical flight and non-mission essential ground support applications
Class S (taken from RD3)	Class S parts are intended for critical flight and mission essential ground support applications

4. REQUIREMENTS

4.1 General

The Final Production test requirements of components, depending on the quality level and the level of lot acceptance tests specified in the purchase order, shall be in accordance with this specification, unless otherwise stated.

Lot Acceptance tests can be ordered and shall be performed in accordance with this specification, unless otherwise stated.

Qualification tests can be ordered and shall be performed in accordance with this specification, unless otherwise stated.

4.1.1 Specifications

For all components, delivery shall conform to this Generic Specification, unless formally agreed otherwise.

4.1.2 FLUX's Responsibility for Performance of Tests and Inspections

FLUX is responsible for the performance of Tests and Inspections required by the applicable specifications. These Tests and Inspections shall be performed at FLUX, or an approved external facility.

4.1.3 Inspection Rights

The Customer has the right to witness any of the tests and inspections scheduled in the relevant specifications. FLUX requires prior notification if the customer wishes to attend.

4.1.4 Mandatory Inspection Points (MIP)

Where applicable, Mandatory Inspection Points (MIP) are conducted for each lot of Transformers and Inductors as defined in the approved PID. If MIPs are included in the Purchase Order, FLUX will notify the Customer at least 5 working days prior to the commencement. The Customer shall within 2 working days indicate in writing, whether the Customer intends to attend or perform the MIP, if the customer does not wish to attend or

perform the MIP, the authority to conduct the MIP shall be delegated to FLUX, whereon it will be performed by qualified personnel, as agreed with the customer.

4.2 Material and Process Selection

Materials and processes shall be selected in accordance with the Process Identification Document (PID), Declared Processes List (DPL) and Declared Materials List (DML) unless formally agreed otherwise with and approved by the Customer.

4.2.1 Materials

Materials have been selected by Flux from FT 08690027[(GD2)] and agreed by the customer and comply to MIL-STD-981C[(RD3)]rules with the following exception.

- Outgassing in accordance with ECSS-Q-ST-70-02[(RD9)].
- Wire – The wires are non-compliant to the requirements of 5.6.2.1 which states that wire over 5 years may not be used. Flux performs IQC in accordance with the IEC standard and re-lifing every 3 years.

4.2.2 Processes

Processes have been selected by Flux from FT 08690019[(GD1)] as detailed in FT 08690028[(GD3)] and agreed by customer and comply to MIL-STD-981C[(RD3)].

4.3 Deliverable Components

Unless stated otherwise Components shall be processed and inspected in accordance with the Process Identification Document (PID). Each delivered component shall be traceable to its production lot. Components shall have completed satisfactorily all tests to the required testing level as specified in the Purchase Order.

4.3.1 Quality Levels

This Generic Specification defines four (4) quality levels of testing severity which are designated by the letters 'X', 'E', 'B' and 'S'(see table 4-1 and Chart I) and nine (9) levels of lot acceptance tests (see table 7-1 and Chart II) which are designated by the letters A, B, C ,D, E, F, G, H & S

Model	Manufacturing and Testing Severity
X	Proto types
E	Engineering Components
B	Flight Components
S	Flight Components (Critical Flight)

Table 4-1 Quality Levels

4.3.1.1 Classification

Unless agreed otherwise in advance, the following classifications apply.

Term	Definition
Family	According to MIL-STD-981[(RD3)], FLUX manufactures family 03 power transformers and family 04 power inductors.
Classes	According to MIL-STD-981[(RD3)], FLUX manufactures class B and S components. Additionally, X and E models as defined herein are available.
Grade	According to MIL-PRF-27[(RD1)], FLUX manufactures grade 4, 5 & 6 components.

4.3.2 Lot Reject

4.3.2.1 X Models

LOT reject does not apply to X models

4.3.2.2 E & B Models

Lot reject may occur during Final Production tests or Lot Acceptance tests, if more than 10 % of a production lot, where at least 2 units are rejected by a major nonconformance

Additionally, LOT rejection may also occur when dispositioned by FLUX's Quality Department if more than 10 % of a production lot, where at least 2 units are rejected by a minor nonconformance or where it is felt a potential risk is present.

In cases where the nonconformance can be screened out this may be waived internally. Additionally, the need for LOT reject may be waived by the customer.

4.3.2.3 S Models

Lot reject may occur during Final Production tests or Lot Acceptance tests, if more than 5 % of a production lot, where at least 2 units are rejected by a major nonconformance

Additionally, LOT rejection may also occur when dispositioned by FLUX's Quality Department if more than 5% of a production lot, where at least 2 units are rejected by a minor nonconformance or where it is felt a potential risk is present.

In cases where the nonconformance can be screened out and with customer consent the units may be subjected to re-screening and the need for LOT reject waived.

Additionally, the need for LOT reject may be waived at any time by the customer.

4.3.3 Temperature Rating

4.3.3.1 Temperature Class

The Temperature class is identified by a single letter in accordance with table below, and denotes the maximum operating temperature (temperature rise plus maximum ambient temperature).

Class	Temperature
Q	85ºC
R	105ºC
S	130ºC
V	155ºC
T	170ºC
U	As Specified

Generally, FLUX's products are rated as Temperature Class S. Individual designs can be rated otherwise on a case-by-case basis.

4.3.3.2 Temperature Derating.

The maximum operating temperature of the device shall not exceed T1 -25ºC, where T1 is the insulation class temperature of the lowest temperature insulation material used in the device. The maximum operating temperature is the same as the allowable hot-spot temperature, which is defined as the sum of the ambient temperature and the device temperature rise.

4.3.3.3 Ambient temperature for screening & test purposes - As specified in MIL-PRF-27[RD1].

For screening and test purposes it is not recommended that a higher operating ambient temperature be specified than that to which the transformer or inductor will actually be exposed. To do so may result in a larger and heavier unit than is needed. In the absence of a specified ambient temperature in the individual document, the following ambient temperatures may be used.

Class	Temperature
Q	65ºC
R	65ºC
S	85ºC
V	105ºC
T	TBC
U	TBC

4.4 Marking

All components procured and delivered to this document and the relevant detail dpecification will be part marked and serialised, unless agreed otherwise. If a component is too small to accommodate all marking, the device will show as much as possible of the marking required, as agreed with the customer via the PDR or other means.

If not specified otherwise by the customer, where possible each component will be marked with the following information. Marking format shall be agreed upon in advance.

Term	Definition
Part number	In accordance with the detail specification, followed by the suffix X, E, B or S, according to the quality level.
Serial number	This number shall be sequential number, typically of 3 digits.
Date Code	A 4-digit code shall be used, the first two digits of which shall be the last two digits of the calendar year. The last two digits of the code shall identify the week, in which the components were manufactured (tinning process or conformal coating whichever process is performed first)
Manufacturer	FLUX logo.
Lead identification	Colour coding by silicone tubing. Where only one colour is used, the length of the tube will be 4 mm and where two colours are used, each will be 2 mm long. The following colour codes shall be used unless otherwise specified in the detail specification.

Number	Colour	Abbreviation
0	Black	BK
1	Brown	BN
2	Red	RD
3	Orange	OG
4	Yellow	YE
5	Green	GN
6	Blue	BU
7	Violet	VT
8	Grey	GY
9	White	WT
-	Transparent	TP

Table 4-2 Colour Codes and Abbreviations

5. PRODUCTION CONTROL

5.1 General

Production shall follow the Process Identification Document (PID), production control and inspections shall be in conjunction with the internal manufacturing operations and inspections documents.

5.2 Process Identification Document (PID)

FLUX will establish and maintain a PID giving the Flow Chart and with reference to processes and materials to be applied.

Once established, the PID shall be called up in all documentation applicable to deliveries according to this Generic Specification and relevant Detail Specification.

The complete PID, comprising all called up operation documents, specifications and calibration records shall be kept by FLUX and made available to the Customer for review.

5.3 Raw Materials and Semi-Finished Product Control

Raw Materials and Semi-Finished products shall be selected and tested in accordance with the requirements of the PID. FLUX shall separate and prevent the use of Raw Materials and Semi-Finished products that are awaiting completion of test results.

5.3.1 Incoming Quality Control

The incoming inspection of raw materials and parts shall be performed with reference to the acceptance criteria defined in the international standard quoted on the procurement specification. For example, wires and cores against the appropriate IEC/CEI standard.

5.4 Traceability

Traceability shall be maintained throughout, from incoming inspection to final test and delivery. In the case of materials with limited shelf life, FLUX's control system shall provide means as to verify the validity of the relevant material.

5.5 Nonconformance control and reporting

Any Nonconformance shall be processed in accordance with the quality assurance requirements of ECSS-Q-ST-20(RD7) and ECSS-Q-ST-10-09(RD6) as detailed in FT 08742201(RD14).

FLUX shall notify the Customer in writing within 2 working days of the determination of any major NC. This is communicated via means of a nonconformance Report (NCR), giving as a minimum, details of the failure and its containment actions. The NCR is to be up issued as more information becomes available. The internal review board shall process the NC and where possible recommend disposition.

All rework or repair is done in line with agreed procedures and recorded in the relevant work log.

5.5.1 Process Tailoring from ECSS-ST-Q-10-09

In an expedition of the NCR process and in order to preserve schedule and remove unnecessary administrative burden. FLUX has made a tailoring of ECSS-Q-ST-10-09(RD6) as detailed herein.

5.5.2 Request for Waiver (RFW)

All nonconformances (NC) with: use as is, limited use or repair dispositions, shall have a Formal RFW incorporated within the NCR. Acceptance of the NCR is deemed as acceptance of the RFW.

5.5.3 Request for Deviation (RFD)

If the Internal Nonconformance Review Board (INRB) decides that disposition is to use as is and that a parameter of the baseline cannot be met and should be changed. The NC will be communicated via means of an RFD rather than an NCR.

If agreed this will change the baseline for this PO and all forthcoming POs for the same part, until such time as the baseline documentation is formally updated.

5.6 Notices of Changes

Major changes to materials, processes or control that do not affect the conformance to the agreed baseline will be communicated to the customer in accordance with AS9116:2015 (RD19).

This includes, but is not limited to:

- Obsolescence of parts or materials
- Unavailability of parts or materials
- Unsuitability of parts or materials
- Changes to processes affecting their qualification status
- Insertion of new processes in the manufacturing flow
- Major changes to test systems
- Major changes to IT systems

In the case of obsolescence FLUX will, wherever possible offer a last buy option.

6. FINAL PRODUCTION TESTS

6.1 General Screening

Screening is based on MIL-STD-981(RD3) Table V (group A screening test for families 03 & 04). Tailoring has been made in order to reduce costs and expedite lead times.

Unless otherwise specified in the Order Baseline Matrix, all components used for deliverable items shall be subjected to the tests and inspections in accordance with section 6.2

6.2 Chart I - Screening test levels

The applicable test methods and requirements are specified in herein.

Test	Quality level				Method (Paragraph)	Requirement (Paragraph)
	X	E	B	S		
Mechanical dimensions (Room Temperature)	✓	✓	✓	✓	9.1.1	9.1.2
Electrical characteristics (Room Temperature)	✓	✓	✓	✓	9.2.1	9.2.4
Thermal shock		✓	✓	✓	9.4.1	9.4.2
Electrical characteristics & Δ Calculation (If requested on Order Baseline Matrix, detail specification or Purchase Order) (Room Temperature)			✓	✓	9.2.2	9.2.4
Burn-in (passive or power)			✓	✓	9.5.1 or 9.5.2	9.5.3
Dielectric withstanding voltage (Room Temperature)		✓	✓	✓	9.6.1	9.6.2
Induced voltage (Room Temperature)surge test		✓	✓	✓	9.7.1	9.7.2
Radiographic Inspection (If requested for B models, mandatory for Class S)			✓	✓	9.8.1	9.8.2
Electrical characteristics (Room Temperature)		✓	✓	✓	9.2.3	9.2.4
Δ Calculations (If requested on Order Baseline Matrix) (Room Temperature)		✓	✓	✓	9.2.3	9.2.4
Visual inspection	✓	✓	✓	✓	9.9.1	9.9.2

6.3 Documentation

Documentation for the Final Production test data shall be in accordance with the requirements of section 10.

6.4 Component lifing

The lifing of Flux A/S components is based on a modified version of ECSS-Q-ST-60-14C

6.4.1 Timing parameters

All timing shall be measured from the original date code for the LOT.

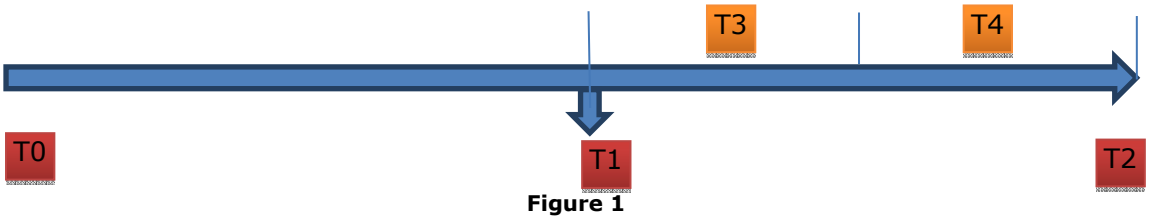


Figure 1

Ref.	Timing parameters	Time
T0	Original Date Code (DC)	-
T1	Maximum allowed storage from T0 with no relifing	7 years
T2	Maximum allowed time between T0 and mounting.	15 years
T3	After 7 years, parts require relifing prior to being sold/used	Up to 4 years
T4	After 11 years, parts will no longer be sold by Flux A/S, but may be relifed by the customer or on their behalf	4 years

This represents Flux's standard timing parameters; other values may be substituted upon agreement.

7. LOT ACCEPTANCE

7.1 General

Unless otherwise specified in the relevant Detail Specification or in the purchase order, sample sizes and test sequence shall be as specified as detailed herein.

Components submitted to lot acceptance testing shall be typical of the proposed for the delivery lot.

LOT sample sizes are subject to customer agreement, typically they are as detailed below.

Level	Testing Sub-Groups			
	1 Electrical	**2 Assembly capability**	**3 Endurance**	**4 Environmental and Mechanical**
LAT A	✓			
LAT B		✓		
LAT C	✓	✓		
LAT D	✓	✓		✓*
LAT E		✓	✓	✓
LAT F		✓	✓	✓
LAT G	✓	✓	✓	✓
LAT H	As specified			
LAT S	These sub-groups do not apply, see 7.3.9.			

*Vibration only.

Table 7-1 Lot Acceptance Levels

7.2 LAT Subgroups

7.2.1 Subgroup 1 - Electrical Testing

Electrical measurements at high and low temperature are considered as non-destructive, therefore parts so tested may form part of the delivery lot. No failures shall be allowed. In case of component failure, the lot shall be considered as failed unless a 100% screening on the failed electrical parameter is performed.

7.2.2 Subgroup 2 - Assembly/Capability Testing

Assembly/capability tests are considered as destructive, therefore parts so tested shall not form part of the delivery lot. No failures shall be allowed. In case of component failure, the lot shall be considered as failed.

7.2.3 Subgroup 3 - Endurance Testing

Endurance tests are considered as destructive, therefore parts so tested shall not form part of the delivery lot. No failures shall be allowed. In case of component failure, the lot shall be considered as failed.

7.2.4 Subgroup 4 – Environmental/Mechanical Testing

Environmental/mechanical tests are considered as destructive, therefore parts so tested shall not form part of the delivery lot. No failures shall be allowed. In case of component failure, the lot shall be considered as failed.

7.3 LAT Levels

All parts produced by FLUX are manufactured in accordance with the definitions as detailed in section 4.3.2.1. Additional LOT Acceptance Testing (LAT) may be ordered as detailed herein.

This additional testing is performed on completed LOTs and does not affect the manufacturing or screening status.

The typical number of samples and the tests which they are subjected to are detailed in the tables below.

The ESCC 3201[RD12] references in section 7.3 pertain to issue 5 as the references to LAT levels were removed in issue 6.

7.3.1 LAT A - Electrical Testing in extended temperatures

Verification of electrical measurements at high and low temperature.

Test		All Samples	Method (Paragraph)	Requirement (Paragraph)
Group 1	Visual Inspection	✓	9.9.1	9.9.2
	Electrical characteristics room temperature	✓	9.2.3	9.2.4
	Electrical characteristics low temperature	✓	9.3.1	9.3.2
	Electrical characteristics high temperature	✓	9.3.1	9.3.2
	Electrical characteristics room temperature	✓	9.2.3	9.2.4
	Visual Inspection	✓	9.9.1	9.9.2
Sample Size = Min 2				Failures Allowed = 0

7.3.2 LAT B - Assembly Capability

Verification of assembly capabilities. In accordance with ESCC 3201[RD12] this LOT Acceptance Testing is destructive, and the samples are not suitable for flight use.

Test		All Samples	Method (Paragraph)	Requirement (Paragraph)
Group 2	Solderability	✓	9.10.1	9.10.2
	Terminal Strength	✓	9.12.1	9.12.2
	Visual Inspection	✓	9.9.1	9.9.2
Sample Size = 2				Failures Allowed = 0

7.3.3 LAT C - Electrical Testing in extended temperatures and Assembly Capabilities

Verification of both electrical measurements at high and low temperature and assembly capabilities based upon ESCC 3201(RD12) Level 3. In accordance with ESCC 3201(RD12) this LOT Acceptance Testing is destructive, and the samples are not suitable for flight use.

Test		All Samples	Method (Paragraph)	Requirement (Paragraph)
Group 1	Visual Inspection	✓	9.9.1	9.9.2
	Electrical characteristics room temperature	✓	9.2.3	9.2.4
	Electrical characteristics low temperature	✓	9.3.1	9.3.2
	Electrical characteristics high temperature	✓	9.3.1	9.3.2
	Electrical characteristics room temperature	✓	9.2.3	9.2.4
	Visual Inspection	✓	9.9.1	9.9.2
Group 2	Solderability	✓	9.10.1	9.10.2
	Terminal Strength	✓	9.12.1	9.12.2
	Visual Inspection	✓	9.9.1	9.9.2
Sample Size = 10 or as per PO				Failures Allowed = 0

7.3.4 LAT D - Electrical Testing in extended temperatures, Assembly Capabilities and Vibration

Verification according to a tailored version ESCC 3201(RD12) Lot Acceptance Testing level 3,with additional vibration testing. In accordance with ESCC 3201(RD12) this LOT Acceptance Testing is destructive, and the samples are not suitable for flight use.

Test		All Samples	Method (Paragraph)	Requirement (Paragraph)
Group 1	Visual Inspection	✓	9.9.1	9.9.2
	Electrical characteristics (room temperature)	✓	9.2.3	9.2.4
	Electrical characteristics (low temperature)	✓	9.3.1	9.3.2
	Electrical characteristics (high temperature)	✓	9.3.1	9.3.2
	Electrical characteristics (room temperature)	✓	9.2.3	9.2.4
	Visual Inspection	✓	9.9.1	9.9.2
Group 2	Solderability	✓	9.10.1	9.10.2
	Terminal Strength	✓	9.12.1	9.12.2
	Visual Inspection	✓	9.9.1	9.9.2
Group 4	Mounting on PCB and Fixture	✓	RD11	
	Visual Inspection	✓	RD11	
	Vibration Testing	✓	9.14.1	9.14.2
	Visual Inspection	✓	9.9.1	9.9.2
Sample Size = 4 or as per PO				Failures Allowed = 0

7.3.5 LAT E - Non-critical flight

Based on the requirements of MIL-STD-981(RD3), this verification testing has been tailored for class B parts (Parts used in non-critical flight and non-mission-essential ground support applications). In accordance with ESCC 3201(RD12) this LOT Acceptance Testing is destructive, and the samples are not suitable for flight use.

Test		Sample			Method(I) (Paragraph)	Requirement (Paragraph)
		1	2	3		
Group 2	Solderability	✓	✓	✓	9.10.1	9.10.2
	Terminal Strength	✓	✓	✓	9.12.1	9.12.2
	Visual Inspection	✓	✓	✓	9.9.1	9.9.2
Group 3	Life Test	✓	✓	✓	9.20.1.1	9.20.1.2
	Visual Inspection	✓	✓	✓	9.9.1	9.9.2
	Dielectric Withstanding Voltage (at atmospheric pressure)	✓	✓	✓	9.6.1	9.6.2
	Electrical characteristics (room temperature)	✓	✓	✓	9.2.3	9.2.4
	Visual and Mechanical Inspection (internal)	✓			9.22	9.22
Group 4	Mounting on PCB and Fixture		✓	✓	RD11	
	Visual Inspection		✓	✓	RD11	
	Electrical characteristics room temperature		✓	✓	9.2.3	9.2.4
	Vibration		✓	✓	9.14.1	9.14.2
	Mechanical Shock		✓	✓	9.15.1	9.15.2
	Visual Inspection		✓	✓	9.14.2 & 9.15.2	
	Dielectric Withstanding Voltage (at reduced voltage)		✓	✓	9.6.1	9.6.2
	Electrical characteristics (room temperature)		✓	✓	9.2.3	9.2.4
	Visual and Mechanical Inspection (internal)		✓		9.22	9.22
Sample Size = 3 or as per PO						Failures Allowed = 0

Note 1: The mounting on PCB and fixture will be performed prior to life test if operational life test is required.

7.3.6 LAT F - Critical flight

Based on the requirements of MIL-STD-981[RD3], this additional verification testing has been tailored for class S parts (Parts used in critical flight and mission-essential ground support applications). These units can be produced as class B and upgraded via testing.

7.3.6.1 Option 1

This testing utilises a small sample. This is typically used for high-cost units and where the schedule allows a longer time frame for testing. This testing is destructive, and the samples are not suitable for flight use.

Group and Test		Sample		Method[1] (Paragraph)	Requirement (Paragraph)
		1	2		
Group 2	Solderability	✓	✓	9.10.1	9.12.2
	Terminal Strength	✓	✓	9.12.1	9.12.2
	Visual Inspection	✓	✓	9.9.1	9.9.2
Group 3	Life Test	✓	✓	9.20.1.1	9.20.1.2
	Visual Inspection	✓	✓	9.9.1	9.9.2
	Induced Voltage	✓	✓	9.7.1	9.7.2
	Dielectric Withstanding Voltage (at atmospheric pressure)	✓	✓	9.6.1	9.6.2
	Electrical characteristics (room temperature)	✓	✓	9.2.3	9.2.4
	Visual and Mechanical Inspection (internal)	✓		9.22	9.22
Group 4	Mounting on PCB and Fixture		✓	RD11	
	Visual Inspection		✓	RD11	
	Electrical characteristics (room temperature)		✓	9.2.3	9.2.4
	Vibration		✓	9.14.1	9.14.2
	Mechanical Shock		✓	9.15.1	9.15.2
	Visual Inspection		✓	9.14.2 & 9.15.2	
	Electrical characteristics (room temperature)		✓	9.2.3	9.2.4
	Dielectric Withstanding Voltage (at reduced voltage)		✓	9.5.1	9.5.2
	Electrical characteristics (room temperature)		✓	9.2.3	9.2.4
	Visual Inspection		✓	9.9.1	9.9.2
	Visual and Mechanical Inspection (internal)		✓	9.22	9.22
Sample Size = 2 or as per PO					Failures Allowed = 0

Note 1 The mounting on PCB and fixture will be performed prior to life test if operational life test is required.

7.3.6.2 Option 2

This testing utilises a larger sample and therefore the units can be split into subgroups and the tests run in parallel (minimum of 4 units). This is typically used for lower cost units or where the schedule does not allow a longer time frame for testing.

Group and Test		Sample				Method[1] (Paragraph)	Requirement (Paragraph)
		1	2	3	4		
Group 2	Solderability	✓	✓	✓	✓	9.10.1	9.12.2
	Terminal Strength	✓	✓	✓	✓	9.12.1	9.12.2
	Visual Inspection	✓	✓	✓	✓	9.9.1	9.9.2
Group 3	Life Test	✓	✓			9.20.1.1	9.20.1.2
	Visual Inspection	✓	✓			9.9.1	9.9.2
	Induced Voltage	✓	✓			9.7.1	9.7.2
	Dielectric Withstanding Voltage (at atmospheric pressure)	✓	✓			9.6.1	9.6.2
	Electrical characteristics (room temperature)	✓	✓			9.2.3	9.2.4
	Visual and Mechanical Inspection (internal)	✓				9.22	9.22
Group 4	Mounting on PCB and Fixture			✓	✓	RD11	
	Visual Inspection			✓	✓	RD11	
	Electrical characteristics (room temperature)			✓	✓	9.2.3	9.2.4
	Vibration			✓	✓	9.14.1	9.14.2
	Mechanical Shock			✓	✓	9.15.1	9.15.2
	Visual Inspection			✓	✓	9.14.2 & 9.15.2	
	Electrical characteristics (room temperature)			✓	✓	9.2.3	9.2.4
	Dielectric Withstanding Voltage (at reduced voltage)			✓	✓	9.5.1	9.5.2
	Electrical characteristics (room temperature)			✓	✓	9.3.3	9.3.4
	Visual Inspection			✓	✓	9.9.1	9.9.2
	Visual and Mechanical Inspection (internal)			✓		9.22	9.22
Sample Size = 4 or as per PO							Failures Allowed = 0

Note 1 The mounting on PCB and fixture will be performed prior to life test if operational life test is required.

7.3.7 LAT G – Extended Testing for Critical flight

Based on the requirements of MIL-STD-981(RD3), this additional verification testing has been tailored for class S parts (Parts used in critical flight and mission-essential ground support applications). These units can be produced as class B and upgraded via testing.

This has been extended to include electrical testing in extended temperature. This testing is destructive, and the samples are not suitable for flight use.

Group and Test		Sample				Method(1) (Paragraph)	Requirement (Paragraph)
		1	2	3	4		
Group 1	Visual Inspection	✓	✓	✓	✓	9.9.1	9.9.2
	Electrical characteristics (room temperature)	✓	✓	✓	✓	9.2.3	9.2.4
	Electrical characteristics (low temperature)	✓	✓	✓	✓	9.3.1	9.3.2
	Electrical characteristics (high temperature)	✓	✓	✓	✓	9.3.1	9.3.2
	Electrical characteristics (room temperature)	✓	✓	✓	✓	9.2.3	9.2.4
	Visual Inspection	✓	✓	✓	✓	9.9.1	9.9.2
Group 2	Solderability	✓	✓	✓	✓	9.10.1	9.10.2
	Terminal Strength	✓	✓	✓	✓	9.12.1	9.12.2
	Visual Inspection	✓	✓	✓	✓	9.9.1	9.9.2
Group 3	Life Test	✓	✓			9.22	9.22
	Visual Inspection	✓	✓			9.9.1	9.9.2
	Induced Voltage	✓	✓			9.7.1	9.7.2
	Dielectric Withstanding Voltage (at atmospheric pressure)	✓	✓			9.6.1	9.6.2
	Electrical characteristics (room temperature)	✓	✓			9.2.3	9.2.4
	Visual and Mechanical Inspection (internal)	✓				9.22	9.22
Group 4	Mounting on PCB and Fixture			✓	✓	RD11	
	Visual Inspection			✓	✓	RD11	
	Electrical characteristics (room temperature)			✓	✓	9.2.3	9.2.4
	Vibration			✓	✓	9.14.1	9.14.2
	Mechanical Shock			✓	✓	9.15.1	9.15.2
	Visual Inspection			✓	✓	9.14.2 & 9.15.2	
	Electrical characteristics (room temperature)			✓	✓	9.3.3	9.3.4
	Dielectric Withstanding Voltage (at reduced voltage)			✓	✓	9.5.1	9.5.2
	Electrical characteristics (room temperature)			✓	✓	9.2.3	9.2.4
	Visual Inspection			✓	✓	9.9.1	9.9.2
	Visual and Mechanical Inspection (internal)			✓		9.22	9.22
Sample Size = 4 or as per PO							Failures Allowed = 0

Note 1 The mounting on PCB and fixture will be performed prior to life test if operational life test is required.

7.3.8 LAT H – Customer specified testing

Any or all tests may be selected with a varying number of samples, as specified by the customer. Testing will be detailed in the appropriate test plan. This is used to address specific areas of concern or where materials may behave in an unpredictable manner

7.3.9 LAT S – Group B Screening

Based on the requirements of MIL-STD-981(RD3), this additional screening has been tailored for Class S parts (Parts used in critical flight and mission-essential ground support applications). These units are produced to Class S requirements.

Group and Test		Sample				Method(1) (Paragraph)	Requirement (Paragraph)
		1	2	3	4		
Group 1	Electrical characteristics	✓	✓			9.2.3	9.2.4
	Resistance to soldering heat	✓	✓			9.10.1	9.10.2
	Terminal Strength	✓	✓			9.12.1	9.12.2
	Vibration	✓	✓			9.14.1	9.14.2
	Mechanical Shock	✓	✓			9.15.1	9.15.2
	Induced Voltage	✓	✓			9.7.1	9.7.2
	Dielectric Withstanding Voltage (at atmospheric pressure)	✓	✓			9.6.1	9.6.2
	Insulation Resistance	✓	✓			RD15	
	Electrical characteristics	✓	✓			9.2.3	9.2.4
	Visual Inspection	✓	✓			9.9.1	9.9.2
	Visual and Mechanical Inspection (internal)	✓				9.22	9.22
Group 2	Solderability			✓	✓	9.10.1	9.10.2
	Resistance to solvents			✓	✓	9.11.1	9.11.2
	Electrical characteristics			✓	✓	9.2.3	9.2.4
	Temperature Rise	To be calculated					
	Life (1000 hours or 6 weeks)(may be accelerated)			✓	✓	9.22	9.22
	Induced Voltage			✓	✓	9.7.1	9.7.2
	Dielectric Withstanding Voltage (at reduced voltage)			✓	✓	9.6.1	9.6.2
	Electrical characteristics			✓	✓	9.2.3	9.2.4
	Visual Inspection			✓	✓	9.9.1	9.9.2
	Visual and Mechanical Inspection (internal)			✓		9.22	9.22
Sample Size = 4							Failures Allowed = 0

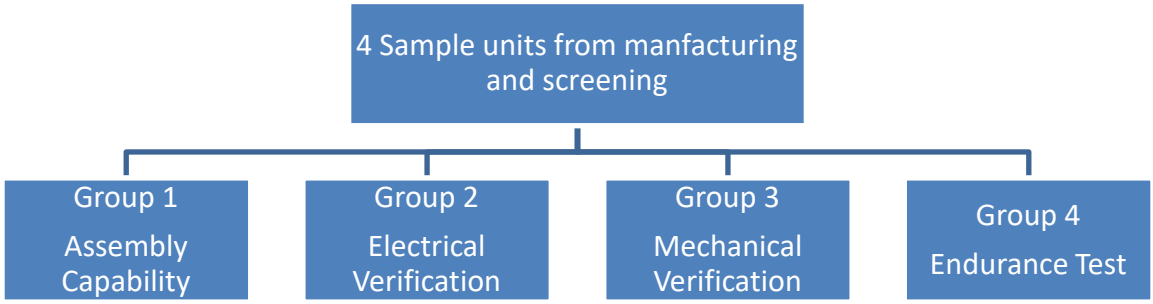
8. QUALIFICATION

8.1 General

Qualification is performed in accordance with MIL-PRF-27(RD1) Table V (Qualification Inspection)

Unless otherwise specified in the relevant Detail Specification or in the purchase order, sample sizes and test sequence shall be as specified in Chart III. Components submitted to qualification testing shall be chosen from a typical production lot.

Group 5 (Fungus) will be used only if specified.



8.2 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 based on 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 the required terminal strength requirements to be the same or lower.	✓		

8.3 Retention of qualification status

There is a conflict between the retention periods stated in MIL-PRF-27 [RD1] and MIL-STD-981[RD3]. For purposes of this specification, MIL-PRF-27 [RD1] 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.

8.4 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	2	3	4		
Group 1	Screening	✓	✓	✓	✓	RD15	RD15
	Solderability	✓	✓	✓	✓	9.10.1	9.10.2
	Visual Inspection	✓	✓	✓	✓	ECSS-Q-ST-70-08	
Group 2	Terminal Strength	✓	✓	✓	✓	9.12.1	9.12.2
	Visual Inspection	✓	✓	✓	✓	ECSS-Q-ST-70-08	
	Dielectric Withstanding Voltage (at atmospheric pressure)	✓	✓	✓	✓	9.6.1	9.6.2
	Electrical characteristics (room temperature)	✓	✓	✓	✓	9.2.3	9.2.4
	Mounting on PCB and Fixture	✓	✓	✓	✓	ECSS-Q-ST-70-08	
	Visual Inspection	✓	✓	✓	✓	ECSS-Q-ST-70-08	
	Electrical characteristics (inductance)	✓	✓	✓	✓	9.2.3	9.2.4
Group 3	Vibration	✓	✓			9.14.1	9.14.2
	Mechanical Shock	✓	✓			9.15.1	9.15.2
	Visual Inspection	✓	✓			9.14.2 & 9.15.2	
	Electrical characteristics (inductance)	✓	✓			9.2.3	9.2.4
	Dielectric withstanding voltage (At reduced voltage)	✓	✓			9.6.1	9.6.2
	Winding continuity	✓	✓			RD15	
	Thermal shock	✓	✓			9.4.1	9.4.2
	Winding continuity	✓	✓			RD15	RD15
	Immersion	✓	✓			9.16.1	9.16.2
	Moisture resistance	✓	✓			9.17.1	9.17.2
	Overload	✓	✓			9.18.1	9.18.2
	Dielectric withstanding voltage (At reduced voltage)	✓	✓			9.6.1	9.6.2
	Induced Voltage					9.7.1	9.7.2
	Insulation resistance	✓	✓			RD15	
	Winding continuity	✓	✓			RD15	
	Visual and mechanical examination	✓	✓			9.9.1	9.9.2
	Electrical characteristics	✓	✓			9.3.3	9.3.4
	Flammability					9.19.1	9.19.2
	Visual and Mechanical Examination (DPA)	✓				RD2	
Group 4	Life test			✓	✓	9.20.2.1	9.20.2.2
	Dielectric withstanding voltage (At reduced voltage)			✓	✓	9.6.1	9.6.2
	Insulation resistance			✓	✓	RD15	
	Visual and mechanical examination			✓	✓	9.9.1	9.9.2
	Electrical characteristics			✓	✓	9.2.3	9.2.4
G5	Group 5 (3 additional components if test is selected)						
	Fungus					9.22	9.22
Sample Size = 4							Failures Allowed = 0

9. TEST METHODS AND REQUIREMENTS

The figures are representative, the optimal conditions will be selected, the testing baseline will be established via the PDR and FDR systems.

Test		Toroids on Carriers	Toroids	Combined Magntics	RM / EFD	IM	Air Coils	Spike Killer	Planar
Mechanical Dimensions									
Dimensional Checks		✓	✓	✓	✓	✓	✓	✓	✓
Mass (when specified)		✓	✓	✓	✓	✓	✓	✓	✓
Electrical Characteristics									
Inductance (main)	*0,250@ 100kHz*	✓	✓	✓	✓	✓	*As specified*		*As specified*
Turns Ratio	*0,250@ 100kHz*	✓	✓		✓	✓			
Saturation Test	*1,0V@ 1kHz*							✓	
Inductance Ratio									
Phase	*0,250@ 100kHz*	✓	✓	✓	✓	✓			
DC – resistance									
Leakage Inductance	*0,250@ 100kHz or 50µA@ 10kHz*								
Insulation Resistance	*500VDC (Min 5000Mohm)*	✓	✓	✓	✓	✓			
Inductance, Room Temp									
Visual Inspection									
Other Screening									
Thermal Shock	*-55ºC to +120ºC 25 cycles*	✓	✓	✓	✓	✓	*As specified*		*As specified*
Burn in (passive)	*+120ºC 96 hours*	✓	✓	✓	✓	✓			
Dielectric Withstanding		✓	✓	✓	✓	✓			
Induced Voltage	*unless agreed otherwise*	✓	✓	✓	✓	✓			
Radiographic Inspection									
Inductance (main)	*0,250@ 100kHz*	✓	✓	✓	✓	✓			
Drift Calculation	*(Values available)*	✓	✓	✓	✓	✓			
Visual Inspection		✓	✓	✓	✓	✓		✓	

Table 9-1 FLUX Standard Screening Test setup

9.1 Mechanical Dimensions

9.1.1 Mechanical dimensions method

Where the detail specification is supplied with mechanical dimensions and/or mass requirements, these shall be verified by suitable means.

9.1.2 Mechanical dimensions requirements

Mechanical dimensions shall be within the limits defined on the detail specification. Tolerances will be agreed via the PDR.

9.2 Electrical Characteristics

During the tests, the item shall preferably be mounted in a fixture, assuring that the item will not be damaged during the test. The connections must not affect the solderability of the pin or the wire.

9.2.1 Electrical characteristics method – Initial measurements

Electrical testing will be performed according to table 9-1 unless formally agreed otherwise.

9.2.2 Electrical characteristics method – Intermediate measurements

This testing is optional and only applicable if a delta requirement is specified in Order Baseline Matrix.

The change in inductance relative to initial measurement shall be calculated and recorded if required in the Order Baseline Matrix.

9.2.3 Electrical characteristics method – Final measurements

The Main Inductance, as applicable, shall be measured and recorded.

If a delta requirement is specified in the Order Baseline Matrix, the change in inductance relative to initial measurement shall be calculated and recorded.

9.2.4 Electrical characteristics requirements

Parameter	Requirement
• **Inductance** • **Inductance drift** • **Turns ratio** • **Leak inductance** • **Winding resistance** • **Magnetising current** • **Saturation time** **(Other parameters as applicable)**	Measured or calculated values shall be within the tolerance band defined in the detail specification.
• **Phase**	Phase shall be as identified in the detail specification. Terminations marked with a dot shall have the same phase.
• **Insulation resistance**	Insulation resistance shall be greater than the value defined in the detail specification.

Table 9-2 Requirements for electrical parameters

9.3 Electrical characteristics at high and low temperatures

9.3.1 Test Method

The parameters to be measured at high and low temperature are specified in the detail specification. Measurements shall be performed at maximum and minimum operational temperatures as specified in the detail specification. All values shall be recorded.

Measurements to be performed after one hour soak at the specified temperature. Maximum slope during temperature change shall be 5°C/min.

9.3.2 Test requirements

The electrical characteristics shall be within the parameters defined on the detail specification.

9.4 Thermal Shock

9.4.1 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.
Dwell time at transition temperature	4 min.
Transfer time	< 5 min.
Number of cycles	25

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.

9.4.2 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.

9.5 Burn-in

Burn-in shall be performed for all flight components using an environmental chamber or oven.

9.5.1 Passive burn-in method

Unless otherwise specified by the customer, the components shall not be powered or loaded during testing.

Burn-in conditions are defined as:

Parameter	Requirement
Test duration	96 hours –0/+4h
Temperature	+120°C ±5°C
Test voltages and currents:	N/A

9.5.2 Power burn-in method

For Class S Transformers with an output greater than 0.8 watts or when specified by the customer, the components will be powered and if applicable loaded during the test.

Powered and loaded conditions are defined as:

Parameter	Requirement
Test duration	96 hours –0/+4h
Temperature(1)	Rated ambient temperature
Test voltages and currents(1)	Rated input voltage and current at minimum rated frequency and at maximum rated load

Powered and no-load conditions are defined as:

Parameter	Requirement
Test duration	96 hours –0/+4h
Temperature(1)	Rated ambient temperature
Test voltages and currents(1)	Rated input voltage and current at minimum rated frequency with no load

Note 1: This information shall be provide by customer and agreed with FLUX prior to test, if not available 85ºC ±5ºC shall be used. See section 4.3.3.

9.5.3 Burn-in requirement

There shall be no evidence of leakage and other visible damage in accordance with MIL-PRF-27(RD1) section 3.24.

9.6 Dielectric Withstanding Voltage

Atmospheric pressure is applicable for all components.

9.6.1 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).

Unless specified otherwise 300V for wires <0.250mm and 500V for wires ≥ 0.250mm will apply.

DWV will be performed once at 100%, any additional testing will be performed at reduced voltage of 75%

Atmospheric pressure applies

Parameter	Requirement
Voltage	500V or 300V rms.(1)
Max. Current	0.10 mA ± 0.02 mA
Ramp Time	Max. 1 s
Dwell Time	Min. 5 s
Frequency	50 Hz

Note 1: Depending on wire thickness.

9.6.2 Dielectric withstanding voltage requirements

During and post-test the magnetic device shall be inspected for evidence of arcing, flashover, breakdown of insulation, and damage in accordance with MIL-PRF-27 (RD1), section 4.7.9.1.

9.7 Induced Voltage

9.7.1 Induced voltage method

Unless agreed otherwise, the units 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 ≥ 0.250mm whichever is greater. If the rated voltage is not known 300V for wires <0.250mm and 500V for wires ≥ 0.250mm will apply.

This test will be performed as surge test with 10 pulses. The test will be performed once at 100%, any additional testing will be performed at reduced voltage of 75%

9.7.2 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 in accordance with MIL-PRF-27 (RD1), section 4.7.10. Means shall be provided to indicate fluctuations of input current.

9.8 Radiographic inspection

This is only undertaken for Class S units or when requested by customer.

9.8.1 Radiographic inspection method

X-ray is optional for X, E & B models and if required should be ordered separately. X-ray is mandatory for S models. X-ray will be performed in accordance with MIL-STD-202(RD2) method 209. Non-film technique.

9.8.2 Radiographic inspection requirements

The Radiographic examination shall include, but not limited to, inspection for extraneous materials, alignments, clearance, and processing damage according to MIL-STD-981(RD3).

9.9 Visual Inspection

9.9.1 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.

9.9.2 Visual inspection requirements

9.9.2.1 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 3 of this specification

9.9.2.2 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 in accordance with MIL-PRF-27 [RD1], section 3.24.

9.10 Solderability

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

9.10.1 Solderability method

Solderability shall be tested by the "Soldering iron method", specified in MIL-STD-202 [RD2] , 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

9.10.2 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.

9.11 Resistance to solvent

This test is not applicable where resistance to solvent data is available.

9.11.1 Resistance to solvent method

Components shall be tested in accordance with MIL-PRF-27 [RD1], using the methods detailed MIL-STD-202 [RD2], method 215.

The following shall apply:

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

9.11.2 Resistance to solvent requirements

Not more than 10 % of the surface shall have peeling, flaking, cracking or corrosion affecting the mechanical or electrical operation of the component in accordance with MIL-PRF-27 (RD1), section 3.24.

9.12 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.

For heavy units where additional fixation is used, this test may be waived.

9.12.1 Terminal strength method

Terminal strength shall be performed by applying a force in the direction of the axis of the termination. The force shall be gradually applied up to 10N and this force shall be held for between 5 to 10 seconds in accordance with MIL-PRF-27 (RD1), section 4.7.7.

9.12.2 Terminal strength requirements

There shall be no evidence of loosening or rupturing of terminals, or other mechanical damage, in accordance with MIL-PRF-27 (RD1), section 4.7.7.

9.13 Salt spray

Only applicable when requested by customer.

9.13.1 Salt spray method

Transformers and inductors shall be tested in accordance with MIL-STD-202 (RD2), method 101. The following shall apply:

- Test condition B
- Salt solution concentration 5%

9.13.2 Salt spray requirements

Transformers and inductors shall be thoroughly washed. The temperature shall not exceed 38°C. The transformer or inductor shall be placed in an oven maintaining 50ºC +/- 3ºC for a period of 24 +/- 4 hours.

At the end of the period, the transformers and inductors shall be removed from the oven and examined for corrosion.

9.14 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'

9.14.1 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 g²/Hz		
	1600-2000	- 12 dB/oct		

Table 9-3 Vibration Test Level

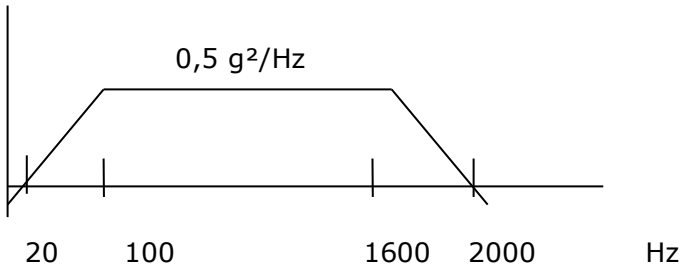


Figure 9-1 Vibration test PSD spectrum

9.14.2 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.

9.15 Mechanical Shock

9.15.1 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.

LOT Acceptance Testing (LAT) shall be as per MIL-PRF-27[RD1], unless agreed otherwise.

9.15.1.1 For Qualification

Due to the high demands of space industry, for qualification purposes FLUX has elected to increase the demands specified by MIL-PRF-27[RD1], which states the units be tested accordance with MIL-STD-202[RD2], method 213 condition I which has a peak value of 100G shock with a sawtooth shape.

To this end, FLUX has decided that the peak value of the shocks is to be 500G or 1000G with a half sine shape in accordance with MIL-STD-202[RD2], method 213 conditions D and E respectively. This will be agreed in advance.

9.15.2 Mechanical shock requirements

There shall be no evidence of physical damage in accordance with MIL-PRF-27[RD1], section 4.7.17. Visual inspection shall be performed after shock testing.

9.16 Immersion

Only applicable when requested by customer.

9.16.1 Immersion method

Components shall be tested in accordance with MIL-STD-202 [RD2], method 104. The following shall apply:

- Test condition A
- After final cycle the components shall be washed under running tap water and dried.

9.16.2 Immersion requirements

The components shall be examined for leakage and other visible damage in accordance with MIL-PRF-27[RD1], section 3.24.

9.17 Moisture resistance

9.17.1 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.

9.17.2 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.

9.18 Overload

9.18.1 Overload method

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

- Input voltage is to be at 112% of normal input voltage
- 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.

9.18.2 Overload requirements

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

9.19 Flammability

Not applicable where flammability data is available.

9.19.1 Flammability method

Components shall be tested in accordance with MIL-STD-202 [RD2], method 111.

9.19.2 Flammability requirements

There shall be no evidence of violent burning which results in an explosive fire, dripping of flaming material, or visible burning which continues beyond the allowable duration after removal of the applied flame in accordance with MIL-PRF-27[RD1], section 4.7.22.

9.20 Life test

Two types of life test are used, passive life test and operational life test.

9.20.1 Passive Life test

9.20.1.1 Test method

The life test conditions are defined as:

Parameter	Requirement
Test duration	500, 1000 hours –0/+24h depending on class and customer requirements
Temperature	Max. operating temperature ±5°C

The maximum rated operating temperature shall be as specified in the detail specification. If not specified, the following temperature shall be used:

- Temperature +120°C ±5°C

The test may be performed in several stages, but the duration at the specified temperature shall be respected

9.20.1.2 Test requirements

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

9.20.2 Operating Life test

9.20.2.1 Test method

Components shall be tested in accordance with MIL-STD-202[RD2]. Life test shall be performed by exposing the components to 5 cycles a week for 12 weeks or 6 weeks for qualification and LAT respectively.

The ambient temperature used depends on the Temperature Class of the unit. The temperatures referenced below are for Temperature Class S.

Four of the cycles consist of 20 hours at 85°C for qualification testing or ambient temperature for LAT testing with operating conditions applied and 3 hours at room temperature, with no operations conditions applied.

The fifth cycle consist of 68 hours at 85°C for qualification testing or ambient temperature for LAT testing with operating conditions applied and 3 hours at room temperature, with no operations conditions applied.

The transition times are to be 30 min ± 5 min each. During transition the samples shall be applied with operating conditions.

In accordance with MIL-STD-981(RD3) life testing for LAT may be accelerated by raising the units 1 temperature class and exposing the components to 5 cycles a week for 3 weeks.

9.20.2.2 Test requirements

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

9.20.3 Acceleration of life test

For LAT the life test may be accelerated in accordance with MIL-STD-981(RD3), by which the temperature class may be increased, and the duration shortened. This is upon request and where materials permit.

9.21 Fungus

The purpose of this fungus test is to assess the extent to which materiel will support fungal growth and how any fungal growth may affect performance or use of the materials.

Microbial deterioration is a function of temperature and humidity where spores are present.

Typically FLUX components are not used in such conditions and in accordance with the tailoring rules defined in MIL-STD-810(RD17), this test is not performed.

This test may be performed on request.

9.21.1 Fungus method

Components shall be tested in accordance with MIL-STD-810(RD17)., method 508.

9.21.2 Fungus requirements

Components to be inspected in accordance with MIL-STD-810(RD17).

9.22 Internal Examination (DPA)

9.22.1 Microsectioning

9.22.1.1 Microsectioning 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.

9.22.1.2 Microsectioning requirements

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

9.22.2 Deconstructive Disassembly

9.22.2.1 Disassembly Method

The Components shall be disassembled and/or dissected and examined to verify that the materials, internal lead wires, internal mounting, impregnation, potting and workmanship are in accordance with the applicable documents.

9.22.2.2 Disassembly Requirements

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

9.23 Cold Temperature Storage

Only applicable when requested by customer

9.23.1 Cold Temperature Storage method

Units will be placed in a thermal chamber at their minimum storage temperature for a period of 96h, after the period the temperature of the chamber shall be gradually increased to room temperature within a period of no more than 8 hours.

9.23.2 Cold Temperature Storage requirements

There shall be no evidence of cracks or other damage.

9.24 Insulation Resistance

MIL-STD-202(RD2), Method 302 with the following details:

• Test condition: B (500V), unless otherwise specified.

9.25 Third Party Testing

All external testing will be performed at accredited facilities and be subject to inspection both prior and post-test.

9.26 Other Testing

Requests for other testing will be evaluated on a case-by-case basis by FLUX's Sales and Engineering and quoted accordingly.

10. DATA DOCUMENTATION

10.1 General

With each delivery lot, the following documentation shall as a minimum is supplied:

- Certificate of Conformance as per paragraph 10.2
- Final production test data (Chart I)
- Lot acceptance test data (Chart II) where applicable.
- Qualification acceptance tests data (Chart III) where applicable

10.2 Certificate of Conformity (CoC)

A Certificate of Conformity will be issued for all deliveries of Engineering and Flight models.

The Certificate of Conformity for the delivery shall include, as a minimum, the following items:

- Reference to Customer purchase order
- Order Confirmation Number
- Customer´s Part Number
- FLUX´s Part Number
- Quantity
- Description
- Applicable Specification(s) including any applicable Request for Deviations
- Manufacturing date code
- Serial numbers
- Manufacturer´s name and address
- Date
- Nonconformance Reports
- Request for Waivers (if applicable)
- Any additional tests or services requested on the Purchase Order

FLUX's QHSE Manager or delegated representative shall sign the CoC.

10.3 Final Production Test Data

FLUX supply test results according to agreed Baseline.

10.4 Lot Acceptance Test Data

When lot acceptance testing is applicable, FLUX will supply the following data:

- Summary attribute data detailing serial numbers of devices submitted to each test and number of failures
- Read and record data for all electrical parameters measured in each test

10.5 Destructive Testing

Components used for lot acceptance or qualification tests deemed as destructive will be clearly identified.

11. DELIVERY

11.1 Packaging

FLUX shall use the appropriate methods to prevent degradation or damage due to corrosion, deterioration or physical damage, and to ensure safe delivery to the Customer.

11.2 Delivery of Documentation

The documentation defined in paragraph 10 shall be delivered together with each delivery lot.

11.3 Container Marking

When not otherwise specified by the purchase order, each shipping container will be marked with the following information:

- Manufacturer's name
- Customer purchase order reference
- Customer part type or number
- FLUX part number
- Lot date code
- Quantity

12. RETURNS / DEFECTIVE PARTS

In the eventuality that delivered parts fail, are found to be defective or nonconforming in any manner. FLUX's quality department should be contacted.

Please include the following information:

- Purchase Order (PO) Number
- Part Number
- LOT Number
- LOT Size
- Number of Failures
- Number of returns
- Failure Observed
- When Failure(s) were observed
- Where Failure(s) were observed
- How Failure(s) were observed
- Required Disposition

The case will then be investigated and dispositioned as necessary.