Electrical, Electronic, and Electromechanical (EEE) Parts Upgrade Screening and Qualification Requirements

International Space Station Program

SSQ 25001, Revision D
February 15th, 2005

National Aeronautics and Space Administration
International Space Station Program
Johnson Space Center, Houston Texas
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Revision History

Revision	Description	Publication Date
New	BASELINE ISSUE	3/14/94
A	Reason: Limit upgrade screening to hermetic parts correct typograhical errors	4/4/94
B	Clarification Of Table I And Improve Sequence Testing In Tables II and III	10/27/94
C	Official PCB Release Version(include CR 25001-003)	6/11/96
D	Revision D is authorized by SSCN 008920. With this revision, the document title was changed and the document was revised in its entirety.	04-08-05

ERU: /s/ Mary C. Nooney 4-8-05

PREFACE

SSQ 25001, International Space Station (ISS) Program Electrical, Electronic, and Electromechanical (EEE) Parts Upgrade screening and Qualification Requirements defines the upgrade screening criteria for EEE parts for use on the ISS Program as required by SSP 30312.

See Directive _____ _____
Program Manager (or delegated authority) Date
Space Station Program

SPACE STATION PROGRAM
ELECTRICAL, ELECTRONIC AND ELECTROMECHANICAL (EEE) PARTS
UPGRADE SCREENING AND QUALIFICATION REQUIREMENTS

February 15th, 2005

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1.0 SCOPE

This document defines the upgrade screening and qualification requirements for non-standard EEE parts as defined in SSP 30423, intended for use in the International Space Station Program (ISSP) and other space applications.

2.0 APPLICABLE DOCUMENTS

The following documents of the issue in effect on date of invitation for bids, or request for proposal or product manufacture, form a part of this specification to the extent specified herein.

2.4 Military Specifications

Applicable Military Specifications for electronic part types are listed in SSP 30423.

MIL-DTL-19491H	Semiconductor Devices, Packaging of
MIL-STD-2073	DOD Standard Practice for Military Packaging

2.2 Military Standards

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MIL-STD-750	Test Methods for Semiconductor Devices
MIL-STD-883	Test Methods and Procedures for Microelectronics
MIL-STD-981	Design, Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Applications
MIL-STD-1686	Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies, and Equipment
MIL-PRF-15305	Coils, Fixed, and Variable, Radio Frequency General Specification For
MIL-PRF-39003/10	Capacitors, Fixed, Electrolytic (Solid Electrolyte), Tantalum, Established Reliability, General Specification for
MIL-PRF-19500	Semiconductor Devices, General Specification for
MIL-PRF-55310	Oscillator, Crystal Controlled, General Specification for
MIL-PRF-27	Transformers and Inductors (Audio, Power, and High-Power Pulse), General Specification For
MIL-PRF-23419	Fuse, Cartridge, Instument Type, General Specification For

2.3 NASA Documents

SSP 30312	Electrical, Electronic, and Electromechanical (EEE) Parts Management and Implementation Plan for the Space Station Program
SSP 30423	Space Station Approved Electrical, Electronic, and Electromechanical EEE Part List
SSP 30512	Space Station Ionizing Radiation Design Environment
SSQ 25000	Destructive Physical Analysis (DPA) Specification for the Space Station Program

2.4 Commercial Specifications

ANSI/ESD S20.20	Development Of An Electrostatic Discharge Control Program for – Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)
ISO10012-1	Equipment, Quality Assurance Requirements for Measuring – Part 1: Metrological Confirmation System for Measuring Equipment
NCSL-Z540.1	Calibration Laboratories and Measuring and Test Equipment – General Requirements

3.0 REQUIREMENTS

3.1 General

EEE Parts shall be upgrade screened and qualified in accordance with the requirements as specified herein. For EEE parts not included in this specification, upgrade screening and qualification shall be coordinated with the International Space Station EEE Parts Control Board (PCB).

3.2 EEE Part Types

Table I EEE Part Types

Part Types	Federal Stock Class	Page Number for Upgrade Screening and Qualification Requirements
Capacitors	5910	4-1
Crystals and Crystal Oscillators	5955	4-16, 4-17, 4-18
Inductors, Coils and Transformers	5950	4-19, 4-20, 4-21
Diodes	5961	4-8, 4-9, 4-10
Filters	5915	4-1
Hybrids/Multi-chips Modules (MCM)	5999	4-14, 4-15
Microcircuits, Monolithic	5962	4-3, 4-4
Plastic Encapsulated Microcircuits	5962	4-5, 4-6, 4-7
Resistors	5905	4-1
Transistors	5961	4-11, 4-12, 4-13
Fuse	5920	4-22, 4-23, 4-24
Connector	5935	4-1
Relays	5945	4-1
Wire and Cable	6145	4-1
Thermistor	5905	4-2

3.3 Standard EEE Parts

Standard EEE Parts are those approved for use in the four (4) application grades as defined in SSP 30312, section 3.2. Standard EEE part types approved for use in a specific application grade is defined in SSP 30423 Tables 4.1-2 to 4.1-19.

3.4 Non-standard EEE Parts

A standard EEE part approved for a specific application grade shall be documented as a non-standard EEE part if it is intended for use in a higher application grade (for example a standard part approved for use in a grade 3 application shall be documented as a non-standard part if it is intended for use in a grade 2 application). Non-standard EEE parts shall meet the Non-standard Part Approval Request (NSPAR) requirements in accordance with SSP 30312. Non-standard EEE parts shall be upgrade screened and qualified in accordance with the requirements as specified herein for the part type.

3.5 Control Units

Prior to any upgrade screening, two (2) parts from each lot shall be designated as control units. Control units shall be maintained at room temperature storage and shall not be subjected to any upgrade screening and qualification testing. The control units shall be measured when correlation is required. After the lot from which the control units were removed completes upgrade screening and qualification the control units shall be shipped in a separate container marked ”Control Units”.

3.6 Radiation Hardness Assurance

EEE parts susceptible to damage from ionizing radiation shall meet their performance requirements while exposed to the radiation environment defined in SSP 30512, by either test or analysis.

3.7 Destructive Physical Analysis (DPA)

DPA shall be performed on each lot of non-standard EEE parts used in grade 1 and grade 2 applications in accordance with SSQ 25000. DPA shall be performed at an approved Space Station test facility.

3.8 Serialization and Marking

Parts to be upgrade screened and qualified shall be serialized in such a manner to identify each part with the test data. When a part is too small for marking the body with a serial number, the lead (if present) shall be labeled with an adhesive-backed serial number or equivalent. All parts that pass upgrade screening and qualification shall be re-marked using the following criteria:

a. Original manufacturer’s marking shall remain as is.

b. Serial number (if room allows).

c. A -RS shall be added to the end of the manufacturer part number to identify that the part has passed all upgrade screening requirements. If there is insufficient room to mark a -RS, then paint a green dot on the part. This would apply to parts upgrade screened to this specification and not to a SCD or other specification. All part marking shall meet the requirements for mark permanency and outgassing in accordance with the applicable military specifications.

d. Parts upgrade screened and qualified to a Source Control Drawing (SCD) shall be marked with the SCD part number if space allows.

3.9 Upgrade Screening and Qualification

Upgrade screening and qualification shall be performed on all non-standard EEE parts as required to be used in flight hardware. The upgrade screening and qualification shall be in accordance with the Tables herein for the applicable part type. The order of precedence shall be testing performed at the EEE part manufacturer followed by an approved Space Station test facility.

3.10 Percent Defective Allowable (PDA)

PDA shall be as follows:

For parts upgrade screened and qualified to be used in a Grade 1 or Grade 2 application, a 5% PDA shall be required for the same tests called out in the applicable Military Specification. Re-submission of the lot shall be allowed one time only with a tightened PDA of 2%, if the initial PDA did not exceed 30%.

For parts upgrade screened to be used in a Grade 3 application, a 20% PDA shall be required for the same tests called out in the applicable Military Specification. Re-submission of the lot shall be allowed one time only with a tightened PDA of 5%, if the initial PDA did not exceed 40%.

3.11 Upgrade Screening Requirement Tables

Upgrade screening requirements are included in Tables 4-1a to 4-8a herein. If a part type is not included in the tables, then the lot shall be upgrade screened to the closest Military Specification requirements as applicable.

3.12 Qualification Requirement Tables

Qualification test requirements are included in Tables 4-1b to 4-8b herein. Qualification testing may be omitted for parts which have received family qualification or process monitor testing as part of military standard processing, or performed by the manufacturer within 6 months of the lot date code procured. Attributes and variables data shall be recorded for each lot.

4.0 UPGRADE SCREENING AND QUALIFICATION REQUIREMENTS

4.1 Capacitors

For a list of acceptable standard capacitors see SSP 30423 Table 4.1-3. Commercial capacitors used in a Grade 1, 2, or 3 application shall be upgrade screened to the closest military specification as defined in Table 4.1-3 of SSP 30423. Commercial capacitors used in Grade 1 and 2 applications shall also be qualified to the closest military specification as defined in Table 4.1-3 of SSP 30423.

4.1.1 Solid Tantalum Capacitors

Commercial solid tantalum capacitors used in Grade 1, 2, and 3 applications shall be 100% tested for surge current as specified in the Group A Inspection requirements in MIL-PRF-39003/10.

4.2 Resistors

For a list of acceptable standard resistors see SSP 30423 Table 4.1-1. Commercial resistors used in a Grade 1, 2, or 3 application shall be upgrade screened to the closest military specification as defined in Table 4.1-1 of SSP 30423. Commercial resistors used in Grade 1 and 2 applications shall also be qualified to the closest military specification as defined in Table 4.1-1 of SSP 30423.

4.3 Filters

For a list of acceptable standard filters see SSP 30423 Table 4.1-4. Commercial filters used in a Grade 1, 2, or 3 application shall be upgrade screened to the closest military specification as defined in Table 4.1-4 of SSP 30423. Commercial filters used in Grade 1 and 2 applications shall also be qualified to the closest military specification as defined in Table 4.1-4 of SSP 30423.

4.4 Connectors

For a list of acceptable standard connectors see SSP 30423 Table 4.1-8. Commercial connectors used in Grade 1, 2, or 3 applications shall be upgrade screened to the closest military specification as defined in Table 4.1-8 of SSP 30423. Commercial connectors used in Grade 1 and 2 applications shall also be qualified to the closest military specification as defined in Table 4.1-8 of SSP 30423.

4.5 Wires and Cables

For a list of acceptable standard wires and cables see SSP 30423 Tables 4.1-16, 4.1-17 and 4.1-18. Commercial wires and cables used in Grade 1, 2, or 3 applications shall be upgrade screened to the closest military specification as defined in Table 4.1-18 of SSP 30423. If test data is available for commercial wire and cable from the manufacturer, for the procured lot that shows compliance to the closest military specification, then upgrade screening need not be repeated.

4.6 Relays

For a list of acceptable standard relays see SSP 30423 Table 4.1-9. Commercial relays used in Grade 1, 2, or 3 applications shall be upgrade screened to the closest military specification as defined in Table 4.1-9 of SSP 30423. Commercial relays used in Grade 1 and 2 applications shall also be qualified to the closest military specification as defined in Table 4.1-9 of SSP 30423.

4.7 Thermistor

For a list of acceptable standard thermistors see SSP 30423 Table 4.1-2. Commercial thermistors used in Grade 1, 2 or 3 applications shall be upgrade screened to the closest military specification as defined in Table 4.1-2 of SSP 30423. Commercial thermistors used in Grade 1 and 2 applications shall also be qualified to the closest military specification as defined in Table 4.1-2 of SSP 30423.

Table 4-1a Monolithic Microcircuit Upgrade Screening Requirements (Hermetic Packages Only)

		Upgrade Screening Required			
Upgrade Screening Test	Test Method In Accordance With MIL-STD-883, Unless Otherwise Specified	From Class "B" to Class "B+"	From Class "C" to Class "B+"	From Class "D" to Class "B+"	From Class "D" to Class "C"
External Visual	2009	X	X	X	
Serialization	In accordance with paragraph 3.8	X	X	X	
DPA	In accordance with SSQ 25000	X	X	X	X [5]
Temperature Cycle	1010		X [1]	X	X [6]
PIND	2020, Condition A	X	X	X [4]	X [4]
Pre-Electrical	5004		X [2]	X	
Burn-in	1015 (160 hours)		X [2]	X [3]	X [6]
Post-Electrical	5004		X [2]	X	
Percent Defect Allowed (PDA)	In accordance with paragraph 3.10		X [2]		
Hermeticity (fine and gross)	1014		X	X	
External Visual	2009	X	X	X	X

Notes:

1. If temperature cycling was done as part of the normal manufacturing process on 100% of parts being procured, then it need not be repeated.
2. If the part is from a Qualified Product Line (QPL) or Qualified Manufacturing Line (QML), then the additional tests indicated by this note are not required.
3. Read and record data is required.
4. Lot jeopardy does not apply.
5. As required by the cognizant EEE parts engineer.
6. Burn-in and temperature cycling can be performed at the assembly level.

Table 4-1b Monolithic Microcircuit Qualification Requirements (Hermetic Packages Only)

		Qualification Required				
Qualification Tests	Test Method In Accordance With MIL-STD-883, Unless Otherwise Specified	From Class "B" to Class "B+"	From Class "C" to Class "B+" [1]	From Class "D" to Class "B+"	From Class "D" to Class "C"	Sample Size and Accept/Reject
Resistance To Solvents	2015		X	X		3 (0)
Solderability	2003		X	X		3 (0)
Shock	2002 (Condition B)		X	X		5 (0)
Acceleration	2001		X	X		5 (0)
Vibration	2007 (Condition A)		X	X		5 (0)
Pre life test Electrical [2]	5004		X	X		
Life test	1005		X	X		22 (0)
Post life test Electrical	5004		X	X		
Percent Defect Allowed (PDA)	In accordance with paragraph 3.10		X	X		
Hermeticity (fine and gross) on life test, vibration, shock and acceleration samples	1014		X	X		Reject on 1
Visual on life test, vibration, shock and acceleration samples	2009		X	X		Reject on 1

Notes:

1. If the part is from a QPL or QML manufacturing line, and data is obtained for qualification performed within 6 months of the procured date code, then the additional tests indicated by this note are not required.
2. Pre electricals need not be performed if data is available from upgrade screening.

Table 4-2a PEMS Upgrade Screening Requirements[1, 5]

Upgrade Screening Test	Test Method In Accordance With MIL-STD-883, Unless Otherwise Specified	Upgrade Screening Required		
		From Class "C" (Enhanced Plastics) to Class "B+"	From Class "D" to Class "B+"	From Class "D" to Class "C"
External Visual	2009	X	X	
Serialize	In accordance with paragraph 3.8	X	X	
Temperature Cycle	1010 (20 cycles[2])	X	X	X[4]
Acoustic Micro Imaging	2030	X	X	
Pre-Burn-in Electrical	Functional and DC parameters in accordance with device specification	X	X	
Burn-in	1015	X (240 hours[3])	X (240 hours[3])	X[4]
Post Burn-in Electrical	Functional and DC parameters in accordance with device specification	X	X	
PDA	In accordance with paragraph 3.10	X	X	
Final Electrical	Parametric and Functional Tests performed at 25^0C, and manufacturer's minimum and maximum rated operating temperatures	X	X	
External Visual	2009	X	X	X

Notes:

1. If the manufacture's flow includes these tests, they need not be repeated.
2. Temperatures shall not exceed the manufacturer's minimum and maximum storage temperatures.
3. Burn-in temperature shall not exceed manufacturer's maximum operating temperature**.** If a minimum of 160 hours of burn-in has been performed, then this test need not be repeated.
4. Burn-in and temperature cycling can be performed at the assembly level.

Table 4-2b PEMS Qualification Requirements[1 6]

		Quantity Required For Qualification		
Qualification Tests	Test Method In Accordance With MIL-STD-883, Unless Otherwise Specified	From Class "C" (Enhanced Plastics) to Class "B+"	From Class "D" to Class "B+"	From Class "D" to Class "C"
External Visual	2009	54	54	NR
Pre-conditioning	JEDEC 22 –A113-B (For Surface Mount Devices)	54	54	NR
	JEDEC 22 –B106-B (For Through Hole Devices)	54	54	NR
C-SAM	IPC/JEDEC J-STD-035	54	54	NR
Temperature Cycle	1010 (500 cycles[2])	22	22	NR
Radiographic Inspection of Temperature Cycle Samples	2012.7	22	22	NR
C-SAM	IPC/JEDEC J-STD-035	22 Thermal Cycle Samples	22 Thermal Cycle Samples	NR
HAST or Autoclave	Method A101 or A110 (JEDEC 22)	10	10	NR
C-SAM	IPC/JEDEC J-STD-035	10 HAST Samples	10 HAST Samples	NR

Table 4-2b PEMS Qualification Requirements (continued) [1]

		Quantity Required For Qualification		
Qualification Tests	Test Method In Accordance With MIL-STD-883, Unless Otherwise Specified	From Class "C" (Enhanced Plastics) to Class "B+"	From Class "D" to Class "B+"	From Class "D" to Class "C"
Pre-Life Test Electrical	Functional and DC parameters in accordance with device specification at 25^0C	22	22	NR
Life Test	Method 1005, Condition D	22 (1000 hours) [3]	22 (1000 hours) [3]	NR
Post Life Test Electrical	Functional and DC parameters in accordance with device specification at 25^0C.	22	22	NR
Final Electrical	Parametric and Functional Tests performed at 25^0C, and manufacturer's minimum and maximum rated operating temperatures	22	22	NR
External Visual	2009	54	54	NR

Notes:

1. If the manufacture's flow includes these tests, they need not be repeated
2. Temperatures shall not exceed the manufacturer's minimum and maximum storage temperatures
3. Burn-in temperature shall not exceed manufacturer's maximum operating temperature
4. This step is not performed if results of the upgrade screening is not available
5. Add up total samples required and update visual
6. If the manufacturer classifies a part as moisture sensitive (ie shipped in a dry pack) the manufacturer's instructions shall be followed

Table 4-3a Diode Upgrade Screening Requirements

Upgrade Screening Test	Test Method In Accordance With MIL-STD-750, Unless Otherwise Specified	Upgrade Screening Required			
		From Class "B" to Class "B+"	From Class "C" to Class "B+"	From Class "D" to Class "B+"	From Class "D" to Class "C"
External Visual	2071	X [4]	X [4]	X	X
Serialization	In accordance with paragraph 3.8			X	
DPA	In accordance with SSQ 25000	X	X	X	X
Surge	4066, Condition B, 10 pulses minimum		X	X	
Constant Acceleration	2006		X	X	
Temperature Cycle	1051, Condition C		X [2]	X [2]	
PIND [1]	In accordance with MIL-PRF-19500	X	X	X	X
Pre-Electrical	Functional and DC parameters in accordance with the applicable MIL-PRF-19500 detail slash sheet or manufacturer's data sheet at 25^0C		X		X
Pre-Electrical	Read and record parameters in accordance with the MIL-PRF-19500 detail slash sheet for an equivalent JANS device			X	
HTRB	1038, Condition A for 48 hours (96 hours for Class "D" parts upgrade upgrade screened to Class "B+")		X [3]	X [3]	
Power Burn-in	1038, Condition B for 160 hours (240 hours for Class "D" parts upgrade upgrade screened to Class "B+")		X [3]	X [3]	

Table 4-3a Diode Upgrade Screening Requirements (continued)

Upgrade Screening Test	Test Method In Accordance With MIL-STD-750, Unless Otherwise Specified	Upgrade Screening Required			
		From Class "B" to Class "B+"	From Class "C" to Class "B+"	From Class "D" to Class "B+"	From Class "D" to Class "C"
Post-Electrical	Functional and DC parameters in accordance with the applicable MIL-PRF-19500 detail slash sheet or manufacturer's data sheet at 25^0C		X		
Post-Electrical	Read and record parameters in accordance with the MIL-PRF-19500 detail slash sheet for an equivalent JANS device			X	
Calculate Deltas	In accordance with MIL-PRF-19500 detail slash sheet			X	
Percent Defect Allowed (PDA)	In accordance with paragraph 3.10 herein		X	X	
Final Electricals	Parametric and Functional Tests performed at 25^0C, and manufacturer's minimum and maximum rated operating temperatures		X	X	
Hermeticity (fine and gross)	1071		X	X	
External Visual	2071	X	X	X	X

Notes:

1. Do not perform for non-cavity diodes
2. Temperatures shall not exceed the manufacturer's minimum and maximum storage temperatures
3. High Temperature Reverse Bias (HTRB) or Burn-in temperature shall not exceed manufacturer's maximum operating temperature
4. This test is optional

Table 4-3b Diode Qualification Requirements

Qualification Tests	Test Method In Accordance With MIL-STD-750, Unless Otherwise Specified	Qualification Required			
		From Class "B" to Class "B+"	From Class "C" to Class "B+"	From Class "D" to Class "B+"	From Class "D" to Class "C"
External Visual and Physical Dimensions	2071 and 2066		28 (0)	28 (0)	
Solderability	2026		3 (0)	3 (0)	
Resistance to Solvents	1022		3 (0)	3 (0)	
Pre Electrical Test	Functional and DC parametrics in accordance with the applicable MIL-PRF-19500 detail slash sheet or manufacturer's data sheet at 25^0C		22 (0)	22 (0)	
Steady State Life Test [1]	1026, 1000 hours at maximum operating temperature		22 (0)	22 (0)	
Post Electrical Test	Functional and DC parametrics in accordance with the applicable MIL-PRF-19500 detail slash sheet or manufacturer's data sheet at 25^0C		22 (0)	22 (0)	

Note:

1. Hermeticity (fine and gross leak) shall be repeated on life test samples

Table 4-4aTransistor Upgrade Screening Requirements

		Upgrade Screening Required			
Upgrade Screening Test	Test Method In Accordance With MIL-STD-750, Unless Otherwise Specified	From Class "B" to Class "B+"	From Class "C" to Class "B+"	From Class "D" to Class "B+"	From Class "D" to Class "C"
External Visual	2071	X [4]	X [4]	X	X
Serialization	In accordance with paragraph 3.8			X	
DPA	In accordance with SSQ 25000	X	X	X	X
Constant Acceleration	2006		X	X	
Temperature Cycle	1051, Condition C		X [2]	X [2]	
PIND [1]	In accordance with MIL-PRF-19500	X	X	X	X
Pre-Electrical	Functional and DC parametrics in accordance with the applicable MIL-PRF-19500 detail slash sheet or manufacturer's data sheet at 25^0C		X	X	
HTRB	1039, Condition A for 48 hours (96 hours for Class "D" parts upgrade screened to Class "B+")		X [3]	X [3]	
Power Burn-in	1039, Condition B for 160 hours (240 hours for Class "D" parts upgrade upgrade screened to Class "B+")		X [3]	X [3]	
Post-Electrical	Functional and DC parametrics in accordance with the applicable MIL-PRF-19500 detail slash sheet or manufacturer's data sheet at 25^0C		X	X	
Calculate Deltas	In accordance with MIL-PRF-19500 detail slash sheet			X	

Table 4-4a Transistor Upgrade Screening Requirements (continued)

Upgrade Screening Test	Test Method In Accordance With MIL-STD-750, Unless Otherwise Specified	Upgrade Screening Required			
		From Class "B" to Class "B+"	From Class "C" to Class "B+"	From Class "D" to Class "B+"	From Class "D" to Class "C"
Percent Defect Allowed (PDA)	In accordance with paragraph 3.10 herein		X	X	
Final Electricals	Parametric and Functional Tests performed at 25^0C, and manufacturer's minimum and maximum rated operating temperatures		X	X	
Hermeticity (fine and gross)	1071		X	X	
External Visual	2071	X	X	X	

Notes:

1. Do not perform for non-cavity diodes
2. Temperatures shall not exceed the manufacturer's minimum and maximum storage temperatures
3. HTRB or Burn-in temperature shall not exceed manufacturer's maximum operating temperature
4. This test is optional

Table 4-4b Transistor Qualification Requirements

Qualification Tests	Test Method In Accordance With MIL-STD-750, Unless Otherwise Specified	Qualification Required			
		From Class "B" to Class "B+"	From Class "C" to Class "B+"	From Class "D" to Class "B+"	From Class "D" to Class "C"
External Visual and Physical Dimensions	2071 and 2066		28 (0)	28 (0)	
Solderability	2026		3 (0)	3 (0)	
Resistance to Solvents	1022		3 (0)	3 (0)	
Pre Electrical Test	Functional and DC parametrics in accordance with the applicable MIL-PRF-19500 detail slash sheet or manufacturer's data sheet at 25^0C		22 (0)	22 (0)	
Steady State Life Test	1042, 1000 hours at maximum operating temperature		22 (0)	22 (0)	
Post Electrical Test	Functional and DC parametrics in accordance with the applicable MIL-PRF-19500 detail slash sheet or manufacturer's data sheet at 25^0C		22 (0)	22 (0)	

Table 4-5a Hybrid Upgrade Screening Requirements

		Upgrade Screening Required	
Upgrade Screening Test	Test Method In Accordance With MIL-STD-883, Unless Otherwise Specified	From Class H to Class K	From Commercial to Class H
External Visual	2009	X	X
Destructive Physical Analysis	In accordance with SSQ 25000	X	X
Temperature Cycling	1010, Condition C (a minimum of 10 cycles)	X	X[5]
Constant Acceleration	2001 (Condition B 3000 g's in Y1 direction only)	X	
PIND	2020 (Condition A)	X [1]	X [1]
Pre Burn-in Electrical Test	In accordance with the device specification at 25^0C	X	X[5]
Burn-in	1015	X [3 4 5]	X [3 5]
Post Burn-in Electrical Test	In accordance with the device specification at 25^0C	X [2]	X [2]
Final Electrical Test	In accordance with the device specification at -55^0C, 25^0C and 125^0C	X	X[5]
Hermeticity (fine and gross leak)	1014	X	X
External Visual	2009	X	X

Notes:

1. Cavity devices only. The lot can be accepted on any of the 5 runs if the number of rejects is less than 1% of the lot size. All defective devices shall be removed from the lot after each run. If the total number of rejects exceed 25% then the lot shall be rejected. Particle Impact Noise Detection (PIND) testing shall be performed on parts that contain a getter until all particles have been captured
2. The PDA for burn-in is 5% or one device whichever is greater. A lot can be re-submitted for burn-in if the number of failures did not exceed twice the PDA. The PDA for re-submitted lots is 2%. If the lot exceed the PDA of 2% after the second burn-in the lot shall be rejected
3. Burn-in shall be performed for 320 hours (168 hours for Class H) at a temperature of $+125^0$C
4. If burn-in is done as part of the QML flow, then it need not be repeated
5. Do not exceed manufacturer's storage or operational temperature limits

Table 4-5b Hybrid Qualification Requirements

Qualification Test	Test Method In Accordance With MIL-STD-883, Unless Otherwise Specified	Qualification Required		
		From Class H to Class K	From Commercial to Class H	Sample Sizes and Reject Criteria
External Visual	2009	X	X	10 (0)
Solderability	2003	X	X	1 (0)
Resistance To Solvents	2015	X	X	2 (0)
Lead Integrity	2004	X	X	2 (0)
Temperature Cycling	1010 (Condition C, perform 100 cycles)	X	X [1]	5 (0)
Pre Electrical Tests	In accordance with the device specification at -55^0C, 25^0C and 125^0C	X	X [1]	5 (0) [2]
Steady State Life Test	1005 (1000 hours at $+125^0$C)	X	X [1]	5 (0) [2]
Post Electrical Tests	In accordance with the device specification at -55^0C, 25^0C and 125^0C	X	X [1]	5 (0) [2]
Heremeticity (fine and gross)	1014	X	X	5 (0) [2]
External Visual	2009	X	X	5 (0) [2]

Notes:

1. Do not exceed manufacturer's storage or operational temperature limits
2. Use thermal cycle samples

Table 4-6a Crystal Oscillator Upgrade Screening Requirements

Upgrade Screening Test	Test Method In Accordance With MIL-STD-883, Unless Otherwise Specified	Upgrade Sscreening Required	
		From Class "B" to Class "B+"	From Commercial to Class "B+"
External Visual	2009	X	X
Destructive Physical Analysis	In accordance with SSQ 25000	X	X
Temperature Cycle	1010, Condition C (a minimum of 10 cycles)	X[5]	X[5]
Constant Acceleration	2001 (Condition A 5000 g's in Y1 direction only)	X	X
PIND	2020 (Condition A)	X [1]	X [1]
Pre Burn-in Electrical Test	In accordance with the device specification at 25^0C	X	X
Burn-in	1015 (at +125^0C for 160 hours)	X [4]	X [3 5]
Post Burn-in Electrical Test	In accordance with the device specification at 25^0C	X [2]	X [2]
Final Electrical Test	In accordance with the device specification at -55^0C, 25^0C and 125^0C	X	X [5]
Frequency Aging	In accordance with MIL-PRF-55310	X	X
Hermeticity (fine and gross leak)	1014	X	X
External Visual	2009	X	X

Table 4-6a Crystal Oscillator Upgrade Screening Requirements (continued)

Notes:

1. Cavity devices only. The lot can be accepted on any of the 5 runs if the number of rejects is less than 1% of the lot size. All defective devices shall be removed from the lot after each run. If the total number of rejects exceed 25% then the lot shall be rejected. PIND testing shall be performed on parts that contain a getter until all particles have been captured
2. The PDA for burn-in is 5% or one device whichever is greater. A lot can be re-submitted for burn-in if the number of failures did not exceed twice the PDA. The PDA for re-submitted lots is 2%. If the lot exceed the PDA of 2% after the second burn-in the lot shall be rejected
3. Burn-in shall be performed for 320 hours at the maximum operating temperature
4. If burn-in is done as part of the QML flow, then it need not be repeated
5. Do not exceed manufacturer's storage or operational temperature limits

Table 4-6b Crystal Oscillator Qualification Requirements

Qualification Test	Test Method In Accordance With MIL-STD-883, Unless Otherwise Specified	Qualification Required		
		From Class "B" to Class "B+"	From Class "C" to Class "B+"	Sample Sizes and Reject Criteria
External Visual	2009	X	X	10 (0)
Solderability	2003	X	X	1 (0)
Resistance To Solvents	2015	X	X	2 (0)
Lead Integrity	2004	X	X	2 (0)
Thermal Shock	1011, Condition C (100 cycles)	X	X [1]	5 (0)
Pre Electrical Tests	In accordance with the device specification at -55^0C, 25^0C and 125^0C	X	X [1]	5 (0) [2]
Steady State Life Test	1005 (1000 hours at $+125^0$C)	X	X [1]	5 (0) [2]
Post Electrical Tests	In accordance with the device specification at -55^0C, 25^0C and 125^0C	X	X [1]	5 (0) [2]
Heremeticity (fine and gross)	1014	X	X	5 (0) [2]
External Visual	2009	X	X	5 (0) [2]

Notes:

1. Do not exceed manufacturer's storage or operational temperature limits
2. Use thermal shock samples

Table 4-7a Magnetics (Inductors, Coils and Transformers) Upgrade Screening Requirements

		Upgrade Screening Required			
Upgrade Screening Test	Test Method In Accordance With MIL-PRF-27, Unless Otherwise Specified	From Class "B" to Class "B+" [1]	From Class "C" to Class "B+" [2]	From Class "D" to Class "B+" [3]	From Class "D" to Class "C"
External Visual	Paragraph 3.24	X	X	X	X
Dielectric Withstanding Voltage	Paragraph 3.11			X	X
Insulation Resistance	Paragraph 3.13			X	
Polarity	Paragraph 4.7.12.14			X	X
Turns Ratio	Paragraph 4.7.12.17			X	X
Initial DC Resistance [5]	In accordance with MIL-PRF-15305, paragraph 3.12.7	X		X	
Thermal Shock	15 cycles (Paragraph 3.7.1)	X			
Thermal Shock	25 cycles (Paragraph 3.7.1)		X	X	
Vibration	Paragraph 3.18		X	X	
Burn-in	In accordance with MIL-STD-981		X	X	
Seal (if applicable)	Paragraph 3.10		X	X	X
Inductance	In accordance with MIL-PRF-15305, paragraph 3.12.1		X	X	X
Final DC Resistance [5]	In accordance with MIL-PRF-15305, paragraph 3.12.7	X	X	X	X
Radiographic Inspection	Appendix C	X	X	X	
Lot Acceptance	5% or 1 device, whichever is greater [4]	X	X		

Table 4-7a Magnetics (Inductors, Coils and Transformers) Upgrade Screening Requirements (continued)

Notes:

1. A Class “B” device is equivalent to a Level T device as specified in MIL-PRF-27
2. A Class “C” device is equivalent to a Level M device as specified in MIL-PRF-27
3. A Class “D” device is equivalent to a commercial device
4. The lot acceptance criteria shall be determined using the cumulative number of failures from all test or upgrade screens. A rejected lot can be re-worked one time only to correct the defects. A re-worked lot shall be re-submitted for upgrade screening. If any failures occur during the second upgrade sceening the lot shall be rejected
5. Direct Current (DC) resistance is required pre and post thermal shock for Class “S” using wire sizes of < 38 AWG only. The DC resistance shall not exceed ± 3%

Table 4-7b Magnetics (Inductors, Coils and Transformers) Qualification Requirements

Qualification Test	Test Method In Accordance With MIL-PRF-27, Unless Otherwise Specified	Qualification Required [1]			
		From Class "B" to Class "B+"	From Class "C" to Class "B+"	From Class "D" to Class "B+"	From Class "D" to Class "C"
External Visual	Paragraph 3.24	10 (0)	10 (0)	10 (0)	N/A
Resistance To Soldering Heat	Paragraph 3.8	2 (0)	2 (0)	2 (0)	N/A
Terminal Strength	Paragraph 3.9	2 (0)	2 (0)	2 (0)	N/A
Temperatrure Rise	Paragraph 3.15	2 (0)	2 (0)	2 (0)	N/A
Solderability	Paragraph 3.5	2 (0)	2 (0)	2 (0)	N/A
Resistance To Solvents	Paragraph 3.6	2 (0)	2 (0)	2 (0)	N/A
Vibration	Paragraph 3.18	2 (0)	2 (0)	2 (0)	N/A
Shock	Paragraph 3.19	2 (0)	2 (0)	2 (0)	N/A
DC Resistance	In accordance with MIL-PRF-15305, paragraph 3.12.7	2 (0)	2 (0)	2 (0)	N/A
Life Test	Paragraph 3.26	2 (0)	2 (0)	2 (0)	N/A
Seal (if applicable)	Paragraph 3.10	2 (0)	2 (0)	2 (0)	N/A
DC Resistance	In accordance with MIL-PRF-15305, paragraph 3.12.7	2 (0)	2 (0)	2 (0)	N/A
External Visual	Paragraph 3.24	2 (0)	2 (0)	2 (0)	N/A

Notes:

1. If Quality Confromance Inspection (QCI) data is available on the procured lot, then those tests need not be repeated

4.8 Fuses

4.8.1 Upgrade Screening of Fuses

For commercial fuses used in grade 1 and 2 applications, upgrade screening shall be in accordance with the following table:

Table 4-8a Fuse Upgrade Screening Requirements

Upgrade Screening Required	Test Methods and Conditions
Visual Inspection [1]	In accordance with MIL-PRF-23419, paragraph 3.21
Mechanical Inspection [2]	In accordance with MIL-PRF-23419, paragraph 4.7.1
Resistance (Cold) [4]	MIL-STD-202, Method 303
Voltage Drop (Hot-1) [5]	100% rated current for 5 minutes (minimum). Voltage drop to device specification (when specified)
Thermal Shock [3]	MIL-STD-202, Method 107, Condition B
Voltage Drop (Hot-2) [5]	100% rated current for 5 minutes (minimum). Voltage drop ratio: (Hot-1/Hot-2) = 0.97 to 1.03
Resistance (Cold) [4]	MIL-STD-202, Method 303
Seal [6]	MIL-STD-202, Method 112, Condition A
Percent Defect Allowed	In accordance with paragraph 3.15

Notes:

1. Use of pure tin is prohibited as a final finish
2. A minimum of 3 fuses shall be measured
3. Fuses rated to < $+125^0$C shall be tested to Condition A
4. The source current for the resistance measurement shall not exceed 10% of the nominal current rating at room temperature. If the resistance of the fuse is not specified, a continuity check shall be substituted
5. The voltage drop (hot) measurement must be recorded to calculate the voltage drop ratio regardless of whether or not it is a specification requirement. Not applicable for Surface Mount Technology (SMT) fuses.
6. Applies to hermetically sealed fuses only.

4.8.2 Qualification of Fuses

For commercial fuses used in grade 1 and 2 applications qualification shall be in accordance with the following table:

Table 4-8b Fuse Qualification Requirements

Qualification Required	Test Methods and Conditions	Sample Size and Reject Criteria
Visual Inspection [1]	In accordance with MIL-PRF-23419, paragraph 3.21	30 (0)
Current-Carrying Capacity [2]	Specified percentage of rated current at –60^{0}C, 25^{0}C, and at the maximum rated temperature. Load time: 30 minutes after temperature stabilization but not less than 1.5 hours. Case temperature rise: ≤70^{0}C (unless specified). Fuse shall not blow	8 (0)
Terminal Strength [2 5]	MIL-STD-202, Method 211. Test condition A or E as applicable	3 (0)
Overload Interrupt [2 3]	Specified percentage of rated current at –20^{0}C, 25^{0}C, and at the maximum rated temperature. Temperature soak time:30 minutes minimum. Load time: 1 minute after fuse blow. Insulation resistance to specification within 1 minute	3 (0)
Insulation Resistance [5]	MIL-STD-202, Method 302	3 (0)
Solderability	MIL-STD-202, Method 208	2 (0)
Short Circuit [2]	Specified current and voltage. Temperature soak time:30 minutes minimum. Load time: 1.0 minute after fuse blow. Insulation resistance to specification within 1 minute	2 (0)
Continuity	In accordance with MIL-PRF-23419, paragraph 3.6	2 (0)
Vibration High Frequency [2]	MIL-STD-202, Method 204	2 (0)
Shock [2]	MIL-STD-202, Method 213	2 (0)
Continuity	In accordance with MIL-PRF-23419, paragraph 3.6	2 (0)
Moisture Resistance [2]	MIL-STD-202, Method 106	2 (0)
Thermal Shock [2 7 8]	MIL-STD-202, Method 107	5 (0)
Seal [9]	MIL-STD-202, Method 112, Condition A	[9]

Table 4-8b Fuse Qualification Requirements (continued)

Qualification Required	Test Methods and Conditions	Sample Size and Reject Criteria
Continuity	Electrical continuity intact	5 (0) [6]
Resistance to Soldering Heat	MIL-STD-202, Method 210	2 (0)
Current-Carrying Capacity [2]	At rated current at 25^0C. Load time: 30 minutes after temperature stabilization but not less than 1.5 hours. Case temperature rise: $\leq 70^0$C (unless specified). Fuse shall not blow	5(0) [6]
Overload Interrupt [2 3]	At rated current at 25^0C. Temperature soak time:30 minutes minimum. Load time: 1 minute after fuse blow. Insulation resistance to specification within 1 minute	5 (0) [6]
Insulation Resistance [5]	MIL-STD-202, Method 302	5 (0) [6]
Thermal Outgassing	ASTM E595 TML: 1.0% maximum CVCM = 0.10% maximum	5 (0) [6]

Notes:

1. Use of pure tin is prohibited as a final finish
2. External visual required after test to verify no evidence of mechanical damage
3. The power supply shall have an open-circuit voltage not less than the specified voltage rating of the fuse under test
4. Materials listed in NASA Reference Publication 1124 that meet Total Mass Loss (TML) and Collected Volatile Condensable Material (CVCM) limits are acceptable for use without further testing
5. Not applicable for SMT fuses
6. Use thermal shock samples
7. Use samples from Test 1
8. Fuses rated at $< +125^0$C shall be tested to Condition A
9. Applies to hermetically sealed fuses only. Perform on Thermal Shock samples.

4.9 Quality Assurance Provisions

4.9.1 Test Facility Quality Program

The parts test and upgrade screening facility or laboratory shall provide for and maintain a quality program which shall ensure that adequate upgrade screening controls and consistent quality is maintained throughout all phases of testing and handling of parts.

4.9.2 Data Retention and Access

The test and upgrade screening laboratory shall retain all test data for a minimum of two years. The test laboratory shall notify the procuring activity and obtain their approval prior to the destruction of upgrade screening and test data.

4.9.3 Test Equipment

All test equipment used in the manufacture, processing, upgrade screening, and testing of parts to this procedure shall conform to the requirements of ISO10012-1 (Equipment, Quality Assurance Requirements for Measuring – Part 1: Metrological Confirmation System for Measuring Equipment) or NCSL-Z540.1 (Calibration Laboratories and Measuring and Test Equipment – General Requirements).

4.9.4 Lot and Inspection Lot Definition

A lot or an inspection lot for purposes of this procedure is: all devices (parts) marked with the same part number and the same lot date code. Lots or inspection lots shall not be split during upgrade screening without prior approval of the product group.

4.9.5 Responsibility for Inspection

The upgrade screening and test laboratory is responsible for the upgrade screening and sample life test requirements specified herein. The procuring activity reserves the right to witness or perform any of the specified tests and inspections set forth herein and to audit the data resulting from the upgrade screening and test inspections or laboratory's performance of these tests and inspections.

4.9.5.1 Detailed Test Procedure Approval

The detailed upgrade screening and sample life test procedure prepared by the upgrade screening and test laboratory shall be approved by the procuring activity prior to the start of testing/inspections.

4.9.6 Failure Analysis

Catastrophic failures (opens, shorts, and non-functional devices) that occurred subsequent to Burn-In, shall be reported to the procuring activity. Failure analysis, if required by the product group, shall be performed at a PCB approved laboratory.

4.9.7 Documentation

The upgrade screening and test laboratory shall provide with each lot of parts upgrade screened and tested the following:

a. Upgrade screening inspection attributes summary data.

b. Upgrade screening inspection variables data; serialized electrical test data, identifiable to each part including delta calculations.

c. Certificate of Conformance.

5.0 PREPARATION FOR DELIVERY

5.1 Packing and Packaging

Each part shall be packed and packaged in accordance with MIL-STD-129. ESD protective packaging shall be in accordance with the contract or purchase order for ESDS itesm. If ESD protective packaging is not specified in the contract or purchase order, requirements for packaging shall be in accordance with MIL-STD-2073 codes GX, JK, JW, K8 or KS for ESDS items.

5.2 Rejected Parts

Parts that have been rejected for not meeting any portion of the specified requirements herein shall be identified and packaged separately.

5.3 Electrostatic Discharge Sensitivity (ESDS)

Electrostatic damage preventative packaging and handling is mandatory whether or not the parts are classified as ESDS. Packages containing ESDS parts shall be identified per the requirements of MIL-STD-1686.