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TAGAMINE. KÕRGE TÖÖKINDLUSEGA JOOTMINE
PINDPAIGALDUSEGA JA ERILIIGILISTELE
TEHNOLOOGIALE

Space product assurance - High-reliability soldering for
surface-mount and mixed technology

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

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English version

Space product assurance - High-reliability soldering for surface-mount and mixed technology

Assurance produit des projets spatiaux - Soudure
haute fiabilité pour technologies à montage de surface
et mixte

Raumfahrtproduktsicherung - Hochzuverlässiges
Löten von Oberflächen-Befestigungen und gemischte
Technologien

This European Standard was approved by CEN on 5 October 2018.

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Table of contents

European Foreword	11
Introduction	12
1 Scope	15
2 Normative references	16
3 Terms, definitions and abbreviated terms	18
3.1 Terms from other standards.....	18
3.2 Terms specific to the present standard	18
3.3 Abbreviated terms.....	20
3.4 Nomenclature	21
3.4.1 Formal verbs	21
4 Principles of reliable soldered connections	22
5 Process identification document (PID)	23
5.1 General.....	23
5.1.1 Purpose	23
5.1.2 Document preparation.....	23
5.1.3 <<deleted>>.....	23
5.1.4 Approval.....	23
5.1.5 SMT contact person	24
5.2 <<deleted>>	24
5.3 Process identification document updating	24
6 Preparatory conditions	25
6.1 Calibration	25
6.2 Facility cleanliness.....	25
6.3 Environmental conditions.....	25
6.4 Precautions against static charges	25
6.5 Lighting requirements	25
6.6 Equipment and tools	25
6.6.1 Brushes.....	25

6.6.2	Cutters and Pliers	26
6.6.3	Bending tools	26
6.6.4	Clinching tools.....	26
6.6.5	Insulation strippers	26
6.6.6	Soldering tools	26
6.6.7	Soldering irons and resistance soldering equipment	26
6.6.8	<<deleted>>	26
6.6.9	Solder baths for degolding and pretinning	26
6.7	Soldering machines and equipment.....	27
6.7.1	General	27
6.7.2	Dynamic wave-solder machines.....	27
6.7.3	Condensation (vapour phase) reflow machines.....	28
6.7.4	Hot gas reflow machines	28
6.7.5	<<deleted>>	28
6.7.6	Convection and radiation reflow systems	28
6.7.7	Other equipment for reflow soldering	29
6.8	Ancillary equipment	29
6.8.1	General	29
6.8.2	Solder deposition equipment.....	29
6.8.3	Automatic device placement equipment.....	29
6.8.4	<<deleted>>	29
6.8.5	Cleanliness testing equipment	30
6.8.6	Magnification aids	30
6.8.7	X-ray inspection equipment.....	30
6.8.8	Metallographic equipment	30
7	Material selection	31
7.1	General.....	31
7.2	Solder	31
7.2.1	Form	31
7.2.2	Composition.....	31
7.2.3	Solder paste.....	31
7.2.4	Maintenance of paste purity	33
7.3	Flux	33
7.3.1	Rosin based flux	33
7.3.2	Corrosive acid flux.....	33
7.3.3	Flux controls for wave-soldering equipment	33
7.4	Solvents.....	33

7.5	Flexible insulation materials	34
7.6	Terminals.....	34
7.7	Wires	34
7.8	Printed circuit substrates.....	34
7.8.1	<<deleted>>	34
7.8.2	<<deleted>>	34
7.8.3	<<deleted>>	34
7.8.4	<<deleted>>	34
7.8.5	<<deleted>>	35
7.8.6	<<deleted>>	35
7.9	Devices.....	35
7.9.1	General	35
7.9.2	<<deleted>>	36
7.9.3	Moisture sensitive devices	36
7.9.4	<<deleted>>	36
7.10	Adhesives, encapsulants and conformal coatings.....	36
8	Preparation for soldering.....	38
8.1	Preparation of devices and terminals	38
8.1.1	Preparation of wires and terminals	38
8.1.2	Preparation of surfaces to be soldered.....	38
8.1.3	Degolding and pretinning of conductors	38
8.1.4	Alloying of pure tin finish	38
8.2	Preparation of solder bit.....	39
8.3	Handling	39
8.4	Storage.....	39
8.5	Baking of PCBs and moisture sensitive devices	39
9	Mounting of devices prior to soldering	40
9.1	General requirements	40
9.2	Lead bending and cutting requirements	40
9.3	Mounting of terminals to PCBs.....	40
9.4	Lead attachment to through holes.....	40
9.5	Mounting of devices to terminals.....	40
9.6	Mounting of through hole connectors to PCBs	40
9.7	Surface mount requirements.....	41
9.7.1	General	41
9.7.2	Stress relief	41
9.7.3	Registration of devices and footprints	42

9.7.4	Lead forming	42
9.7.5	Mounting devices in solder paste	42
9.7.6	Leadless devices	43
9.7.7	Leaded devices	43
9.7.8	<<deleted>>	43
9.7.9	Stacking and bonding of heavy devices	43
10	Attachment of conductors to terminals, solder cups and cables	45
11	Soldering to printed circuit boards	46
11.1	General	46
11.2	<<deleted>>	46
11.3	Solder applications to PCBs	46
11.4	Wicking	46
11.5	Soldering of SMDs	46
11.5.1	General requirements	46
11.5.2	End-capped and end-metallized devices	47
11.5.3	Bottom terminated chip devices	49
11.5.4	Cylindrical and square end-capped devices	50
11.5.5	Castellated chip carrier devices	52
11.5.6	Flat pack and Gull-wing leaded devices with round, rectangular, ribbon leads	53
11.5.7	Devices with "J" leads	54
11.5.8	Area array devices	54
11.5.9	Devices with ribbon terminals without stress relief	56
11.5.10	L-Shape inwards devices	57
11.5.11	Stacked modules devices with leads protruding vertically from bottom	58
11.5.12	Leaded device with plane termination	59
11.5.13	Moulded magnetics	59
11.6	<<deleted>>	60
11.7	<<deleted>>	60
11.8	<<deleted>>	60
12	Cleaning of PCB assemblies	61
12.1	General	61
12.2	Ultrasonic cleaning	61
12.3	Monitoring for cleanliness	61
13	Final inspection	62
13.1	General	62

13.2	Acceptance criteria	62
13.3	Visual rejection criteria.....	63
13.4	X-ray rejection criterion	65
13.5	Warp and twist of populated boards.....	65
13.6	Inspection records	65
14	Verification procedure.....	66
14.1	General.....	66
14.2	Verification by similarity	68
14.2.1	General	68
14.2.2	Conditions for similarity	69
14.3	Verification programme.....	71
14.4	Electrical testing of devices.....	75
14.4.1	General	75
14.5	Vibration and shock	78
14.6	Temperature cycling test.....	78
14.7	Microsection	79
14.7.1	Microsection facilities	79
14.7.2	Microsectioning	79
14.8	<<deleted>>	95
14.9	Special verification testing for hermetic ceramic area array packages	95
14.9.1	<<deleted>>	95
14.9.2	<<deleted>>	95
14.9.3	General	95
14.9.4	Evaluation of capability samples	98
14.9.5	Verification	98
14.10	Verification acceptance and rejection criteria	99
14.11	Approval of verification	108
14.12	Withdrawal of approval status.....	108
14.13	Conditions for delta verification	108
14.14	Verification of cleanliness	111
14.15	Verification approval procedure	111
14.15.1	Request for verification	111
14.15.2	Technology sample	111
14.15.3	Audit of assembly processing.....	111
14.15.4	Verification programme	112
14.15.5	Final verification review.....	112
14.15.6	Certification approval of assembly line	112

15 Quality assurance	113
15.1 General	113
15.2 Data	113
15.3 Nonconformance	113
15.4 Calibration	113
15.5 Traceability	113
15.6 Workmanship standards	113
15.7 Inspection	114
15.8 Operator and inspector training and certification	114
15.9 Quality records	114
16 <<deleted and moved into clause 14.7.2 and Annex I>>	115
Annex A (informative) <<deleted>>	116
Annex B (informative) <<deleted, SMT summary table DRD created in Annex H>>	117
Annex C (informative) <<deleted>>	118
Annex D (informative) Example of an SMT audit report	119
Annex E (informative) Additional information	128
E.1 <<deleted>>	128
E.2 Melting temperatures and choice	128
Annex F (normative) Process Identification Document (PID) - DRD	129
F.1 DRD identification	129
F.1.1 Requirement identification and source document	129
F.1.2 Purpose and objective	129
F.2 Expected response	129
F.2.1 Scope and content	129
F.2.2 Special remarks	131
Annex G (normative) Verification programme report - DRD	132
G.1 DRD identification	132
G.1.1 Requirement identification and source document	132
G.1.2 Purpose and objective	132
G.2 Expected response	132
G.2.1 Scope and content	132
G.2.2 Special remarks	133
Annex H (normative) SMT summary table - DRD	134

H.1	DRD identification	134
H.1.1	Requirement identification and source document	134
H.1.2	Purpose and objective	134
H.2	Expected response	134
H.2.1	Scope and content	134
H.2.2	Special remarks	134
Annex I (informative) Visual and X-ray workmanship standards		136
I.1	Workmanship illustrations for standard SMDs	136
I.1.1	Chip components	136
I.1.2	MELF components	139
I.1.3	Gull-wing leaded devices with round, rectangular, ribbon shape	140
I.1.4	“J” leaded devices	142
I.1.5	L-shape Inward leaded component	144
I.1.6	LCC devices	144
I.1.7	Miscellaneous soldering defects	145
I.2	Workmanship illustrations for ball grid array devices	146
I.3	Workmanship illustrations for column grid array devices	148
Bibliography		151
Figures		
Figure 9-1: Exposed element		43
Figure 11-1: Mounting of rectangular and square end-capped and end-metallized devices		48
Figure 11-2: Mounting of bottom terminated chip devices		49
Figure 11-3: Mounting of cylindrical end-capped devices		50
Figure 11-4: Mounting of square end-capped devices		51
Figure 11-5: Mounting of castellated chip carrier devices		52
Figure 11-6: Mounting of gull-wing leaded devices with round, rectangular, ribbon leads		53
Figure 11-7: Mounting of devices with “J” leads		54
Figure 11-8: <<deleted>>		55
Figure 11-9: Typical ceramic area array showing ball grid array configuration on left and column grid array on right (CBGA & CCGA)		55
Figure 11-10: Typical assembled CCGA device		55
Figure 11-11: Mounting of devices without stress relief		56
Figure 11-12: Mounting of devices with “L-shape inwards” leads (1 = Toe, 2 = Heel)		57
Figure 11-13: Mounting of stacked modules devices with leads protruding vertically from bottom		58

Figure 11-14: Mounting of leaded devices with leads with plane termination	59
Figure 11-15: <<deleted>>	60
Figure 14-1: Verification programme flow chart (standard flow)	74
Figure 14-2: Verification programme flow chart (electrical testing)	77
Figure 14-3: Verification programme flow chart (AAD)	97
Figure 14-4: <<deleted>>	100
Figure I-1 : Preferred solder (see also Table 11-1)	136
Figure I-2 : Acceptable, maximum solder (see also Table 11-1)	136
Figure I-3 : Acceptable, minimum Solder (see also Table 11-1)	137
Figure I-4 : Unacceptable, excessive solder (see also Table 11-1)	137
Figure I-5 : Unacceptable, poor wetting (see also Table 11-1)	137
Figure I-6 : Unacceptable, excessive tilt (see also Table 11-1)	138
Figure I-7 : Unacceptable, tombstone effect	138
Figure I-8 : Examples of Unacceptable solder joints - (see also Table 11-1)	138
Figure I-9 : Acceptable, terminal wetted along end, face and sides (see also Table 11-1)	139
Figure I-10 : Acceptable, maximum solder joint (see also Table 11-3)	139
Figure I-11 : Not Acceptable, insufficient solder joint (see also Table 11-3)	139
Figure I-12 : Unacceptable overhang	139
Figure I-13 : Examples of Gullwing leads: Acceptable	140
Figure I-14 : Examples of gull-wing device with rectangular lead: Acceptable	140
Figure I-15 : Acceptable, minimum solder joint	140
Figure I-16 : Unacceptable, insufficient heel fillet	141
Figure I-17 : Unacceptable, excessive solder	141
Figure I-18 : Unacceptable, excessive solder	141
Figure I-19 : Preferred solder joint	142
Figure I-20 : Acceptable solder joint	142
Figure I-21 : Unacceptable, excessive solder joint	143
Figure I-22 : Unacceptable, excessive degolding	143
Figure I-23 : Acceptable, preferred solder joint	144
Figure I-24 : LCC General view, acceptable solder joints	144
Figure I-25 : Examples of unacceptable soldering	145
Figure I-26 : Angled-transmission X-radiograph showing solder paste shadow due to partial reflow: Reject	146
Figure I-27 : Micrograph showing	146
Figure I-28 : Perpendicular transmission X-radiograph showing unacceptable defects	147
Figure I-29 : Perpendicular transmission X-radiograph showing non-wetted footprint	147
Figure I-30 : Underside view showing missing column	148

Figure I-31 : CGA mounted on PCB showing columns tilted < 10°: Accept.....	148
Figure I-32 : X-radiograph of CGA mounted on PCB showing solder bridge: Reject.....	149
Figure I-33 : X-radiograph of CGA showing solder fillets at base of columns: acceptable ...	149
Figure I-34 : Micrograph of CGA mounted on PCB, bent column: reject	150
Figure I-35 : Micrograph of CGA mounted on PCB	150

Tables

Table 7-1: Chemical composition of spacecraft solders	32
Table 7-2: <<deleted>>	34
Table 11-1: Dimensional and solder fillet for rectangular and square end capped devices.....	48
Table 11-2: Dimensional and solder fillet for bottom terminated chip devices	49
Table 11-3: Dimensional and solder fillet for cylindrical end-capped devices	50
Table 11-4: Dimensional and solder fillet for square end-capped devices	51
Table 11-5: Dimensional and solder fillet for castellated chip carrier devices.....	52
Table 11-6: Dimensional and solder fillet for gull-wing leaded devices with round, rectangular, ribbon leads.....	53
Table 11-7: Dimensional and solder fillet for devices with “J” leads	54
Table 11-8: Dimensional and solder fillet for area array devices	55
Table 11-9: Dimensional and solder fillet for devices without stress relief	56
Table 11-10: Dimensional and solder fillet for “L-shape inwards” devices	57
Table 11-11: Dimensional and solder fillet for stacked modules devices with leads protruding vertically from bottom	58
Table 11-12: Dimensional and solder fillet for leaded devices with plane termination	59
Table 14-1: Device type classification.....	68
Table 14-2: Device microsection location	81
Table 14-3: Critical zone definition per device type and acceptance criteria	101
Table 14-4: Conditions invoking verification.....	110
Table E-1 : Guide for choice of solder type.....	128
Table H-1 : Device type preparation and mounting configuration.....	135

European Foreword

This document (EN 16602-70-38:2019) has been prepared by Technical Committee CEN-CENELEC/TC 5 "Space", the secretariat of which is held by DIN.

This standard (EN 16602-70-38:2019) originates from ECSS-Q-ST-70-38C Rev.1.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2019, and conflicting national standards shall be withdrawn at the latest by October 2019.

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This document has been prepared under a standardization request given to CEN by the European Commission and the European Free Trade Association.

This document has been developed to cover specifically space systems and has therefore precedence over any EN covering the same scope but with a wider domain of applicability (e.g. : aerospace).

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Introduction

This Standard prescribes requirements for electrical connections of leadless and leaded surface mounted devices (SMD) on spacecraft and associated equipment, utilising a range of substrate assemblies and employing solder as the interconnection media. The principal types of SMDs can be gathered in the following families:

<p>Rectangular and square end-capped or end-metallized device with rectangular body, leadless chip (see 11.5.2) e.g. end capped chip resistors and end capped chip capacitors.</p>	
<p>Cylindrical and square end-capped devices with cylindrical body, leadless chip (see 11.5.4) e.g. MELF for cylindrical end capped or e.g. D-5A for square end capped</p>	
<p>Bottom terminated chip device (see 11.5.3) This type of device has metallised terminations on the bottom side only. e.g. inductors and SMD0.5, SMD1, SMD2, SMD0.2, SMD0.22 e.g. Quad Flat Pack No lead (QFN)</p>	

<p>Castellated chip carrier device (see 11.5.5)</p> <p>The main device of this type is leadless ceramic chip carrier (LCCC).</p> <p>e.g. LCC6</p>	
<p>Flat pack and gull-wing leaded device with round, rectangular, ribbon leads (see 11.5.6)</p> <p>e.g. small-outline transistor (SOT), small-outline package (SO), flat pack and quad flat pack (QFP) and SMD connectors with stress-relief.</p> <p>This family also comprises devices for through-hole mounting that have been reconfigured to surface mounting.</p>	
<p>Moulded magnetics (see 11.5.13)</p> <p>e.g. 1553 interface transformers or specific transformers</p>	
<p>“J” leaded device (see 11.5.7)</p> <p>e.g. ceramic leaded chip carriers (CLCC) and plastic leaded chip carriers (PLCC).</p>	

<p>Area array devices (AAD) (see 11.5.8)</p> <p>The interconnections between solder footprints on the devices and solder footprints on the PCB consist entirely of solder.</p> <p>The devices have either solder balls (Ball Grid Array - BGA) or solder columns (Column Grid Array - CGA) applied to the solder footprints on the devices prior to mounting on a PCB (normally done by the device manufacturer). The solder balls on the BGAs can consist of either eutectic solder or high temperature solder (5 - 10 % Sn) whereas the solder columns on the CGAs always consist of high temperature solder. Although BGAs are usually presented as a device family, there exist a large number of BGA devices with wide-ranging properties. The vast majority of BGA devices are non hermetic.</p>	
<p>Devices with ribbon terminals without stress relief (flat lug leads) (see 11.5.9)</p> <p>This package has flat leads extending from the sides</p>	
<p>Device with Inward formed L-shaped leads (see 11.5.10)</p> <p>e.g. moulded tantalum chip capacitors.</p>	
<p>Stacked modules devices with leads protruding vertically from bottom (see 11.5.11)</p>	
<p>Leaded device with plane termination (see 11.5.12)</p> <p>e.g. Diode PAcKage (DPAK or TO252)</p>	 <p>DPAK</p>

1

Scope

This Standard defines the technical requirements and quality assurance provisions for the manufacture and verification of high-reliability electronic circuits based on surface mounted device (SMD) and mixed technology.

The Standard defines acceptance and rejection criteria for high-reliability manufacture of surface-mount and mixed-technology circuit assemblies intended to withstand normal terrestrial conditions and the vibrational g-loads and environment imposed by space flight.

The proper tools, correct materials, design and workmanship are covered by this document. Workmanship standards are included to permit discrimination between proper and improper work.

The assembly of leaded devices to through-hole terminations and general soldering principles are covered in ECSS-Q-ST-70-08.

Requirements related to printed circuit boards are contained in ECSS-Q-ST-70-10, ECSS-Q-ST-70-11 and ECSS-Q-ST-70-12. The mounting and supporting of devices, terminals and conductors prescribed herein applies to assemblies at PCB level designed to continuously operate over the mission within the temperature limits of -55 °C to +85 °C.

For temperatures outside this normal range, special design, verification and qualification testing is performed to ensure the necessary environmental survival capability.

Special thermal heat sinks are applied to devices having high thermal dissipation (e.g. junction temperatures of 110 °C, power transistors) in order to ensure that solder joints do not exceed 85 °C.

Verification of SMD assembly processes is made on test vehicles (surface mount verification samples). Temperature cycling ensures the operational lifetime for spacecraft. However, mechanical testing only indicates SMD reliability as it is unlikely that the test vehicle represents every flight configuration.

This Standard does not cover the qualification and acceptance of the EQM and FM equipment with surface-mount and mixed-technology.

The qualification and acceptance tests of equipment manufactured in accordance with this Standard are covered by ECSS-E-ST-10-03.

This standard may be tailored for the specific characteristics and constraints of a space project, in accordance with ECSS-S-ST-00.

Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revisions of any of these publications do not apply. However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references the latest edition of the publication referred to applies.

EN reference	Reference in text	Title
EN 16601-00-01	ECSS-S-ST-00-01	ECSS system — Glossary of terms
EN 16601-40	ECSS-M-ST-40	Space project management — Configuration and information management
EN 16602-10-09	ECSS-Q-ST-10-09	Space product assurance — Nonconformance control system
EN 16602-20	ECSS-Q-ST-20	Space product assurance — Quality assurance
EN 16602-60	ECSS-Q-ST-60	Space product assurance — Electrical, electronic and electromechanical (EEE) components
EN 16602-60-05	ECSS-Q-ST-60-05	Space product assurance — Generic requirements for hybrids
EN 16602-60-13	ECSS-Q-ST-60-13	Space product assurance - Commercial electrical, electronic and electromechanical (EEE) components
EN 16602-70	ECSS-Q-ST-70	Space product assurance — Materials, mechanical parts and processes
EN 16602-70-01	ECSS-Q-ST-70-01	Space product assurance — Cleanliness and contamination control
EN 16602-70-02	ECSS-Q-ST-70-02	Space product assurance — Thermal vacuum outgassing test for the screening of space materials
EN 16602-70-08	ECSS-Q-ST-70-08	Space product assurance — Manual soldering of high-reliability electrical connections
EN 16602-70-10	ECSS-Q-ST-70-10	Space product assurance — Qualification of printed circuit boards
EN 16602-70-11	ECSS-Q-ST-70-11	Space product assurance — Procurement of printed circuit boards

EN reference	Reference in text	Title
EN 16602-70-12	ECSS-Q-ST-70-12	Space product assurance — Design rules for printed circuit boards
EN 16602-70-28	ECSS-Q-ST-70-28	Space product assurance — Repair and modification of printed circuit board assemblies for space use.
EN 16602-70-71	ECSS-Q-ST-70-71	Space product assurance — Materials processes and their data selection
	MIL-STD-883 Method 2009	Test Method Standard, Microcircuits
	IPC-TM-650: 2.6.3.3 Issue 2004	Test methods manual. Surface Insulation Resistance, Fluxes