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HERSCHEL/SPIRE

DRCU Declared Material List (DML)

Reference: SAp-SPIRE-NC-0060-02
Issue: 1.1
Date: 24/03/03

	Function	Name	Date	Visa
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DOCUMENT STATUS and CHANGE RECORD

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26/10/01	0.0	Draft
14/11/01	0.1	Released for comments and verification
13/02/03	1.0	5 Purpose 9 Material groups Group 2 “Copper and copper alloys” used 10 Column 8 filled Addition of item 1-3 11 Group 2 table
24/03/03	1.1	11 Justification, approval status of item 2-1

List of acronyms

AD / RD	Applicable / Reference Document
ADP	Acceptance Data Package
CDR	Critical Design Review
CEA	Commissariat à l'Energie Atomique
DCU	Detector Control Unit
DML	Declared Material List
DMPL	Declared Mechanical Part List
DPL	Declared Processes List
DRCU	Detector Readout and Control Unit
EIDP	End Item Data Package
FCU	FPU Control Unit
FIRST	Far InfraRed and Sub millimeter Telescope
FM	Flight Model
FMECA	Failures Modes Effects & Criticality Analysis
FPU	Focal Plane Unit
FS	Flight Spare
GSE	Ground Support Equipment
HIFI	Heterodyne Instrument for First
ICD	Interface Control Document
LAM	Laboratoire d'Astrophysique de Marseilles
MAIV	Manufacturing, Assembly, Integration Verification
MCU	Mechanisms Control Unit
MGSE	Mechanical Ground Support Equipment
N/A	Not Applicable
PA / QA	Product / Quality Assurance
PACS	Photoconductor Array Camera & Spectrometer
PCB	Printed Circuit Board
PDR	Preliminary Design Review
PSU	Power Supply Unit
QM	Qualification Model
RFA	Request For Approval
RT	Room Temperature
S/C	SpaceCraft
SAP	Service d'Astrophysique
SCU	Subsystems Control Unit
SPIRE	Spectral & Photometric Imaging Receiver
TBC	To Be Confirmed
TBD	To Be Defined

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1 Purpose

This document lists the materials expecting to be used in the SPIRE/DRCU QM2, FM, FS.

2 Documentation

2.1 Applicable documents

The following documents will describe subsystems physically contained in the DRCU. These documents are to be written.

MCU DML	Subsystem under LAM responsibility but physically contained in the FCU box.
PSU DML	Subsystem to be furnished by a subcontractor (with spatial experience) under SAP responsibility

2.2 Reference documents

ECSS-Q-70A	Materials, mechanical parts and processes
PSS-01-700 2.0	The technical reporting and approval procedure for materials and processes
PSS-01-701 1.3	Data for selection of space materials
PSS-01-703 1.0	The black-anodising of aluminium with inorganic dyes
ECSS-Q-70-36A	Material selection for controlling stress-corrosion cracking

CNES Guide for science projects EEE, Materials, and Processes Lists

3 Subassembly and equipment codes

Subassembly codes		Names	Responsibility	
DRCU		Detector Readout and Control Unit	SAP	
	FCU	FPU (Focal Plane Unit) Control Unit	SAP	
		MCU	Mechanisms Control Unit	LAM
		SCU	Subsystems Control Unit	SAP
		PSU	Power Supply Unit	SAP
	DCU	Detector Control Unit	SAP	

4 Codes used in the list

4.1 Environment codes

These codes are used to indicate the type of environment to which the material is subjected.

'Radiation' Code	
Code	Meaning
G	Geostationary orbit
L	Low Earth orbit
B	Radiation belt
I	Interplanetary
P	Planetary

For components, which are attached outside the satellite, 'S' is added for Shadow if the material is in the shade or 'L' for Light if the material is in the illuminated area.

'Environment' Code	
Code	Meaning
V	Vacuum
H	Hermetic
M	Manned
E	High pressure

'Temperature' Code	
Code	Meaning
1	$0 \leq 100$ K
2	$101 \leq 200$ K
3	$201 \leq 300$ K
etc.	etc.

The given temperature code correspond to the operating temperature. If needed, the thermal cycle is described by two values, e.g.: 3/5.

4.2 'Size' code

'Size' Code	
Code	Meaning
0	$0 \leq 1$
1	$1 \leq 10$
2	$10 \leq 100$
3	$100 \leq 1000$
4	$1000 \leq 10000$

The 'Size' code represents:

Surface area	A in cm ²
Volume	V in cm ³
Mass	W in (g)

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4.3 Test Code

'Outgassing' Code	
Code	Meaning
P	Material which has undergone the outgassing tests described in document ESA.ECSS-Q-70-02A
F	Material not included in specifications
U	Unknown characteristics

'Inflammability' Code	
Code	Meaning
P	Material which has undergone the inflammability tests described in document ESA.PSS.01.721
F	Material not included in specifications
U	Unknown characteristics

'Toxicity' Code	
Code	Meaning
P	Material which has undergone the toxicity tests described in document ESA.PSS.01.729
F	Material not included in specifications
U	Unknown characteristics

'Stress corrosion' Code	
Code	Meaning
1	The material is included in table I of document ESA.ECSS-Q-70-36A
2	The material is included in table II of document ESA.ECSS-Q-70-36A
3	The material is included in table III of document ESA.ECSS-Q-70-36A
P	Material complying with project requirements but not mentioned in the PSS (test ref. mandatory)
F	Material not included in specifications
U	Unknown characteristics

'Corrosion' Code	
Code	Meaning
P	Material complying with project requirements
F	Material not included in specifications
U	Unknown characteristics

4.4 Approval codes

These codes refer to:

- Comments made by the user or sub-contractor laboratory on use of the material in question;
- Comments from the 'higher level' (the instrument manager in charge of drawing up the list).

'Approval' Code	
Code	Meaning
A	Approved: use without restriction.
Y	Approved with restriction: the material requires special treatment before use (protection, coating, etc.)
D	Approved with waiver: the material does not comply with requirements but no replacement is possible. Its use should be limited.
P	Decision pending: material for which an evaluation report or waiver is necessary.
O	Open: new material for which an examination or evaluation is under way.
C	Eliminated: material which is no longer used.

5 Material groups

Code	Group	Used
1	Aluminium and aluminium alloys	<input checked="" type="checkbox"/>
2	Copper and copper alloys	<input checked="" type="checkbox"/>
3	Nickel and nickel alloys	<input type="checkbox"/>
4	Titanium and titanium alloys	<input type="checkbox"/>
5	Steels	<input type="checkbox"/>
6	Stainless steels	<input type="checkbox"/>
7	Metals for soldering	<input checked="" type="checkbox"/>
8	Miscellaneous metallic material	<input type="checkbox"/>
9	Optical materials	<input type="checkbox"/>
10	Adhesives, coatings, varnishes	<input checked="" type="checkbox"/>
11	Adhesive tapes	<input type="checkbox"/>
12	Paints, primers and inks	<input type="checkbox"/>
13	Lubricants	<input type="checkbox"/>
14	Coating resins and foam	<input type="checkbox"/>
15	Reinforced plastic	<input type="checkbox"/>
16	Rubber and elastomers	<input type="checkbox"/>
17	Thermoplastic resins	<input type="checkbox"/>
18	Duroplastic resins	<input type="checkbox"/>
19	Wires and cables	<input checked="" type="checkbox"/>
20	Sundry non-metallic materials	<input type="checkbox"/>

Group 1 - Aluminium and aluminium alloys

1	2	3	4	5	6	7	8	9			10
								9.1	9.2	9.3	
Item no.	Trade identification or standard description	Chemical nature and type of product	1. Manufacturer 2. Distributor 3. Proc. Spec. no. Issue / Revision	Process parameters	1. Sub-system code 2. Equipment code 3. Use	1. Rad 2. Env 3. Temp	1. A 2. V 3. W	1. Outgassing 2. Inflammability 3. Toxicity 4. Stress corrosion 5. Corrosion	1. Criticality ¹ 2. Justification 3. Subcontractor comments	Approval status	Comments ESA Approval
1-1	EN AW-6082-T6	Aluminium alloy Al rem Si 0,7-1,3 Mg 0,6-1,2 Mn 0,40-1,0 Fe <0,50 Cr <0,25 Zn <0,20 Ti <0,10 Cu <0,10 Others <0,15	1. TBD 2. TBD 3. EN 573-1,3 EN 515	o Alodine 1200 o Black-anodising with inorganic dyes following PSS-01-703 issue 1	1. DRCU 2. DCU, FCU/(MCU+SCU) 3. Salt bath brazed structures of electronic boxes	R I E V T 3/4	A V W4	1. N/A 2. N/A 3. N/A 4. 1 High resistance ECSS-Q-70-36A 5. P	1. Not critical 2. PSS-01-703 1.0 ECSS-Q-70-36A 3.	A	
1-2	EN AW-2618A-T851	Aluminium Alloy Al rem Cu 1,8-2,7 Mg 1,2-1,8 Fe 0,9-1,4 Ni 0,8-1,4 Si 0,15-0,25 Mn <0,25 Ti <0,2 Zn <0,15 Others <0,15	1. TBD 2. TBD 3. EN 573-1,3 EN 515	o Alodine 1200 o Black-anodising with inorganic dyes following PSS-01-703 issue 1	1. DRCU 2. DCU, FCU/(MCU+SCU) 3. Support structures and front panel of electronic board Screwed cover and base of the electronic box	R I E V T 3/4	A V W4	1. N/A 2. N/A 3. N/A 4. 1 High resistance ECSS-Q-70-36A 5. P	1. Not critical 2. PSS-01-703 1.0 ECSS-Q-70-36A 3.	A	
1-3	EN AW-6061	Aluminium alloy Al rem Mg 0,8-1,2 Si 0,40-0,8 Cu 0,15-0,40 Cr 0,04-0,35 Fe <0,7 Mn <0,15 Zn <0,25 Ti <0,15 Others <0,15	1. TBD 2. TBD 4. EN 573-1,3 EN 515	o Black-anodising o Glued with Scotchweld EC 2216 B/A Gray (10-2)	1. DRCU 2. DCU, FCU/(MCU+SCU) 3. Identification labels	R I E V T 3/4	A V W1	1. N/A 5. N/A 6. N/A 7. 1 High resistance ECSS-Q-70-36A 5. P	1. Not critical 2. PSS-01-703 1.0 ECSS-Q-70-36A 3.	A	

¹ As defined in ECSS-Q-70A §3.1.4 Criticality analysis



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Group 2 – Copper and copper alloys

1	2	3	4	5	6	7	8	9			10
								9.1	9.2	9.3	
Item no.	Trade identification or standard description	Chemical nature and type of product	1. Manufacturer 2. Distributor 3. Proc. Spec. no. Issue / Revision	Process parameters	1. Sub-system code 2. Equipment code 3. Use	1. Rad 2. Env 3. Temp	1. A 2. V 3. W	1. Outgassing 2. Inflammability 3. Toxicity 4. Stress corrosion 5. Corrosion	1. Criticality ¹ 2. Justification 3. Subcontractor comments	Approval status	Comments ESA Approval
2-1	Beryllium copper alloy C17200	Copper alloy Cu rem Be 1,8-2,0 Al 0,20 Si 0,20 Co 0,20	1. TBD 2. APITEC 3. ASTM B 194 QQ-C-533 SAE J463 AMS 4530,4532	<ul style="list-style-type: none"> o Satin Tin finish following ASTM B-545 o Glued STYCAST 2850 FT / catalyst9 (10-1) 	1. DRCU 2. DCU, FCU/(MCU+SCU) 3. Copper beryllium finger strips used for thermal contact between the front panel of the electronic boards and the box top	R I A E V V T 3/4 W2		1. N/A 2. N/A 3. N/A 6. 1 High resistance ECSS-Q-70-36A 4. P	1. Not critical 2. Used for Integral ECSS-Q-70-36A 3.	A	

¹ As defined in ECSS-Q-70A §3.1.4 Criticality analysis



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Group 7 – Metals for soldering

1	2	3	4	5	6	7	8	9			10
								9.1	9.2	9.3	
Item no.	Trade identification or standard description	Chemical nature and type of product	1. Manufacturer 2. Distributor 3. Proc. Spec. no. Issue / Revision	Process parameters	1. Sub-system code 2. Equipment code 3. Use	1. Rad 2. Env 3. Temp	1. A 2. V 3. W	1. Outgassing 2. Inflammability 3. Toxicity 4. Stress corrosion 5. Corrosion	1. Criticality ¹ 2. Justification 3. Subcontractor comments	Approval status	Comments ESA Approval
7-1	EN AW-4047A	Aluminium alloy Al rem Si 11-13 Fe <0,6 Cu <0,30 Zn <0,20 Mn <0,15 Mg <0,10 Ti <0,15 Others <0,15	1. TBD 2. TBD 3. EN 573	<ul style="list-style-type: none"> o Alodine 1200 o Black-anodising with inorganic dyes following PSS-01-703 issue 1 	1. DRCU 2. DCU FCU/(MCU+SCU) 3. Salt bath brazing of EN AW-6082-T6 (Item 1-1)	R I A E V V T 3/4 W		1. N/A 2. N/A 3. N/A 4. U 5. P	1. Not critical 2. Used for SOHO/GOLF XMM/EPIC 3. The surface treatment (column 5) is done on the brazed structures.	A	
7-2	S-Sn60Pb40E	Brazing alloy Sn 59,5-60,5 Pb rem	1. TBD 2. TBD 3. ISO 9453	<ul style="list-style-type: none"> o RMA Flux (precise type TBD) o Protected by conformal coating 	1. DRCU 2. DCU, SCU 3. Soldering of electronic components on PCB	R I A E V V T 3/4 W		1. N/A 2. N/A 3. N/A 4. N/A 5. P	1. Not critical 2. ESA PSS-01-701 1.3 S-12 3. Could be used at SAP for corrective action.	A	
7-3	S-Sn62Pb36Ag2	Brazing alloy Sn 61,5-62,5 Pb rem Ag 1,8-2,2	1. TBD 2. TBD 3. ISO 9453	<ul style="list-style-type: none"> o RMA Flux (precise type TBD) o Protected by conformal coating 	1. DRCU 2. DCU, SCU 3. Soldering of SMC on PCB	R I A E V V T 3/4 W		1. N/A 2. N/A 3. N/A 4. N/A 5. P	1. Not critical 2. ESA PSS-01-701 1.3 S-14 3.	A	
7-4	S-Sn63Pb37E	Brazing alloy Sn 62,5-63,5 Pb rem	1. TBD 2. TBD 3. ISO 9453	<ul style="list-style-type: none"> o RMA Flux (precise type TBD) o Protected by conformal coating 	1. DRCU 2. DCU, SCU 3. Soldering of electronic components on PCB	R I A E V V T 3/4 W		1. N/A 2. N/A 3. N/A 4. N/A 5. P	1. Not critical 2. ESA PSS-01-701 1.3 S-13 3.	A	

¹ As defined in ECSS-Q-70A §3.1.4 Criticality analysis



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Group 10 – Adhesives, coatings, varnishes

1	2	3	4	5	6	7	8	9			10
								9.1	9.2	9.3	
Item no.	Trade identification or standard description	Chemical nature and type of product	1. Manufacturer 2. Distributor 3. Proc. Spec. no. Issue / Revision	Process parameters	1. Sub-system code 2. Equipment code 3. Use	1. Rad 2. Env 3. Temp	1. A 2. V 3. W	1. Outgassing 2. Inflammability 3. Toxicity 4. Stress corrosion 5. Corrosion	1. Criticality ⁱ 2. Justification 3. Subcontractor comments	Approval status	Comments ESA Approval
10-1	STYCAST 2850 FT / catalyst9	Two-part epoxy encapsulant	1. Emerson & Cuming	<ul style="list-style-type: none"> o Base 100 o Catalyst 9 3 o 16 hours at 25°C 	1. DRCU 2. DCU FCU/(MCU+SCU) 3. Reinforcement of the soldered joint of heavy components	R I A E V V T 3/4 W		1. P 2. N/A 3. N/A 4. N/A 5. N/A	1. Not critical 2. ESA PSS-01-701 1.3 S-19 3.	A	
10-2	Scotchweld EC 2216 B/A Gray	Two-part epoxy structural adhesive	1. Minnesota Mining & Manufacturing (3M)	<ul style="list-style-type: none"> o Base 100 o Accelerator Gray 140 o 24 hours at RT 	1. DRCU 2. DCU, FCU 3. Component sticking Seals ⁱⁱ on fasteners	R I A E V V T 3/4 W		1. P 2. N/A 3. N/A 4. N/A 5. N/A	1. Not critical 2. ESA PSS-01-701 1.3 S-7 3.	A	
10-3	Nusil CV-1152	Dimethyl diphenyl silicone polymer	1. McGhan-Nusil Corp	<ul style="list-style-type: none"> o 7 days at RT 	1. DRCU 2. DCU FCU/(MCU+SCU) 3. Thin & Thick layer conformal coating on electronic board	R I A E V V T 3/4 W		1. P 2. N/A 3. N/A 4. N/A 5. N/A	1. Not critical 2. ESA PSS-01-701 1.3 C-10 3.	A	
10-4 (1)	Solithane 113	Polyurethane two part coating resin	1. Uniroyal Chemical Company Inc	<ul style="list-style-type: none"> o Solithane 113 100 o C 300 100 o 6 hours at 60°C o Thin layer 	1. DRCU 2. DCU FCU/(MCU+SCU) 3. Thin layer conformal coating on electronic board	R I A E V V T 3/4 W		1. P 2. N/A 3. N/A 4. N/A 5. N/A	1. Not critical 2. ESA PSS-01-701 1.3 S-16 3. Traditionally used by Sap but should be replaced by item 10-3 TBC	A	

ⁱ As defined in ECSS-Q-70A §3.1.4 Criticality analysis
ⁱⁱ Used to identify the element tightened with defined torque



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Group 10 – Adhesives, coatings, varnishes

1	2	3	4	5	6	7	8	9			10
Item no.	Trade identification or standard description	Chemical nature and type of product	1. Manufacturer 2. Distributor 3. Proc. Spec. no. Issue / Revision	Process parameters	1. Sub-system code 2. Equipment code 3. Use	1. Rad 2. Env 3. Temp	1. A 2. V 3. W	9.1	9.2	9.3	Comments ESA Approval
								1. Outgassing 2. Inflammability 3. Toxicity 4. Stress corrosion 5. Corrosion	1. Criticality ¹ 2. Justification 3. Subcontractor comments	Approval status	
10-4 (2)	Solithane 113	Polyurethane two part coating resin	1. Uniroyal Chemical Company Inc	<ul style="list-style-type: none"> o Solithane 113 100 o C 300 74 o 6 hours at 60°C o Thick layer 	1. 2. 3. Thick layer conformal coating on electronic board	R I E V T 3/4	A V W	1. P 2. N/A 3. N/A 4. N/A 5. N/A	1. Not critical 2. ESA PSS-01-701 1.3 S-16 3. Traditionally used by Sap but should be replaced by item 10-3 TBC		



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Group 19 – Wires and cables

1	2	3	4	5	6	7	8	9			10
								9.1	9.2	9.3	
Item no.	Trade identification or standard description	Chemical nature and type of product	1. Manufacturer 2. Distributor 3. Proc. Spec. no. Issue / Revision	Process parameters	1. Sub-system code 2. Equipment code 3. Use	1. Rad 2. Env 3. Temp	1. A 2. V 3. W	1. Outgassing 2. Inflammability 3. Toxicity 4. Stress corrosion 5. Corrosion	1. Criticality ¹ 2. Justification 3. Subcontractor comments	Approval status	Comments ESA Approval
19-1	KT 26	High purity copper silver plated + PTFE insulation	1. FILECA TBC 2. TBD 3.	°	1. 2. 3.	R I E V T 3/4	A V W	1. 2. 3. 4. 5.	1. 2. 3.		
19-2	MTV	High purity copper silver plated	1.FILOTEX TBC 2. TBD 3.	°	1. 2. 3.	R I E V T 3/4	A V W	1. 2. 3. 4. 5.	1. 2. 3.		
19-3	BTV 1/26 AQ	High purity copper silver plated	1.FILOTEX TBC 2. TBD 3.	°	1. 2. 3.	R I E V T 3/4	A V W	1. 2. 3. 4. 5.	1. 2. 3.		

The choice of the type of wire used for the QM2, FM, FS is depending on the choice of the subcontractor cabling the electronic boards (not done yet).

¹ As defined in ECSS-Q-70A §3.1.4 Criticality analysis