

SPIRE

**SUBJECT: SPIRE Warm Electronics Handling and
Mechanical Integration Procedure**

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DOCUMENT No: SPIRE-RAL-PRC-002808

ISSUE: 1

Date: 22/1/07

CHECKED BY:

APPROVED BY:

SPIRE

Project Document

SPIRE Warm Electronics Handling and
Mechanical Integration Procedure

Ref: SPIRE-RAL-PRC-
002808

Issue: 1

Date: 22 January 2007

Page: 2 of 19

Distribution

Part of the SPIRE EIDP

Change Record

ISSUE	DATE	
1	14/10/04	First issue

Table of Contents

SPIRE	1
CHANGE RECORD	3
TABLE OF CONTENTS	4
REFERENCES	6
APPLICABLE DOCUMENTS	6
1. INTRODUCTION	7
2. SCOPE	7
3. DELIVERY CONDITION	7
3.1 SHOCK RECORDERS	7
4. TRANSPORT	7
4.1 IN DEDICATED EXPERIMENT CONTAINERS	7
4.2 AFTER INTEGRATION ON THE SPACECRAFT (IN SPACECRAFT CONTAINER)	7
5. STORAGE	8
5.1 IN DEDICATED EXPERIMENT CONTAINER	8
5.2 OUT OF CONTAINER (IN RR100 CLEANROOM, AWAITING INTEGRATION)	8
6. HANDLING	8
6.1 GENERAL	8
6.2 ESD PROTECTION	8
6.3 UNPACKING FROM DEDICATED EXPERIMENT CONTAINER	8
6.3.1 DCU:	8
6.3.2 FCU:	9
6.3.3 DPU:	9
6.4 PREPARATION FOR INTEGRATION	10
6.5 PREPARATION FOR PACKING	10
6.5.1 DCU:	10
6.5.2 FCU:	10
6.5.3 DPU:	10
6.6 PACKING IN CONTAINERS	10
6.6.1 DCU:	10
6.6.2 FCU:	11
6.6.3 DPU:	11
7. INTEGRATION	11
7.1 REQUIRED TOOLS/MGSE	11
7.2 MECHANICAL INTEGRATION TO SPACECRAFT	12
7.2.1 DCU:	12
7.2.2 FCU:	13
7.2.3 DPU:	13
7.3 ELECTRICAL INTEGRATION	14
7.4 REMOVAL FROM SPACECRAFT	14

7.4.1	DCU:	14
7.4.2	FCU:	14
7.4.3	DPU:	14
8.	RED TAG ITEMS	15
9.	GREEN TAG ITEMS.....	15
10.	ANNEX A - INTERFACE DRAWINGS.....	16

References

Applicable Documents

AD1	SPIRE-RAL-PRC-002807	Warm units electrical integration procedure.
AD2	SAP-SPIRE-CB-0120-03	DCU QM1 and FCU QM1 packaging, unpacking and handling procedure

Reference Documents

1. INTRODUCTION

2. SCOPE

This document describes the procedures to be followed when handling the SPIRE Warm electronics units after delivery to ESA or Industry.

It covers the handling and mechanical integration procedures to be followed for the following units:

HSDPU Herschel Spire Digital Processor Unit

HSFCU Herschel Spire Focal plane Control Unit

HSDCU Herschel Spire Detector Control Unit

It covers only the PFM units

3. DELIVERY CONDITION

The SPIRE instrument warm units will be delivered in the following condition:-

The units will be supplied in dedicated, re-useable, containers.

Within these containers the units will be double bagged in dissipative film.

3.1 Shock recorders

Attached to the outside of the transportation containers are shock indicators

Upon inspection, if any of these recorders have triggered the project team at RAL should be informed.

4. TRANSPORT

4.1 In dedicated experiment containers

Protect from rain and moisture.

Transport in closed vehicles only.

Protect from extremes of temperature, -10°C to +50°C, and prevent the formation of dew at any time.

4.2 After integration on the spacecraft (in spacecraft container)

Equivalent to Cleanroom 10,000 conditions.

No other specific requirement.

5. STORAGE

5.1 In dedicated experiment container

Protect from rain and moisture.

Protect from extremes of temperature, 10°C to +30°C.

5.2 Out of container (in RR100 cleanroom, awaiting integration)

No specific requirement.

6. HANDLING

6.1 General.

The SPIRE warm electronics units are typical of any spacecraft electronics units with the normal handling requirements.

These units are ESD sensitive.

6.2 ESD protection

All the units are sensitive to ESD.

In particular, the SPIRE DCU contains very sensitive detector electronics that are susceptible to damage by Electro Static Discharge.

On delivery all connectors will be protected by conductive covers.

When handling, all personnel shall wear anti static protection (wrist straps or other suitable method)

6.3 Unpacking from dedicated experiment container.

Allow the container to stand for 24 hours after transport so that it can reach room temperature before opening.

Before opening the container, the following checks must be carried:

- Checking of the external condition of the container.
- Checking of the seals integrity.
- Checking the presence of shock detectors and their states (nominal colour: white).

Clean outside of container with a vacuum cleaner and wipe down with isopropyl alcohol.

Move to a semi clean area.

6.3.1 DCU:

Step	Description	Sign off	comments
1	Remove the seals if fitted to the container.		
2	Open the container.		
3	Inspect the condition of the inside of the container.		
4	Vacuum any debris from the outer film covering.		
5	Remove the outer film covering.		

6	The units are fitted to base plates within the containers Undo the base plate fixings and remove the unit and base plate from the container.		
7	Close the container and store it in a suitable location.		
8	The Flight units can now be transferred to a clean area.		
9	Connect the base plate to an electrical ground		
10	Remove the inner film covering from the top of the unit.		
11	Check of the external condition of the units.		
12	Transfer the ground wire to the earth stud on the unit.		
13	Undo the 12 fasteners and remove the unit from the base plate.		
14	Store ready for integration.		
15	Record the operations in the logbook.		

6.3.2 FCU:

Step	Description	Sign off	comments
1	Remove the seals if fitted to the container.		
2	Open the container.		
3	Inspect the condition of the inside of the container.		
4	Vacuum any debris from the outer film covering.		
5	Remove the outer film covering.		
6	The units are fitted to base plates within the containers Undo the base plate fixings and remove the unit and base plate from the container.		
7	Close the container and store it in a suitable location.		
8	The Flight units can now be transferred to a clean area.		
9	Connect the base plate to an electrical ground		
10	Remove the inner film covering from the top of the unit.		
11	Check of the external condition of the units.		
12	Transfer the ground wire to the earth stud on the unit.		
13	Undo the 12 fasteners and remove the unit from the base plate.		
14	Store ready for integration.		
15	Record the operations in the logbook.		

6.3.3 DPU:

Step	Description	Sign off	comments
1	Remove the seals if fitted to the container.		
2	Open the container.		
3	Inspect the condition of the inside of the container.		
4	This unit is double bagged and supported in foam packing. Remove the unit from the box.		
5	Vacuum any debris from the outer bag.		
6	Transfer to a clean room.		

7	Remove the inner bagging material.		
8	Attach a ground wire to the grounding stud.		
9	Check of the external condition of the units		
10	Close the container and store it in a suitable location.		
11	Record the operations in the logbook.		

6.4 Preparation for integration.

Cable tie bases to be attached to the DCU and FCU at locations defined. Black surface finish has been omitted from these areas. This is an industry activity.

6.5 Preparation for packing.

6.5.1 DCU:

Fit the lifting handles.

Fit protective conductive caps to all connectors.

6.5.2 FCU:

Fit the lifting handles.

Fit protective conductive caps to all connectors.

6.5.3 DPU:

Fit protective conductive caps to all connectors.

6.6 Packing in containers.

6.6.1 DCU:

In a clean area.

Step	Description	Sign off	comments
1	Position a layer of dissipative film on the base plate large enough to cover the whole unit.		
2	Position unit on base plate		
3	Fit attachment screws through the film		
4	Attach grounding strap.		
5	Wrap the unit with the layer of film attached to the base.		
6	The bagged unit can now be moved to a less clean area.		
7	Inspect the condition of the inside of the container		
8	Vacuum any debris from the container.		
9	Fit the unit and base plate to the container base		
10	Cover with another clean dissipative film and tape to the base plate		

11	Close the container and store it in a suitable location.		
12	Fit seals to the catches.		
13	Record the operations in the logbook.		

6.6.2 FCU:

In a clean area.

Step	Description	Sign off	comments
1	Position a layer of dissipative film on the base plate large enough to cover the whole unit.		
2	Position unit on base plate		
3	Fit attachment screws through the film		
4	Attach grounding strap.		
5	Wrap the unit with the layer of film attached to the base.		
6	The bagged unit can now be moved to a less clean area.		
7	Inspect the condition of the inside of the container		
8	Vacuum any debris from the container.		
9	Fit the unit and base plate to the container base		
10	Cover with another clean dissipative film and tape to the base plate		
11	Close the container and store it in a suitable location.		
12	Fit seals to the catches.		
13	Record the operations in the logbook.		

6.6.3 DPU:

In a clean area.

Step	Description	Sign off	comments
1	Wrap the unit in a layer of dissipative film.		
2	Transfer to a less clean area if desired.		
3	Wrap the unit in a second layer of film.		
4	Inspect the condition of the inside of the container.		
5	Vacuum any debris from the container as necessary.		
6	Place the unit in the container, making sure that it is well supported by the foam packing.		
7	Close the container.		
8	Fit seals to the latches.		
	Record the operations in the logbook.		

7. INTEGRATION

7.1 Required tools/MGSE

SPIRE supplied tools/MGSE:-

Antistatic bagging material for repacking
Shock detectors

Supplied by spacecraft

Isopropyl alcohol
Earth conductor wrist straps
Fixation bolts, see below
Torque wrench to cover 1.5 to 8.25 Nm
Allan key, spanners etc
DVM for electrical isolation testing

7.2 Mechanical integration to spacecraft.

All the warm electronics units are mounted to the SVM panel with a number of standard fasteners as follows:

UNIT and Model	Fastener size	Qty
DPU FM	M4	6
DCU FM	M4	12
FCU FM	M5	12

7.2.1 DCU:

This unit is supplied with lifting handles.

This unit should be connected to a ground wire at all times until it is attached to the grounded SC panel.

Assuming step 6.3.1 has been completed

Step	Description	Sign off	comments
1	Lift unit with its handles to an ESD safe area.		
2	Inspect the unit for damage including all connector pins/sockets		
3	Replace connector caps and leave in place until harness mating		
4	Check bottom of the unit for any damage to mounting feet/surfaces		
5	Lift unit with handles and place on the SVM panel.		
6	Fit 12 off fasteners do not tighten fully at this stage		
7	Tighten fasteners to the specified torque, tightening opposite pairs of screws in sequence.		
8	Remove temporary grounding wire and connect the Flight ground strap to the M4 stud on the unit.		

9	Torque to 3 Nm		
10	Remove lifting handles, by removing the two M5 nuts and extracting the handle – NOTE the two blocks to which the handles are attached are now unrestrained and free to drop off. Care must be taken to avoid this.		

7.2.2 FCU:

This unit is supplied with lifting handles.

This unit should be connected to a ground wire at all times until it is attached to the grounded SC panel.

Assuming step 6.3.1 has been completed

Step	Description	Sign off	Comments
1	Lift unit with its handles to an ESD safe area.		
2	Inspect the unit for damage including all connector pins/sockets		
3	Replace connector caps and leave in place until harness mating		
4	Check bottom of the unit for any damage to mounting feet/surfaces		
5	Lift unit with handles and place on the SVM panel.		
6	Fit 12 off fasteners do not tighten fully at this stage		
7	Tighten fasteners to the specified torque, tightening opposite pairs of screws in sequence.		
8	Remove temporary grounding wire and connect the Flight ground strap to the M4 stud on the unit.		
9	Torque to 3 Nm		
10	Remove lifting handles, by removing the two M5 nuts and extracting the handle – NOTE the two blocks to which the handles are attached are now unrestrained and free to drop off. Care must be taken to avoid this.		

7.2.3 DPU:

This unit should be connected to a ground wire at all times until it is attached to the grounded SC panel.

Step	Description	Sign off	Comments
1	Transfer the unit to an ESD safe area.		
2	Inspect the unit for damage including all connector pins/sockets		
3	Replace connector caps and leave in place until harness mating		
4	Check bottom of the unit for any damage to mounting feet/surfaces		
5	Lift unit and place on the SVM panel.		
6	Fit 6 of fasteners do not tighten fully at this stage		
7	Tighten fasteners to the specified torque, tightening opposite pairs of screws in sequence.		

8	Remove temporary grounding wire and connect the Flight ground strap to the M5 stud on the DPU.		
9	Torque to 4 Nm		

7.3 Electrical integration

Refer to AD1 for electrical integration procedures.

7.4 Removal from spacecraft.

7.4.1 DCU:

Step	Description	Sign off	Comments
1	Assuming the electrical disconnection has taken place		
	Ensure connector caps are fitted		
2	Fit lifting handles,		
3	Remove the Flight ground strap and connect the temporary grounding wire		
4	Loosen all fixation screws (12 off)		
5	Remove the 12 of fasteners		
6	Lift unit with handles from the SVM panel.		
7	Inspect the unit for damage including all connector pins/sockets		

7.4.2 FCU:

Step	Description	Sign off	comments
1	Assuming the electrical disconnection has taken place		
	Ensure connector caps are fitted		
2	Fit lifting handles,		
3	Remove the Flight ground strap and connect the temporary grounding wire		
4	Loosen all fixation screws (12 off)		
5	Remove the 12 of fasteners		
6	Lift unit with handles from the SVM panel.		
7	Inspect the unit for damage including all connector pins/sockets		

7.4.3 DPU:

Step	Description	Sign off	comments
1	Assuming the electrical disconnection has taken place		
2	Ensure connector caps are fitted		
3	Remove the Flight ground strap and connect the temporary		

	grounding wire		
4	Loosen all fixation screws (6 off)		
5	Remove the 6 off fasteners		
6	Lift unit from the SVM panel.		
7	Inspect the unit for damage including all connector pins/sockets		

8. RED TAG ITEMS

Connector covers are fitted to all connectors
Lifting handles are fitted to the DCU and FCU

9. GREEN TAG ITEMS

There are no green tag items

SPIRE

Project Document

SPIRE Warm Electronics Handling and
Mechanical Integration Procedure

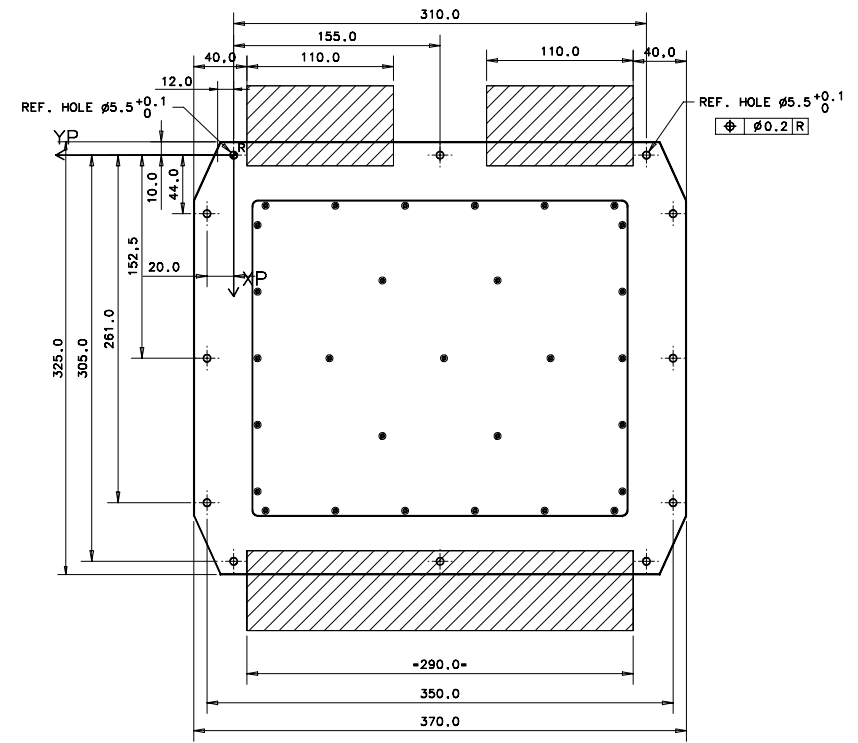
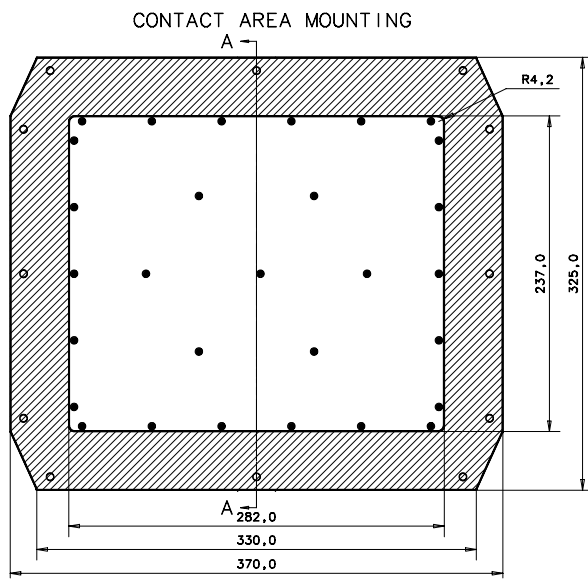
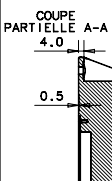
Ref: SPIRE-RAL-PRC-
002808

Issue: 1

Date: 22 January 2007

Page: 16 of 19

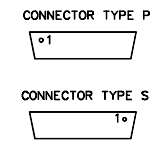
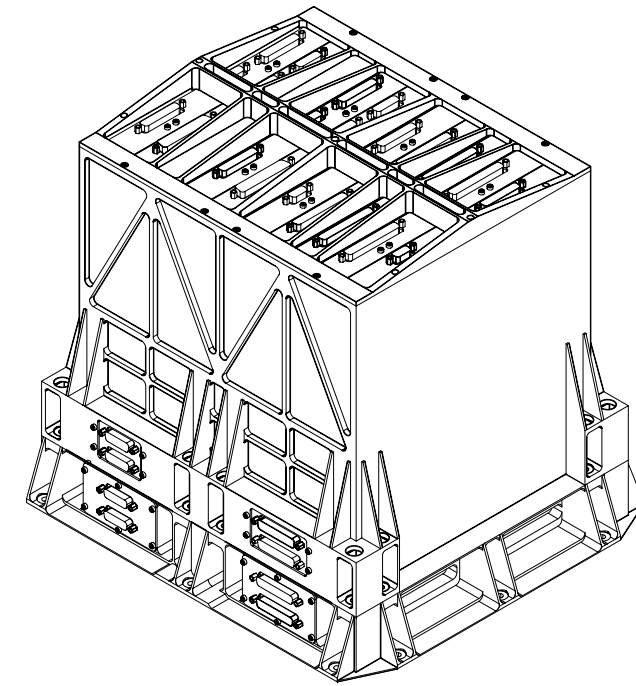
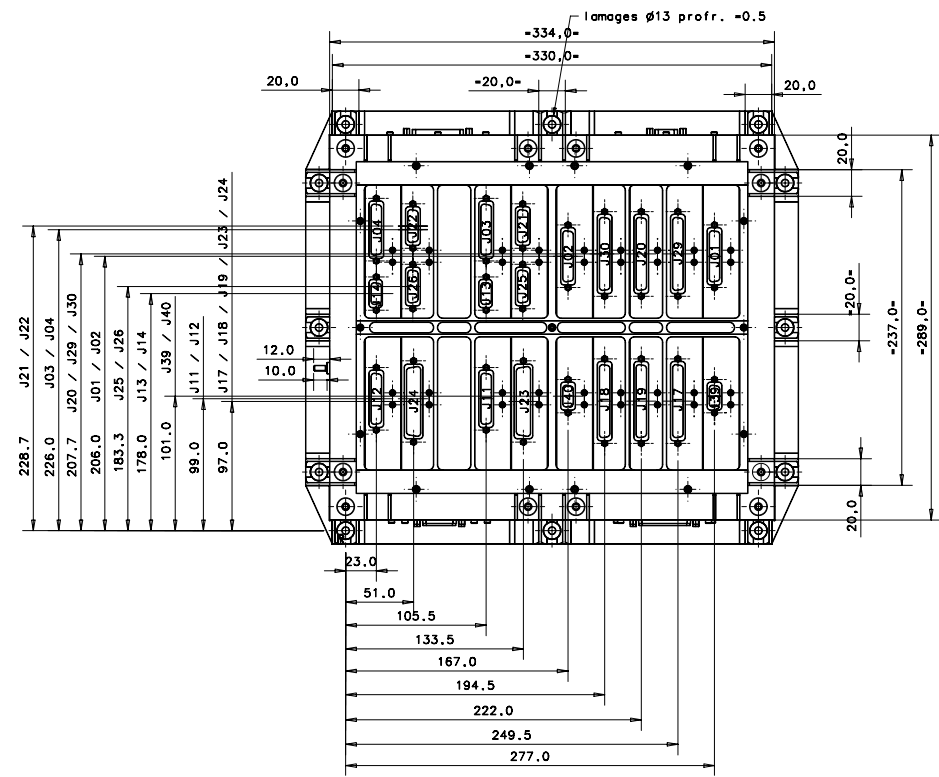
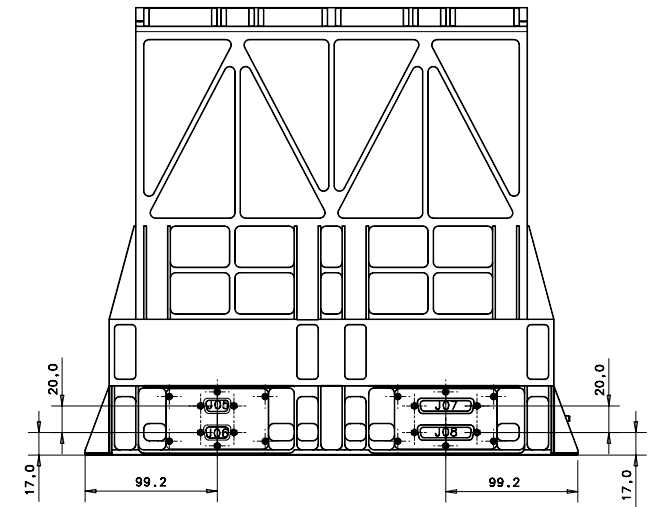
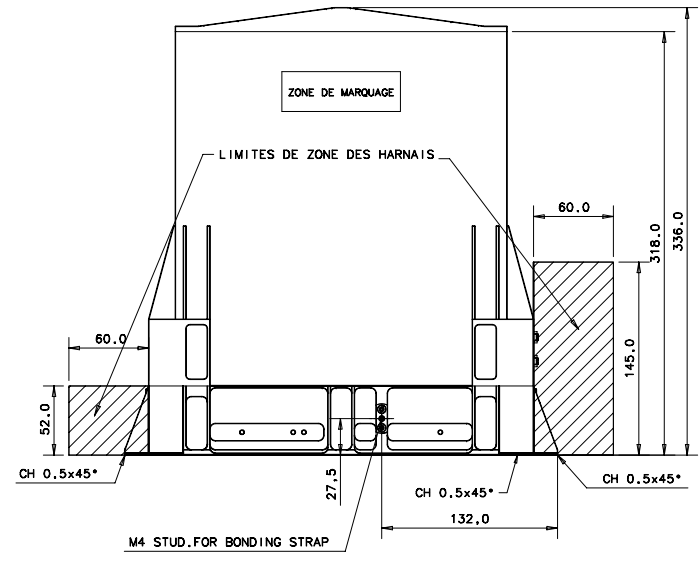
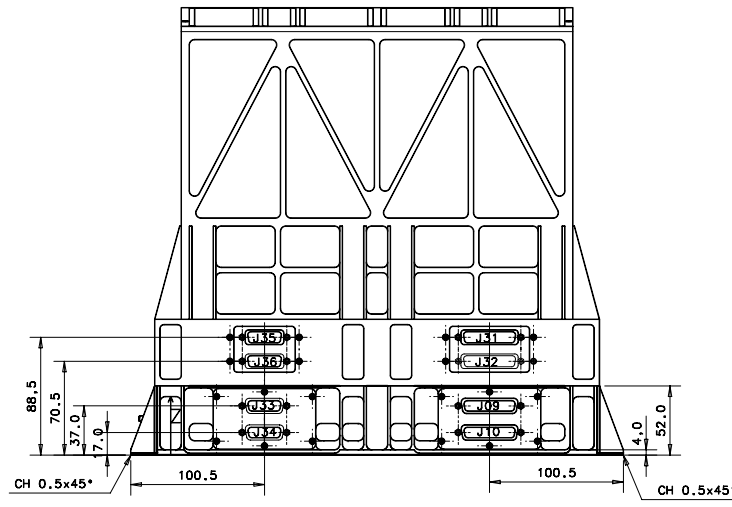
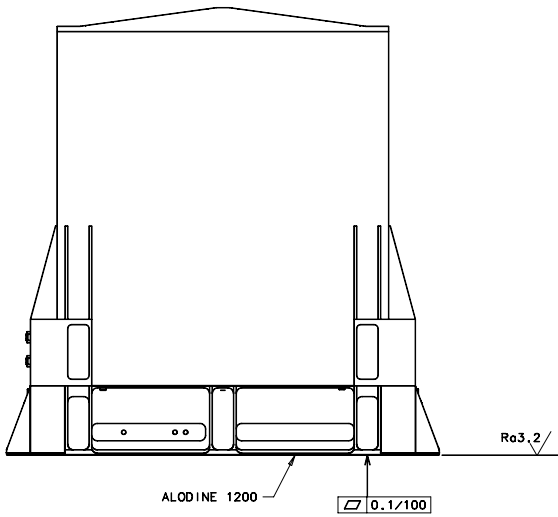
10. ANNEX A - INTERFACE DRAWINGS



NOTES

MATERIAL AL 6082
 CENTRE OF GRAVITY REFERRED TO REFERENCE HOLE
 X=148,8mm Y=-153mm Z=138,5mm
 MOMENTS OF INERTIA REFERRED TO CENTRE OF GRAVITY
 JX=0.338 Kg.m² JY=0.318 Kg.m² JZ=0.282 Kg.m²
 CONTACT AREA MOUNTING FEET=51656mm²
 THERMAL COATING AND BLACK ANODISING ESA,PSS,703
 SURFACE EMISSIVITY >0.85
 TORQUE VALUE FOR CONNECTOR FIXATION SCREWS=
 -MALE=0,3mN
 -FEMALE=0,45mN
 ESTIMATED MASS=16254g
 CP=1170j/kg.*K

CONNECTORS					
IDENT	TYPE	INTERFACE NAME	IDENT	TYPE	INTERFACE NAME
J01	DBMA 25S	MAC-M/DPU-M	J21	DAMA 15S	TEMP-M/FPU-TS-1-M
J02	DBMA 25S	MAC-R/DPU-R	J22	DAMA 15S	TEMP-R/FPU-TS-1-R
J03	DBMA 25S	CCHK-IF-M/DPU-M	J23	DDMA 50S	TEMP-M/FPU-TS-2-M
J04	DBMA 25S	CCHK-IF-R/DPU-R	J24	DDMA 50S	TEMP-R/FPU-TS-2-R
J05	DEMA 9P	PSU-M/PCDU-M	J25	DAMA 15S	TEMP-M/FPU-MEC-TS-M
J06	DEMA 9P	PSU-R/PCDU-R	J26	DAMA 15S	TEMP-R/FPU-MEC-TS-R
J07	DBMA 25S	PSU-M/DCU	J27	NA	NA
J08	DBMA 25S	PSU-R/DCU	J28	NA	NA
J09	DBMA 25S	PSU-M/MCU-M	J29	DCMA 37P	SMEC-M/FPU-SMECm-2-M
J10	DBMA 25S	PSU-R/MCU-R	J30	DCMA 37P	SMEC-R/FPU-SMECm-2-R
J11	DBMA 25S	CCHK-IF-M/FPU-COOL-CAL-M	J31	DBMA 25P	MCU-M/PSU-M
J12	DBMA 25S	CCHK-IF-R/FPU-COOL-CAL-R	J32	DBMA 25P	MCU-R/PSU-R
J13	DEMA 9S	CCHK-IF-M/FPU-PH-STIM-M	J33	DAMA 15S	PSU-M/SCU-M
J14	DEMA 9S	CCHK-IF-R/FPU-PH-STIM-R	J34	DAMA 15S	PSU-R/SCU-R
J15	NA	NA	J35	DAMA 15P	SCU-M/PSU-M
J16	NA	NA	J36	DAMA 15P	SCU-R/PSU-R
J17	DCMA 37S	SMEC-M/FPU-SMECm-1-M	J37	NA	NA
J18	DCMA 37S	SMEC-R/FPU-SMECm-1-R	J38	NA	NA
J19	DCMA 37S	BSM-M/FPU-BSM-M	J39	DEMA 9S	MAC-H/JTAG
J20	DCMA 37S	BSM-R/FPU-BSM-R	J40	DEMA 9S	MAC-R/JTAG



Indice	Modifications	Date	Dessiné par	Vérifié par	Approuvé par
K	Mise à jour	08/04	DHENAIN		
J	Mise à jour	01/04	DHENAIN		
I	Modif position CdG	12/03	DHENAIN		
H	Mise à jour	11/03	DHENAIN		
G	Mise à jour	04/03	DHENAIN		
F	Mise à jour	10/02	DHENAIN		
E	Mise à jour connecteurs	09/02	DHENAIN		
D	Mise à jour	07/02	DHENAIN		
C	Mise à jour	06/02	DHENAIN		
B	Mise à jour	05/02	DHENAIN		
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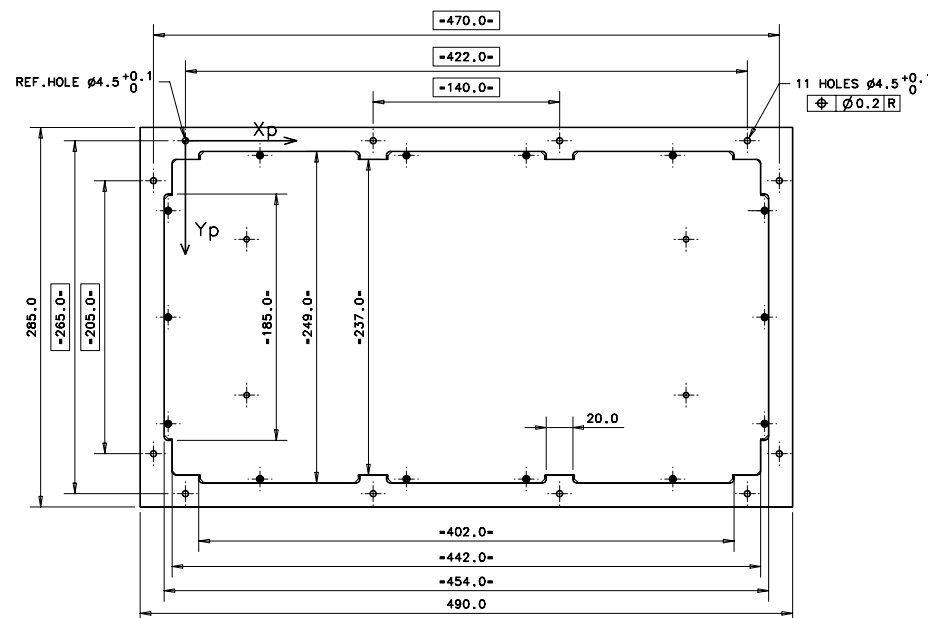
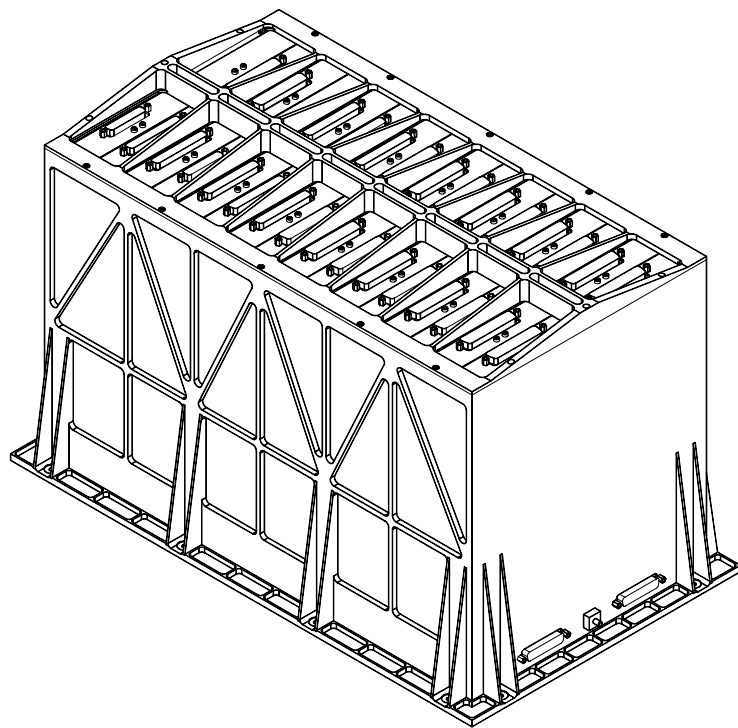
Spécifications particulières

Tolérances générales	Indice de rugosité général	SOUS-TRAITANT
±0.1	Tol.ang.:	
±0.2	Casser les angles vifs	

Matière: Protection

Traitement thermique: Echelle Poids Niveau qualité 1/2

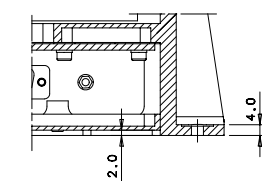
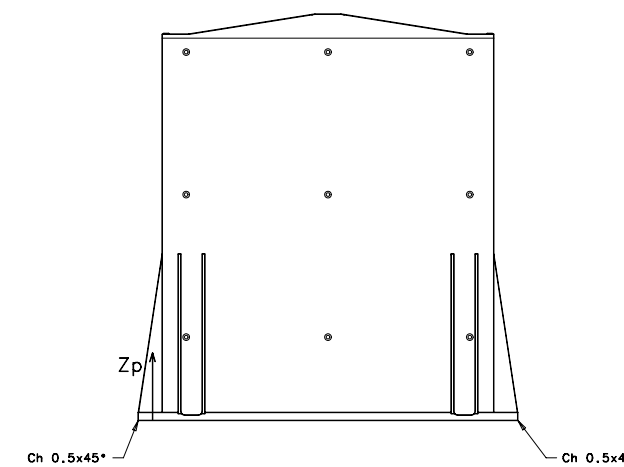
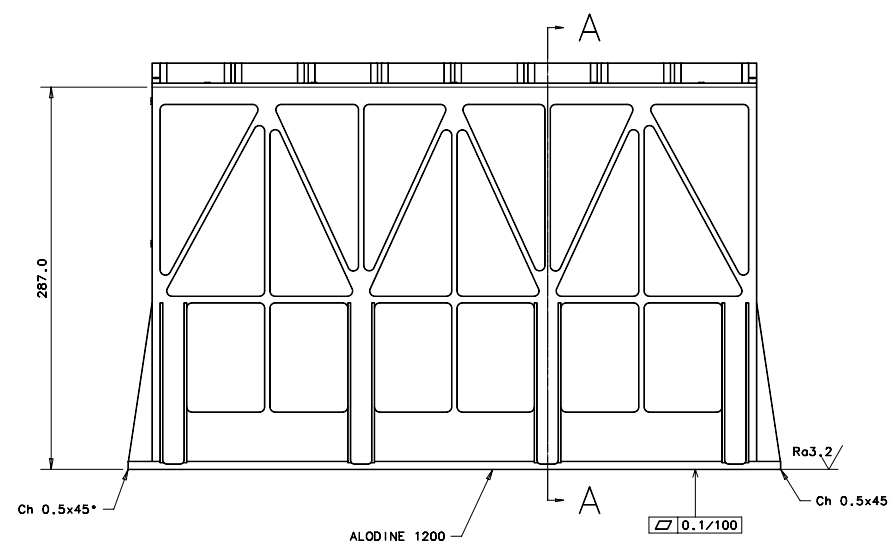
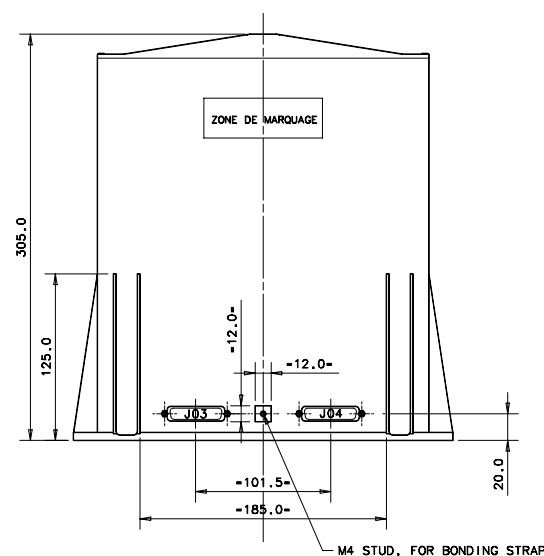
SPIRE
FCU ELECTRONIC BOX
MECHANICAL INTERFACE CONTROL DRAWING



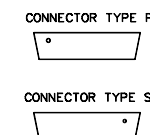
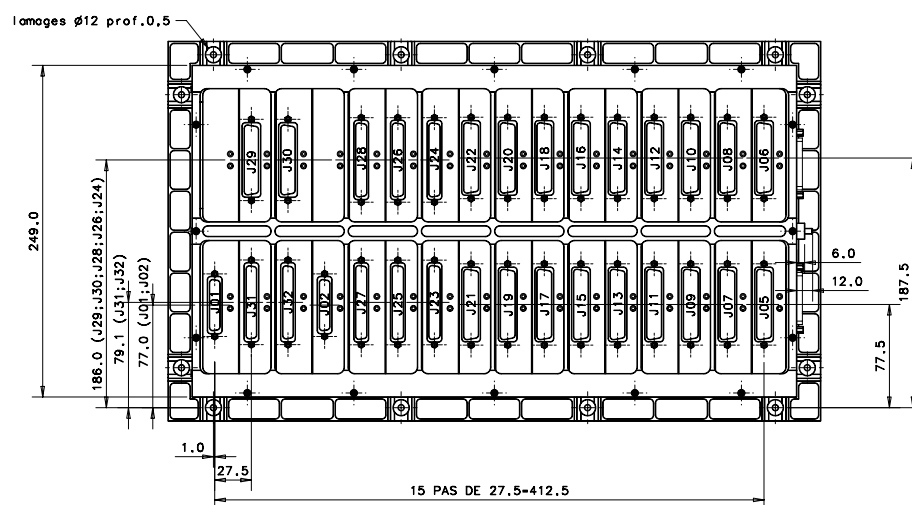
CONNECTORS					
IDENT	TYPE	FUNCTIONS	IDENT	TYPE	FUNCTIONS
J01	DBMA 25S	DAQ_IF_M/DPU_M	J17	DDMA 50P	LIA_P_7/FPU
J02	DBMA 25S	DAQ_IF_R/DPU_R	J18	DDMA 50P	LIA_P_7/FPU
J03	DBMA 25P	DCU/PSU_M	J19	DDMA 50P	LIA_P_8/FPU
J04	DBMA 25P	DCU/PSU_R	J20	DDMA 50P	LIA_P_8/FPU
J05	DDMA 50P	LIA_P_1/FPU	J21	DDMA 50P	LIA_P_9/FPU
J06	DDMA 50P	LIA_P_1/FPU	J22	DDMA 50P	LIA_P_9/FPU
J07	DDMA 50P	LIA_P_2/FPU	J23	DCMA 37P	LIA_S_1/FPU
J08	DDMA 50P	LIA_P_2/FPU	J24	DCMA 37P	LIA_S_1/FPU
J09	DDMA 50P	LIA_P_3/FPU	J25	DCMA 37P	LIA_S_2/FPU
J10	DDMA 50P	LIA_P_3/FPU	J26	DCMA 37P	LIA_S_2/FPU
J11	DDMA 50P	LIA_P_4/FPU	J27	DCMA 37P	LIA_S_3/FPU
J12	DDMA 50P	LIA_P_4/FPU	J28	DCMA 37P	LIA_S_3/FPU
J13	DDMA 50P	LIA_P_5/FPU	J29	DDMA 78S	BIAS_M/FPU
J14	DDMA 50P	LIA_P_5/FPU	J30	DDMA 78S	BIAS_R/FPU
J15	DDMA 50P	LIA_P_6/FPU	J31	DCMA 37S	BIAS_M/FPU
J16	DDMA 50P	LIA_P_6/FPU	J32	DCMA 37S	BIAS_R/FPU

NOTES

MATERIAL AL 6082
 CENTRE OF GRAVITY REFERRED TO REFERENCE HOLE
 X=213.2mm Y=132.4mm Z=157.9mm
 MOMENTS OF INERTIA REFERRED TO CENTRE OF GRAVITY
 JXp=0.471 Kg.m² JYp=0.250 Kg.m² JZp=0.444 Kg.m²
 CONTACT AREA MOUNTING FEET=28180mm²
 THERMAL COATING AND BLACK ANODISING ESA.PSS.703
 SURFACE EMISSIVITY >0.85
 TORQUE VALUE FOR CONNECTOR FIXATION SCREWS=
 - MALE=0.3mN
 - FEMALE=0.45mN
 SPECIFIC HEAT 1170 J/Kg.*K
 ESTIMATED MASS=14442g



COUPE PARTIELLE A-A
 ECHELLE:1/1



Indice	Modifications	Date	Dessiné par	Vérifié par	Approuvé par
A	Origine	11/01	DHENAIN

Spécifications particulières					
G	Mise à jour	08/04	DHENAIN		
F	Mise à jour	06/04	DHENAIN		
E	Mise à jour	01/04	DHENAIN		
D	Ajout coupe A-A	10/02	DHENAIN		
C	Mise à jour	09/02	DHENAIN		
B	Mise à jour	06/02	DHENAIN		
A	Origine	11/01	DHENAIN		

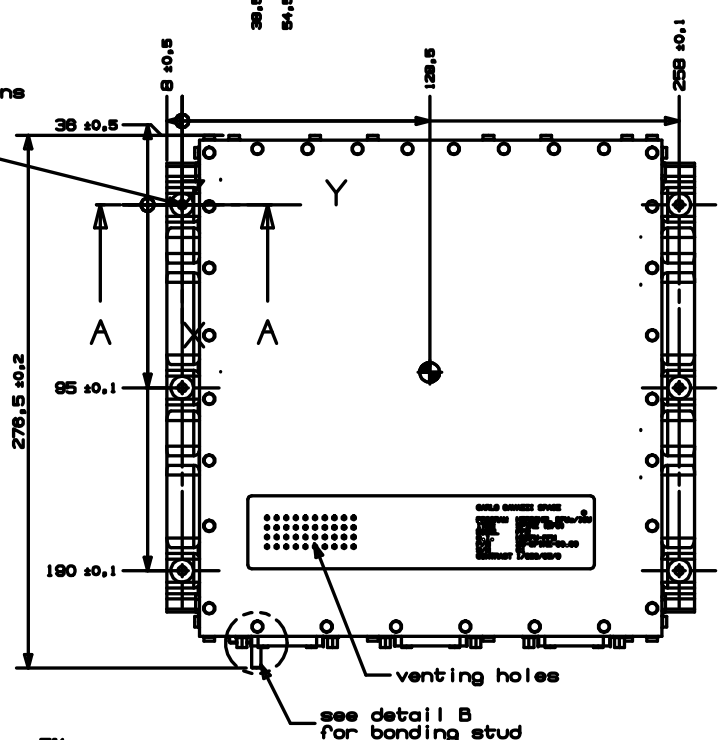
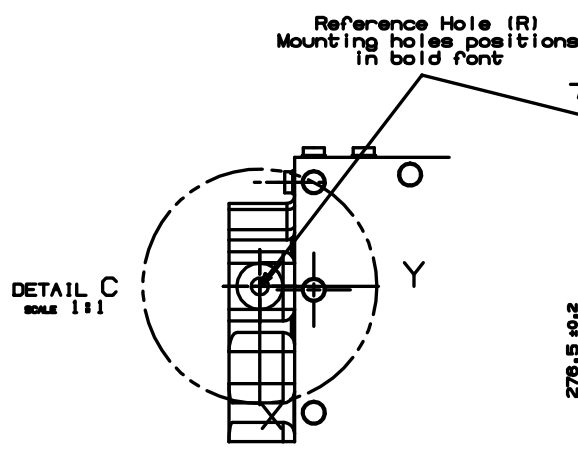
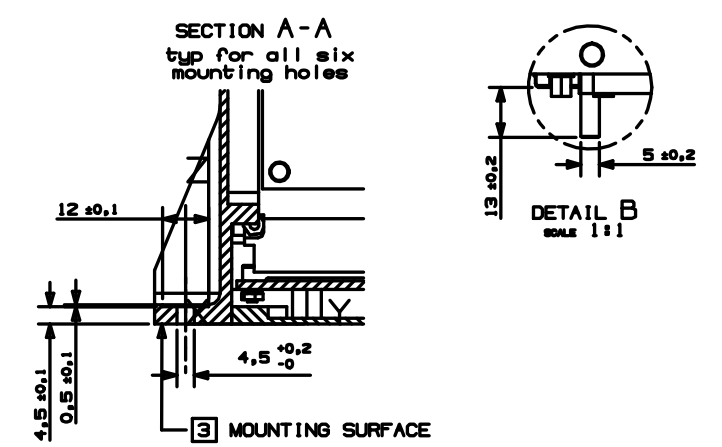
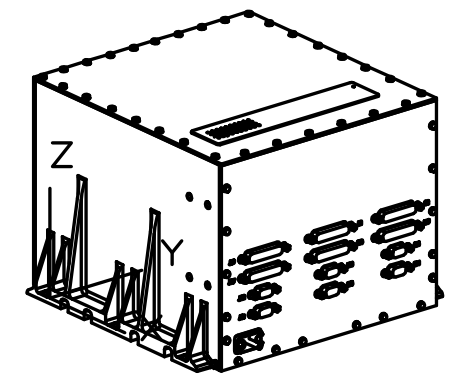
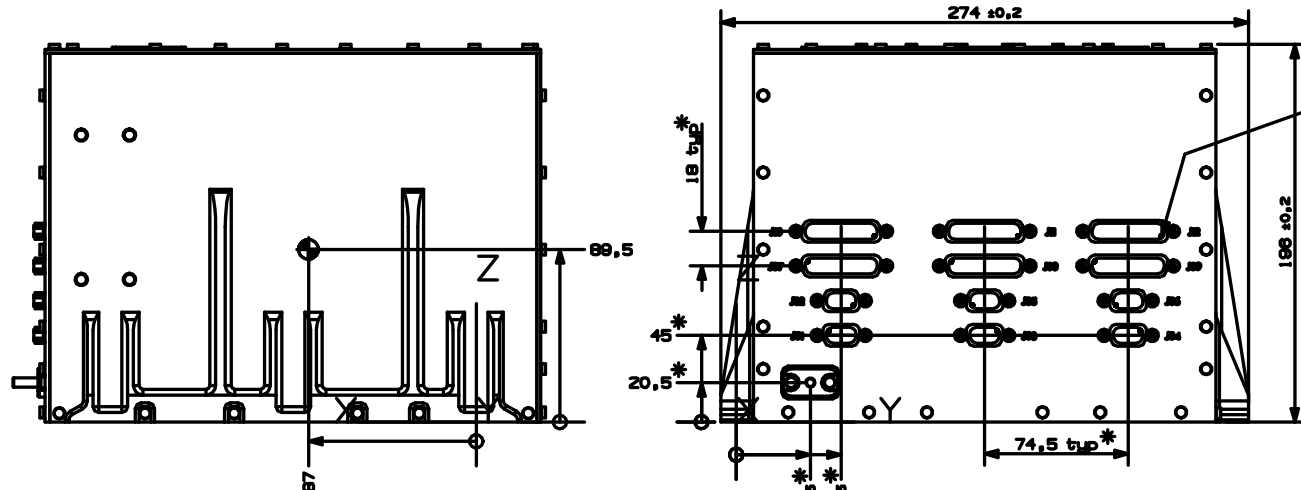
Matériau: Protection
 Traitement thermique: Echelle Poids Niveau qualité
 1/2

SPIRE
HSDCU ELECTRONIC BOX
MECHANICAL INTERFACE CONTROL DRAWING

Il n'est permis d'utiliser ce dessin qu'avec licence spéciale ou autorisation expresse - loi du 11 mars 1957

SAP/GERES COMMISSARIAT A L'ENERGIE ATOMIQUE C.E.N. SACLAY
 Tel:01.69.08.78.25
 01.69.08.59.78
 Fax:01.69.08.79.96

AO SPIR-MX-5100 000 G



ID	P/N	Function
J01	3401002 01B DEMAGP NMBFO	from DPU Prime to PDU Prime
J02	3401002 01B DEMAGP NMBFO	from DPU Red. to PDU Red.
J03	3401002 01B DEMAGS NMBFO	from DPU Prime to Bus A Prime
J04	3401002 01B DEMAGS NMBFO	from DPU Prime to Bus B Prime
J05	3401002 01B DEMAGS NMBFO	from DPU Red. to Bus A Red.
J06	3401002 01B DEMAGS NMBFO	from DPU Red. to Bus B Red.
J07	3401002 01B DEMAZSP NMBFO	from DPU Prime to DCU Prime
J08	3401002 01B DEMAZSP NMBFO	from DPU Prime to MCU Prime
J09	3401002 01B DEMAZSP NMBFO	from DPU Red. to DCU Red.
J10	3401002 01B DEMAZSP NMBFO	from DPU Red. to MCU Red.
J11	3401002 01B DEMAZSP NMBFO	from DPU Red. to SCU Red.
J12	3401002 01B DEMAZSP NMBFO	from DPU Red. to SCU Red.

- NOTES:**
- OVERALL DIMENSION:
 X : 276.5 mm
 Y : 274 mm
 Z : 196 mm
 - GENERAL ASSEMBLY TOLERANCE ±0.2 mm
 - MOUNTING SURFACE (Lateral Walls):
 CONTACT AREA: 8000 mm² (Calculated only)
 FLATNESS: less than 0.1mm/100mm
 ROUGHNESS: less than 3.2 micron
 - INDICATES THE CENTRE OF GRAVITY ±5%
 - MASS (NOT INCLUDING MOUNTING HARDWARE): 7.24 Kg ± 5%
 - EMISSION: > 0.8 (OUTER WALLS)
 - POWER DISSIPATION: MAX 14.6 W ± 0.5 W
 - MATERIALS:
 WALLS : AL 7075 T7351 QQ-A-250/12 or EQUIVALENT
 BONDING STUD : AISI 316 PASSIVATION ACCORDING TO QQ-P-35
 - MAX TORQUE ON BONDING STUD M5: 4 Nm
 - MAX TORQUE ON CONNECTORS: 0.3 Nm
 - SURFACE TREATMENT:
 WALLS : BLACK ANODIZE ACCORDING TO MIL-A-8625 TYPE III CLASS 2
 BASEPLATE : ALODINE I200 MIL-C-5541 CLASS 3
 - NO EIGEN MODES WITH FREQUENCY LOWER THAN 140Hz AND EFFECTIVE ASSOCIATED MASS HIGHER THAN 5% PRESENT IN INSTALLED CONFIGURATION (Analysis Results)
 - * INDICATES CONNECTOR PIN 1
 - * DIMENSION INDICATED FOR INFORMATION ONLY AND NOT SUBJECTED TO VERIFICATION

FILE MODEL: herchehel_casej_rev06
 FILE DRAWING: pfm_10d_ap1rev0.dwg

REV	DOWN	DATE	CHECK	DATE	CHECK	DATE	REV	DATE	PA	DATE	CHK	DATE	CHK	DATE	CHK	DATE	CHK	DATE

DESIGNED BY: CARLO GAVAZZI SPACE
 DRAWING TITLE: HERSCHEL SPIRE (DPU) INTERFACE CONTROL DOCUMENT
 APPLICATION: A2
 PART NUMBER: 20-SPIRE-00.02
 SHEET 1 OF 1
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