EADS astrium

Procedure

Herschel

Title: **MECHANICAL & THERMAL INTEGRATION OF SPIRE WARM UNITS**

CI-No: 125 200

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Issue	Date	Sheet	Description of Change	Release
1	28.02.2007	All	Initial Issue	

Table of Contents

Table of Figures

List of Tables

1 Scope

This document describes the mechanical and thermal integration activities for the HERSCHEL PFM SPIRE warm units onto the SVM Instrument Panels -Z (SPIRE and CCU, Panel 7).

It summarises the nominal integration flow, test configuration, integration constraints, GSE set up and the step by step procedure.

The assembly and quality verification of H/W components be delivered in pre-integrated status will be performed according separate procedures provided by suppliers and are not part of this procedure.

The document is built up as a step by step procedure.

1.1 Objectives

The objective of this procedure is:

- to check all inputs before integration
- to define the self-locking and final torque moments for fasteners
- to provide all parts for defined unit integration
- to integrate the unit according procedure
- to measure the bonding resistance
- to close out the integration / removal activity
- generate the relevant report

1.2 Integration Flow

	-Z Panel
1	HSDCU
2	HSFCU
3	HSDPU

The sequence of the integration steps for the equipment listed above is not mandatory but preferable.

The integration in coarse steps:

- verify unit Serial-No allocation as defined by System Engineering (if not unique)
- Visual inspection of structure and unit
- Prepararation of mechanical set-up and MGSE
- Preparation of components to be integrated (unit, Sigraflex, fixation elements, bond strap etc.)
- Installation of instrumentation (thermocouples, accelerometers if applicable)

- Determination of mass of items to be integrated
- Preparation of bonding measurement equipment
- Fixation of the Sigraflex with two guiding pins
- Integration of unit according step by step instruction onto structure (Orientation acc. Ref.-hole)
- Check of flatness of interface between unit and structure
- Bonding measurement
- Check completeness

2 Documents/Drawings

The following documents of the latest issue in effect or as defined herein form a part of this document to the extent specified herein.

2.1 Applicable Documents

AD 1	SPIRE Warm Electronics Handling and Mechanical Integration Procedure	SPIRE-RAL-PRC-002808
AD 2	SPIRE Mechanical Interface Drawings (Annex 1)	SCI-PT-IIDB/SPIRE-02124
AD 3	SPIRE panel interface	HP00HD0000P05 sheet 44
AD 4	-Z lateral panel assy (SPIRE)	0200HP003 – sheet1/3/4/5/
AD 5	ESD rules for Herschel PLM & S/C Integration Activities	HP-2-ASED-PR-0062, tbi
AD 6	Red/Green-Tag Item List for Herschel EPLM; Living List	HP-2-ASED-LI-0027
AD 7	Herschel PFM Warm Units Mechanical Integration Specification (including ASED comments, FX-0017-07)	HP-2-ASP-SP-1009
AD 8	PA Plan	HP-2-ASED-PL-0007
AD 9	Contamination Control Plan	HP-2-ASED-PL-0023

2.2 Reference Documents

RD 1	Documentation Identification Procedure and Documentation Management	HP-2-ASED-PR-0001

2.3 Abbreviations

For abbreviations see RD 01

3 Configuration

3.1 Initial H/W Configuration

It is assumed that, prior to the integration of the warm units; the Warm Interconnecting Harness (WIH) has been integrated on the SVM panel.

- Warm units placed in clean room class 100 000 in upright position on an ESD capable table.
- All connectors are covered by safety connectors and black ESD capable dust caps
- -Z panel installed on Panel Tilting Trolley (PTT) with inner surface upwards and grounded.
- Instrumentation with Tie-bases, thermocouples or accelerometer if applicable finished

4 Conditions

4.1 Personnel

Personnel necessary to complete activities according to this present procedures

Responsibility	Name / Organisation
Operator	*)
Operator	*)
Operator	*)
PA Responsible	*)

*) Names and possible additional personal are to be registered prior to the integration activities.

4.2 Environmental

Cleanliness: class 100 000

Temperature: 22°C ± 3°C

Pressure: ambient

Rel. humidity: 40 % - 60 %

4.3 General Instructions for Integration

4.3.1 General Safety Requirements, Precautions

- Respect of the standard technical rules for mechanical and electrical integration and test activities are sufficient.
- Special hazard precautions are not expected, except for the comments mentioned in the step by step procedure for the relevant item
- The flight H/W has to be handled by authorized personnel only

- During non integration phase the flight H/W has to be protected against contamination by appropriate means like blind flanges, caps or protective foils

The following tasks have to be regarded before start of any integration/test activity:

- IRR has been successfully held to ensure that the relevant procedures, drawings, applicable documents are available, reviewed and approved
- Formal release to start with activity is given by QA
- The necessary GSE and H/W is available, accepted and applicable for use
- Safe working conditions for personnel and H/W are existing and will be applied
- Skilled and authorized personnel is available
- Incoming inspection of H/W have been performed by QA and engineering

4.3.2 QA Requirements

QA shall monitor all operations (handlings, transportation and installation) as necessary to assure compliance with this procedure and the applicable sections of the PA Plan (AD 8).

In the course of this procedure QA shall pay particular attention to

- ensure adequate cleanliness conditions
- ensure that all safety aspects are considered
- the application of adequate protections to critical surfaces
- the records in the log sheet
- to ensure that tools and test equipment used is within current calibration cycle

4.3.3 ESD constraints

During all handling activities of the SPIRE warm unit's attention should be paid to AD 5 (ESD rules for Herschel PLM & S/C Integration Activities)

NOTE: for SPIRE warm units:

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)

4.4 GSE

All GSE and integration equipment is fit checked and carries valid calibration certificates.

4.4.1 MGSE

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
	Set of tools	ASED		
	Torque wrench to cover 1.5 to 8.25 Nm	ASED		
	Allan key, spanners etc	ASED		
	Panel Tilting Trolley	Alenia		
	Isopropyl alcohol	ASED		

Table 4-1: MGSE

4.4.2 EGSE

Qty.	Designation/Manufacturer	Provided by	Drawing/Ident. NR:	Calibr. Date
	Digital Volt Meter	ASED		
	ESD protection tools	ASED		

Table 4-2: EGSE

4.4.3 OGSE

N/A

4.4.4 Special Integration Equipment

N/A

5 Step by Step Procedure

5.1 General

During handling activities the boxes and personnel must be grounded all along!

5.2 Torque levels

All units to the SVM to be torqued (according HP-2-ASP-SP-1009, AD 7) with:

Type of bolt	self locking torque (Nm)	nominal torque (Nm)	Remarks
M4	0,17 to 0,6	3,0 ± 4%	The self-locking torque shall be measured for each interface point with the screws intended to be used and applied directly in complement of the nominal torque value defined for the considered equipment.
M5	0,22 to 1,1	4,3 ± 4%	The self-locking torque shall be determined by measuring the average value on 10% of the interface points with a minimum of 5 points with the screws intended to be used. This average value shall then add to the nominal torque defined for the considered equipment.
M6	0,4 to 2,0	8,0 ± 4%	

5.2.1 Measurement of the bonding resistance

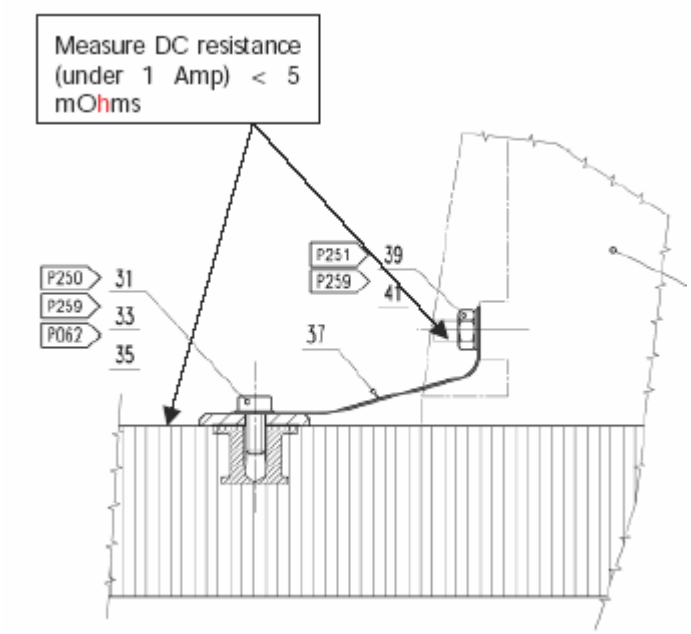
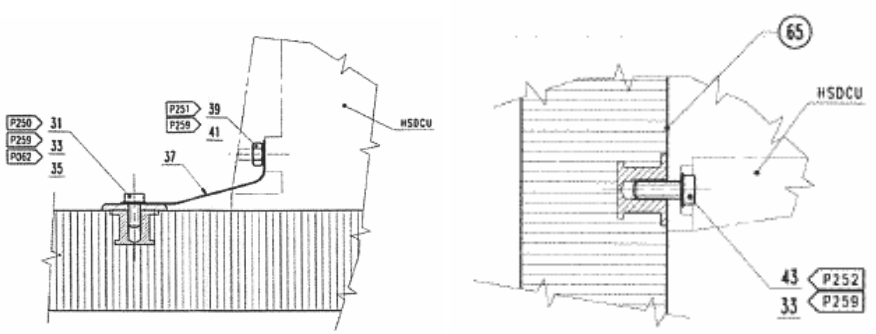


Figure 5.2-1: Measurement of the bonding resistance according to the above mentioned sketch

For the grounding strap, a raw band A5 is delivered by ALENIA, and grounding straps are to be cut to the dimensions needed during AIT integration by ASED. In the principle, all straps are passing above the SVM harness and below the WIH routing on the panels. This rule could be locally adapted to improve installability.

It may be found some interface between HSFCU strap and WIH Tie-rap basis at the same location. This could be overcome either by a re-shape of the grounding strap to pass aside the Tie-bases, or by a re-shape to pass over the harness.

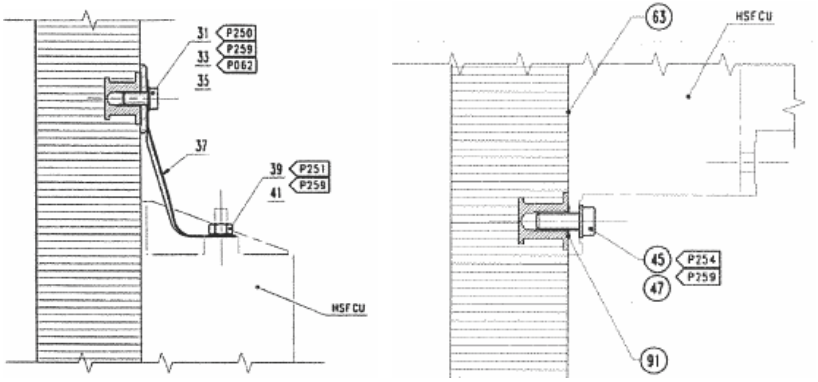
Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
5.3	**Preparation for integration of HSDCU on SVM –Z Instrument Panel (SPIRE and CCU)**						
.1	Presence of Helicoils and good positioning, according to standard criteria						
.2	Visible check of I/Fs (no damages, visible clean)						
.3	Determination of mass of items to be integrated (screws, washers, bond straps, sigraflex, HSDCU)						
.4	Note HSDCU serial number						
.5	Fix the thermal filler by two guiding pins						

Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
5.3.1	***Integration of HSDCU on SVM –Z Instrument Panel***						
.1	 Figure 5.3-1: grounding and fixation sketch for HSDCU						
.2	Lift the HSDCU at the lifting handles to the panel by hand (gloves and ESD wrist strap are mandatory).						
.3	Check clearance at the mounting feet. If the clearance is larger than 0.1 mm, a NCR shall be raised.						
.4	Attach the unit to instrument plate with 12 attachment screws (M4x 12) and washers. Final torque + RT (RT: 0,17 – 0,6 Nm): tightening opposite pairs of screws in sequence.	3 Nm + RT	± 4%				
.5	Measure the grounding strap resistance. The resistance shall be less than 2.5 mΩ under 1 Amp.	< 2.5 mΩ at 1 Amp					
.6	Remove temporary grounding wire and connect the Flight ground strap to the M4 stud on the unit.						

Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
.7	Connect the grounding strap on the unit bonding stud (LN9161-04M) and on the panel dedicated insert (M4x 9). Final torque + RT (RT: 0,17 – 0,6 Nm)	3 Nm + RT 1.8 Nm + RT	± 4% ± 4%				
.8	Measure DC resistance (under 1 Amp) < 5 mΩ	< 5 mΩ at 1 Amp					
.9	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.						
.10	**NOTE**: The removal of the connectors dust caps is not authorised in this mechanical integration phase.						
.11	Second torque of HSDCU after 24 h with final torque from step 3						
.12	Second torque of HSDCU after 48 h with final torque from step 3						
.13	Final visual inspection						

Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
5.4	**Preparation for integration of HSFCU on SVM –Z Instrument Panel (SPIRE and CCU)**						
.1	Presence of Helicoils and good positioning, according to standard criteria						
.2	Visible check of I/Fs (no damages, visible clean)						

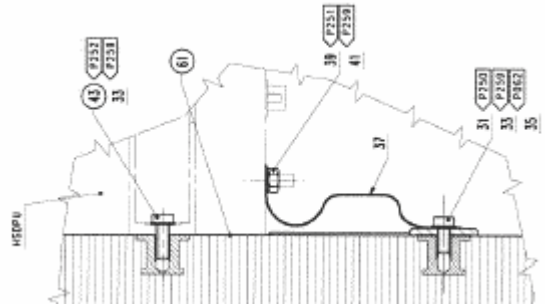
Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
.3	Determination of mass of items to be integrated (screws, washers, bond straps, sigraflex, HSFCU)						
.4	Note HSFCU serial number						
.5	Fix the thermal filler by two guiding pins						
.6	NOTE: Aluminium washers are installed to increase friction coefficient at equipment-to-panel contact. This disposition allows reducing installation torque for these units. A cut is made in thermal filler to allow installation of Aluminium washers. Aluminium washers can be maintained in place before WU mating, with spots of cyano-acrylate type glue (space qualified wrt outgasing criteria).						

Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
5.4.1	***Integration of HSFCU on SVM –Z Instrument Panel***						
.1	 Figure 5.4-1: grounding and fixation sketch for HSFCU						
.2	Lift the HSFCU at the lifting handles to the panel by hand (gloves and ESD wrist strap are mandatory).						
.3	Check clearance at the mounting feet. If the clearance is larger than 0.1 mm, a NCR shall be raised.						
.4	Attach the unit to instrument plate with 12 attachment screws (M5x 14) and washers. Final torque + RT (RT: 0,22 – 1,1 Nm): tightening opposite pairs of screws in sequence.	4,3 Nm + RT	± 4%				
.5	Measure the grounding strap resistance. The resistance shall be less than 2.5 mΩ under 1 Amp.	< 2.5 mΩ at 1 Amp					

Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
.6	Remove temporary grounding wire and connect the Flight ground strap to the M4 stud on the unit.						
.7	Connect the grounding strap on the unit bonding stud (LN9161-04M) and on the panel dedicated insert (M4x 9). Final torque + RT (RT: 0,17 – 0,6 Nm)	3 Nm + RT 1.8 Nm + RT	± 5% ± 4%				
.8	Measure DC resistance (under 1 Amp) < 5 mΩ	< 5 mΩ at 1 Amp					
.9	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.						
.10	**NOTE**: The removal of the connectors dust caps is not authorised in this mechanical integration phase.						
.11	Second torque of HSFCU after 24 h with final torque from step 3						
.12	Second torque of HSFCU after 48 h with final torque from step 3						
.13	Final visual inspection						

Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
5.5	**Preparation for integration of HSDPU on SVM –Z Instrument Panel (SPIRE and CCU)**						
.1	Presence of Helicoils and good positioning, according to standard criteria						

Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
.2	Visible check of I/Fs (no damages, visible clean)						
.3	Determination of mass of items to be integrated (screws, washers, bond straps, sigraflex, HSDPU)						
.4	Note HSDPU serial number						
.5	Fix the thermal filler by two guiding pins						

Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
5.5.1	***Integration of HSDPU on SVM –Z Instrument Panel***						
.1	 Figure 5.5-1: grounding and fixation sketch for HSDPU						

Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
.2	Lift the HSDPU to the panel by hand (gloves and ESD wrist strap are mandatory).						
.3	Check clearance at the mounting feet. If the clearance is larger than 0.1 mm, a NCR shall be raised.						
.4	Attach the unit to instrument plate with 6 attachment screws (M4x 12) and washers. Final torque + RT (RT: 0,17 – 0,6 Nm): tightening opposite pairs of screws in sequence.	3 Nm + RT	± 4%				
.5	Measure the grounding strap resistance. The resistance shall be less than 2.5 mΩ under 1 Amp.	< 2.5 mΩ at 1 Amp					
.6	Remove temporary grounding wire and connect the Flight ground strap to the M5 stud on the unit.						
.7	Connect the grounding strap on the unit bonding stud (LN9161-05M) and on the panel dedicated insert (M4x 9). Final torque + RT (RT: 0,17 – 0,6 Nm)	4 Nm + RT 1.8 Nm + RT	± 4% ± 4%				
.8	Measure DC resistance (under 1 Amp) < 5 mΩ	< 5 mΩ at 1 Amp					
.9	**NOTE**: The removal of the connectors dust caps is not authorised in this mechanical integration phase.						
.10	Second torque of HSDPU after 24 h with final torque from step 3						
.11	Second torque of HSDPU after 48 h with final torque from step 3						
.12	Final visual inspection						

6 Summary Sheets

6.1 Procedure Variation Summary

	Test Change	Curr. No.: Date: Page 1 of

Test designation	Test Procedure	Issue 1	Rev.
Test step changed	Reason for Change:		

Prepared by:	Resp. Test Leader	Project Engineer
PA/QA		

6.2 Non Conformance Report (NCR) Summary

Status list of applicable NCR to be attached

6.3 Sign-off Sheet

	Date	Signature
Integration Manager		
Operator		
PA Responsible		

END OF DOCUMENT

	Name	Dep./Comp.		Name	Dep./Comp.
	Alberti von Mathias Dr.	ASG22		Sonn Nico	ASG51
X	Barlage Bernhard	AED13		Steininger Eric	AED32
X	Bayer Thomas	ASA42	X	Stritter Rene	AED11
	Brune Holger	ASA45	X	Suess Rudi	OTN/ASA44
	Edelhoff Dirk	AED2		Wagner Klaus	ASG22
	Fehringer Alexander	ASG13	X	Wietbrock Walter	AET12
X	Fricke Wolfgang Dr.	AED 65		Wöhler Hans	ASG22
X	Geiger Hermann	ASA42	X	Wössner Ulrich	ASE252
X	Grasl Andreas	OTN/ASA44			
X	Grasshoff Brigitte	AET12			
	Hamer Simon	Terma			
X	Hendry David	Terma			
X	Hengstler Reinhold	ASA42			
	Hinger Jürgen	ASG22			
X	Hohn Rüdiger	AED65			
	Hölzle Edgar Dr.	AED32			
	Huber Johann	ASA42			
X	Hund Walter	ASE252			
X	Idler Siegmund	AED312			
	Ivády von András	FAE12			
	Jahn Gerd Dr.	ASG22			
X	Kalde Clemens	ASM2			
X	Kameter Rudolf	OTN/ASA42			
	Kettner Bernhard	AET42			
X	Knoblauch August	AET32			
X	Koelle Markus	ASA43	X	Alcatel Alenia Space Cannes	AAS-F
X	Koppe Axel	AED312		Alcatel Alenia Space Torino	AAS-I
X	Kroeker Jürgen	AED65	X	ESA/ESTEC	ESA
	La Gioia Valentina	Terma			
X	Lang Jürgen	ASE252		**Instruments:**	
X	Langenstein Rolf	AED15		MPE (PACS)	MPE
	Langfermann Michael	ASA41	X	RAL (SPIRE)	RAL
	Maukisch Jan	ASA43		SRON (SPIRE)	SRON
	Much Christoph	ASA43			
	Müller Jörg	ASA42			
X	Müller Martin	ASA43		**Subcontractors:**	
	Peltz Heinz-Willi	ASG13		Alcatel Alenia Space Antwerp	ABSP
	Pietroboni Karin	AED65		Austrian Aerospace	AAE
	Platzer Wilhelm	AED2		Austrian Aerospace	AAEM
X	Reichle Konrad	ASA42		BOC Edwards	BOCE
	Runge Axel	OTN/ASA44		Dutch Space Solar Arrays	DSSA
	Schink Dietmar	AED32		EADS Astrium Sub-Subsyst. & Equipment	ASSE
	Schlosser Christian	OTN/ASA44		EADS CASA Espacio	CASA
	Schmidt Rudolf	FAE12		EADS CASA Espacio	ECAS
X	Schmidt Thomas	ASA42		European Test Services	ETS
	Schuler Günter	ASA42		Patria New Technologies Oy	PANT
	Schweickert Gunn	ASG22		SENER Ingenieria SA	SEN