Title: **SPIRE FPU and JFETs PFM Mechanical Integration Report**

CI-No: 125 200

| | | | |
|---|---|---|---|
| Prepared by: | A. Koppe | Date: | 24.09.2008 |
| Checked by: | Th. Bayer | | 24.09.2008 |
| Checked by: | for J. Kroeker | | 1.10.2008 |
| Product Assurance: | R. Stritter | | 25.09.08 |
| Configuration Control: | W. Wietbrock | | 25.09.2008 |
| Project Management: | Dr. W. Fricke | | 01/10/2008 |

Distribution: See Distribution List (last page)

| Issue | Date | Sheet | Description of Change | Release |
|---|---|---|---|---|
| 1 | 24.09.2008 | all | Initial issue | |

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**None**

# 1 Scope

## 1.1 Objective

This report describes the mechanical, thermal and electrical integration of the HERSCHEL PFM SPIRE FPU and JFETs onto the optical Bench Plate (OBP).

It summarizes the integration flow, test configuration, integration constraints and step by step process.

All described activities were performed in the ASTRIUM GmbH CR under class 100 cleanliness conditions at Friedrichshafen.

The applicable integration procedure is HP-2-ASED-PR-0083, iss. 1.

# 2 Documents/Drawings

## 2.1 Applicable 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.

| | | |
|---|---|---|
| AD 1 | Mechanical/Thermal Integration of PFM SPIRE FPU & JFETs | HP-2-ASED-PR-0083, iss. 1 |

## 2.2 Reference Documents

N/A

# 3 Test Report Summary

## 3.1 Operations

The mechanical, thermal and electrical integration of the SPIRE FPU and JFETs PFM according to HP-2-ASED-PR-0083 onto the optical bench plate and the measurement of the connectors, bonding, isolation was performed according to the procedure as given below.

## 3.2 Integration Procedure

HP-2-ASED-PR-0083 Issue 1 / Rev. - 10.04.2007 (Red-marked by RAL)

## 3.3 Integration Readiness Review

HP-2-ASED-MN-1332, IRR for SPIRE FPU PFM, 17.04.07

## 3.4 Procedure Variations

One Procedure Variations has been raised (instead of fixation bolts with plain shanks, standard screws have been used - see para. 6.1 of as run procedure).

## 3.5 Non Conformances

The following NCR has been raised:

HP-121000-ASED-NCR-3216 SPIRE FPU FM fixation bolts not according to SPIRE I/F drawing.

Status: closed

## 3.6 Conclusion

The mechanical, thermal and electrical integration of the SPIRE FPU and JFETs PFM have been performed successfully and are considered ready for the mechanical tests.
The grounding and isolation measurements taken showed all the expected values.
Special care has been taken on ESD constraints during the integration activities.
All steps of the procedure were executed with one procedure variation concerning the fixation bolts as a result of NCR HP-121000-ASED-NCR-3216.

# 4 AS-RUN Procedure

## 4.1 Assembly facilities

ASED Integration Centre, Friedrichshafen,

Building IC, clean room class 100

## 4.2 Assembly dates

Integration on 17.04.2007

## 4.3 Integration Procedure

Mechanical/Thermal Integration of PFM SPIRE FPU & JFETs

HP-2-ASED-PR-0083

Issue 1 / Rev. - 10.04.2007

## 4.4 Integration Sequences

The integration sequence has been performed according to step by step procedure in para. 5 of AD1.

## 4.5 Personal

| | |
|---|---|
| Operator (ASED) | H. Geiger |
| Operator mech. (ASED) | K. Reichle |
| Operator electr. (ASED) | A. Grasl, J. Lang |
| PA Responsible (ASED) | Th. Schmidt, R. Langenstein |

# 5 Attachment

- AS-RUN Copy of the integration procedure
- Pictures

Title: **Mechanical/Thermal Integration of PFM SPIRE FPU & JFETs**

CI-No: 125 200

| | | |
|---|---|---|
| Prepared by: | Th. Bayer | Date: 12.04.07 |
| Checked by: | R. Hohn | 12.04.07 |
| Engineering | S. Idler | 13.04.07 |
| Product Assurance: | R. Stritter | 15.04.07 |
| Configuration Control: | W. Wietbrock | 16.04.07 |
| Project Management: | Dr. W. Fricke | 16/04/2007 |

Distribution: See Distribution List (last page)

| Issue | Date | Sheet | Description of Change | Release |
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| 1 | 10.04. 2007 | all | Initial Issue | |

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Annex 1

Electrical Integration Procedure

## Table of Figures

## List of Tables

# 1 Scope

This document describes the mechanical and thermal integration activities for the HERSCHEL PFM SPIRE FPU onto the Optical Bench Plate (OBP).

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

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 or removed (unit, fixation elements, thermal strap, green-/red tag items etc.)
- Determination of mass of items to be integrated
- Preparation of bonding measurement equipment
- Fixation of MGSE to FPU and JFETs
- Removal of detector L0 strap

- Removal from transit base plate
- Integration of FPU and JFETs according step by step instruction onto OBP
- Integration of thermal straps
- Isolation measurement
- Remove of red tag items (e.g. alignment mirror after alignment check)
- 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 End Item Data Package

| | | |
|---|---|---|
| EID 1 | SPIRE PFM End Item Data Package | SPIRE-RAL-PRJ-002017 |
| EID 2 | OBA | HP-2-SEN-DP-0004 |

## 2.2 Applicable Documents

| | | |
|---|---|---|
| AD 1 | SPIRE FPU Handling and Mechanical Integration Procedure | SPIRE-RAL-PRC-002802 |
| AD 2 | Making SPIRE ESD Safe | SPIRE-RAL-NOT-002028 |
| AD 3 | SPIRE FPU MGSE | DW A1-5264-404-4/5/6/7/8 |
| AD 4 | SPIRE Mechanical Interface Drawings P 13 to 26 | SPIRE-RAL-DWG-001409 |
| AD 5 | L0 Thermal Strap Assembly | DW A1-5264-309A |
| AD 6 | Optical Bench Assembly Drawing | HP-2-ASED-DW-0117-1/2 |
| AD 7 | Optical Bench Assembly I/F Drawing | HP-2-ASED-ID-0042-02 |
| AD 8 | Optical Bench Assembly I/F Drawing | HP-2-ASED-ID-0042-10 |
| AD 9 | Red/Green-Tag Item List for Herschel EPLM | HP-2-ASED-LI-0027 |
| AD 10 | PA Plan | HP-2-ASED-PL-0007 |
| AD 11 | Contamination Control Plan | HP-2-ASED-PL-0023 |

## 2.3 Reference Documents

| | | |
|---|---|---|
| RD 1 | Documentation Identification Procedure and Documentation Management | HP-2-ASED-PR-0001 |
| RD 2 | ESD rules for Herschel PLM & S/C Integration Activities | HP-2-ASED-PR-0062 |

## 2.4 Abbreviations

For abbreviations see RD 01

# 3 Configuration

## 3.1 Initial H/W Configuration

- The PLM will be fixed to the Integration Dolly in upright position (x-direction upwards) under CR 100 conditions.
- The upper CVV bulkhead, upper thermal shields and OBP shield will be removed.
- OBP prepared and ready for integration of SPIRE FPU.
- SPIRE FPU and JFETs placed in clean room class 100 in upright position on an ESD capable table prepared (inclusive temporary grounding strap) and ready for integration.
- Alignment cube is fitted to the FPU (red tag item)
- FPU aperture cover is fitted to the FPU (red tag item)
- Harness between FPU and the JFETs is fitted
- Connectors are covered by safety connectors or black ESD capable dust caps (red tag items)
- MGSE prepared and checked for lifting activities.

## 3.2 XYZ axis orientation

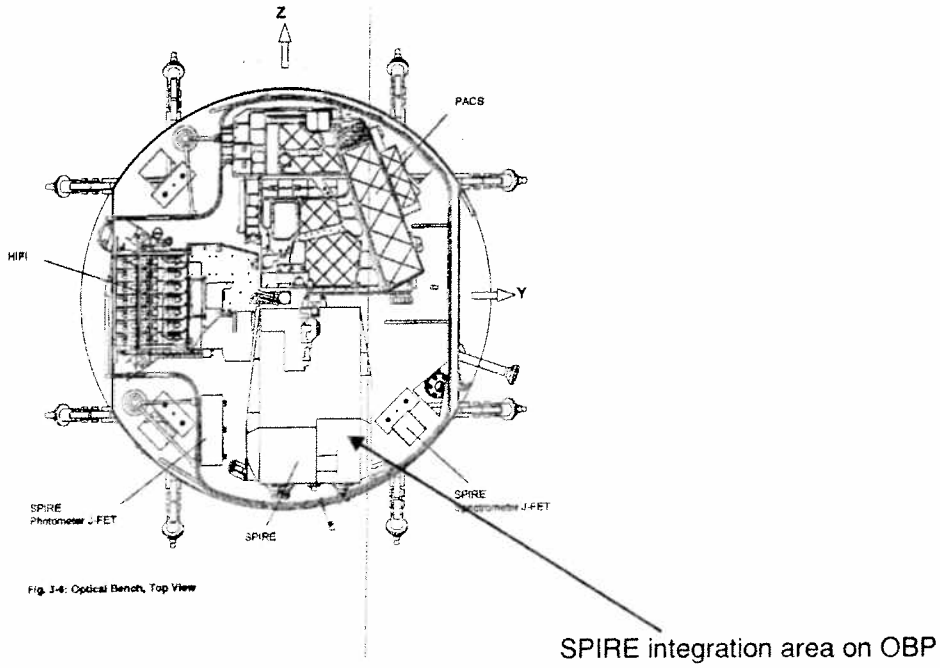



Figure 3.2-1: axis orientation, top view of OBA

# 4 Conditions

## 4.1 Personnel

Personnel necessary to complete activities according to this present procedures

| Responsibility | Name / Organisation |
|---|---|
| Operator | *) |
| Operator | *) Reichle U. |
| Operator | *) Gerger H. |
| PA Responsible | *) T. Schmidt / R. Longenstein |
| Instrument Responsible | *) |
| | |

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

## 4.2 Environmental

| | |
|---|---|
| Cleanliness: | class 100 |
| Temperature: | 22°C ± 3°C |
| Pressure: | ambient |
| Rel. humidity: | 40 % - 60 % |

## 4.3 General Instructions for Integration of SPIRE FPU & JFETs

The FPU is a delicate optical instrument and should be handled with extreme care at all time. Contamination of the optical surfaces within the instrument is prevented by the aperture cover. This cover should remain in place unless it is necessary to remove it.

**WARNING:** the bipod legs on two corners of the instrument are very thin section and easily damaged. Care must be taken at all times not to put side loads into these items. These are at risk at all times when the FPU is not attached to a rigid plate. When it is attached to a rigid plate i.e. the OBP or transport plate, then it is tolerant of loads from vibration, lateral expansion, thermal tests....For this reason take care, that the SPIRE FPU need to be settled on distance spacers/auxiliary feet in order not to damage the mounting feet.

### 4.3.1 General Safety Requirements, Precautions

- Respect of the standard technical rules for mechanical and electrical integration and test activities are sufficient.
- Other 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 10).

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 FPU and JFETs attention must be paid to AD 2 (Making SPIRE ESD safe) and RD 2 (ESD rules for Herschel PLM & S/C Integration Activities)

**NOTE:** for SPIRE FPU and JFETs:

All the units are sensitive to ESD.

The SPIRE instrument contains very sensitive detectors that are susceptible to damage by Electro static discharge. On delivery all connectors will be protected by covers or shorting plugs as appropriate.

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

When the Cryo harness is not connected to the DRCU and the FPU Faraday Shield Link connected to Backshell at the warm end, then the FPU is electrically floating and prone to ESD damage. To avoid this, the FPU should at all time be connected to an electrical ground, when removed from its container and not bagged in dissipative film.

## 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 | | |
| | GPHD (general purpose hoisting device) | ASED | | |
| | 5 T crane | ASED | | |
| | Torque wrench to cover 1.5 to 8.25 Nm | ASED | | |
| | Allen key, spanners etc | ASED | | |
| | Isopropyl alcohol | ASED | | |

Table 4.4-1: MGSE

### *4.4.2 EGSE*

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

Table 4.4-2: EGSE

### 4.4.3 OGSE

**N/A**

### 4.4.4 Special Integration Equipment

| Qty. | Designation/Manufacturer | Provided by | Drawing/Ident. NR: | Calibr. Date |
|---|---|---|---|---|
| | FPU and JFET handling frame. | RAL | | |
| | FPU/JFET/baseplate lifting gear | RAL | | |
| | FPU and JFET lifting and hoisting device | RAL | | |
| | JFET fixation hardware | RAL | | |
| | Isolation washers, special screws and studs | RAL | | |
| | L3 pressure plates 2-off | RAL | | |
| | L1 strap screws M8 2off, M3 4off (these screws will be prepared for wire locking) | RAL | | |
| | Locking wire (for above screws) | RAL | | |
| | L1 bushes for the vent line end | RAL | | |
| | Temporary FPU Grounding Strap including M4 x 6mm fastener to connect to OBP<br>**NOTE**: Could possibly be attached to the unused harness support bracket holes, or any other convenient tapped hole. | RAL | | |
| | Fixation bolts:<br>• FPU M6 12 off<br>• L0 straps M4 16 off<br>• L0 pressure plate 4 off<br>• L3 strap M4 4off | ASED | | |

Table 4.4-3: Special Integration Equipment

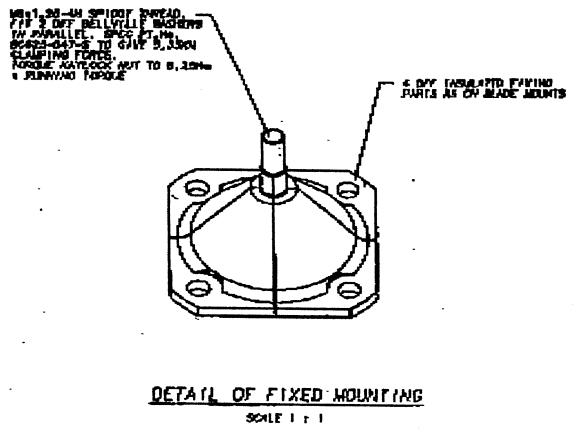
# 5 Step by Step Procedure

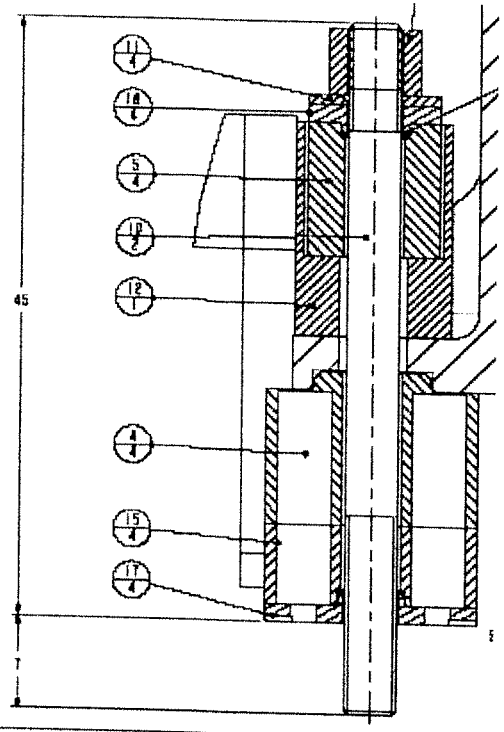
The FPU is supplied with the JFETs and associated harness already fitted. The following tasks need to be carried out before integration onto the OBP. Only standard tools are required at this stage.
The FPU is supplied with the alignment cube fitted and should be left in place until all alignment activities are complete. It can be removed and replaced within the alignment tolerances required if necessary.

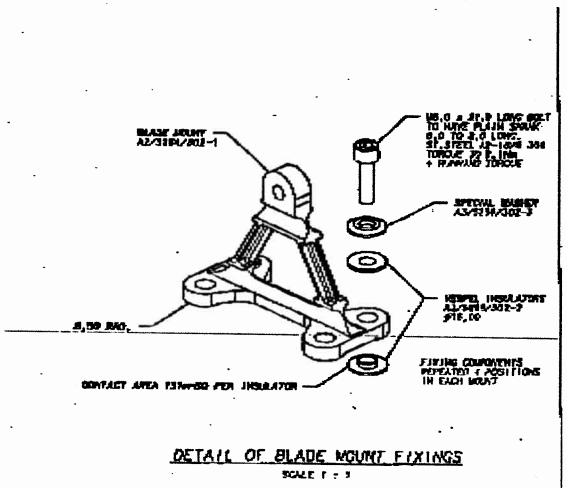
| Step-No. | Integration-Step-Description | Nominal Value | Tolerance | Actual Value | Remarks | P | N |
|---|---|---|---|---|---|---|---|
| ***5.1.1*** | ***Preparation for integration on Optical Bench Plate*** | | | | | | |
| .1 | The JFETs will be fitted to the spacecraft together with the FPU. They will need supporting during this activity. The SPIRE supplied MGSE provides provision to support the JFETS during integration. | | | | | √ | |
| .2 | The FPU is electrically connected to the baseplate for ESD protection. This strap has to be disconnected from the baseplate and connected directly to secure ground (CVV) for all handling activities of the FPU & JFETs. | | | | | √ | |
| .3 | Fit the lifting attachment to the FPU as shown in annex A.<br>Attach the JFETs to the MGSE using lacing cord. | | | | Reichle, Geiger,17.04.2007 | √ | |

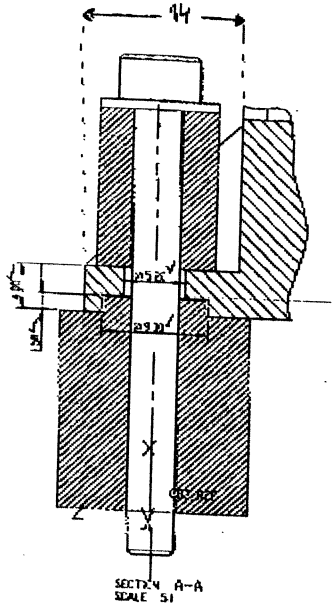
| Step-No. | Integration-Step-Description | Nominal Value | Tolerance | Actual Value | Remarks | P | N |
|---|---|---|---|---|---|---|---|
| *5.1.2* | ***Removal from Base Plate*** | | | | | | |
| .1 | **WARNING:** The bipod legs on two corners of the instrument are very thin section CFRP components, and easily damaged. Care must be taken at all times not to put side loads into these items. These are at risk at all times when the FPU is not attached to a rigid plate.<br>**Note:** All screws that interface to the spacecraft are metric threads. | | | | Reichle 18.04.2007 | √ | |
| .2 | Undo the five M4 fasteners which secure the Photometer JFET rack (HSJP; 8 JFETs) to the baseplate.<br>Leave the screws in position as they cannot be removed form the JFET rack. | | | | | √ | |
| .3 | Undo the four M4 fasteners that secure the Spectrometer JFET rack (HSJS; 2 JFETs) to the baseplate.<br>**Note**: Two of these fasteners are studs with nuts on the top, the nuts should be removed and the studs left in place. | | | | | √ | |
| .4 | The two remaining L0 straps are also secured to the baseplate. To release these from the baseplate, undo the 4 off M4 fasteners on each strap and remove the fasteners.<br>**NOTE:** The undersides of these straps form the thermal interface to the HTT pods. Their surfaces are flat and soft gold plated, these surfaces can easily be damaged and the thermal performance of the instrument may suffer as a result. | | | | | √ | |
| .5 | Remove the M8 nut from the cone foot, thus leaving the cone on the baseplate. | | | | | √ | |
| .6 | Remove the 8 fasteners on the transit blade mounts that attach the FPU to the baseplate. | | | | | √ | |

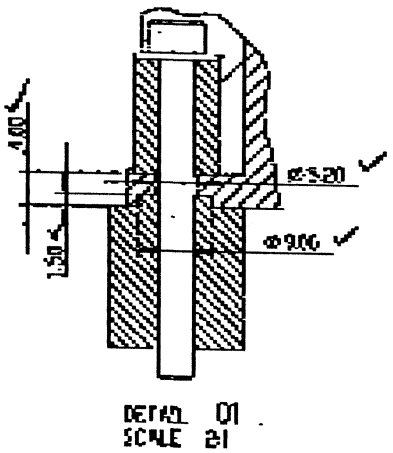
| Step-No. | Integration-Step-Description | Nominal Value | Tolerance | Actual Value | Remarks | P | N |
|---|---|---|---|---|---|---|---|
| .7 | Lift the FPU and JFETs together from the baseplate by crane. | | | | | √ | |
| .8 | **In general:** Visible check of I/F (no damages, visible clean) before any integration activities | | | | T.Schmidt 18.04.07 | √ | |
| .9 | Exchange the transit blade mounts against the flight blade mounts | 8.1 Nm | +/- 10% above running torque | 8.2 Nm | Will be done by SPIRE team 18.04.07 | √ | |
| .10 | Determination of mass of all items to be integrated (screws, washers, thermal straps, FPU & JFETs...) | | | 48,73 kg | Incl. L0 Straps, L1 /L3 I/F bolts & screws | √ | |
| .11 | The FPU and JFETs are now ready for integration. | | | | | √ | |

| Step-No. | Integration-Step-Description | Nominal Value | Tolerance | Actual Value | Remarks | P | N |
|---|---|---|---|---|---|---|---|
| ***5.1.3*** | ***Mechanical integration of FPU and JFETs onto OBP*** | | | | | | |
| .1 | Fix the cone to the OBP using the four M6x21 cap head screws.<br>**Note:** there are special washers (part number A3/5264/302-3) under the head of each screw and also Vespel insulating bushes (A3/5264/302-2) either side of the mounting flange.<br>  <br>DETAIL OF FIXED MOUNTING<br>SCALE 1 : 1 | 8.1 Nm | +/- 10% above running torque | 8,4 Nm<br><br>R> 20MΩ | Cone mounted and torqued by Reichle 18.04.2007<br><br>Check Isolation of Cone To OBA ≥ 10MΩ Checked by Grasl | √<br><br>√ | |

| Step-No. | Integration-Step-Description | Nominal Value | Tolerance | Actual Value | Remarks | P | N |
|---|---|---|---|---|---|---|---|
| .2 | Fix the Spectrometer JFET studs (2 off) as indicated on interface drawing 0-KE-0104-360 (p 21 of AD 4).<br>Note: these should be screwed into the OBP until 45mm of stud are protruding from the surface.<br>  | 45 mm | +/- 0.5 mm | | Geiger 17.04.2007 | √ | |
| .3 | Lift the FPU and JFETs above the OBP | | | | | √ | |

| Step-No. | Integration-Step-Description | Nominal Value | Tolerance | Actual Value | Remarks | P | N |
|---|---|---|---|---|---|---|---|
| .4 | Very gently lower the assembly onto the OBP, ensuring that the JFET studs engage on the JFETs and the cone mount engages in its location on the FPU.<br>NOTE: the cone is very thin walled section and large moments can be applied if the FPU is not lowered with its interface plane parallel to the OBP | | | | 18.04.2007 Reichle, SPIRE Team, Scharmberg | √ | |
| .5 | The flexible ends of the L0 straps are unsupported at this stage and will need to be guided by hand into place as the FPU is lowered | | | | | √ | |
| .6 | When all units are resting on the OBP, fit the attachment screws (M6X21) to the bipod feet as for the cone mount.<br>  <br> | 8.1 Nm | +/- 10% above running torque | 8,4 Nm | See procedure variation 6.1<br>18.04.2007 Reichle | √ | |
| .7 | Fit the two Bellville washers and the M8 Kaylock nut to the cone mount. | 8.25Nm | +/- 10% above running torque | 8,6 Nm | 18.04.2007 Reichle | √ | |
| .8 | Remove the lifting/handling fixture. | | | | Measure isolation of FPU to OBA ≥ 10 MΩ | √ | |

| Step-No. | Integration-Step-Description | Nominal Value | Tolerance | Actual Value | Remarks | P | N |
|---|---|---|---|---|---|---|---|
| .9 | SPIRE JFET Photometer and Spectrometer will be delivered with fixation hardware:<br>Isolation washers, special screws and studs. | | | | The thermal compensators are already mounted on the unit. | √ | |
| .10 | Fit the 5 long bolts to secure the photometer to the OBP.<br>Note that there are washers under the head of each screw.<br>  | 2,1 Nm | +/- 10% above running torque | 2,2 Nm | 18.04.2007 Reichle<br><br>Check Isolation of JFET Chassis to OBA ≥ 10 MΩ | √ | |

| Step-No. | Integration-Step-Description | Nominal Value | Tolerance | Actual Value | Remarks | P | N |
|---|---|---|---|---|---|---|---|
| .11 | Fit the two long bolts and two nuts to secure the spectrometer to the OBP.<br>Note that there are washers under the head of each screw.<br>  <br> | 2,1 Nm | +/- 10% above running torque | 2,2 Nm<br><br>R> 20MΩ | 18.04.2007 Reichle<br><br>Check Isolation of JFET chassis I/F OBA<br>≥ 10MΩ<br>Checked by Grasl | √<br><br>√ | |
| | | | | | | | |

| Step-No. | Integration-Step-Description | Nominal Value | Tolerance | Actual Value | Remarks | P | N |
|---|---|---|---|---|---|---|---|
| ***5.1.4*** | ***Integration of thermal links*** | | | | | | |
| .1 | **L0 straps:**<br>The cooler pump and evaporator straps:<br>Ensure that the lower flexible of these two straps align with the pod interfaces. Fit the attachment screws (10 x M4 for the evaporator strap, 6 x M4 screws for the pump). | 2.1 Nm | +/- 10% above running torque | | | √ | |
| .2 | Detector strap:<br>Integration of the strap assembly to the FPU inclusive the Torlon frames according to AD 1, § 6.2.2.2 | | | | Will be done by SPIRE team | √ | |
| .3 | Ensure that the lower flexible align with the pod interface. Fit the spreader plate and temperature sensor with the 6 x M4 attachment screws. | 2.1 Nm | +/- 10% above running torque | | | √ | |
| .4 | **L1 straps:**<br>Fit the two L1 straps to the FPU using at each location, 1 x insulation bush, 1 x Bellville washer type B0750-056-S and 1 x M8 bolt. | 10.5 Nm | +/- 10% above running torque | 10,5 Nm | See OW 351<br>Reichle 02.05.2007 | √ | |
| .5 | Integrate the 2 x M4 bolts with insolating bushes and 2 x Bellville washers (type B0375-020-S) under each screw head | 1.5 Nm | +/- 10% above running torque | 1,5 Nm | | √ | |
| .6 | On final assembly the M8 fasteners to be wire locked to the M4 fasteners. Screws will be prepared for wire locking | | | | Reichle 02.05.2007 | √ | |
| .7 | **L3 straps:**<br>Fit the two L3 straps to the JFET's using the attachment hardware (L3 thermal strap clamp provided by SPIRE) as shown in interface drawings 0-KE-0104-350 and 0-KE-0104-360. | 2.5 Nm | +/- 10% above running torque | 2,5 Nm | See OW 351 | √ | |

| Step-No. | Integration-Step-Description | Nominal Value | Tolerance | Actual Value | Remarks | P | N |
|---|---|---|---|---|---|---|---|
| ***5.1.5*** | ***Isolation measurement*** | | | | | | |
| .1 | **General:**<br>This test is to be carried out under control of SPIRE team. The removal of the safe plugs from the JFET units places the instrument in a state where it is more susceptible to ESD damage. The process is to be carried out with attention to safe ESD procedures, including the use of ionized air flow over the connectors during mating/demating operations. | | | | | | |
| .2 | Remove the temporary ground strap between the FPU and the CVV | | | | | √ | |
| .3 | **FPU/OBP Isolation:**<br>Measure and record the electrical isolation between the chassis of the FPU and the OBP. | >= 1 MΩ | | >20 MΩ<br>Grasl | Remove of safe plugs and cover with ESD caps accord. to AD 1 | √ | |
| .4 | **Spect. Det. Box/OBA isolation:**<br>Measure and record the electrical isolation between the detector boxes thermal strap (on the Instrument side of the electrical isolation joint) and the OBP. | >= 1 MΩ | | 55 KΩ | Due to ESD termination connectors | √ | |
| .5 | **Phot. Det. Box/OBP isolation:**<br>Measure and record the electrical isolation between the evaporator thermal strap (on the Instrument side of the electrical isolation joint) and the OBP. | >= 1 MΩ | | 77 KΩ<br>02.05.2007<br>Grasl | Due to ESD termination connectors | √ | |
| .6 | **Spect. Det. Box/FPU isolation:**<br>Measure and record the electrical isolation between the detector boxes thermal strap (on the Instrument side of the electrical isolation joint) and the FPU. | >= 1 MΩ | | 0,3 Ω<br>02.05.2007<br>Grasl | | √ | |

| Step-No. | Integration-Step-Description | Nominal Value | Tolerance | Actual Value | Remarks | P | N |
|---|---|---|---|---|---|---|---|
| .7 | **Phot. Det. Box/FPU isolation:** Measure and record the electrical isolation between the evaporator thermal strap (on the Instrument side of the electrical isolation joint) and the FPU. | >= 1 MΩ | | 0,3 Ω 02.05.2007 Grasl | | √ | |
| .8 | **Phot. Det. Box/Spect. Det. Box isolation:** Measure and record the electrical isolation between the evaporator thermal strap and the detector boxes thermal strap (both on the Instrument side of the electrical isolation joint). | >= 1 MΩ | | 0,3 Ω 02.05.2007 Grasl | | √ | |
| .9 | Fix the temporary grounding strap from the FPU to the OBP. | | | | | √ | |
| .10 | Repeat the measurement of the resistance between the OBP and the FPU to ensure that grounding has been successful. | < 3Ω | | 0,3 Ω 02.05.2007 | | √ | |

| Step-No. | Integration-Step-Description | Nominal Value | Tolerance | Actual Value | Remarks | P | N |
|---|---|---|---|---|---|---|---|
| ***5.1.6*** | ***Removal of Red Tag items before Integration of Optical Bench shield*** | | | | | | |
| .1 | **Alignment Cube:**<br>Unscrew the three fixing screws and store them with the alignment cube in the "red tag box" | | | | To be removed after alignment activities<br>16.8.07 H. Geiger | ✓ | |
| .2 | **Aperture cover:**<br>The aperture cover is removed by unscrewing the four 2-56 UNC (imperial) cap head screws, which are captive in the cover, and lifting the cover clear. | | removed<br>30.10.07<br>see SD-0192 | | To be removed at the latest opportunity prior to closure of the Instrument Shield. | ✓ | |
| .3 | **Temporary grounding strap:**<br>Removed during the Cryo harness Integration Procedure. | | | | | ✓ | |
| .4 | **Shorting plugs:**<br>Removed during the Cryo harness Integration Procedure. | | | | | ✓ | |
| .5 | When removed all red tag items shall be bagged and stored in the dedicated "SPIRE red tag box" and mentioned in the Red/Green-Tag Item List for Herschel EPLM (AD 9) | P-2-ASED-LI-0027, Issue 1 | | | 31.10.07<br>P. L. | ✓ | |
| .6 | There are no Green Tag Items | | | | | ✓ | |

| Step-No. | Integration-Step-Description | Nominal Value | Tolerance | Actual Value | Remarks | P | N |
|---|---|---|---|---|---|---|---|
| ***5.1.7*** | ***Final visual inspection*** | | | | | | |
| .1 | Visual inspection of the SPIRE FPU & JFETs, with regard to damages and visible contamination. | No damages, visible clean | | | * 30.10.07 | ✓ | |
| .2 | Visual inspection of the mounting of the feet and of the thermal links to the SPIRE FPU, with regard to damages and visible contamination | No damages, visible clean | | | * 30.10.07 | ✓ | |
| .3 | Visual inspection of the electrical connectors to the SPIRE FPU, with regard to damages and visible contamination | No damages, visible clean | | | * 30.10.07 | ✓ | |
| .4 | Check that all Red Tag Items are dismounted prior to closure of optical bench with optical bench shield. | | | see SD-0192 | 30.10.07 | ✓ | |
| .5 | MIP | | | | 30.10.07 | ✓ | |

* Final Inspection of ESA + TAS-F 30.10.07 see Log book

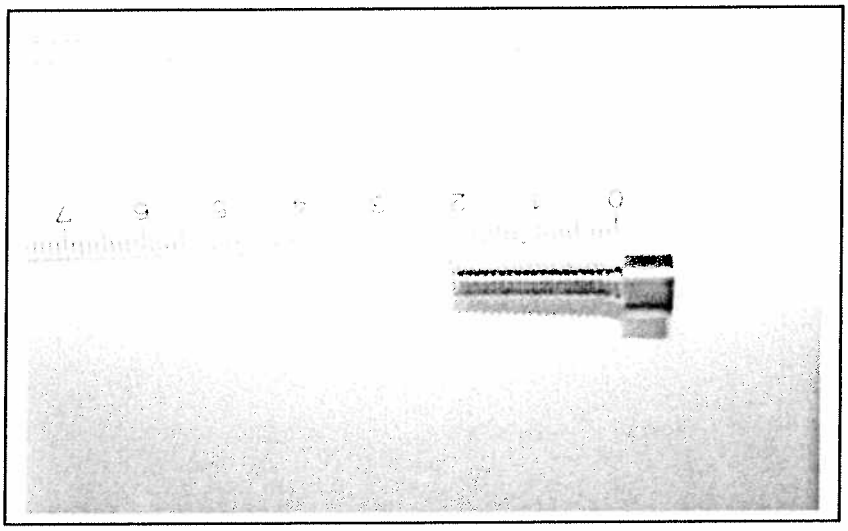
Annex 1 : Electrical Integration Procedure SPIRE-RAL-PRC-002882 Iss. 2

# 6 Summary Sheets

## 6.1 Procedure Variation Summary

| | Test Change | Curr. No.:<br>Date:<br>Page 1 of | |
|---|---|---|---|
| Test designation<br>Mechanical integration | Test Procedure<br>HP-2-ASED-PR-0083 | Issue<br>1 | Rev. |
| Test step changed<br>4.4.4. Fixation bolts FPU M6 | Reason for Change:<br>Discrepancy between IRD-A and IRD-B | | |

It has been agreed by all parties see HP-121000-ASED-NC- 3216 NRB disposition that for the FPU M6 fixation bolts with plain shanks as requested by drawing number SPIRE INTERFACE 5264 300 sheet 4 ( see Detail of blade mount fixings ) Standard screws ISO 4762 M6 x 21mm A2-70 with a 3.1B material certificate without plain shank will be used.



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

## 6.2 Non Conformance Report (NCR) Summary

Status list of applicable NCR to be attached

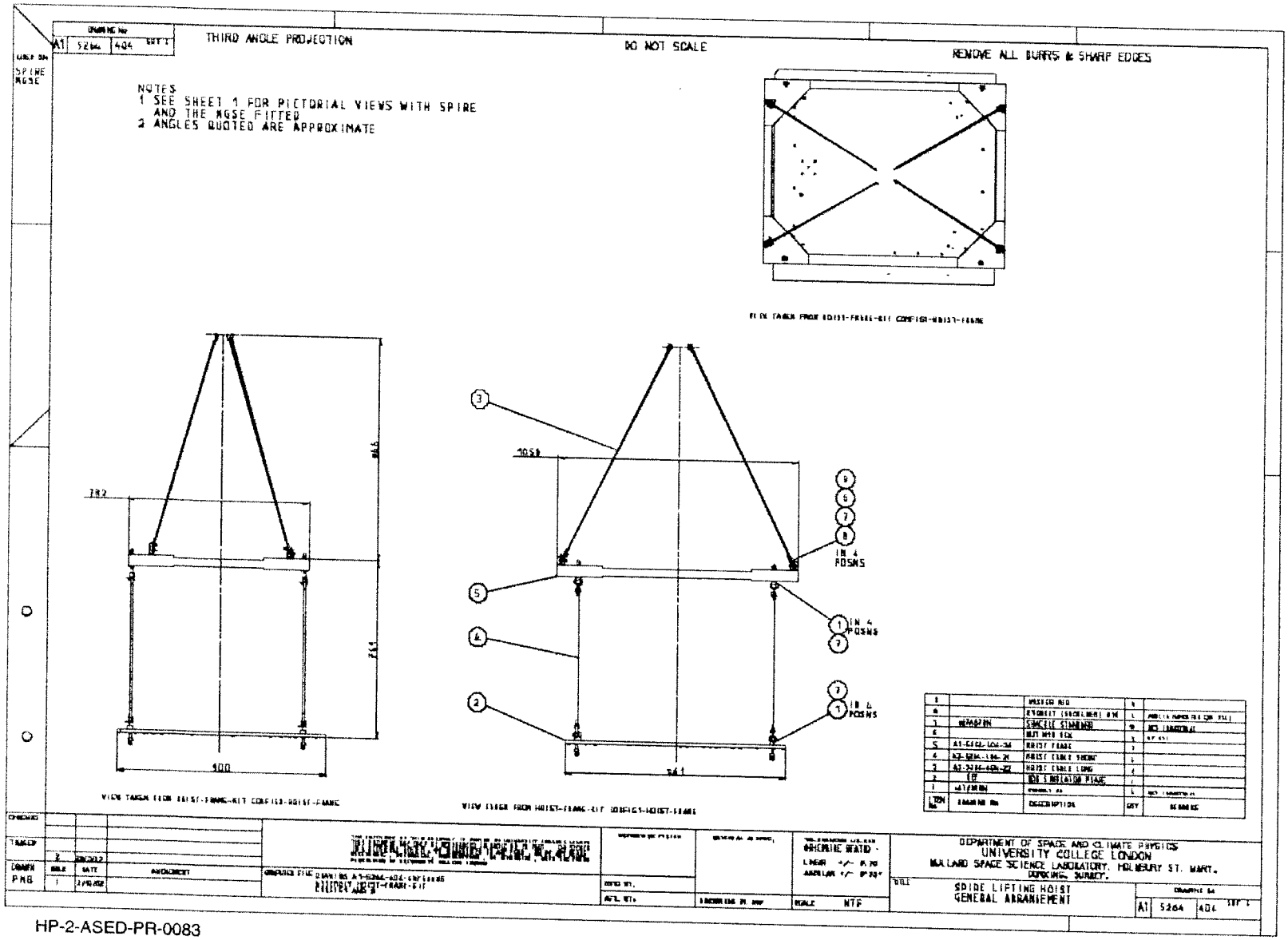
| NCR - No. | NCR - Title | Date | Open Closed | PA sig. |
|---|---|---|---|---|
| HP-121000-ASED-NCR-3216 | SPIRE FPU FM fixation bolts not according to SPIRE I/F drawing | 18.04.2007 | closed | |

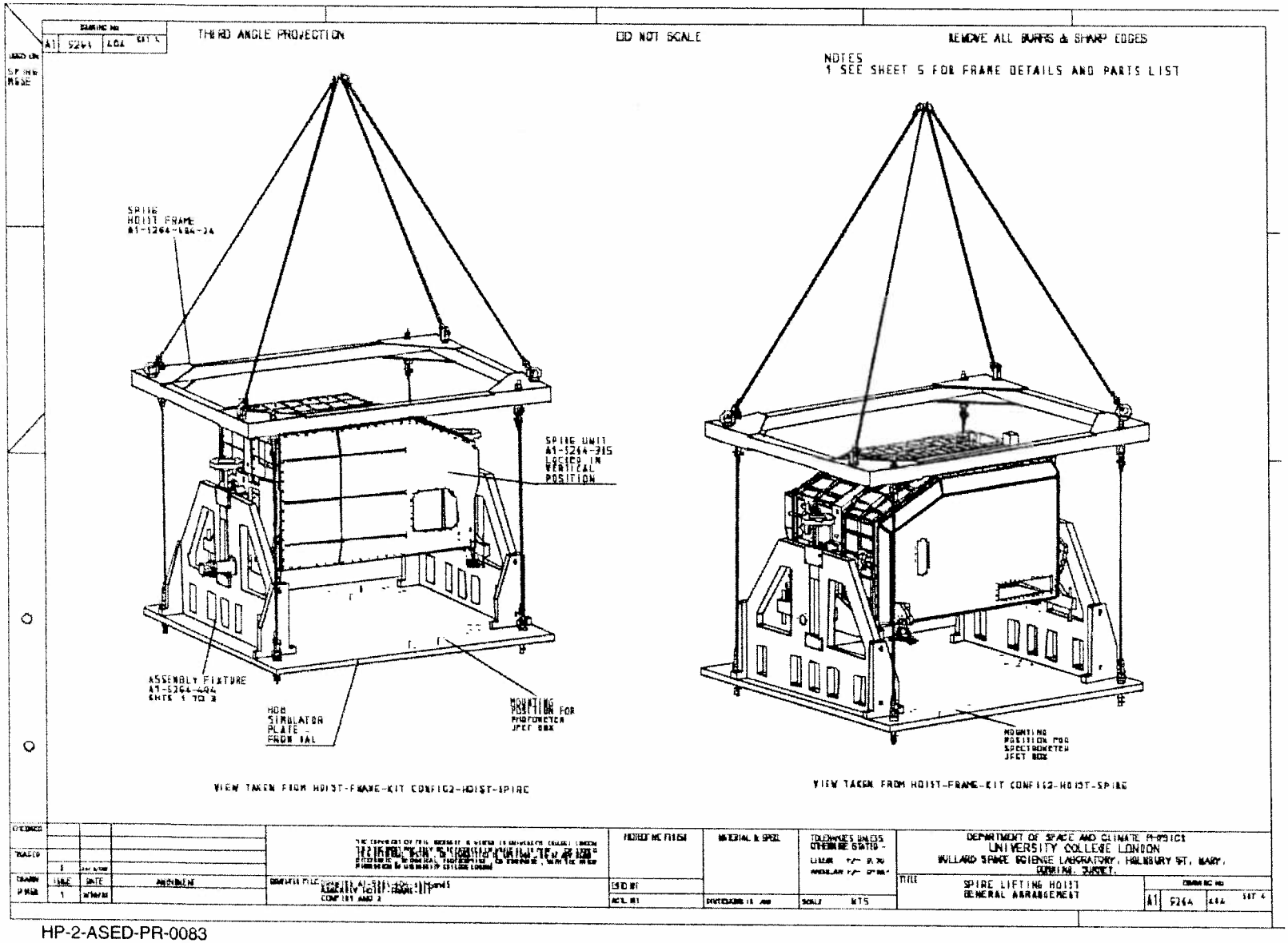
## 6.3 Sign-off Sheet

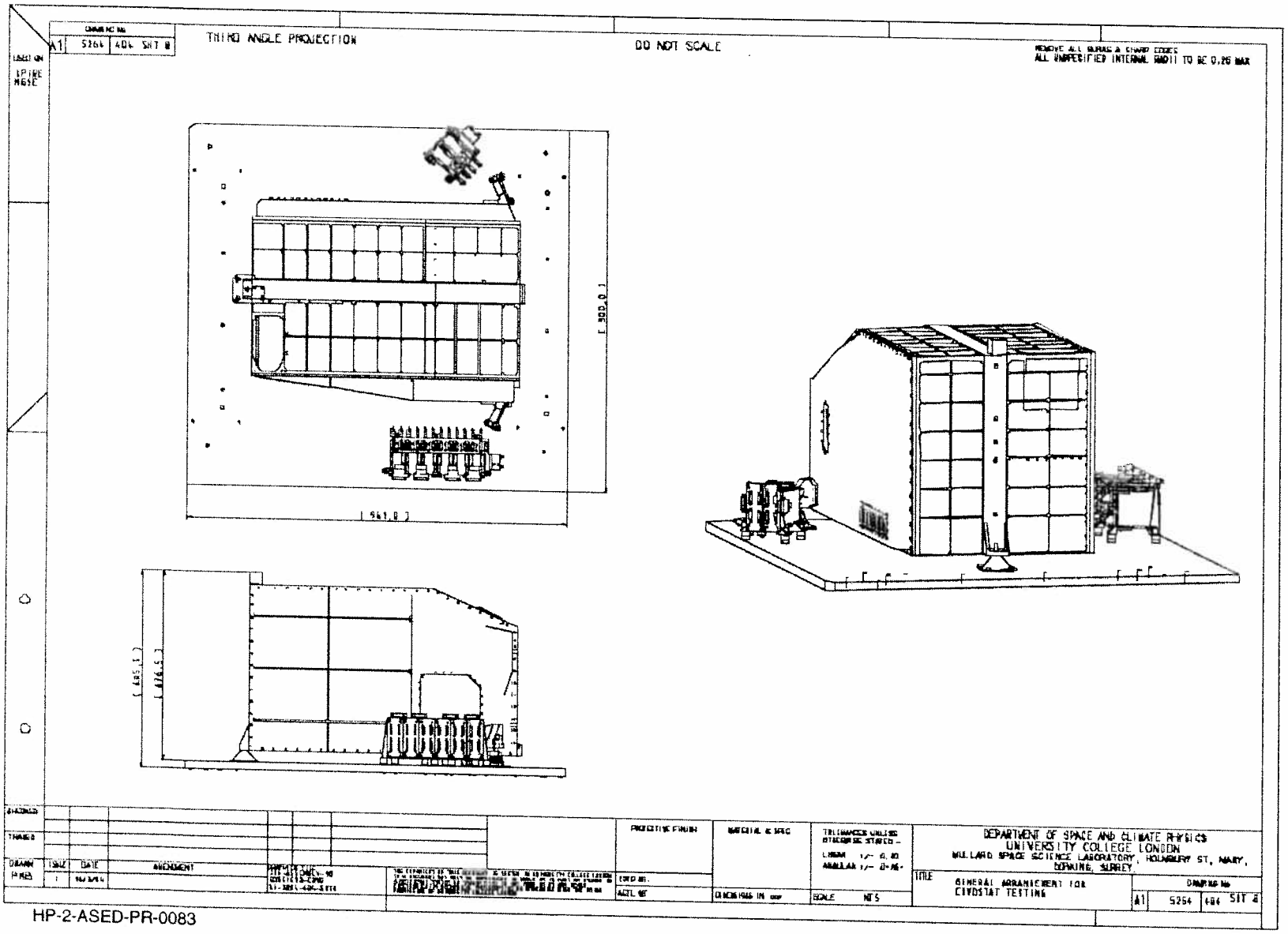
| | Date | Signature |
|---|---|---|
| **Integration Manager** | 31.10.01 | |
| **Operator** | 31.10.01 | |
| **PA Responsible** | 31.10.01 | |

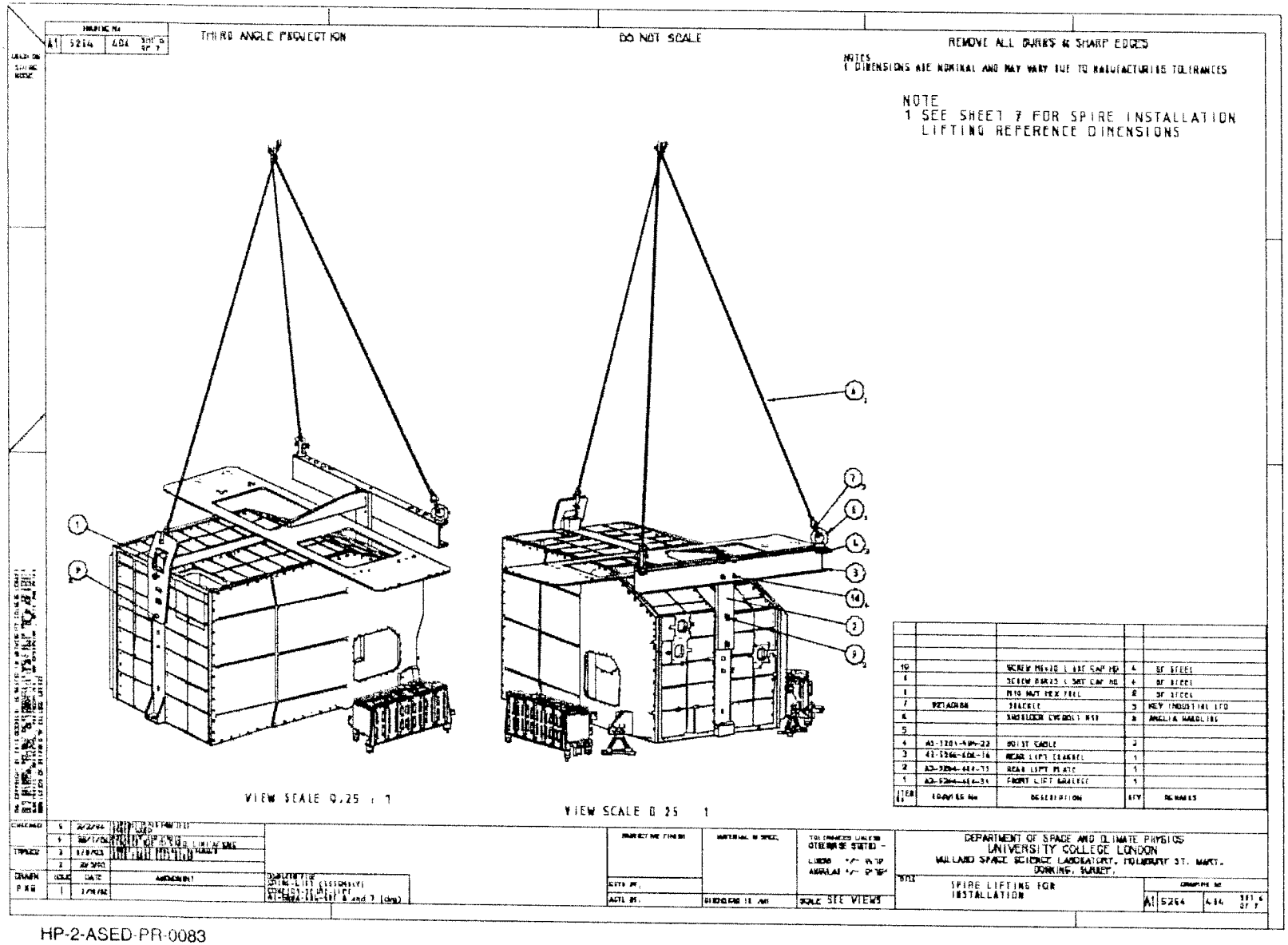
# 7 ANNEX A

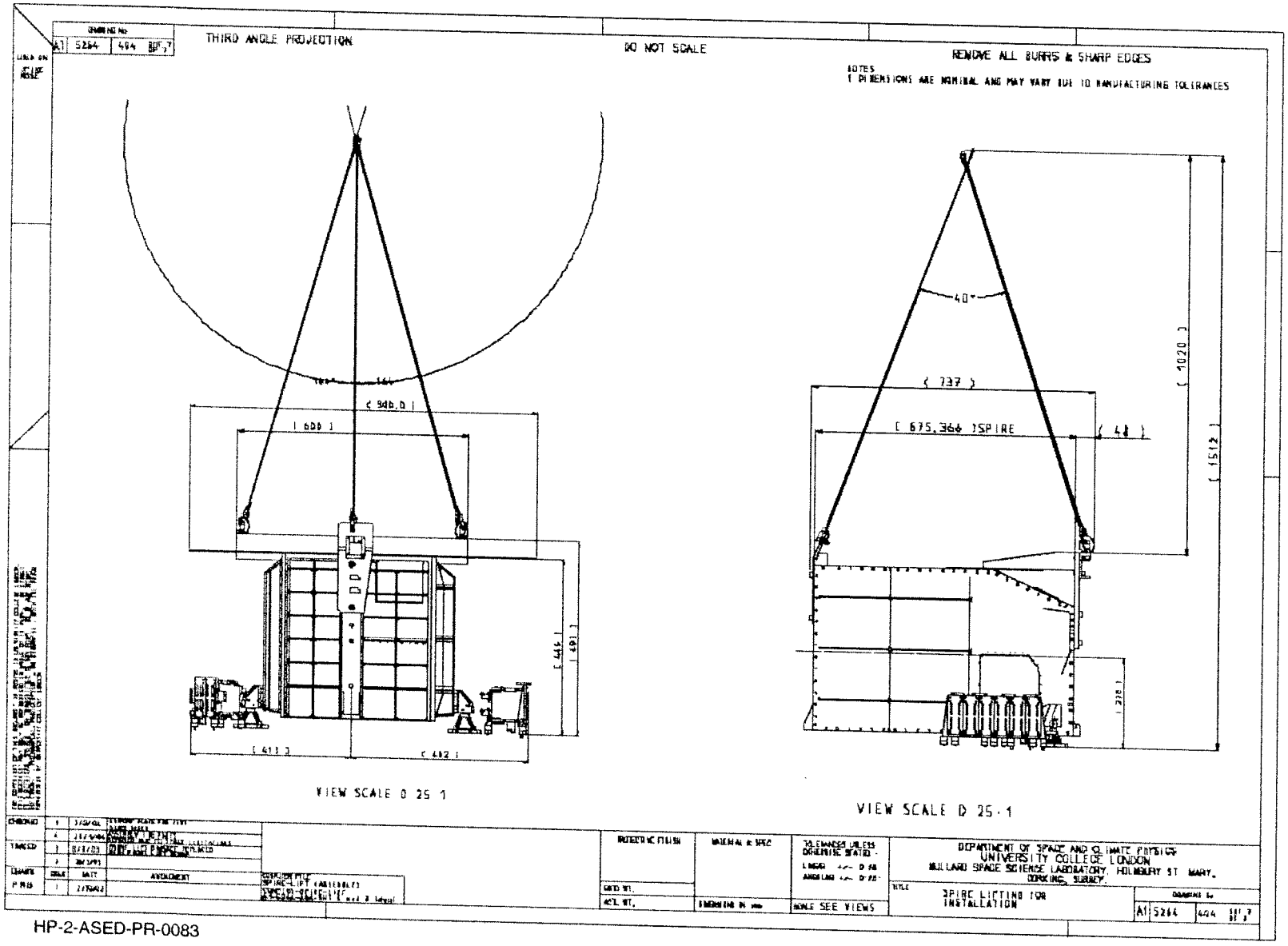
## 7.1 DRAWINGS OF SPIRE FPU MGSE


THIRD ANGLE PROJECTION
DO NOT SCALE
REMOVE ALL BURRS & SHARP EDGES
NOTES
1 SEE SHEET 1 FOR PICTORIAL VIEWS WITH SPIRE AND THE MGSE FITTED
2 ANGLES QUOTED ARE APPROXIMATE
SPIRE MGSE
782
1056
IN 4 POSNS
IN 4 POSNS
IN 4 POSNS
500
541
DEPARTMENT OF SPACE AND CLIMATE PHYSICS
UNIVERSITY COLLEGE LONDON
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.
SPIRE LIFTING HOIST
GENERAL ARRANGEMENT
A1 5264 404


THIRD ANGLE PROJECTION
DO NOT SCALE
REMOVE ALL BURRS & SHARP EDGES
NOTES
1 SEE SHEET 5 FOR FRAME DETAILS AND PARTS LIST
SPIRE HOIST FRAME A1-1264-484-2A
SPIRE UNIT A1-5264-315 LOCKED IN VERTICAL POSITION
ASSEMBLY FIXTURE A1-5264-484
HDR SIMULATOR PLATE - FROM RAL
MOUNTING POSITION FOR PHOTOMETER JFET BOX
MOUNTING POSITION FOR SPECTROMETER JFET BOX
VIEW TAKEN FROM HOIST-FRAME-KIT CONFIG2-HOIST-SPIRE
VIEW TAKEN FROM HOIST-FRAME-KIT CONFIG2-HOIST-SPIRE
DEPARTMENT OF SPACE AND CLIMATE PHYSICS
UNIVERSITY COLLEGE LONDON
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.
TITLE
SPIRE LIFTING HOIST GENERAL ARRANGEMENT
A1 5264 484

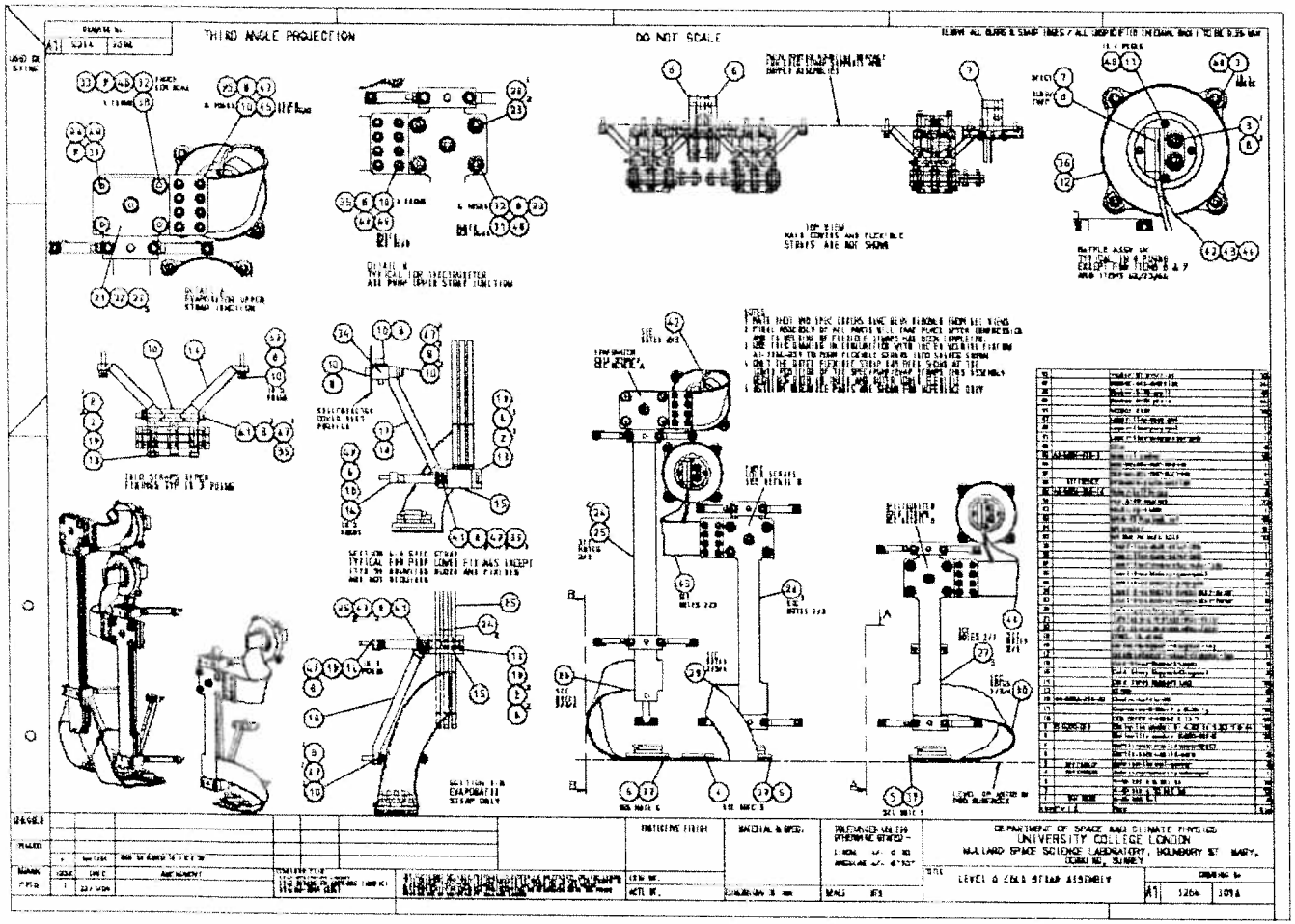

THIRD ANGLE PROJECTION
DO NOT SCALE
DEPARTMENT OF SPACE AND CLIMATE PHYSICS
UNIVERSITY COLLEGE LONDON
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY
GENERAL ARRANGEMENT FOR CRYOSTAT TESTING


THIRD ANGLE PROJECTION
DO NOT SCALE
REMOVE ALL BURRS & SHARP EDGES
NOTES
1 DIMENSIONS ARE NOMINAL AND MAY VARY DUE TO MANUFACTURING TOLERANCES
NOTE
1 SEE SHEET 7 FOR SPIRE INSTALLATION LIFTING REFERENCE DIMENSIONS
VIEW SCALE 0.25 : 1
VIEW SCALE 0.25 : 1
DEPARTMENT OF SPACE AND CLIMATE PHYSICS
UNIVERSITY COLLEGE LONDON
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.
SPIRE LIFTING FOR INSTALLATION
SCALE SEE VIEWS


THIRD ANGLE PROJECTION
DO NOT SCALE
REMOVE ALL BURRS & SHARP EDGES
NOTES
1 DIMENSIONS ARE NOMINAL AND MAY VARY DUE TO MANUFACTURING TOLERANCES
40°
( 737 )
[ 675.364 ]SPIRE
( 48 )
( 1020 )
( 1512 )
( 946.0 )
[ 600 ]
[ 613 ]
( 482 )
VIEW SCALE 0.25:1
VIEW SCALE 0.25:1
DEPARTMENT OF SPACE AND CLIMATE PHYSICS
UNIVERSITY COLLEGE LONDON
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST MARY,
DORKING, SURREY.
SPIRE LIFTING FOR INSTALLATION
A1 5264 494

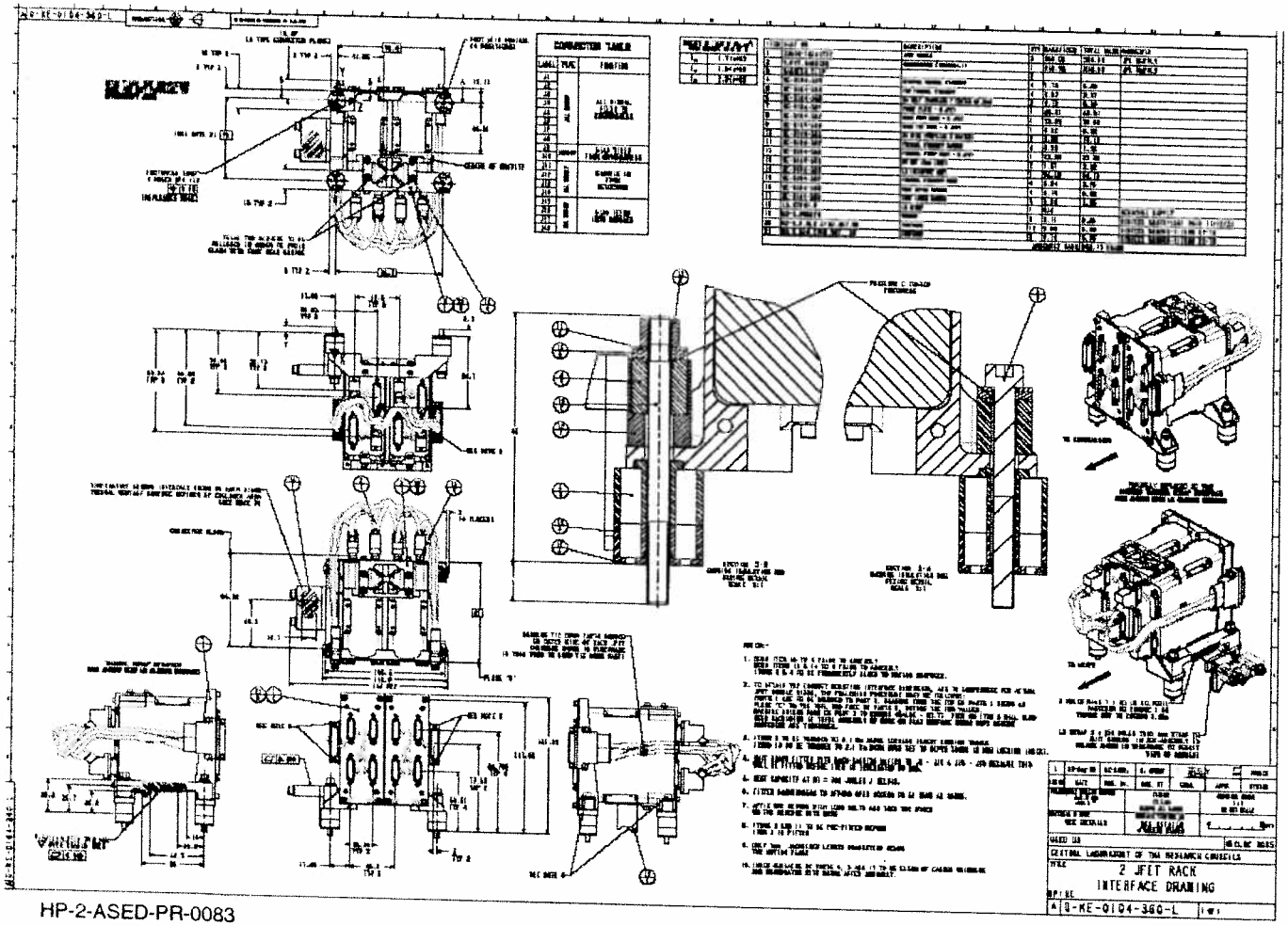
# 8 ANNEX B

## 8.1 L0 Thermal Strap Assembly

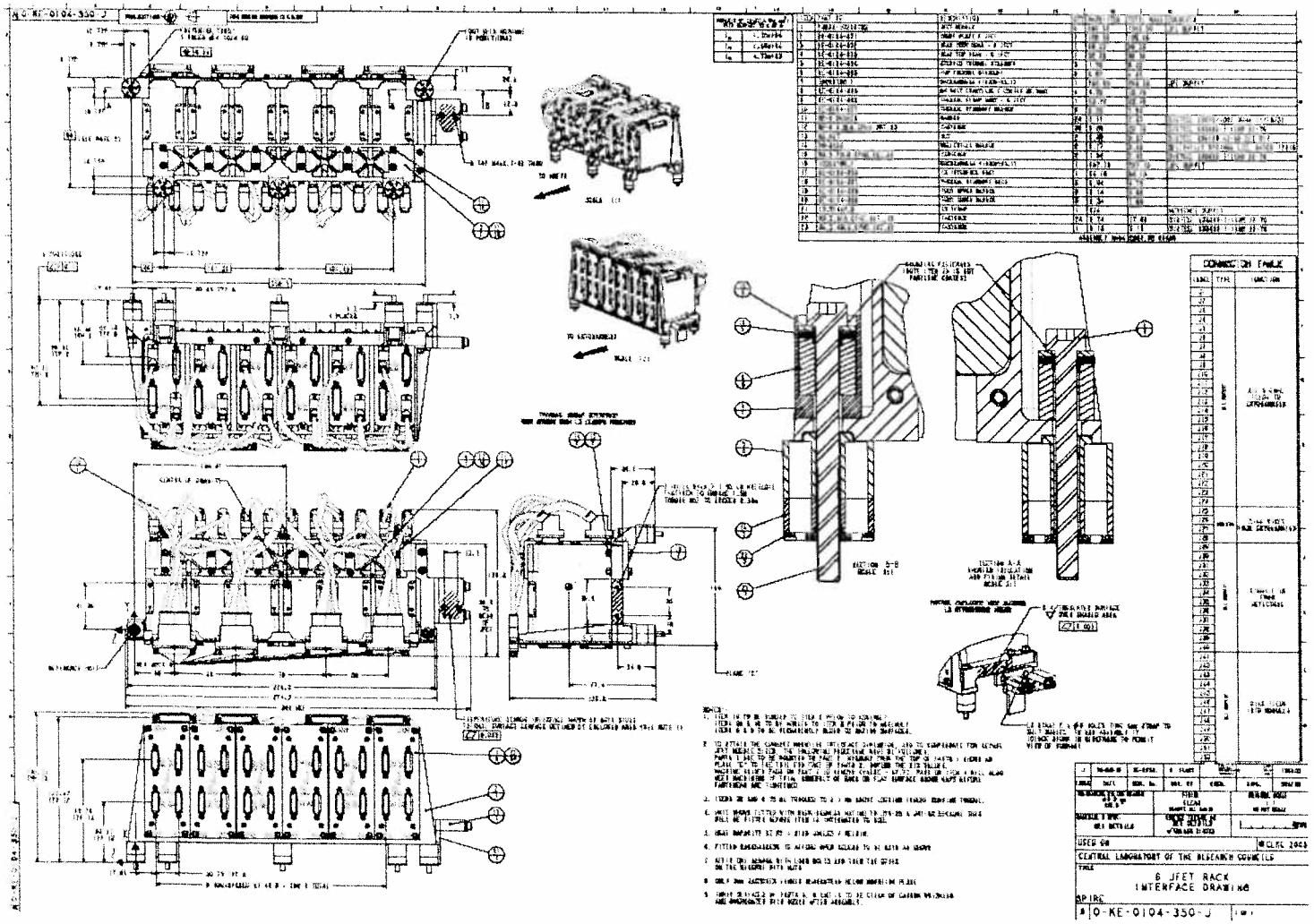


# 9 ANNEX C

## 9.1 Spectrometer I/F drawing



## 9.2 Photometer I/F drawing



END OF DOCUMENT

| | Name | Dep./Comp. | | Name | Dep./Comp. |
|---|---|---|---|---|---|
| | Alberti von Mathias Dr. | ASG23 | | Schuler Günter | ASA42 |
| | Baldock Richard | FAE12 | | Schweickert Gunn | ASG23 |
| X | Barlage Bernhard | AED13 | | Sonn Nico | ASG51 |
| X | Bayer Thomas | ASA42 | | Steininger Eric | AED32 |
| | Brune Holger | ASA45 | X | Stritter Rene | AED11 |
| | Edelhoff Dirk | AED2 | X | Suess Rudi | OTN/ASA44 |
| | Fehringer Alexander | ASG13 | | Theunissen Martijn | DSSA |
| X | Fricke Wolfgang Dr. | AED 65 | | Wagner Klaus | ASG23 |
| X | Geiger Hermann | ASA42 | X | Wietbrock Walter | AET12 |
| X | Grasl Andreas | OTN/ASA44 | | Wöhler Hans | ASG23 |
| X | Grasshoff Brigitte | AET12 | X | Wössner Ulrich | ASE252 |
| | Hamer Simon | Terma | | | |
| X | Hendry David | Terma | | | |
| X | Hengstler Reinhold | ASA42 | | | |
| | Hinger Jürgen | ASG23 | | | |
| X | Hohn Rüdiger | AED65 | | | |
| | Hölzle Edgar Dr. | AED32 | | | |
| | Huber Johann | ASA42 | | | |
| X | Hund Walter | ASE252 | | | |
| X | Idler Siegmund | AED312 | | | |
| | Iványi von András | FAE12 | | | |
| | Jahn Gerd Dr. | ASG23 | | | |
| | Kalde Clemens | ASM2 | | | |
| | Kameter Rudolf | OTN/ASA42 | | | |
| X | Kettner Bernhard | AET42 | | | |
| | Knoblauch August | AET32 | X | Alcatel Alenia Space Cannes | AAS-F |
| | Koelle Markus | ASA43 | | Alcatel Alenia Space Torino | AAS-I |
| | Koppe Axel | AED312 | X | ESA/ESTEC | ESA |
| X | Kroeker Jürgen | AED65 | | | |
| | La Gioia Valentina | Terma | | **Instruments:** | |
| X | Lang Jürgen | ASE252 | | MPE (PACS) | MPE |
| X | Langenstein Rolf | AED15 | X | RAL (SPIRE) | RAL |
| | Langfermann Michael | ASA41 | | SRON (HIFI) | SRON |
| | Martin Olivier | ASA43 | | | |
| | Maukisch Jan | ASA43 | | | |
| | Much Christoph | ASA43 | | **Subcontractors:** | |
| | Müller Jörg | ASA42 | | Alcatel Alenia Space Antwerp | ABSP |
| X | Müller Martin | ASA43 | | Austrian Aerospace | AAE |
| | Peltz Heinz-Willi | ASG13 | | Austrian Aerospace | AAEM |
| | Pietroboni Karin | AED65 | | BOC Edwards | BOCE |
| | Platzer Wilhelm | AED2 | | Dutch Space Solar Arrays | DSSA |
| X | Reichle Konrad | ASA42 | | EADS Astrium Sub-Subsyst. & Equipment | ASSE |
| | Runge Axel | OTN/ASA44 | | EADS CASA Espacio | CASA |
| X | Schink Dietmar | AED32 | | EADS CASA Espacio | ECAS |
| | Schlosser Christian | OTN/ASA44 | | European Test Services | ETS |
| | Schmidt Rudolf | FAE12 | | Patria New Technologies Oy | PANT |
| X | Schmidt Thomas | AED15 | | SENER Ingenieria SA | SEN |

Annex 1 to 72-0083

HP-2-RAL-PR-0017_2_0



# SPIRE

**SUBJECT: SPIRE PFM SIH ELECTRICAL INTEGRATION PROCEDURE**

**PREPARED BY:** Douglas Griffin

**UPDATED BY:** J. Lang

**DOCUMENT No:** SPIRE-RAL-PRC-002882

**ISSUE:** 2.0 **Date:** 18.04.2007

**CHECKED BY:** E. Sawyer **Date:**

**APPROVED BY :**

ASED-Eng.: J. Lang Date: 18.4.07

ASED-PA: R. Stritter Date:

ASED-AIT: M. Müller Date: 18.4.07

RAL-E.Sawyer Date: 18-4-07

18.4.2007 T. Schmidt finished 31-10-07

# Change Record

| ISSUE | DATE | |
|---|---|---|
| 1.0 | 12-04-2007 | Initial release - |
| 2.0 | 18-04-2007 | ASED update |

# Table of Contents

# 1. APPLICABLE/REFERENCE DOCUMENTS

| Number | TITLE | Document Number | Issue |
|---|---|---|---|
| AD 1 | SPIRE FPU Handling and Mechanical Integration Procedure | SPIRE-RAL-PRC-002802 | 2 |
| AD 2 | Making SPIRE ESD Safe | SPIRE-RAL-NOT-002028 | 2 |
| AD 3 | SPIRE FM Warm Functional Test Procedures | SPIRE-RAL-PRC-2422 | 2.2 |
| AD 4 | ESD-Rules for Herschel PLM & Integration Activities | HP-2-ASED-PR-0062 | 1 |

| Number | TITLE | Document Number | Issue |
|---|---|---|---|
| RD1 | Email: Instruments El. Integration Flow (See §4 Appendix 1 – EADS Integration Sequence Email) | NA | NA |
| RD2 | Cryo Harness Interconnection Diagram SPIRE (PFM) | 2547-121430-030-01-0B | B |
| RD3 | Cryo-Harness Interconnection Diagram SPIRE (PFM) | HP-2-ASED-ID-0091-01-0B | B |
| RD4 | PFM CVV int SPIRE SIH Integration | HP-2-ASED-TP-0050 | 1 |

# 2. SCOPE AND INTRODUCTION

This document establishes the detailed procedure to be followed for the electrical integration of the SIH to the SPIRE FPU, JFP and JFS. It also covers the mating of the SIH-CS-01 to -13 harnesses to the CVV-FTHR connectors 211121 J22 to J34. As outlined in RD 1 (see Appendix 1.
The incorporation of the measurement of the balance of Idd and Iss for the JFET modules is a result of the fact that an extra propagating failure mechanism was discovered during the SPIRE PFM-4 ILT campaign. It is a diagnostic test of the integrity of the entire SPIRE detector system in the warm condition. The chronological SIH connector mating and fixation in final flight configuration and its inspections need, have been edit in the step-by-step procedure too. The final CVV internal inspection to be performed by ASED , Alcatel & ESA after the SPIRE cold-unit and SIH electrical integration is covered here in too.

# 3. MATING OF SIH-CS-01 TO -13 TO FPU, JFP AND JFS

## 3.1 Prerequisites

1. The FPU, JFP and JFS are mechanically integrated to the OBA as detailed in AD 1, §6.2.1 through §6.2.4
2. The SIH-CS-XX harnesses have been integrated into the cryostat

## 3.2 Notes:

1. The Isolation Test detailed in AD 1, §6.2.5 (Isolation Test) is to be completed during the first stage of the procedure. The results must be compliant with the specified pass criteria for the integration to continue.
2. The FPU, JFP and JFS are ESD sensitive. Handling of these units is to be carried out by personnel suitably trained and equipped. Prior to carrying out the mating operations detailed below, the Pxx and Jxx connectors are to put in an ionized air stream for > 30 sec to discharge the harness.
3. The connector mating operations detailed below are to be recorded in the relevant sections of the paper PFM SPIRE EIDP
4. Red tag items removed from the FPU and JFET modules (safeing plugs and ESD caps to be placed in the SPIRE red tag box and stored in the SPIRE transport container)

| No: | Activity | Remarks/Results | Sign off |
|---|---|---|---|
| 8 | Remove and store ESD cover from FPU 121100 J23<br>Mate FPU SIH 121100 P23 (Prime thermometry)<br>Perform torque of 0,33 Nm | Identify removed cold-unit connector shorting-plugs as RED-TAG Item & store it in subject cubboard.<br>Visual inspection of FPU connectors and vacuum cleaning carried out at this stage. | √ |
| 9 | Remove and store ESD cover from FPU 121100 J24<br>Inspect FPU J24 jackpost threads<br>Mate FPU SIH 121100 P24 (Red. thermometry)<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm<br>Check SIH connector fixation bolts are fit to end, else lock with EC2216 | | √ |
| 10 | Remove and store ESD cover from FPU J19<br>Mate FPU SIH 121100 P19 (Prime cooler)<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 11 | Remove and store ESD cover from FPU 121100 J20<br>Inspect FPU J20 jackpost threads<br>Mate FPU SIH 121100 P20 (Red. cooler)<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm<br>Check SIH connector fixation bolts are fit to end, else lock with EC2216 | | √ |
| 12 | Remove and store ESD cover from FPU 121100 J25<br>Inspect FPU J25 jackpost threads<br>Mate FPU SIH 121100 P25 (Prime BSM)<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm<br>Check SIH connector fixation bolts are fit to end, else lock with EC2216 | | √ |

### 3.3 Detailed Step-by-step Procedure Carried out on 19/4/07

| No: | Activity | Remarks/Results | Sign off |
|---|---|---|---|
| | **Grounding check** | | |
| 1 | Carry out the activities in AD 1, §6.2.5 | **FPU / OBA:**<br>**Spect. Det. Box / OBA:**<br>**Phot. Det. Box / OBA:**<br>**Spect. Det. Box / FPU:**<br>**Phot. Det. Box / FPU:**<br>**Phot. Det. Box / Spect. Det. Box:** | **OC**<br>**OC**<br>**OC**<br>**OC**<br>**OC**<br>**OC** |
| 2 | Remove the ESD covers from the JFP 121210 J25 through JFP J28 and remate the Type-III safeing plugs | Identify removed cold-unit connector-covers as RED-TAG Item & store it in subject cubboard<br>Note, debris found in JFP J25, removed mechanically and vacuum cleaner | √ |
| | **Mating of FPU SIH** | The connector codes shall be defined, because E-PLM mationg / Demating DB updates | |
| 3 | Detailed inspection be performed on FPU J20, J22, J24 & J25 for properly tight srew-lock assies, else fixation bolts to be locally stoppped by use of EC2216 | ( HP-2-ASED-NC-1340 ) | √ |
| 4 | Verify that SPIRE Safeing Plug Type-VIII is mated to CVV FTHR 211121 J30. If not installed, then mate | Take Saving-plugs from RED-TAG Item cubboard & record removal | √ |
| 5 | Verify that SPIRE Safeing Plug Type-VIII is mated to CVV FTHR 211121 J29. If not installed, then mate | Take Saving-plugs from RED-TAG Item cubboard & record removal | √ |
| 6 | Verify that SPIRE Safeing Plug Type-VII is mated CVV FTHR 211121 J34. If not installed, then mate | Take Saving-plugs from RED-TAG Item cubboard & record removal | √ |
| 7 | Verify that SPIRE Safeing Plug Type-VII is mated to SVM-CB 312300 J05 CVV FTHR 211121 J33. If not installed, then mate | Take Saving-plugs from RED-TAG Item cubboard & record removal | √ |

| No: | Activity | Remarks/Results | Sign off |
|---|---|---|---|
| 13 | Remove and store ESD cover from FPU 121100 J26<br>Mate FPU SIH 121100 P26 (Red. BSM)<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 14 | Remove and store ESD cover from FPU 121100 J21<br>Mate FPU SIH 121100 P21 (Prime S-Cal)<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 15 | Remove and store ESD cover from FPU 121100 J22<br>Inspect FPU J22 jackpost threads<br>Mate FPU SIH 121100 P22 (Red. S-Cal)<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm<br>Check SIH connector fixation bolts are fit to end, else lock with EC2216 | | √ |
| 16 | Remove and store safeing plug from FPU 121100 J29<br>Mate FPU SIH 121100 P21 (Prime SMEC)<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | **7M ohm due to safe plug in J30** |
| 17 | Remove and store safeing plug from FPU 121100 J30<br>Mate FPU SIH 121100 P30 (Red. SMEC)<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | **7M ohm due to safe plug in J30** |
| 18 | Remove and store safeing plug from FPU 121100 J27<br>Mate FPU SIH 121100 P27 (Prime SMEC)<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | **7M ohm due to safe plug in J30** |
| 19 | Remove and store safeing plug from FPU 121100 J28<br>Mate FPU SIH 121100 P28 (Red. SMEC)<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | **7M ohm due to safe plug in J30** |

| No: | Activity | Remarks/Results | Sign off |
|---|---|---|---|
| | | | |
| | **Mating of JFS (Spectrometer) SIH** | | |
| 20 | Verify that SPIRE Safeing Plug Type-VI is mated to CVV FTHR 211121 J32.<br>If not installed, then mate | Take Saving-plugs from RED-TAG Item cubboard & record removal | √ |
| 21 | Verify that SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J31.<br>If not installed, then mate | Take Saving-plugs from RED-TAG Item cubboard & record removal | √ |
| 22 | Remove SPIRE Safeing Plug Type-III from JFS 121220 J09 | **Inspection of all JFS connectors carried out at this point** | √ |
| 23 | Mate JFS SIH 121220 P09<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | **Short, remove PO9, fit P10 OK, Try P09 again, >1M** | |
| 24 | Remove SPIRE Safeing Plug Type-III from JFS 121220 J10 | | |
| 25 | Mate JFS SIH 121220 P10<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | **473K with safing plug J32** |
| 26 | Remove and store ESD cover from JFS 121220 J07<br>Mate JFS SIH 121220 P07<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 27 | Remove and store ESD cover from JFS J05<br>Mate JFS SIH 121220 P05<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 28 | Remove and store ESD cover from JFS 121220 J06<br>Mate JFS P06<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |

| No: | Activity | Remarks/Results | Sign off |
|---|---|---|---|
| 29 | Remove and store ESD cover from JFS 121220 J02<br>Mate JFS SIH 121220 P02<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 30 | Remove and store ESD cover from JFS 121220 J01<br>Mate JFS SIH 121220 P01<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 31 | Remove and store ESD cover from JFS 121220 J03<br>Mate JFS SIH 121220 P03<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 32 | Remove and store ESD cover from JFS 121220 J04<br>Mate JFS SIH 121220 P04<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 33 | Verify that 312300 J1 and J02 Launch-latches are integrated. | N/A for CVVint Integration | |
| | | | |
| | **Mating of JFP SIH ( Photometer )** | | |
| 34 | Verify that SPIRE Safeing Plug Type-V is mated to CVV FTHR 211121 J26.<br>If not installed, then mate | | √ |
| 35 | Verify that SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J22 .<br>If not installed, then mate | | √ |
| 36 | Verify that SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J23 .<br>If not installed, then mate | | √ |
| 37 | Verify that SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J24.<br>If not installed, then mate | | √ |
| 38 | Verify that SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J25.<br>If not installed, then mate | | √ |

| No: | Activity | Remarks/Results | Sign off |
|---|---|---|---|
| 39 | Verify that SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J27.<br>If not installed, then mate | | √ |
| 40 | Verify that SPIRE Safeing Plug Type-VII is mated to CVV FTHR 211121 J28.<br>If not installed, then mate | | √ |
| 41 | Verify that 312100 J1A and J1B links are integrated. | N/A for CVVint Integration | |
| 42 | Remove and store SPIRE Safeing Plug Type-III from JFP 121210 J25 | Store Saving-plugs in RED-TAG Item cubboard | √ |
| 43 | Mate JFP SIH 121210 P25 to J25<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 44 | Remove and store SPIRE Safeing Plug Type-III from JFP 121210 J27 | Store Saving-plugs in RED-TAG Item cubboard | √ |
| 45 | Mate JFP SIH 121210 P27 to J27<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 46 | Remove and store SPIRE Safeing Plug Type-III from JFP 121210 J26 | Store Saving-plugs in RED-TAG Item cubboard | √ |
| 47 | Mate JFP SIH 121210 P26 to J26<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 48 | Remove and store SPIRE Safeing Plug Type-III from JFP 121210 J28 | Store Saving-plugs in RED-TAG Item cubboard | √ |
| 49 | Mate JFP SIH 121210 P28 to J28<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 50 | Remove and store ESD cover from JFP121210 J16<br>Mate JFP SIH 121210 P16<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | **55K due to safe plugs** |

| No: | Activity | Remarks/Results | Sign off |
|---|---|---|---|
| 51 | Remove and store ESD cover from JFP 121210 J15<br>Mate JFP SIH 121210 P15<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 52 | Remove and store ESD cover from JFP 121210 J13<br>Mate JFP SIH 121210 P13<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 53 | Remove and store ESD cover from JFP 121210 J14<br>Mate JFP P14<br>Perform torque of 0,33 Nm | | √ |
| 54 | Remove and store ESD cover from JFP 121210 J18<br>Mate JFP SIH 121210 P18<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 55 | Remove and store ESD cover from JFP 121210 J17<br>Mate JFP P17<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 56 | Remove and store ESD cover from JFP 121210 J21<br>Mate JFP SIH 121210 P21<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | **Disconnected and reconnected to reroute harness** | √√ |
| 57 | Remove and store ESD cover from JFP 121210 J22<br>Mate JFP SIH 121210 P22<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |

| No: | Activity | Remarks/Results | Sign off |
|---|---|---|---|
| 58 | Remove and store ESD cover from JFP 121210 J24<br>Mate JFP SIH 121210 P24<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 59 | Remove and store ESD cover from JFP 121210 J23<br>Mate JFP P23<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 60 | Remove and store ESD cover from JFP 121210 J19<br>Mate JFP SIH 121210 P19<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 61 | Remove and store ESD cover from JFP 121210 J20<br>Mate JFP SIH 121210 P20<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 62 | Remove and store ESD cover from JFP 121210 J02<br>Mate JFP SIH 121210 P02<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 63 | Remove and store ESD cover from JFP 121210 J01<br>Mate JFP SIH 121210 P01<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 64 | Remove and store ESD cover from JFP 121210 J05<br>Mate JFP SIH 121210 P05<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |

| No: | Activity | Remarks/Results | Sign off |
|---|---|---|---|
| 65 | Remove and store ESD cover from JFP 121210 J06<br>Mate JFP SIH 121210 P06<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 66 | Remove and store ESD cover from JFP 121210 J10<br>Mate JFP SIH 121210 P10<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 67 | Remove and store ESD cover from JFP 121210 J09<br>Mate JFP P09<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 68 | Remove and store ESD cover from JFP 121210 J11<br>Mate JFP SIH 121210 P11<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 69 | Remove and store ESD cover from JFP 121210 J12<br>Mate JFP SIH 121210 P12<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 70 | Remove and store ESD cover from JFP 121210 J08<br>Mate JFP SIH 121210 P08<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 71 | Remove and store ESD cover from JFP 121210 J07<br>Mate JFP SIH 121210 P07<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |

| No: | Activity | Remarks/Results | Sign off |
|---|---|---|---|
| 72 | Remove and store ESD cover from JFP121210 J03<br>Mate JFP P03<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 73 | Remove and store ESD cover from JFP 121210 J04<br>Mate JFP SIH 121210 P04<br>Measuere FPU Isolation Resistance to OBA structure [ R > 1MΩ ]<br>Perform torque of 0,33 Nm | | √ |
| 74 | Record mate/demate activities in paper EIDP log | Record in E-PLM Mating / Demating DB too | |
| | **Verification of Instrument Grounding** | | |
| 75 | Remove SPIRE Safeing Plug Type-V from CVV FTHR 211121 J26 | | √ |
| 76 | Remove SPIRE Safeing Plug Type-VI from CVV FTHR 211121 J32 | | √ |
| 77 | Remove SPIRE Safeing Plug Type-VIII from CVV FTHR 211121 J30 | | √ |
| 78 | Remove SPIRE Safeing Plug Type-VIII from CVV FTHR 211121 J29 | | √ |
| 79 | Prepare a 128-way BOB with short contacts & mate Short-plug to remove charge | | √ |
| 80 | Mate BOB to CVV FTHR 211121 J32 | | √ |
| 81 | Demate BOB Short-plug | | √ |
| 82 | Verify FPU Isolation from OBA by measuring Pin 5 to Chassis: s.b. > 1 MOhm | | OC |
| 83 | Verify Analogue Ground Isolation from OBA by measuring Pin 93 to Chassis: s.b. > 1 MOhm | | OC |
| 84 | Demate BOB from CVV FTHR 211121 J32 | | √ |
| 85 | Prepare a 128-way BOB ~~and~~ with short contacts & mate Short-plug to remove charge | | √ |
| 86 | Demate BOB Short-plug | | √ |
| 87 | Mate BOB to CVV FTHR 211121 J26 | | √ |
| 88 | Verify FPU Isolation from OBA by measuring Pin 2 to Chassis: s.b. > 1 MOhm | | OC |
| 89 | Verify Analogue Ground Isolation from OBA by measuring Pin 36 to Chassis: s.b. > 1 MOhm | | OC |

| No: | Activity | Remarks/Results | Sign off |
|---|---|---|---|
| 90 | Demate BOB from CVV FTHR 211121 J26 | | √ |
| 91 | Mate SPIRE Safeing Plug Type-V to CVV FTHR 211121 J26 | | √ |
| 92 | Mate SPIRE Safeing Plug Type-VI to CVV FTHR 211121 J32 | | √ |
| 93 | Mate SPIRE Safeing Plug Type-VIII to CVV FTHR 211121 J30 | | √ |
| 94 | Mate SPIRE Safeing Plug Type-VIII to CVV FTHR 211121 J29 | | √ |
| 95 | Perform final srew-lock fixation " prior flight "<br>PA to perform final FPU & JFET SIH inspection | **To be completed later** 30.10.01 | ✓ |
| 96 | ASED final inspection of SPIRE Cold-unit & SIH integration | 30.10.01 | ✓ |
| 97 | RAL final inspection of SPIRE Cold-unit & SIH integration | | √ |
| 98 | AAS-F final inspection of SPIRE Cold-unit & SIH integration | 30.10.01 | ✓ |
| 99 | ESA final inspection of SPIRE Cold-unit & SIH integration | 30.10.01 | ✓ |
| 100 | End of step by step procedure - CVV internal part | | ✓ |

30.10.01 final inspection before OBS closure see Logbook SUM

SPIRE FPU SIH I/F-Connectors (RD-3)

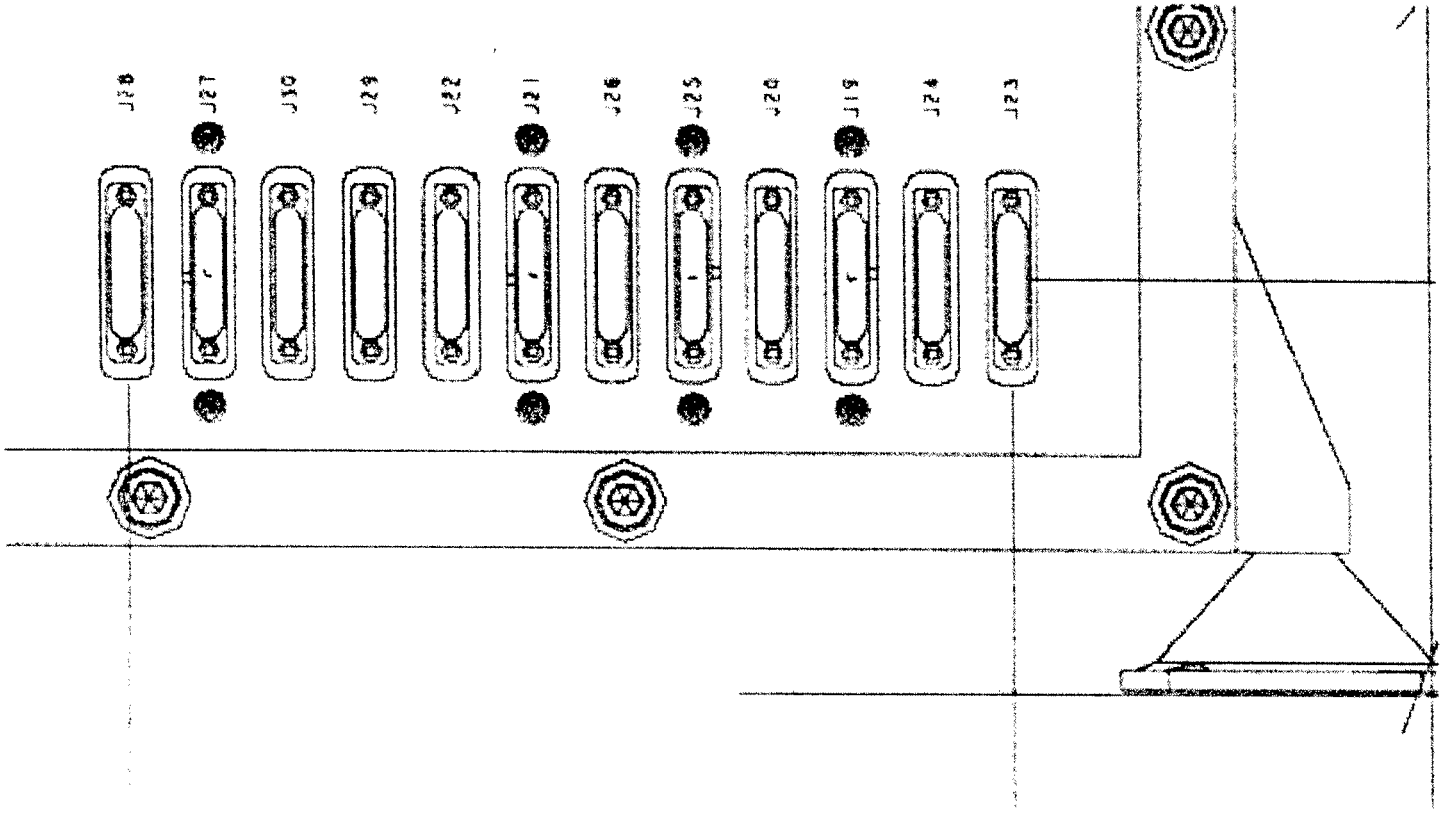



Figure 10.4-2: SPIRE FPU SIH I/F Connectors

SPIRE JFS SIH I/F-Connectors (RD-3)

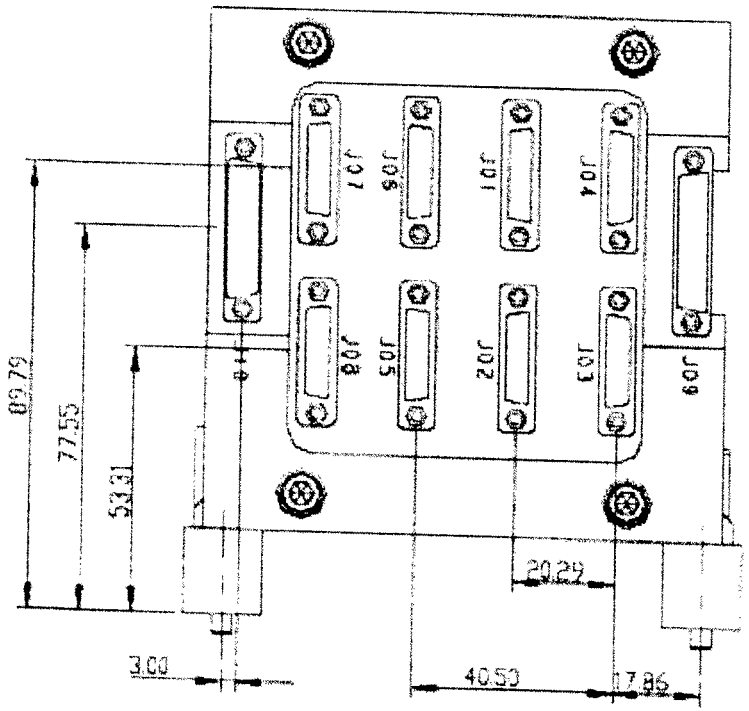



Figure 10.4-4: SPIRE JFS SIH I/F Connectors

SPIRE JFP SIH I/F-Connectors (RD-3)

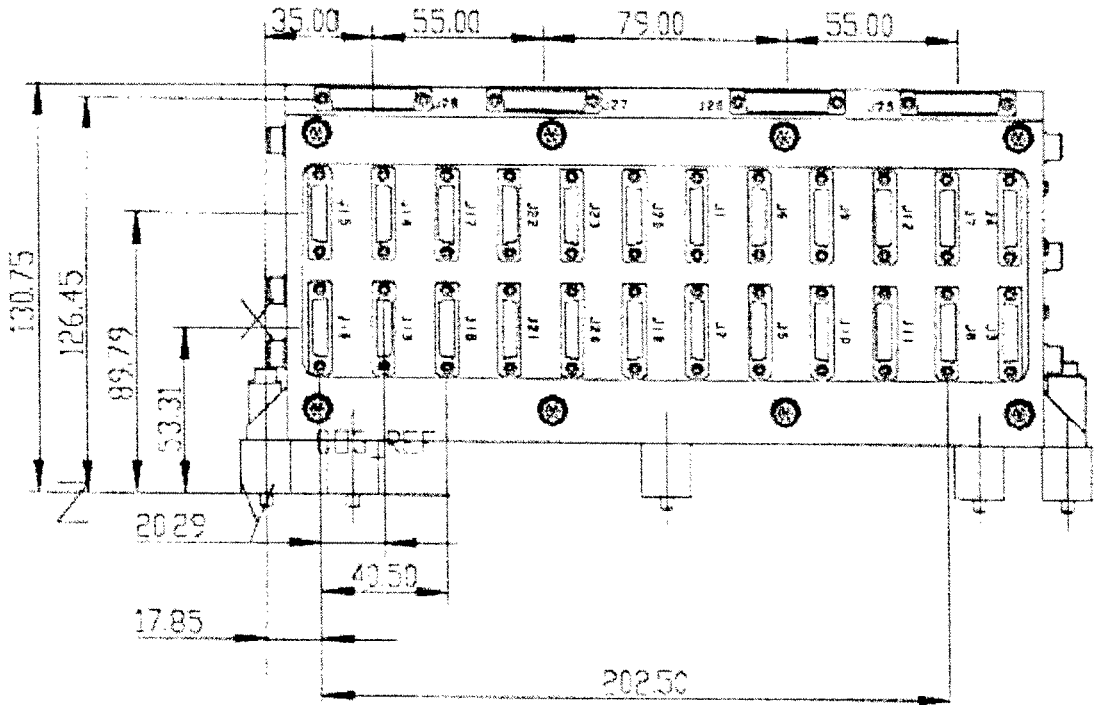



Figure 10.4-6: SPIRE JFP SIH I/F Connectors

**End of CVVint SPIRE PFM FPU , JFET & SIH Electrical Integration Procedure**

# 4. APPENDIX 1 – EADS INTEGRATION SEQUENCE EMAIL

**From:** Idler, Siegmund [Siegmund.Idler@astrium.eads.net]
**Sent:** 20 March 2007 16:50
**To:** Sawyer, EC (Eric)
**Cc:** Bernard.Collaudin@alcatelaleniaspace.com; Guy.Doubrovik@alcatelaleniaspace.com; Benoit.Gobillot@alcatelaleniaspace.com; King, KJ (Ken); Griffin, DK (Doug); 'carsten.scharmberg@esa.int'; Mueller, Martin; Koppe, Axel; Sonn, Nico; Schink, Dietmar
**Subject:** Instruments El. Integration Flow

Dear Eric,

as agreed during the SPIRE DRB, please find below the instruments electrical integration sequence as currently discussed as option. The major difference to the previous planning is, that - for schedule recovery reasons - the CVV-SVM preliminary mating is cancelled and the first warm test with the integrated instrument is with the evacuated warm CVV. However, the ESA/AAS-F instruction to follow this option is still outstanding! Nevertheless, could you please base your procedures to be delivered on this option since it is the most likely one to be followed.

Activities on SVM

1. Integrate WIH on SVM (already done)
2. Integrate WU on SVM
3. Connect WIH to WU
4. Perform el. integration tests of WU
5. Perform WU functional test (via CCS)
6. Close panel

Activities on EPLM

7. Integrate FPU on OBA
8. Integrate CVV ext. SIH (and connect SIH to CVV feed throughs)
9. Install termination plugs on open ends of CVV ext. SIH (on SVM CB side)
10. Connect SIH to FPU
11. Perform stand alone test with HIFI FPU (using the FCU EQM)
12. Close and evacuate CVV

Activities on S/C

13. Mate CVV with SVM
14. Connect WU to FPU (remove termination plugs and mate SIH at SVM CB)
15. Perform instrument warm functional test

Note: Only those activities are listed which are related to the instrument electrical integration and which support the understanding of it.

Regards

Siegmund

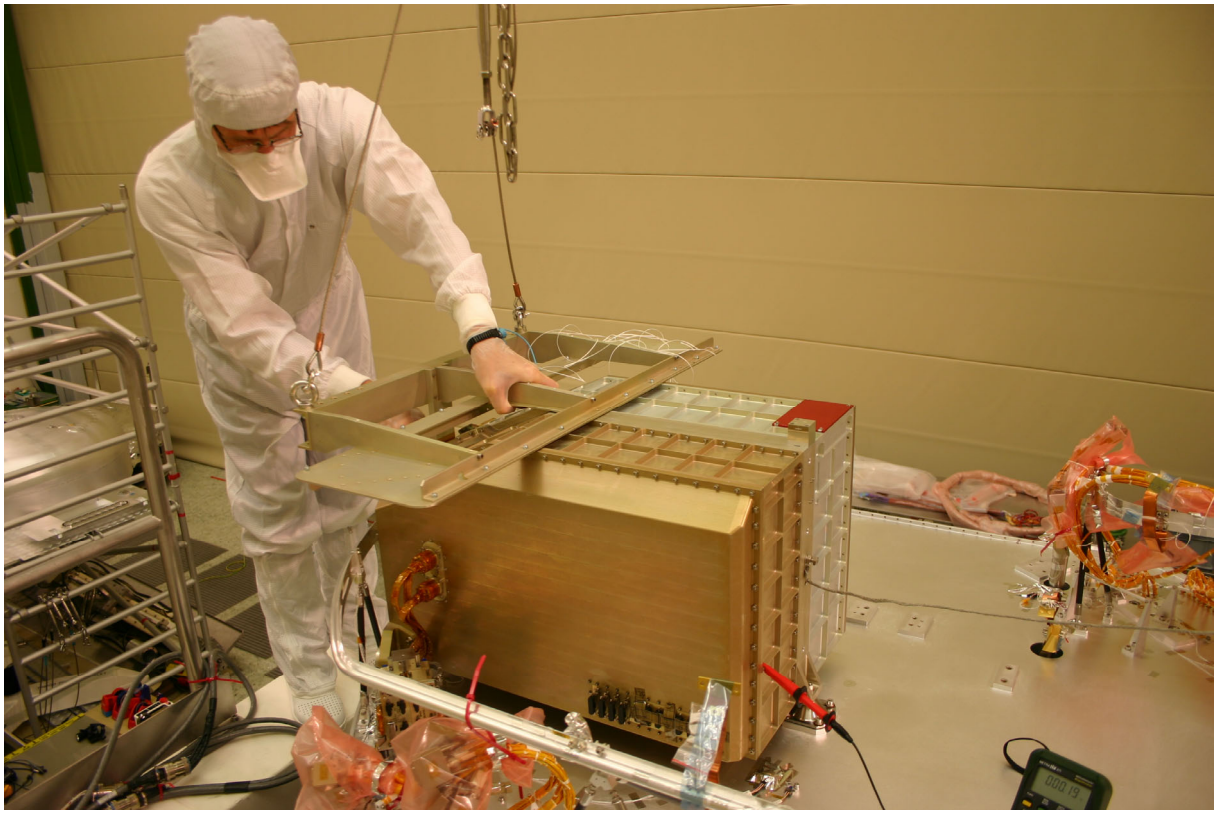


Figure 1: SPIRE FPU Integration Preparation

Figure 2: SPIRE FPU in flight to its position

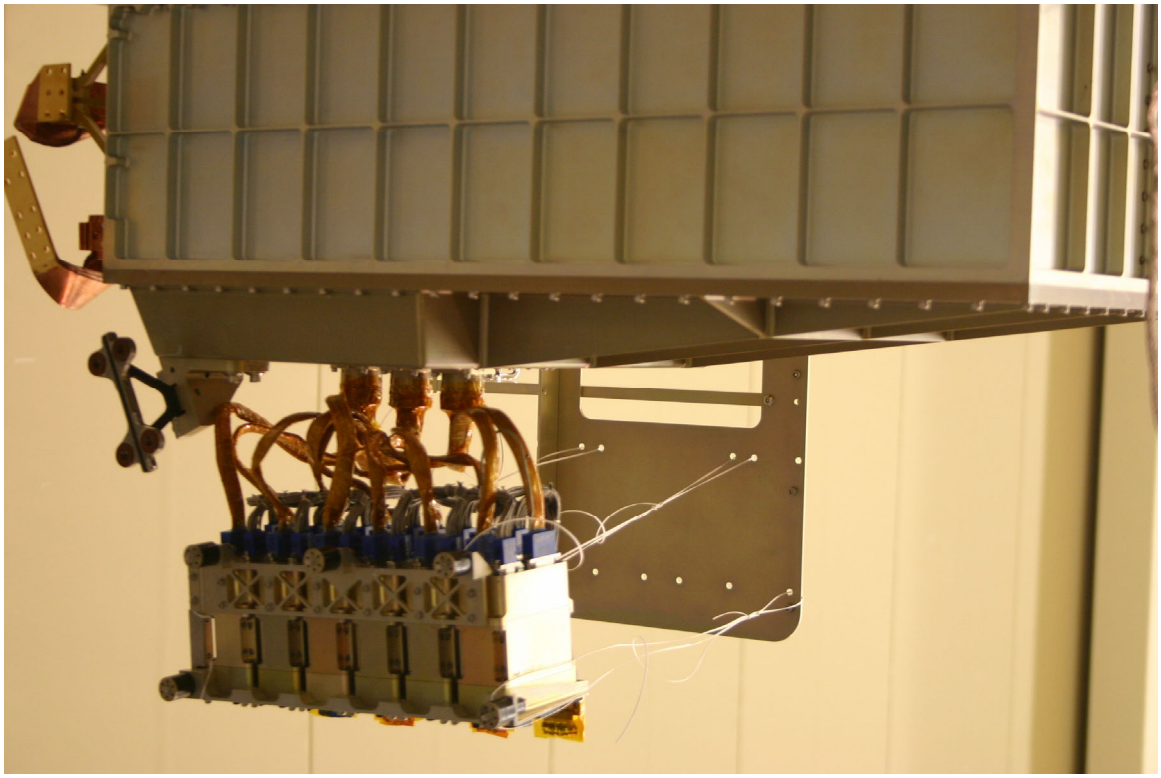


Figure 3: Photometer JFET assembly

Figure 4: Integration on OBP

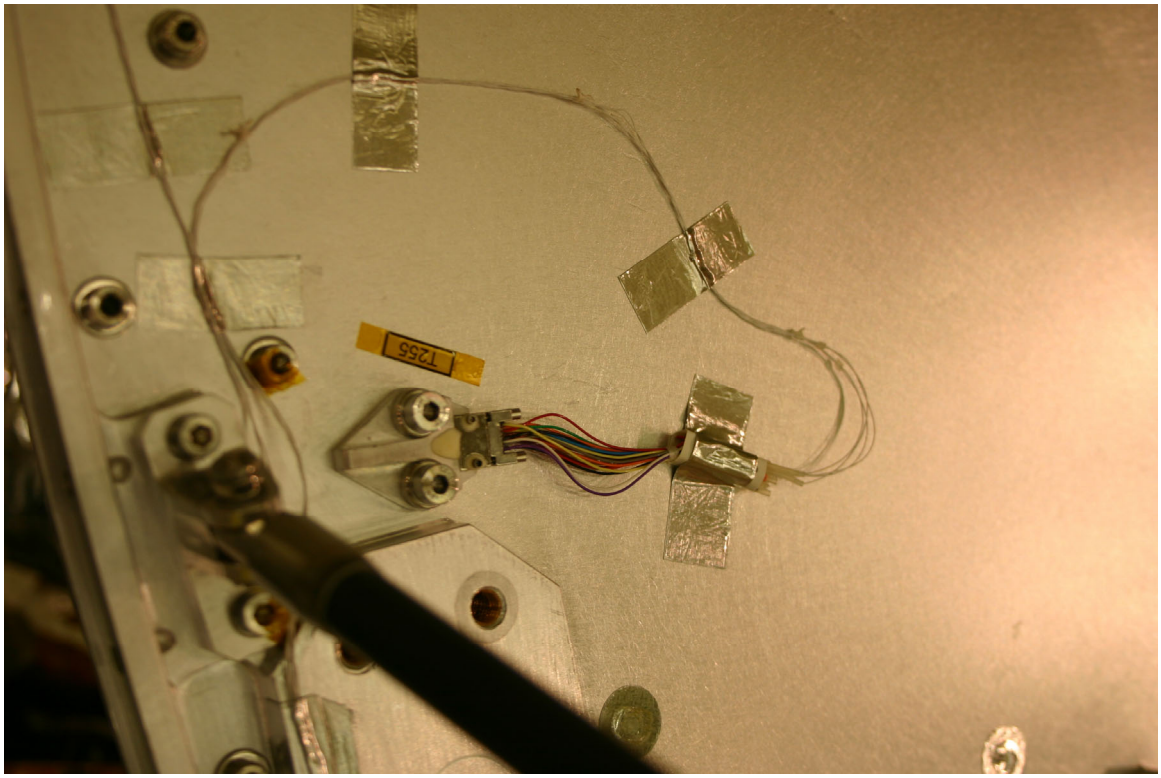



Figure 5: Temperature Sensor T255

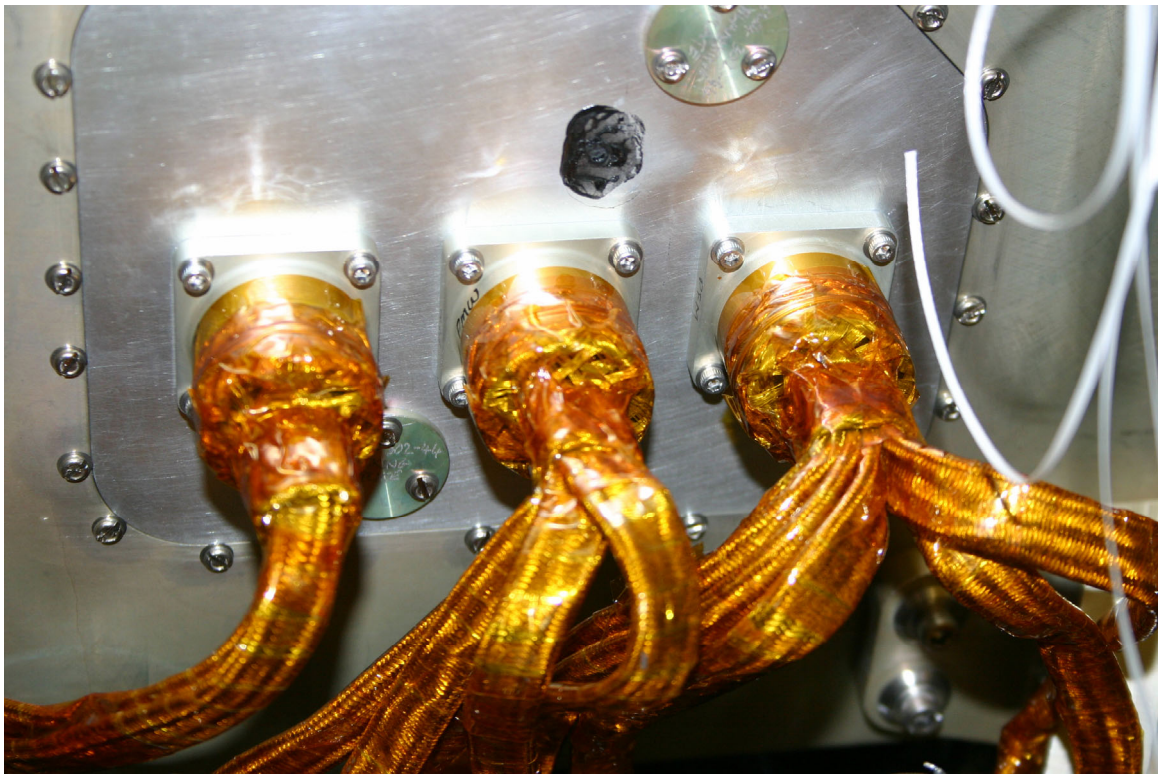


Figure 6: JFET Harness connectors HS PLW, HS PMW and HS PSW of SPIRE Photometer

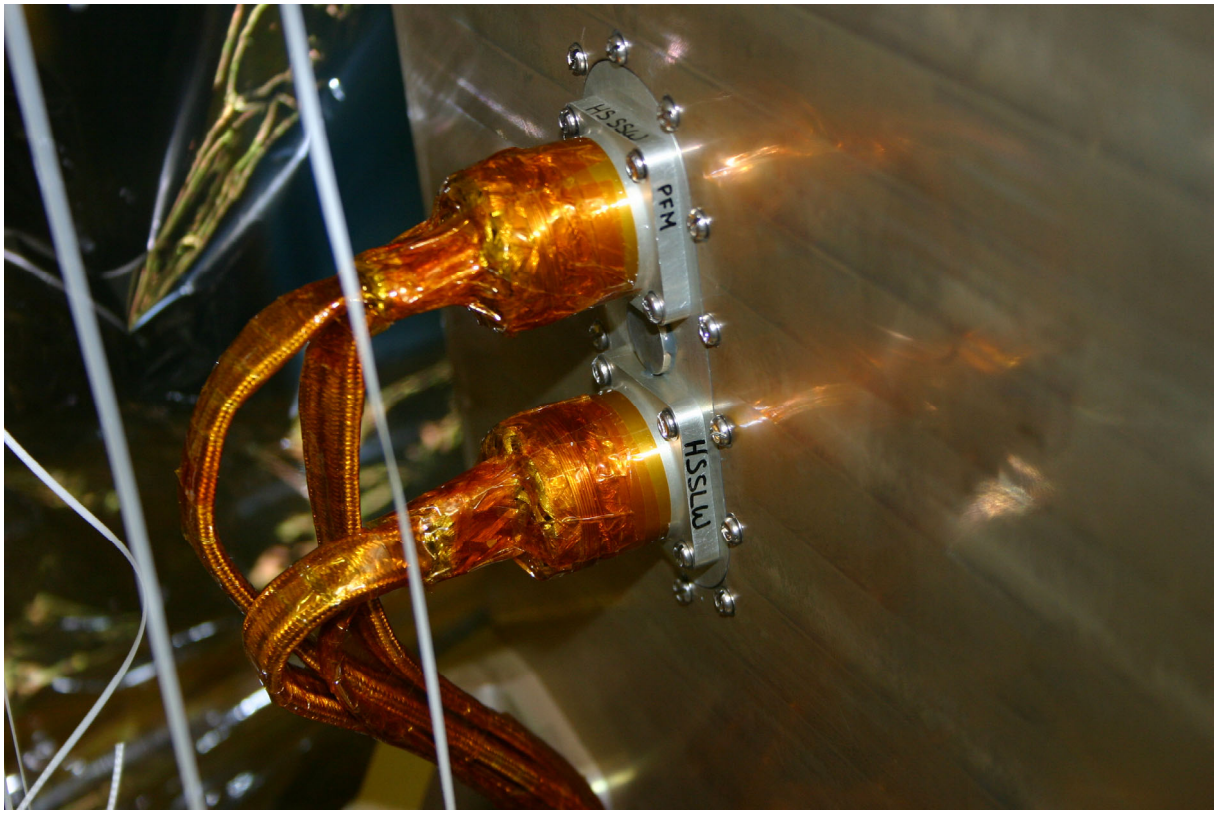



Figure 7: JFET Harness connectors HS SSW and HS SLW of SPIRE Spectrometer

END OF DOCUMENT

| | Name | Dep./Comp. | | Name | Dep./Comp. |
|---|---|---|---|---|---|
| | Baldock Richard | FAE12 | | Schweickert Gunn | ASG23 |
| | Barlage Bernhard | AED13 | X | Sonn Nico | ASG51 |
| X | Bayer Thomas | ASA42 | | Steininger Eric | AED321 |
| | Brune Holger | ASA45 | X | Stritter Rene | AED11 |
| | Chen Bing | HE Space | | Suess Rudi | OTN/ASA44 |
| | Davis William | Captec | | Theunissen Martijn | DSSA |
| | Edelhoff Dirk | AED21 | | Vascotto Riccardo | HE Space |
| | Fehringer Alexander | ASG15 | | Wagner Klaus | ASG23 |
| X | Fricke Wolfgang Dr. | AED 65 | X | Wietbrock Walter | AET12 |
| X | Geiger Hermann | ASA42 | | Wöhler Hans | ASG23 |
| X | Grasl Andreas | OTN/ASA44 | | Wössner Ulrich | ASE252 |
| | Grasshoff Brigitte | AET12 | | Zumstein Armin | AED15 |
| | Hamer Simon | Terma | | | |
| | Hanka, Erhard | FI522 | | | |
| | Hendrikse Jeffrey | HE Space | | | |
| X | Hendry David | Terma | | | |
| | Hengstler Reinhold | ASA42 | | | |
| | Hinger Jürgen | ASG23 | | | |
| | Hohn Rüdiger | AED65 | | | |
| | Hopfgarten Michael | AET32 | | | |
| | Huber Johann | ASA42 | | | |
| | Hund Walter | ASE252 | | | |
| X | Idler Siegmund | AED312 | | | |
| | Iványi von András | FAE12 | | | |
| | Jahn Gerd Dr. | ASG23 | X | ESA/ESTEC | ESA |
| | Jolk Matthias | AET1 | X | Thales Alenia Space Cannes | TAS-F |
| | Klenke Uwe | ASG72 | | Thales Alenia Space Torino | TAS-I |
| | Kölle Markus | ASA43 | | | |
| | König Werner | AET32 | | | |
| X | Koppe Axel | AED312 | | **Instruments:** | |
| X | Kroeker Jürgen | AED65 | | MPE (PACS) | MPE |
| | La Gioia Valentina | Terma | X | RAL (SPIRE) | RAL |
| X | Lang Jürgen | ASE252 | | SRON (HIFI) | SRON |
| | Langenstein Rolf | AED15 | | | |
| X | Langfermann Michael | ASA41 | | | |
| | Leitermann Stefan | AET12 | | **Subcontractors:** | |
| | Liberatore Danilo | Rhea | | Austrian Aerospace | AAE |
| | Martin Olivier | Altec | | Austrian Aerospace | AAEM |
| | Maukisch Jan | ASA43 | | BOC Edwards | BOCE |
| | Much Christoph | ASA43 | | Dutch Space Solar Arrays | DSSA |
| | Müller Martin | ASA43 | | EADS Astrium Sub-Subsyst. & Equipment | ASSE |
| | Pietroboni Karin | AED65 | | EADS CASA Espacio | CASA |
| X | Reichle Konrad | ASA42 | | EADS CASA Espacio | ECAS |
| | Runge Axel | OTN/ASA44 | | European Test Services | ETS |
| | Saal Christoph | External | | Patria New Technologies Oy | PANT |
| | Schink Dietmar | AED321 | | SENER Ingenieria SA | SEN |
| | Schmidt Thomas | AED15 | | Thales Alenia Space, Antwerp | TAS-ETCA |