EADS Astrium

Procedure

Herschel

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

CI-No: 125 200

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Project Management:	Dr. W. Fricke	16/04/2007

Distribution: See Distribution List (last page)

Issue	Date	Sheet	Description of Change	Release
1	10.04.2007	All	Initial Issue	

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1 Scope

This document describes the mechanical and thermal integration activities for the HERSCHEL PFM SPIRE FPU & JFETs 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 & JFETs.
- 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

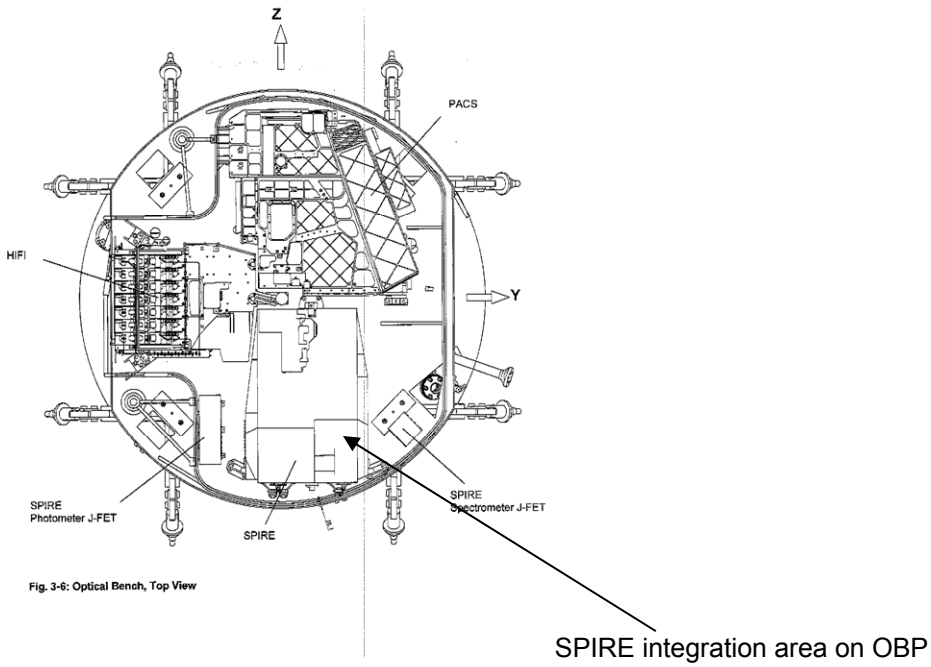


Figure 3.2-1: axis orientation, top view of OBA

4 Conditions

4.1 Personnel

Personnel necessary to complete activities according to this present procedures

Responsibility	Name / Organisation
Operator	*)
Operator	*)
Operator	*)
PA Responsible	*)
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 **NOTE**: Could possibly be attached to the unused harness support bracket holes, or any other convenient tapped hole.	RAL		
	Fixation bolts: • FPU M6 12 off • L0 straps M4 16 off • L0 pressure plate 4 off • L3 strap M4 4off	ASED		

Table 4.4-3: Special Integration Equipment

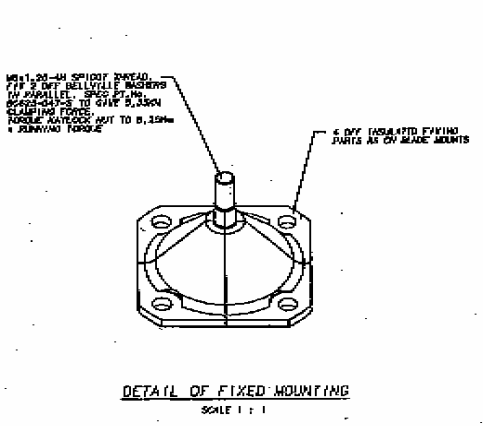
5 Step by Step Procedure

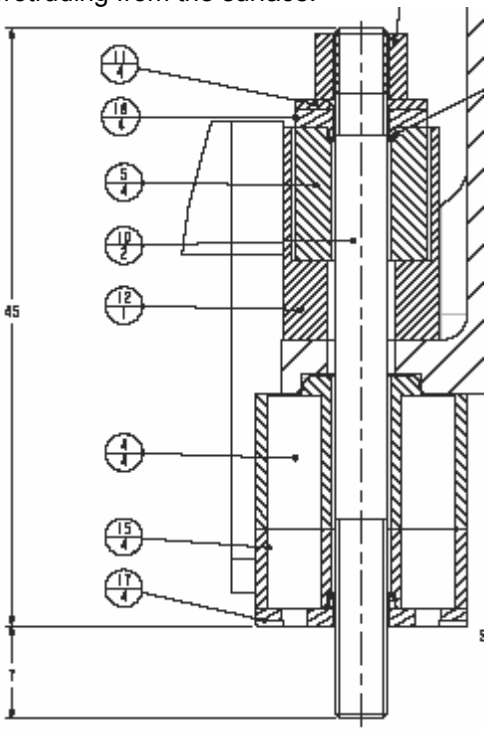
The FPU is supplied with the JFETs and associated harness already fitted. The following tasks need to be carried out before integration onto the OBP. Only standard tools are required at this stage.
The FPU is supplied with the alignment cube fitted and should be left in place until all alignment activities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

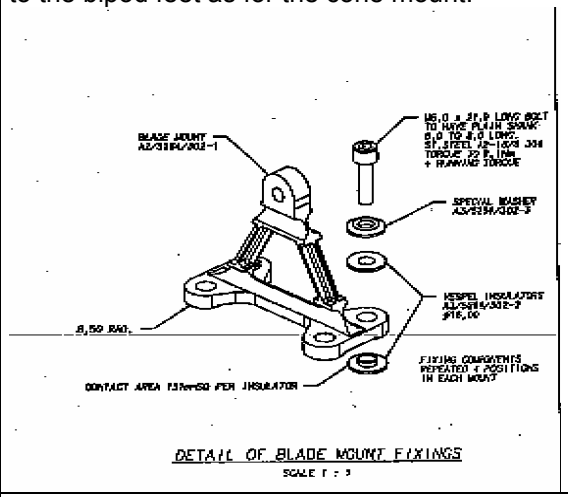
Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
5.1.1 Preparation for integration on Optical Bench Plate							
.1	The JFETs will be fitted to the spacecraft together with the FPU. They will need supporting during this activity. The SPIRE supplied MGSE provides 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. Attach the JFETs to the MGSE using lacing cord.						

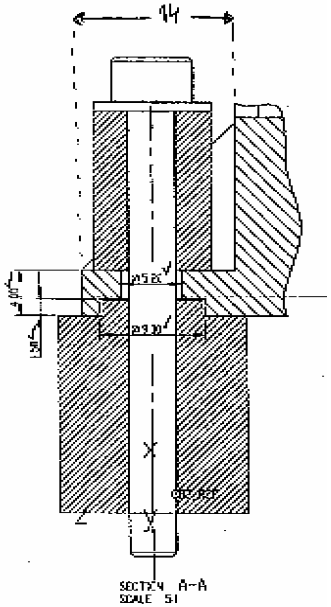
Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
5.1.2	***Removal from Base Plate***						
.1	**WARNING:** The bipod legs on two corners of the instrument are very thin section CFRP components, and easily damaged. Care must be taken at all times not to put side loads into these items. These are at risk at all times when the FPU is not attached to a rigid plate. **Note:** All screws that interface to the spacecraft are metric threads.						
.2	Undo the five M4 fasteners which secure the Photometer JFET rack (HSJP; 8 JFETs) to the baseplate. 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. **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. **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.						

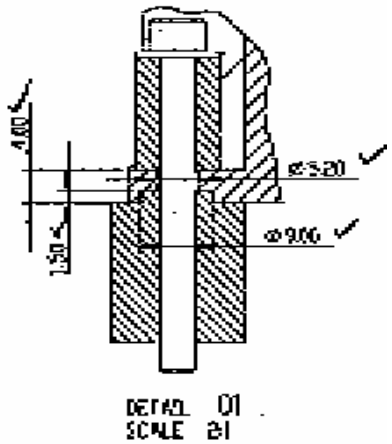
Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
.7	Lift the FPU and JFETs together from the baseplate by crane.						
.8	**In general:** Visible check of I/F (no damages, visible clean) before any integration activities						
.9	Exchange the transit blade mounts against the flight blade mounts	8.1 Nm	+/- 10% above running torque		Will be done by SPIRE team		
.10	Determination of mass of all items to be integrated (screws, washers, thermal straps, FPU & JFETs…)						
.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. **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. 	8.1 Nm	+/- 10% above running torque				

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). Note: these should be screwed into the OBP until 45mm of stud are protruding from the surface. 	45 mm	+/- 0.5 mm				
.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. 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						
.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. 	8.1 Nm	+/- 10% above running torque				
.7	Fit the two Bellville washers and the M8 Kaylock nut to the cone mount.	8.25Nm	+/- 10% above running torque				
.8	Remove the lifting/handling fixture.						

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: 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. Note that there are washers under the head of each screw. 	2,1 Nm	+/- 10% above running torque				

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. Note that there are washers under the head of each screw. 	2,1 Nm	+/- 10% above running torque				

Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
5.1.4	***Integration of thermal links***						
.1	**L0 straps:** The cooler pump and evaporator straps: 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: 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:** 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				
.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				
.6	On final assembly the M8 fasteners to be wire locked to the M4 fasteners. Screws will be prepared for wire locking						
.7	**L3 straps:** 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				

Step-No.	Integration-Step-Description	Nominal Value	Tolerance	Actual Value	Remarks	P	N
5.1.5	***Isolation measurement***						
.1	**General:** 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:** Measure and record the electrical isolation between the chassis of the FPU and the OBP.	>= 1 MΩ			Remove of safe plugs and cover with ESD caps accord. to AD 1		
.4	**Spect. Det. Box/OBA isolation:** 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					
.5	**Phot. Det. Box/OBP isolation:** 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					
.6	**Spect. Det. Box/FPU isolation:** 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					

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					
.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					
.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					

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:** Unscrew the three fixing screws and store them with the alignment cube in the "red tag box"				To be removed after alignment activities		
.2	**Aperture cover:** 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.				To be removed at the latest opportunity prior to closure of the Instrument Shield.		
.3	**Temporary grounding strap:** Removed during the Cryo harness Integration Procedure.						
.4	**Shorting plugs:** 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					
.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					
.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					
.3	Visual inspection of the electrical connectors to the SPIRE FPU, with regard to damages and visible contamination	No damages, visible clean					
.4	Check that all Red Tag Items are dismounted prior to closure of optical bench with optical bench shield.						
.5	MIP						

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

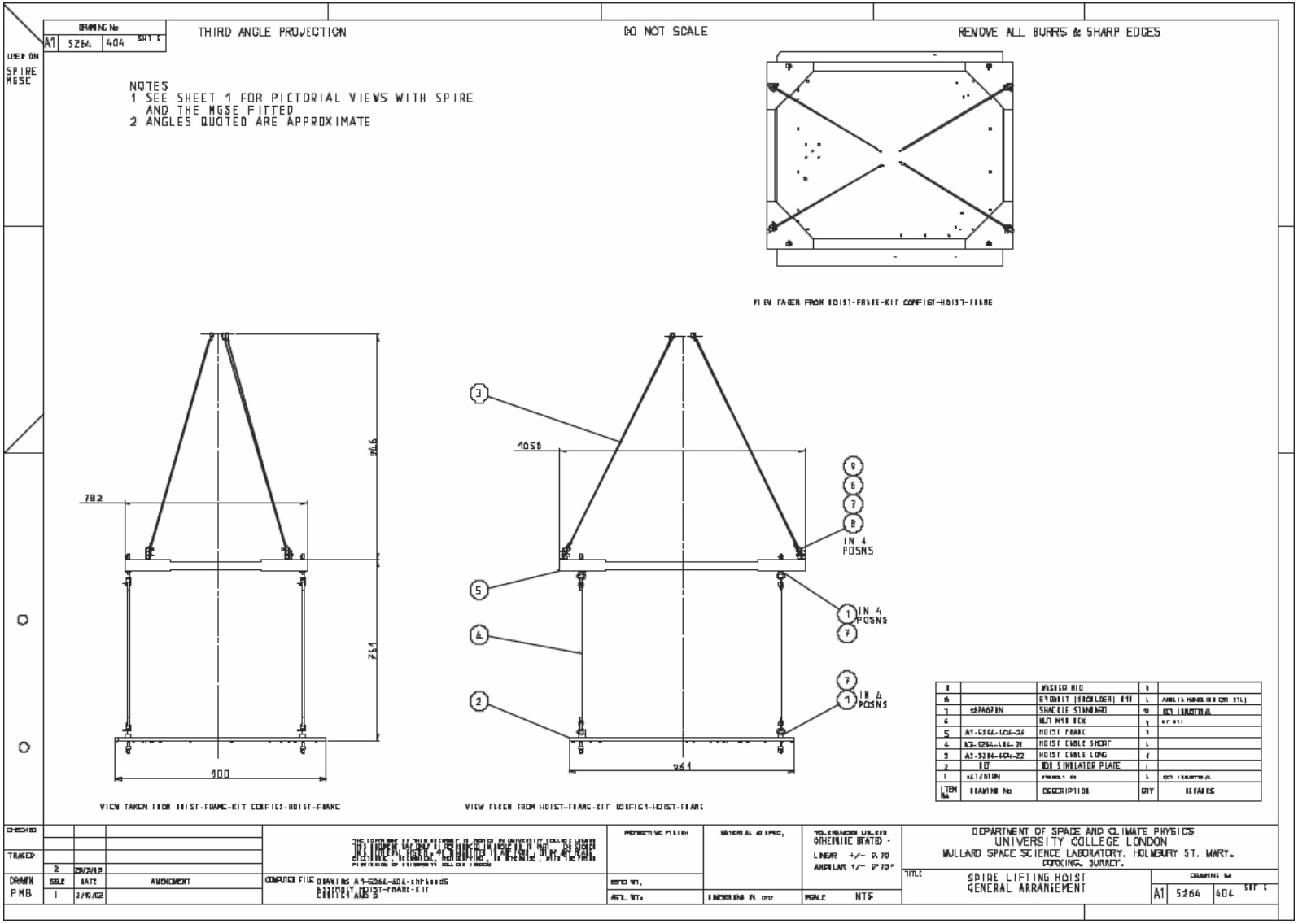
Status list of applicable NCR to be attached

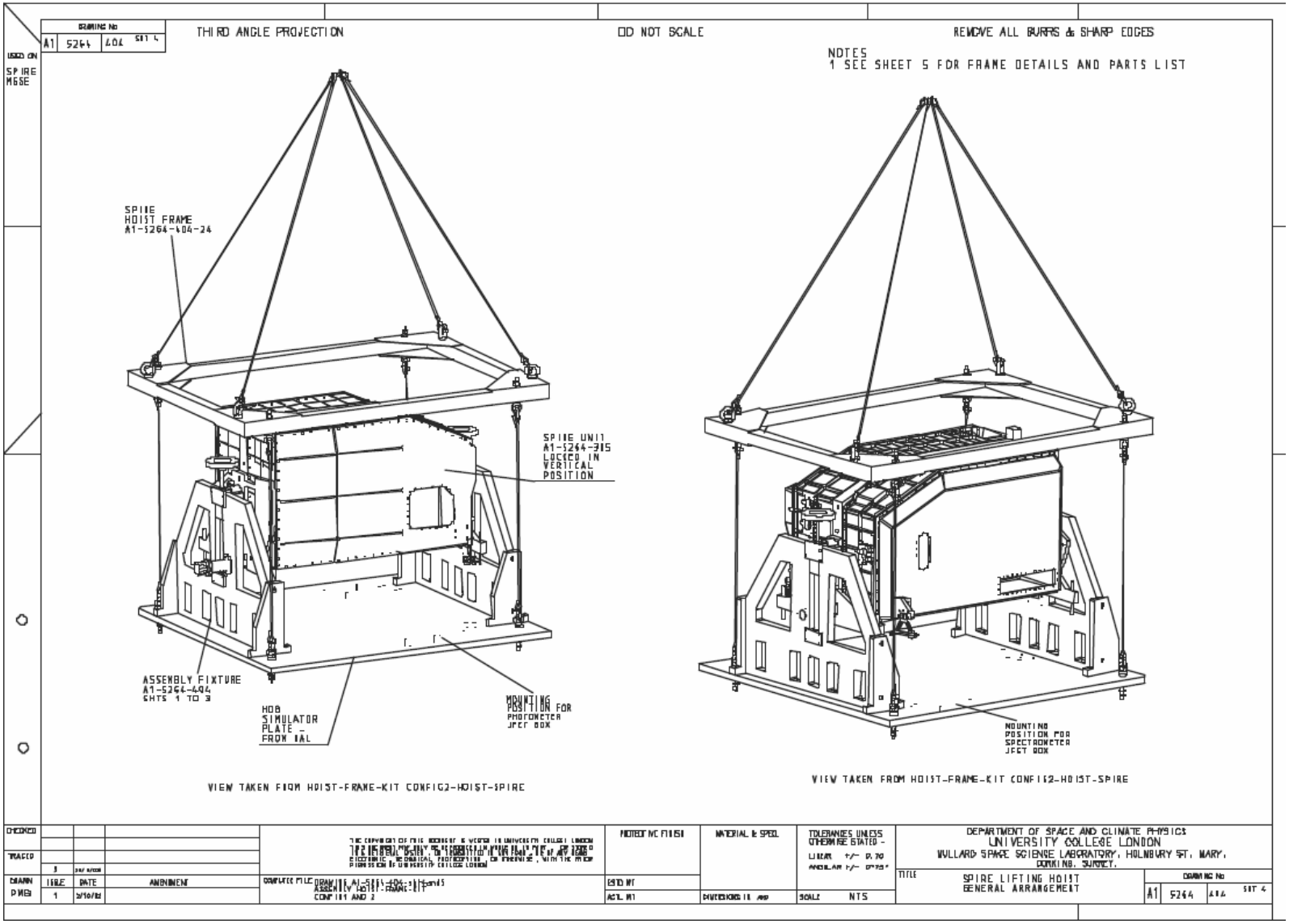
6.3 Sign-off Sheet

	Date	Signature
Integration Manager		
Operator		
PA Responsible		

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
VIEW TAKEN FROM HOIST-FRAME-KIT CONFIG1-HOIST-FRAME
VIEW TAKEN FROM HOIST-FRAME-KIT CONFIG1-HOIST-FRAME
900
782
1056
IN 4 POSNS
IN 4 POSNS
IN 4 POSNS
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 A1-5264-604-24
SPIRE UNIT A1-5264-915 LOCKED IN VERTICAL POSITION
ASSEMBLY FIXTURE A1-5264-604 SHTS 1 TO 3
HDB SIMULATOR PLATE - FROM RAL
MOUNTING POSITION FOR PHOTOMETER JFET BOX
VIEW TAKEN FROM HOIST-FRAME-KIT CONFIG2-HOIST-SPIRE
MOUNTING POSITION FOR SPECTROMETER JFET BOX
VIEW TAKEN FROM HOIST-FRAME-KIT CONFIG2-HOIST-SPIRE
DEPARTMENT OF SPACE AND CLIMATE PHYSICS
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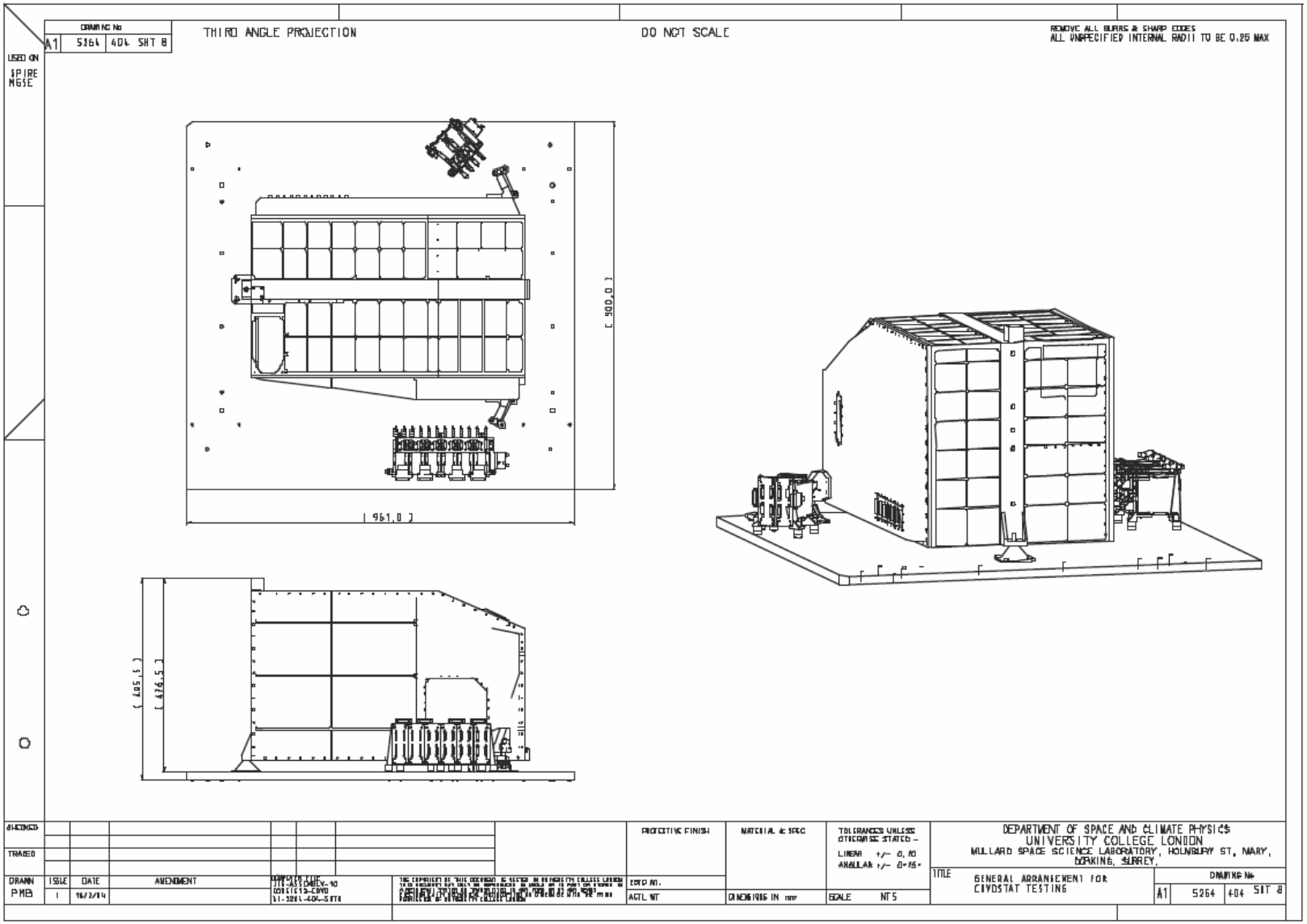
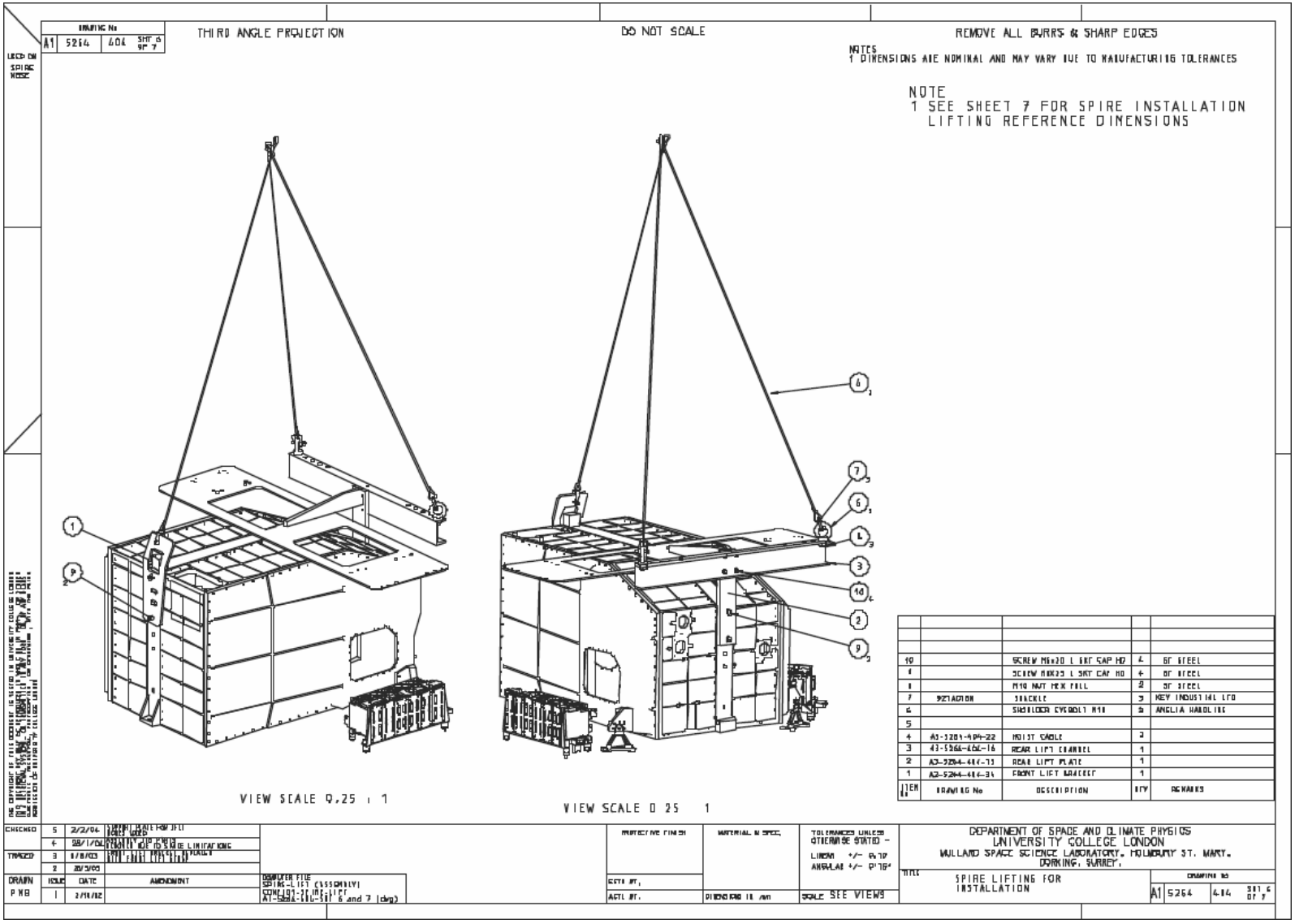
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.
SPIRE LIFTING HOIST GENERAL ARRANGEMENT
A1 5264
SCALE NTS


DRAWING No
A1 5264 404 SHT 8
THIRD ANGLE PROJECTION
DO NOT SCALE
REMOVE ALL BURRS & SHARP EDGES
ALL UNSPECIFIED INTERNAL RADII TO BE 0.25 MAX
USED ON
SPIRE MGSE
(900.0)
(961.0)
(507.5)
(476.5)
DEPARTMENT OF SPACE AND CLIMATE PHYSICS
UNIVERSITY COLLEGE LONDON
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.
TITLE
GENERAL ARRANGEMENT FOR CRYOSTAT TESTING
DRAWING No
A1 5264 404 SHT 8
DRAWN PMB
ISSUE 1
DATE 16/3/14
AMENDMENT


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
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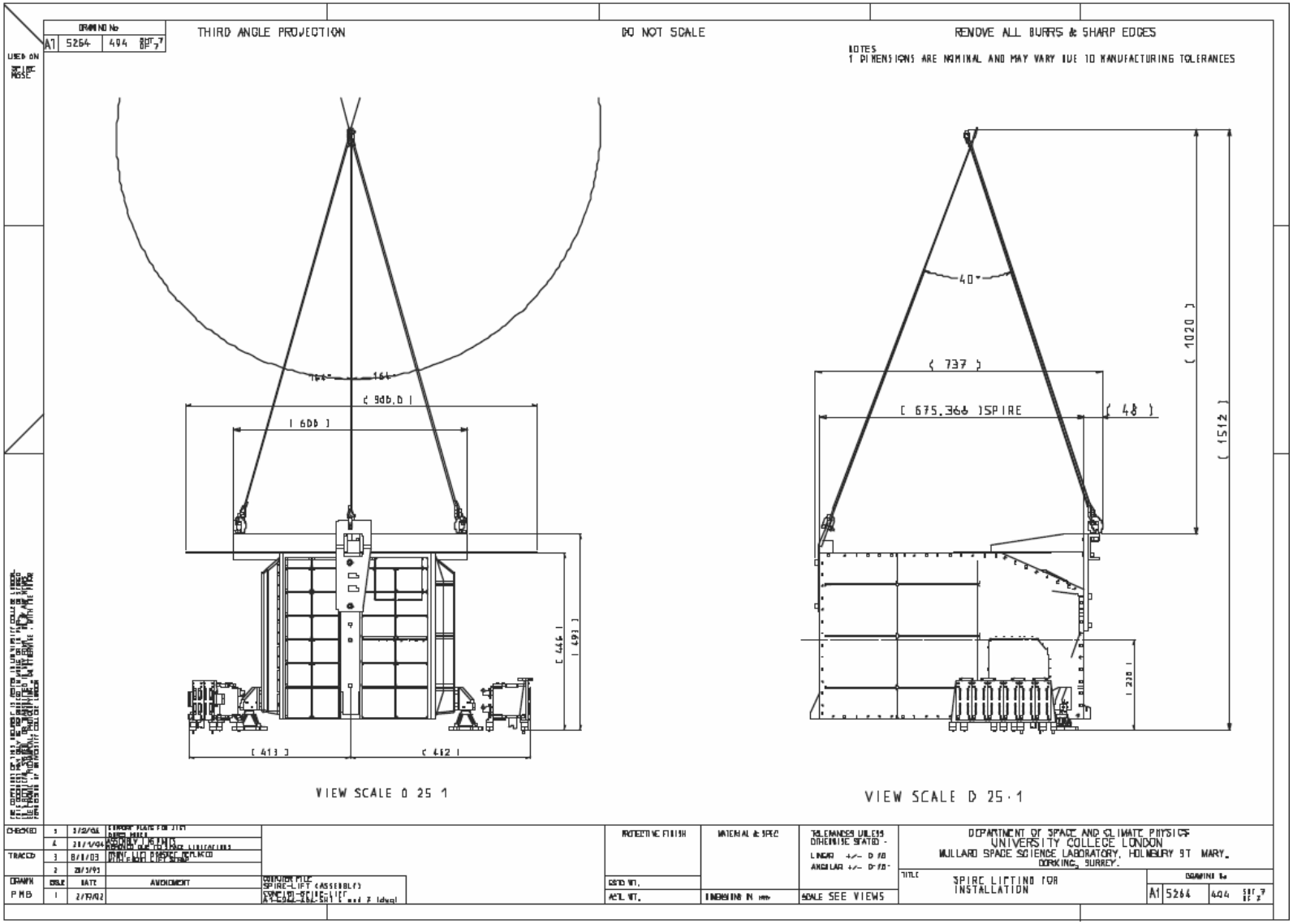
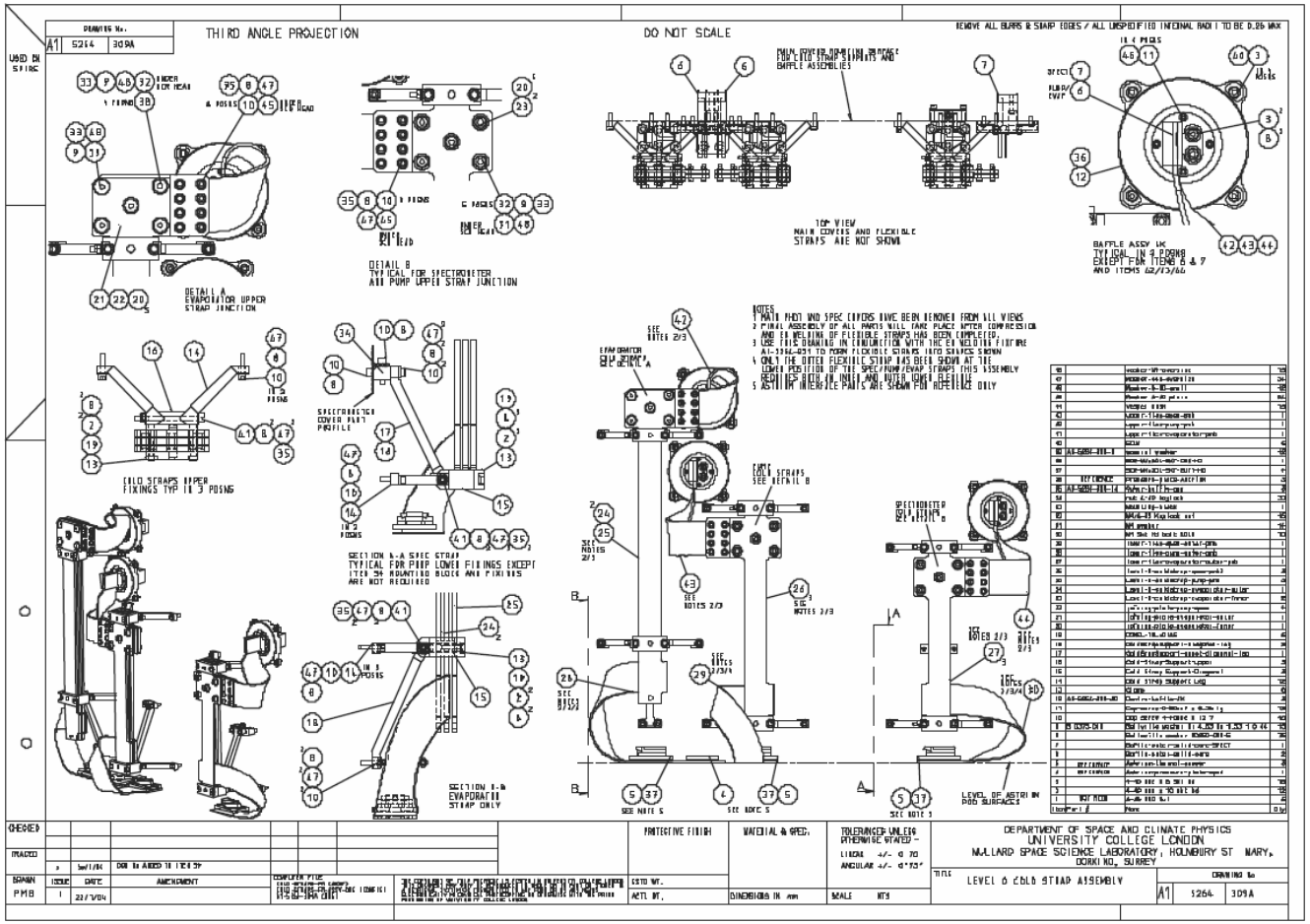
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY,
DORKING, SURREY,
SPIRE LIFTING FOR INSTALLATION


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
675.368 ISPIRE
48
1020
1512
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 404

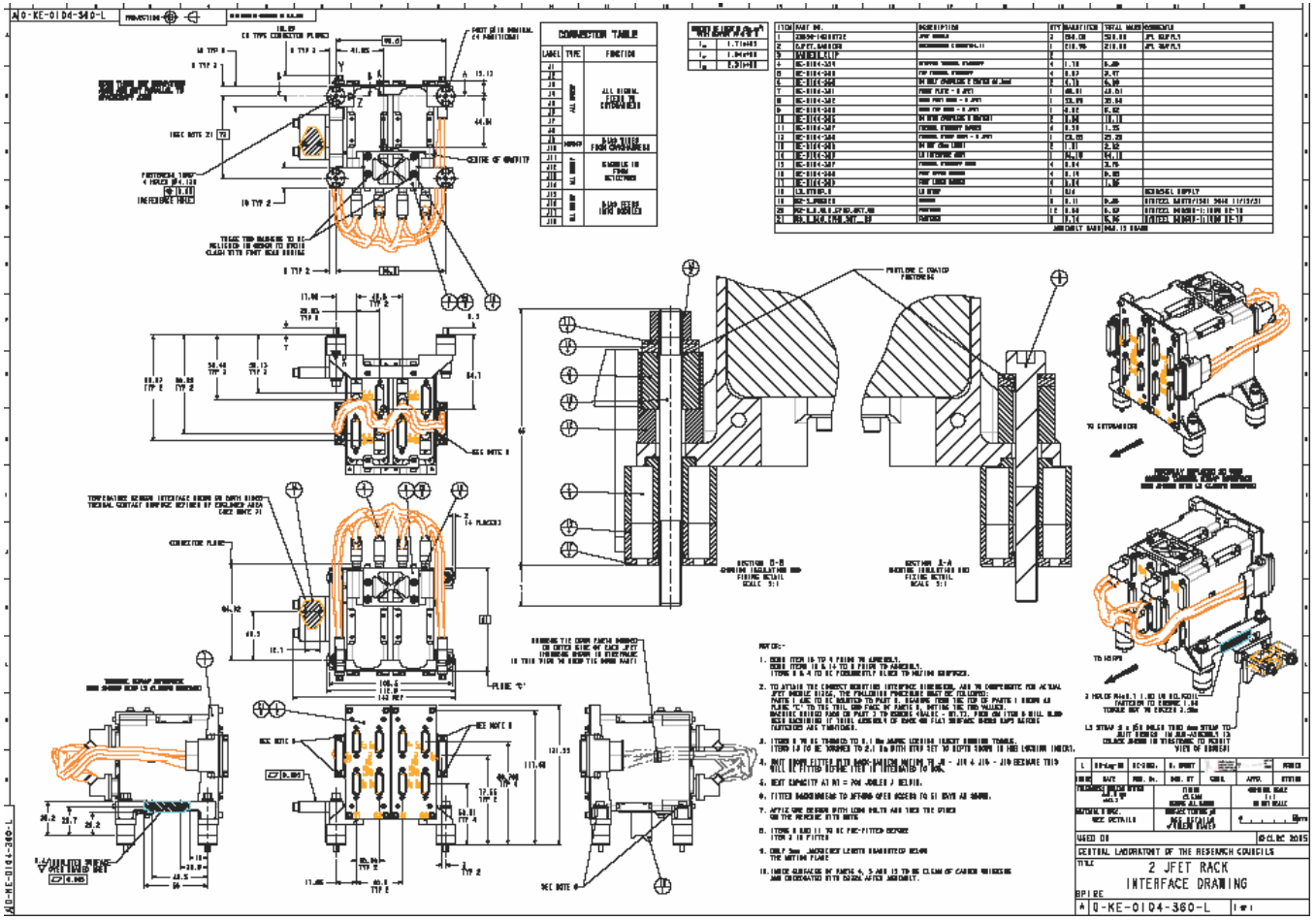
8 ANNEX B

8.1 L0 Thermal Strap Assembly

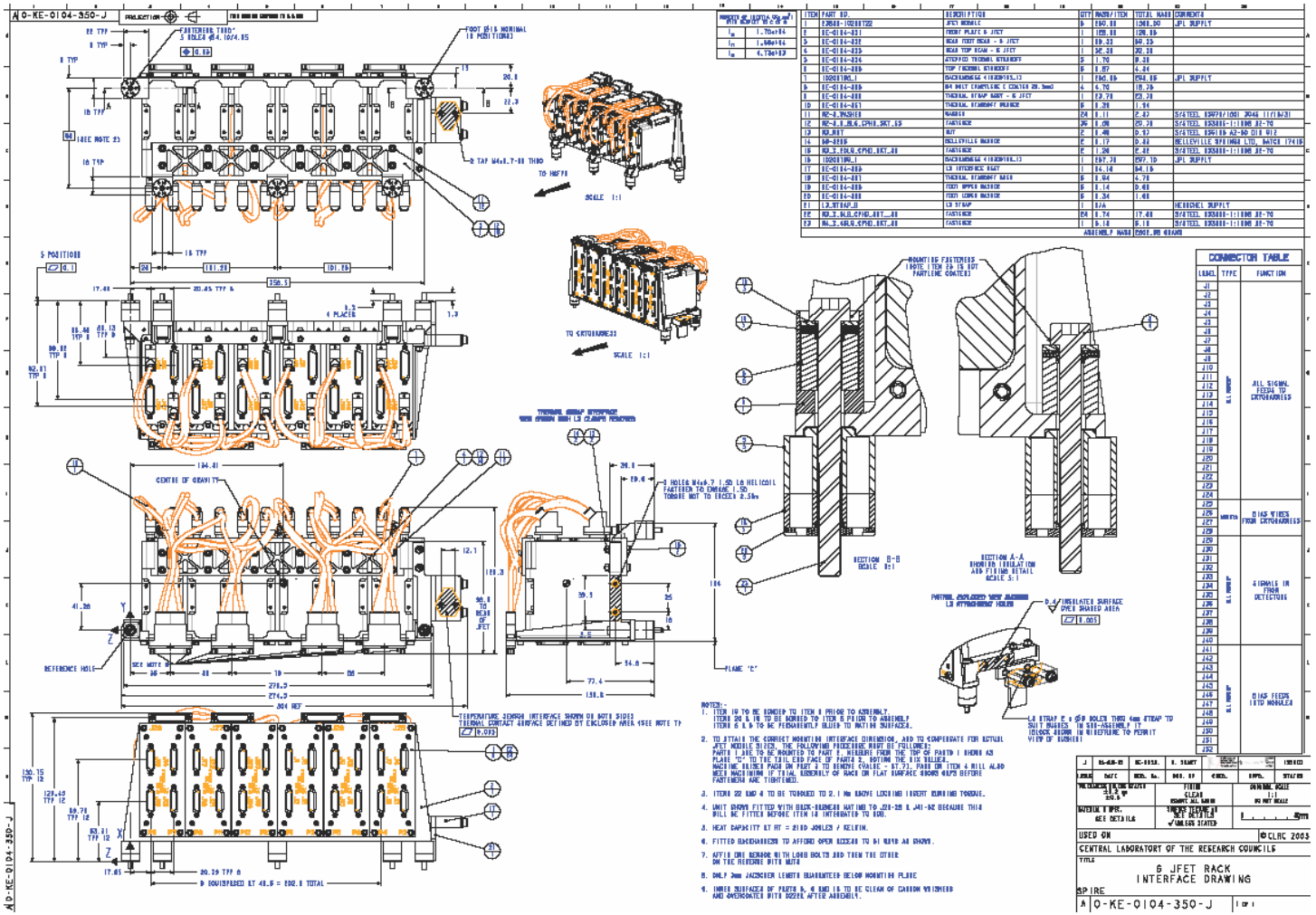


9 ANNEX C

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			
	Ivády 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