SPIRE

SUBJECT: **SPIRE FPU Handling and Mechanical Integration Procedure**

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Distribution

Change Record

ISSUE	DATE	SECTION	
1	17/1/07	all	First issue
2	21/3/07	2	Ref to sect 8 changed to sect 7
		2	Note on L0 strap added
		5.2	Ref to RD1 added
		5.3.2	Section re-worded for clarity
		5.4.2	Section deleted
		5.5	Step one now refers to section 6.3
		5.5	Step 3 removed
		6.2.1	Step 3 reworded
		6.3.3.2	Step 7 added

Table of Contents

Glossary

Cold Units	SPIRE FPU, JFP and JFS
CQM	Cold Qualification Model
DCU	Detector Control Unit
DPU	Digital Processing Unit
DRCU	SPIRE DCU and FCU, i.e the two units with interfaces with the SIH-SS
ESD	Electro static Discharge
FCU	Focal plane Control Unit
FPU	Focal Plane Unit
HOB	Herschel Optical Bench
JFP	Herschel Spire JFET Photometer Module
JFS	Herschel Spire JFET Spectrometer Module
JFET	Junction Field Effect Transistor
L0	Level 0 (Zero)
MSSL	Mullard Space Science Laboratory
OBA	Optical Bench Assembly
PFM	Proto Flight Model
RAL	Rutherford Appleton Laboratory
SIH-CS	Cryogenic Cryoharness between CVV-CB and Instrument
SIH-IS	Intermediate Cryoharness between CVV-CB and SVM-CB
SIH-SS	SVM Cryoharness between SVM-CB and DRCU
SPIRE	Spectral and Photometric Imaging REceiver
TBC	To Be Confirmed
Warm Units	SPIRE DPU, FCU and DCU
WIH	(SPIRE) Warm Interconnection Harness

References

Applicable Documents

AD1
AD 2
AD 3

Reference Documents

RD1 . "***Making SPIRE ESD Safe*** - SPIRE-RAL-NOT-002028

1. SCOPE

This document describes the procedures to be followed when handing the SPIRE FPU after delivery to ESA/Industry.
It covers the handling and integration procedures to be followed.
It covers the PFM only.

2. DELIVERY CONDITION

The SPIRE instrument is delivered in the following condition:-

The FPU is supplied in a dedicated, re-useable, container.
The container consists of an inner and outer box.
The inner box is mounted on shock attenuating mounts.
Alignment cube is fitted to the FPU. (red tag item). See section 7 for further details.
FPU aperture cover fitted (red tag item). See section 7 for further details.
Harnesses between the FPU and JFETs fitted.
FPU and JFETs attached to a baseplate.
The FPU is attached to the base plate using transit supports, these will be exchanged for the flight supports during the integration process.
Shorting plus or covers will be fitted to all electrical connectors See section 7 for further details.
FPU and JFETs double wrapped in dissipative film.
Witness mirrors and/or PFO plates will be fitted to the baseplate
Silica gel moisture control devices will not be used.
The detector L0 strap is not fitted to the FPU, it is attached to the base plate in a special fixture for transit.

2.1 Shock recorders

Attached to the inner box, inside the transportation container are re-settable shock indicators These operate in three axis and are set to 5,10 and 25g.
Upon inspection, if any of these recorders have triggered the project team at RAL should be informed.
'Tip and Tell' tilt sensors are attached to the outside of the FPU container.
Upon inspection, if any of these recorders have triggered the project team at RAL should be informed

3. TRANSPORT

3.1 In dedicated experiment containers

Protect from rain and moisture.
Transport in closed vehicles only.
Protect from extremes of temperature, -10°C to +50°C, and prevent the formation of dew at any time.

3.2 After integration on the spacecraft (in spacecraft container)

Equivalent to Cleanroom 100 conditions
Assuming that the cryostat is closed:
FPU Aperture cover (red-tag item) shall be removed
Alignment cube (red-tag item) shall be removed
No other specific requirement.
For transport the CVV is closed, evacuated, cooled, OBA in vertical position, z-axis downwards.

4. STORAGE

4.1 In dedicated experiment container

Ensure aperture cover (red-tag item) is fitted.
Protect from rain and moisture.
Protect from extremes of temperature, 10°C to +30°C.
Alignment cube is fitted.

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

Ensure aperture cover (red-tag item) is fitted.
Alignment cube is fitted

5. HANDLING

5.1 General.

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 HOB or its transport plate then it is tolerant of loads from vibration, lateral expansion, thermal tests, etc.

5.2 ESD protection

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 cryoharness 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. Refer to RD 1 for further information.

5.3 Unpacking from dedicated experiment container

The FPU is supplied attached to a baseplate together with the JFETs and the JFET harness already integrated. It is bagged in dissipative film.
This base plate is then covered by an inner container, which is mounted via shock attenuating mounts to the outer container base.
To remove the FPU and JFETs from the container, the following procedure should be followed: -

Outer container

Inner container

5.3.1 Removal from outer container:

Step	Description	Sign off	comments
1	This first stage can be carried out in a non clean area.		
2	Clean the outer surfaces of the outer container with a vacuum cleaner and an IPA wipe to remove the worst of the contamination accumulated during transit and storage.		
3	Undo the nine latches that secure the container lid and remove the lid.		
4	Attach a grounding strap to the instrument baseplate.		
5	Undo the 28, M8 bolts that secure the inner container to the secondary base plate.		
6	Clean the outer surfaces of the inner container with a vacuum cleaner and an IPA wipe.		
7	Attach the lifting MGSE to the 4 eye bolts on the base plate.		
8	Lift the inner container clear of the outer.		
9	Wipe the under surface of the inner container.		
10	The inner container can now be moved into a cleaner environment (class 100,000)		
11	Position the inner container on a convenient table for next phase.		

5.3.2 Removal from inner container:

Step	Description	Sign off	comments
1	Remove the 40 screws that attach the inner container lid to its base plate.		
2	Lift off the inner container lid		
3	There are two layers of protective bagging which enclose the FPU, JFETs and harness and is taped to the base plate		
4	Remove the outer bagging material, leaving the inner film in place		
5	Attach the MGSE to the lifting eyes on the base plate. Move the instrument and base plate in to the class 100 clean area.		
6	When the instrument is in the class 100 area, the inner bagging material can be removed		
7	Shorting plugs on the JFP and JFS provide ESD protection at this stage.		

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5.4 Preparation for integration

The FPU is supplied with the JFETs and associated harness already fitted.
The following tasks need to be carried out before integration onto the spacecraft.
Only standard tools are required at this stage.

5.4.1 Fitting of MGSE and JFET supports

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.

Step	Description	Sign off	comments
1	Fit the lifting attachment to the FPU as shown in annex A.		
2	Attach the JFETS to the MGSE using lacing cord.		

5.4.2 Removal of detector L0 strap

Section deleted

5.4.3 Removal from transit base plate

WARNING: The flight 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.

Step	Description	Sign off	comments
1	Attach a ground strap directly to the FPU		
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 that two of these fasteners are studs with nuts on the top, the nuts should be removed and the studs left in place.		
4	Two L0 straps are 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 spacecraft helium tank 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	Unbolt the cone from the FPU by undoing the M8 nut, thus leaving the cone on the baseplate.		
6	Undo and remove the 8 fasteners on the transit blade mounts that attach the FPU to the baseplate.		
7	The FPU and JFETs can now be lifted from the baseplate.		
8	While suspended from the crane, remove the transit blade		

	mounts		
9	Fit the flight blade mounts.		To be carried out by SPIRE team.
10	Torque the screws to 8.1 Nm. +/- 10% above running torque		
11	The FPU and JFETs are now ready for integration.		

5.5 Packing in the dedicated experiment container

Step	Description	Sign off	comments
1	Assuming activities described in section 6.3 (removal from spacecraft) have been carried out, and the FPU and JFETs are supported on a crane,		
2	The Spectrometer JFET studs (2 off) as indicated on interface drawing 0-KE-0104-360. Should still be fitted to the baseplate		
3	This step removed		
4	Remove the Flight blade mounts if fitted		
5	Fit the transit blade mounts		
6	Very gently lower the assembly onto the baseplate, ensuring that the JFET studs engage on the JFETs and the cone mount engages in its location on the FPU.		
7	When all units are resting on the baseplate, fit the attachment screws (M6X21) to the bipod feet, torque the screws to 8.1 Nm. +/- 10% above running torque.		
8	Fit the M8 nut and Belleville washer to the mounting cone. Torque to 8.25 Nm. +/- 10% above running torque.		
9	Remove the lifting/handling fixture.		
10	Fit the two long bolts and two nuts to secure the spectrometer JFET. Torque the screws to 2.1 Nm. +/- 10% above running torque.		
11	Fit the 5 long bolts to secure the photometer JFET. Torque the screws to 2.1 Nm. +/- 10% above running torque.		
12	Secure the L0 straps to the baseplate using M4X20 socket head cap screws. Torque the screws to 1.5 Nm. +/- 10% above running torque.		
13	Fit the electrical grounding strap between the FPU and the baseplate.		
14	Cover the FPU and JFETs with a double layer of clean lumaloy film and secure each one with tape to the baseplate.		
15	Fit the inner container lid and secure with the 40 fasteners supplied		
16	Fit the lifting frame Ref MSSL/5264/404 to the four eyebolts in the plate.		
17	Lift the plate into the base of the outer container.		
18	Attach with the 28 fasteners provided		
19	Check the shock monitors and reset if necessary		
20	Fit the outer lid and secure with the 9 catches.		

6. INTEGRATION

6.1 Required tools/MGSE

SPIRE supplied tools/MGSE:-

FPU and JFET handling frame.
FPU/JFET/baseplate lifting gear
JFET fixation hardware
Isolation washers, special screws and studs
L3 pressure plates 2-off
L1 strap screws M8 2off, M3 4off (these screws will be prepared for wire locking)
Wire for locking above screws.
L1 bushes for the vent line end (already supplied)
Temporary FPU Grounding Strap including M4 x 6mm fastener to connect to OBA
NOTE, Could possibly be attached to the unused harness support bracket holes, or any other convenient tapped hole.

Supplied by spacecraft

Crane, with low speed capability
Fixation bolts,
FPU M6 12 off -
L0 straps M4 16 off -
L0 pressure plate 4 off
L3 strap M4 4off
Torque wrench to cover 1.5 to 8.25 Nm
Allan key, spanners etc
DVM for electrical isolation testing

6.2 Mechanical integration to spacecraft

6.2.1 FPU and JFETs

Assuming activities described in section 5.4 have been carried out, and the FPU and JFETs are supported on a crane.

Step	Description	Sign off	comments
1	Fix the Spectrometer JFET studs (2 off) as indicated on interface drawing 0-KE-0104-360. Note these should be screwed into the HOB until 45mm of stud are protruding from the surface.		
2	Fit the flight cone to the spacecraft OBA. 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.		

3	Position the FPU over the HOB		
4	Very gently lower the assembly onto the HOB, ensuring that the JFET studs engage on the JFETs and the cone mount engages in its location on the FPU.		
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	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 HOB		
7	When all units are resting on the HOB, fit the attachment screws (M6X21) to the bipod feet as for the cone mount.		
8	Fit the two Bellville washers and the M8 Kaylock nut to the cone mount. Torque to 8.25Nm.		
9	Remove the lifting/handling fixture.		

6.2.2 L0 straps

6.2.2.1 The cooler pump and evaporator straps

Step	Description	Sign off	comments
1	These will be in place at this stage.		
2	Ensure that the lower flexibles of these two straps align with the pod interfaces. Fit the spreader plates together with their temperature sensors. Fit the attachment screws (ten M4 For the evaporator strap, six M4 screws for the pump		
3	Torque to specification defined by Astrium		

6.2.2.2 Detector strap

Step	Description	Sign off	comments
1	Offer up the strap assembly to the FPU and fit the two M4 screws that attach the strap to the FPU cold interface, detector		SPIRE activity
3	Torque the attachment screws 2.2 Nm +/- 10% above running torque		SPIRE activity
4	Attach the torlon frames with the 5 off 4-40 UNC screws previously removed.		SPIRE activity
5	Torque the screws to 0.76 Nm +/- 10% above running torque		SPIRE activity
7	Ensure that the lower flexibles align with the pod interface. Fit the spreader plate and temperature sensor with the six M4 attachment screws .		
8	Torque in accordance with Astrium specification.		

6.2.3 L1 straps.

Step	Description	Sign off	comments
1	Fit the two L1 straps to the FPU as indicated in annex C, using at each location, one insulating bush, one Bellville washer type B0750-056-S and one M8 bolt		
2	Torque the M8 bolt to 10.5 Nm +/- 10% above running torque		
3	Fit the two M4 bolts with isolating bushes and two Bellville washers (type B0375-020-S) under each screw head		
4	Torque the M4 bolts to 1.5 Nm +/- 10% above running torque		
5	On final assembly the M8 fasteners are to be wire locked to the M4 fasteners. Screws will be prepared for wire locking		

6.2.4 L3 straps.

Step	Description	Sign off	comments
1	Fit the two L3 straps to the JFETs 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, annex 3		
2	Torque to 2.5 Nm.		
3	Note. Spacecraft temperature sensors, two sensors on each clamp, fit to this interface.		

6.2.5 Isolation test

This test is to be carried out with a witness from the SPIRE project team. The removal of the safeing 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 particular attention to safe ESD procedures, including the use of ionized air flow over the connectors during mating/demating operations.

Step	Description	Sign off	comments
1.	Remove the temporary earth strap between the FPU and the cryostat		
	FPU/OBA Isolation		
2.	Measure and record the electrical isolation between the chassis of the FPU and the cryostat. Pass criteria is >= 1 M? isolation.		
3.	Remove the safeing plugs form JFP J25, J26, J27 and J28 while maintaining ionized air flow over the unit.		
4.	Cover JFP J25, J26, J27 and J28 with black, dissipative dust covers.		
5.	Remove the safeing plugs from JFS J09 and J10 while maintaining ionized air flow over the unit.		
6.	Cover JFS J09 and J10 with black, dissipative dust covers.		
	Spect. Det. Box / OBA Isolation		

7.	Measure the isolation between the OBA and the Detector Boxes Thermal Strap (on the instrument side of the electrical isolation joint). Pass criteria is >= 1MOhm		
	Phot. Det. Box / OBA Isolation		
8.	Measure the isolation between the OBA and the Evaporator Thermal Strap (on the instrument side of the electrical isolation joint). Pass criteria is >= 1MOhm		
	Spect. Det. Box / FPU Isolation		
9.	Measure the isolation between the FPU and the Detector Boxes Thermal Strap (on the instrument side of the electrical isolation joint). Pass criteria is >= 1MOhm		
	Phot. Det. Box / FPU Isolation		
10.	Measure the isolation between the FPU and the Evaporator Thermal Strap (on the instrument side of the electrical isolation joint). Pass criteria is >= 1MOhm		
	Phot. Det. Box / Spect. Det. Box Isolation		
11.	Measure the isolation between the Detector Boxes Thermal Strap and the Evaporator Thermal Strap (both on the instrument side of the electrical isolation joints). Pass criteria is >= 1MOhm		
12.	Fix the temporary grounding strap from the FPU to the OBA		
13.	Repeat the measurement of the resistance between the cryostat and the FPU to ensure that grounding has been successful, reading should be less than 3?		

6.3 Removal from spacecraft

6.3.1 L3 straps.

Step	Description	Sign off	comments
1	Note. Spacecraft temperature sensors, two sensors on each clamp, fit to this interface.		
2	Loosen and remove the two M4 fasteners attaching the clamp block and L3 strap to the JFETS		
3	L3 thermal strap clamp is provided by SPIRE and should remain with the instrument		
4	Remove the two L3 straps from the JFETs		

6.3.2 L1 straps.

Step	Description	Sign off	comments
1	Remove the wire locking from the two M8 fasteners and the four M4 fasteners.		

2	Loosen the two M8 and four M4 fasteners		
3	Remove the fasteners		
4	Retract the L1 straps from the FPU.		
5	Keep the fasteners and insulating bushes with the FPU		

6.3.3 L0 straps

6.3.3.1 The cooler pump and evaporator straps

Step	Description	Sign off	comments
1	These straps to be left attached to the FPU		
2	Remove the fasteners (ten M4 For the evaporator strap, six M4 screws for the pump) which attach the lower flexibles to the pod interfaces.		
3	Remove the spreader plates together with their temperature sensors.		
4	These spreaders and sensors are spacecraft supplied		

6.3.3.2 Detector strap

Step	Description	Sign off	comments
1	This strap to be removed before deintegration of the FPU		SPIRE activity
2	Remove the fasteners (six M4 screws) which attach the lower flexible to the pod interfaces.		SPIRE activity
3	Remove the spreader plate together with the temperature sensor.		SPIRE activity
4	Loosen and remove the two M4 fasteners that connect the strap to the detector box		SPIRE activity
5	Loosen and remove the 5 4-40 UNC fasteners that attach the Torlon supports to the FPU		SPIRE activity
6	Remove the strap assembly.		SPIRE activity
7	Place strap in its fixture on the transit base plate		

6.3.3.3 FPU and JFETs

Step	Description	Sign off	comments
1	Remove all electrical connections, see section separate procedure		
2	Unbolt the cone from the FPU by undoing the M8 nut, thus leaving the cone on the OBA		
3	Undo the five M4 fasteners which secure the Photometer JFET rack (HSJFP) to the HOB.		
4	Undo the four M4 fasteners that secure the Spectrometer JFET rack (HSJFS)to the HOB. Note that two of these fasteners are studs with nuts on the top.		
5	Undo and remove the 8 fasteners that attach the FPU to the		

	OBA, 4 on each bipod.		
6	The FPU and JFETs can now be lifted from the HOB		

7. RED TAG ITEMS

The following red tag items are fitted to the FPU when delivered.

1. An aperture cover – To be removed at the latest opportunity prior to closure of the cryostat taking into account the possibility that the cover may not be able to be removed once the Instrument Shield is integrated.

2. Alignment cube – To be removed after alignment activities has ended and prior to closure of the cryostat taking into account the possibility that the cover may not be able to be removed once the Instrument Shield is integrated.

3. Temporary grounding strap – Removed during the Cryoharness Integration Procedure. (must be removed prior to integration of Instrument Shield)

4. Shorting plugs – Removed during the Cryoharness Integration Procedure.

When removed all red tag items shall be bagged and stored in the dedicated “red tag box”.

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.

The alignment cube is removed by unscrewing the three fixing screws and lifting clear.

8. GREEN TAG ITEMS

There are no green tag items

ANNEX A - DRAWINGS OF SPIRE FPU MGSE

DRAWING No. A1 5264 404 SHT 4

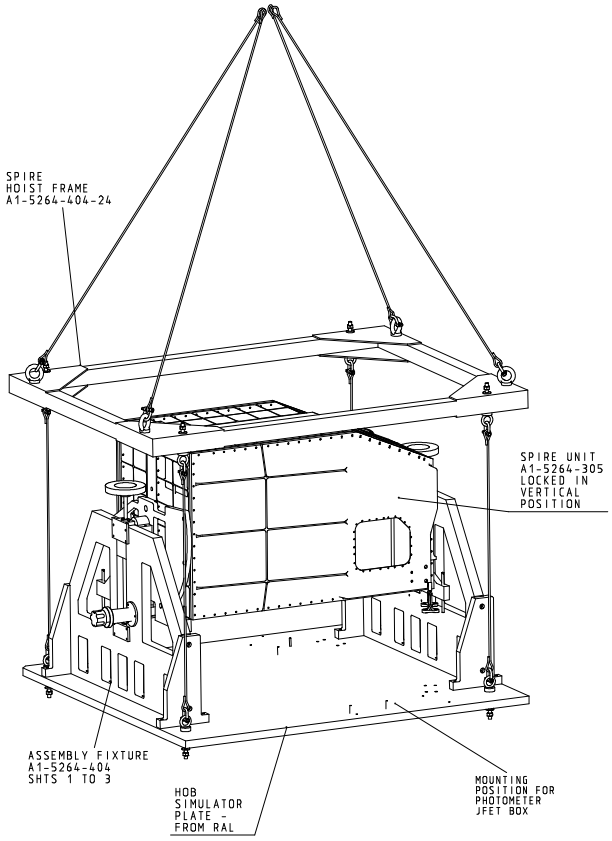
THIRD ANGLE PROJECTION

DO NOT SCALE

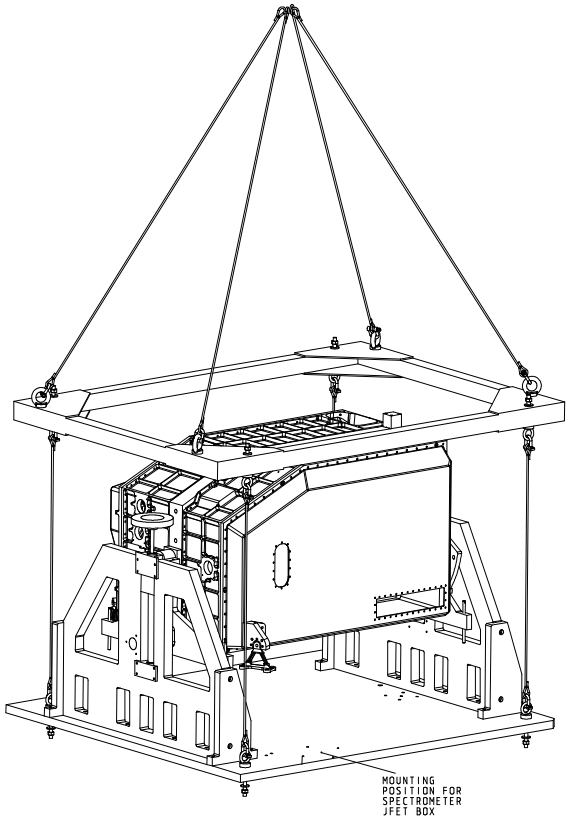
REMOVE ALL BURRS & SHARP EDGES

USED ON SPIRE MGSE

NOTES
1 SEE SHEET 5 FOR FRAME DETAILS AND PARTS LIST



VIEW TAKEN FROM HOIST-FRAME-KIT CONFIG2-HOIST-SPIRE



VIEW TAKEN FROM HOIST-FRAME-KIT CONFIG2-HOIST-SPIRE

CHECKED					PROTECTIVE FINISH	MATERIAL & SPEC.	TOLERANCES UNLESS OTHERWISE STATED - LINEAR +/- 0.10 ANGULAR +/- 0°15'	DEPARTMENT OF SPACE AND CLIMATE PHYSICS UNIVERSITY COLLEGE LONDON MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.	
TRACED				THE COPYRIGHT OF THIS DOCUMENT IS VESTED IN UNIVERSITY COLLEGE LONDON. THIS DOCUMENT MAY ONLY BE REPRODUCED IN WHOLE OR IN PART, OR STORED IN A RETRIEVAL SYSTEM, OR TRANSMITTED IN ANY FORM, OR BY ANY MEANS ELECTRONIC, MECHANICAL, PHOTOCOPYING, OR OTHERWISE, WITH THE PRIOR PERMISSION OF UNIVERSITY COLLEGE LONDON			TITLE SPIRE LIFTING HOIST GENERAL ARRANGEMENT	DRAWING No A1 5264 404 SHT 4
	2	28/3/03							
DRAWN PMB	ISSUE 1	DATE 2/10/02	AMENDMENT	COMPUTER FILE DRAWING A1-5264-404-sht4and5 ASSEMBLY HOIST-FRAME-KIT CONFIG1 AND 2	ESTD WT. ACTL WT.	DIMENSIONS IN mm	SCALE NTS		

DRAWING No. A1 5264 404 SHT 5

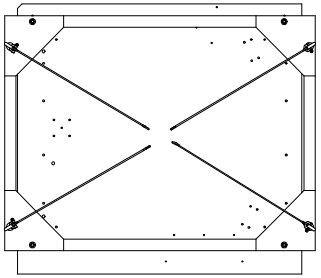
THIRD ANGLE PROJECTION

DO NOT SCALE

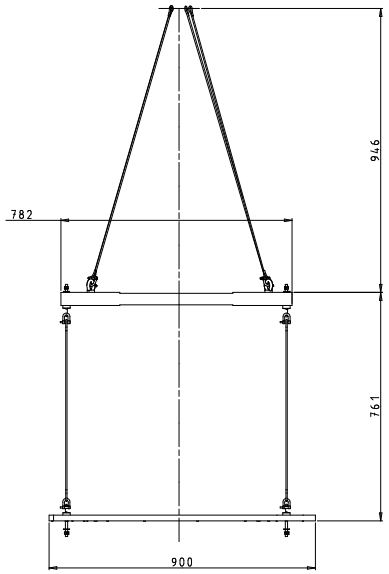
REMOVE ALL BURRS & SHARP EDGES

USED ON SPIRE MGSE

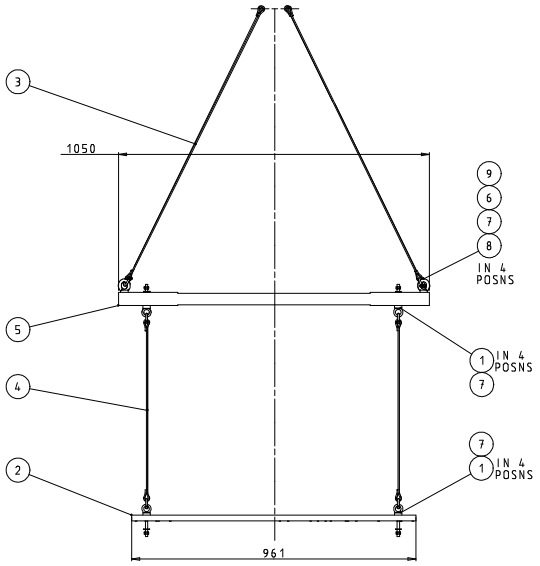
NOTES
1 SEE SHEET 1 FOR PICTORIAL VIEWS WITH SPIRE AND THE MGSE FITTED
2 ANGLES QUOTED ARE APPROXIMATE



VIEW TAKEN FROM HOIST-FRAME-KIT CONFIG1-HOIST-FRAME



VIEW TAKEN FROM HOIST-FRAME-KIT CONFIG2-HOIST-FRAME



VIEW TAKEN FROM HOIST-FRAME-KIT CONFIG1-HOIST-FRAME

ITEM No	DRAWING No	DESCRIPTION	QTY	REMARKS
9		WASHER M10	4	
8		EYEBOLT (SHOULDER) M10	4	ANGLIA HANDLING (ST STL)
7	927A078N	SHACKLE STANDARD	12	KEY INDUSTRIAL
6		NUT M10 HEX	4	ST STL
5	A1-5264-404-24	HOIST FRAME	1	
4	A3-5264-404-21	HOIST CABLE SHORT	4	
3	A3-5264-404-22	HOIST CABLE LONG	4	
2	REF	HOB SIMULATOR PLATE	1	
1	947A078N	EYEBOLT M8	8	KEY INDUSTRIAL

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	2	28/3/03							
DRAWN	ISSUE	DATE	AMENDMENT	COMPUTER FILE DRAWING A1-5264-404-sht1and5 ASSEMBLY HOIST-FRAME-KIT CONFIG1 AND 2	ESTD WT.		SCALE NTS	TITLE SPIRE LIFTING HOIST GENERAL ARRANGEMENT	DRAWING No A1 5264 404 SHT 5
PMB	1	2/10/02			ACTL WT.	DIMENSIONS IN mm			

DRAWING No.			
A1	5264	404	SHT 6 OF 7

THIRD ANGLE PROJECTION

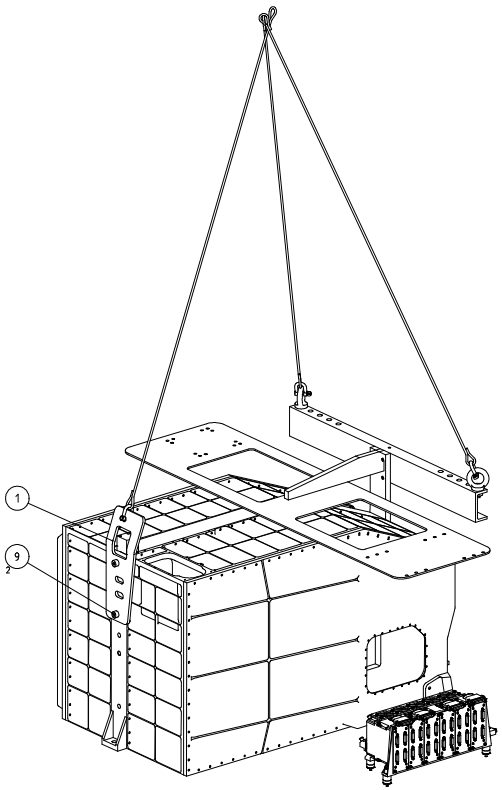
DO NOT SCALE

REMOVE ALL BURRS & SHARP EDGES

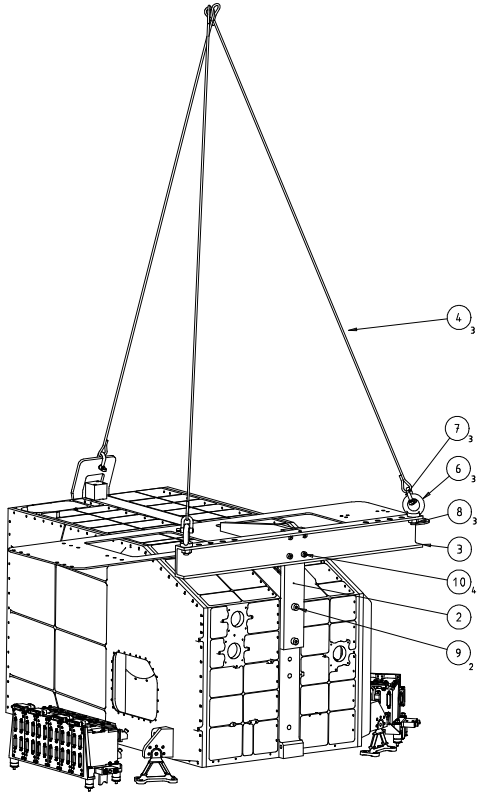
USED ON SPIRE MGSE

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

ITEM No	DRAWING No	DESCRIPTION	QTY	REMARKS
10		SCREW M6x20 L SKT CAP HD	4	ST STEEL
9		SCREW M8X25 L SKT CAP HD	4	ST STEEL
8		M10 NUT HEX FULL	2	ST STEEL
7	927A0078N	SHACKLE	3	KEY INDUSTIAL LTD
6		SHOULDER EYEBOLT M10	2	ANGLIA HANDLING
5				
4	A3-5264-404-22	HOIST CABLE	3	
3	A3-5264-404-16	REAR LIFT CHANNEL	1	
2	A3-5264-404-15	REAR LIFT PLATE	1	
1	A2-5264-404-34	FRONT LIFT BRACKET	1	

CHECKED	5	2/2/04	SUPPORT PLATE FOR JFET BOXES ADDED
	4	28/1/04	ASSEMBLY JIG PARTS REMOVED DUE TO SPACE LIMITATIONS
TRACED	3	8/8/03	FRONT LIFT BRACKET REPLACED WITH FRONT LIFT STRAP
	2	28/3/03	
DRAWN	ISSUE	DATE	AMENDMENT
PMB	1	2/10/02	

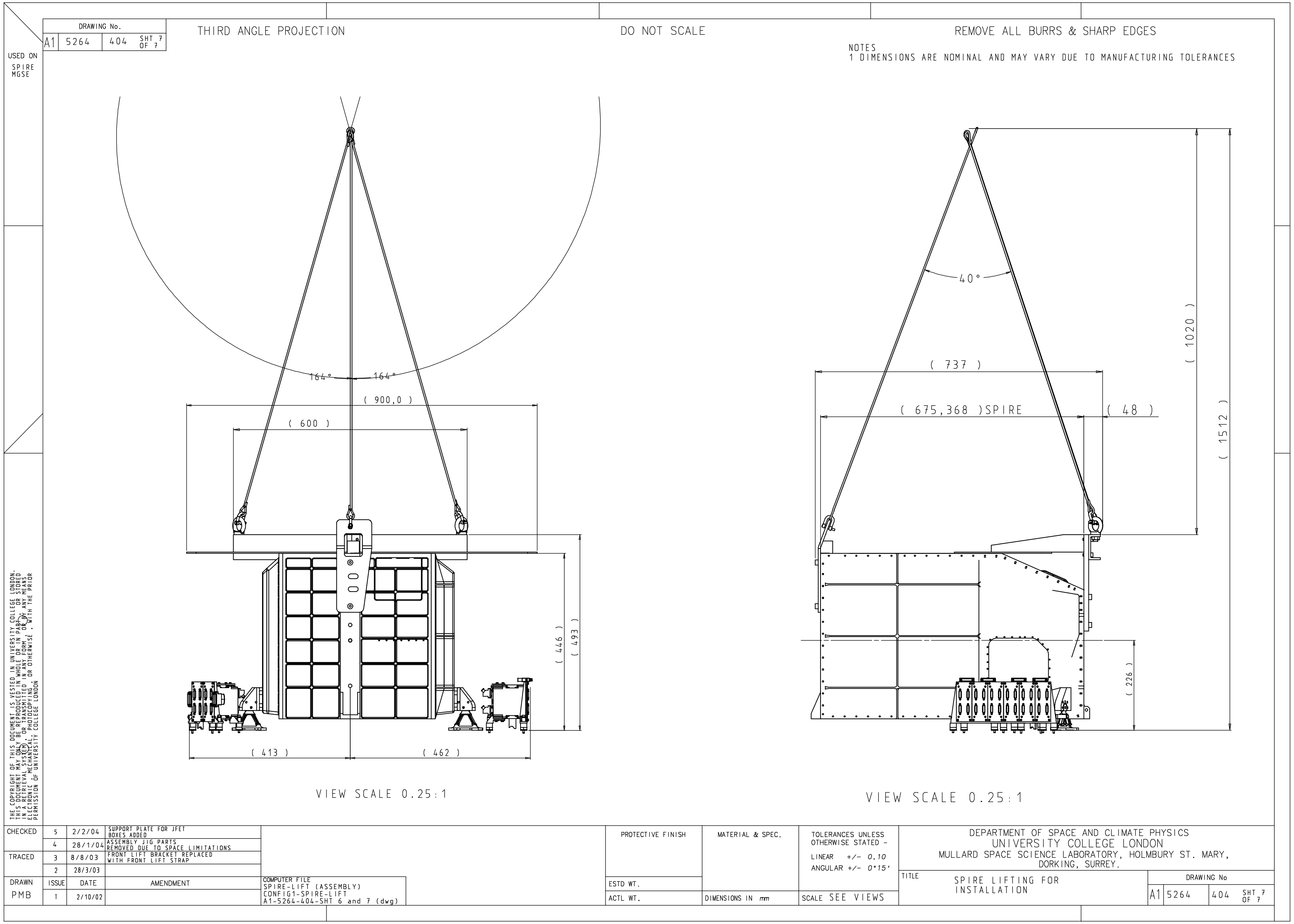
COMPUTER FILE
SPIRE-LIFT (ASSEMBLY)
CONFIG1-SPIRE-LIFT
A1-5264-404-SHT 6 and 7 (dwg)

PROTECTIVE FINISH	MATERIAL & SPEC.	TOLERANCES UNLESS OTHERWISE STATED -
		LINEAR +/- 0.10
ESTD WT.		ANGULAR +/- 0°15'
ACTL WT.	DIMENSIONS IN mm	SCALE SEE VIEWS

DEPARTMENT OF SPACE AND CLIMATE PHYSICS
UNIVERSITY COLLEGE LONDON
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.

TITLE: SPIRE LIFTING FOR INSTALLATION

DRAWING No			
A1	5264	404	SHT 6 OF 7



DRAWING No.
A1 5264 404 SHT 7 OF 7
THIRD ANGLE PROJECTION
DO NOT SCALE
REMOVE ALL BURRS & SHARP EDGES
NOTES
1 DIMENSIONS ARE NOMINAL AND MAY VARY DUE TO MANUFACTURING TOLERANCES
USED ON
SPIRE MGSE
164°
164°
(900,0)
(600)
(446)
(493)
(413)
(462)
VIEW SCALE 0.25:1
40°
(737)
(675,368)SPIRE
(48)
(1020)
(1512)
(226)
VIEW SCALE 0.25:1
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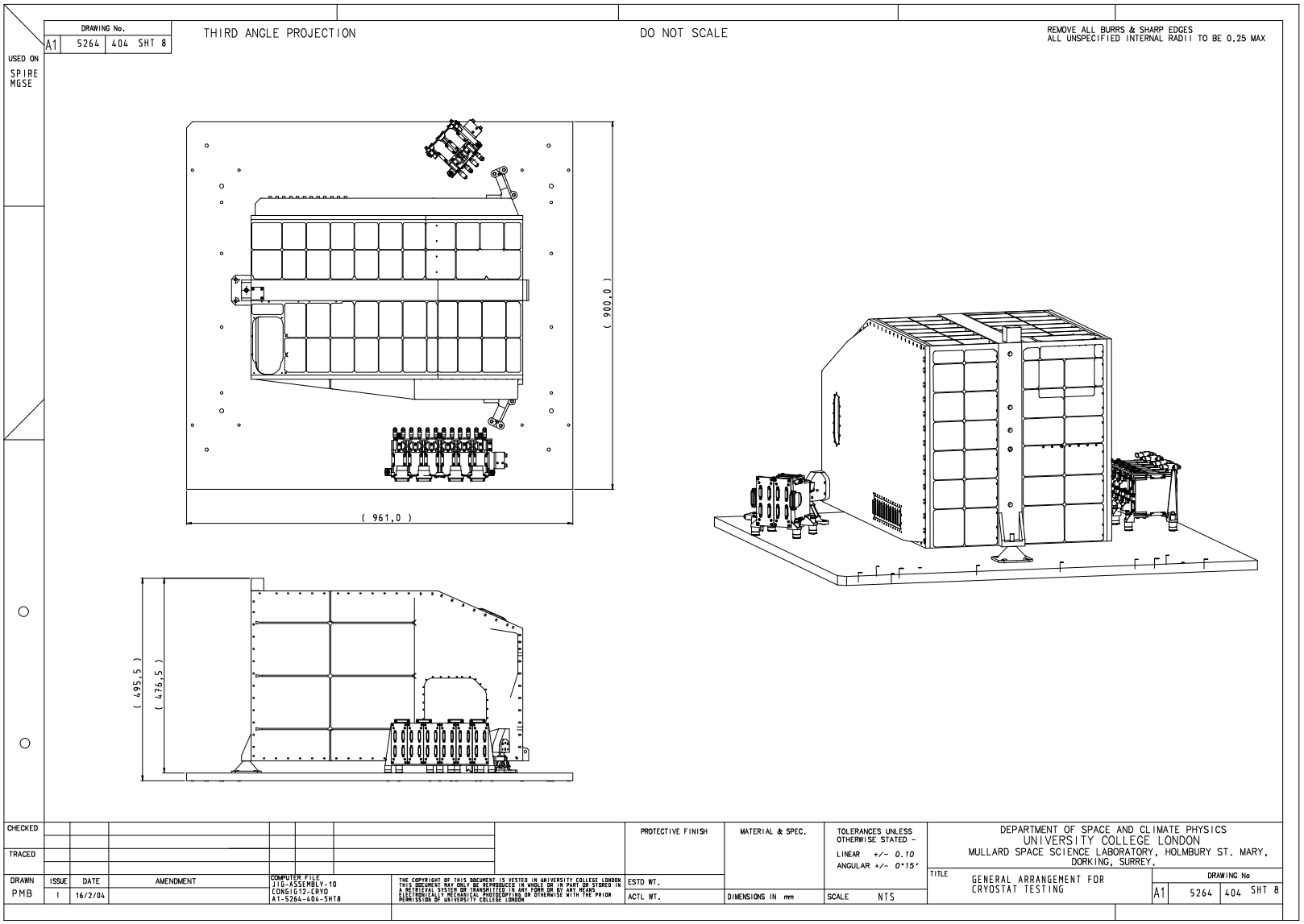
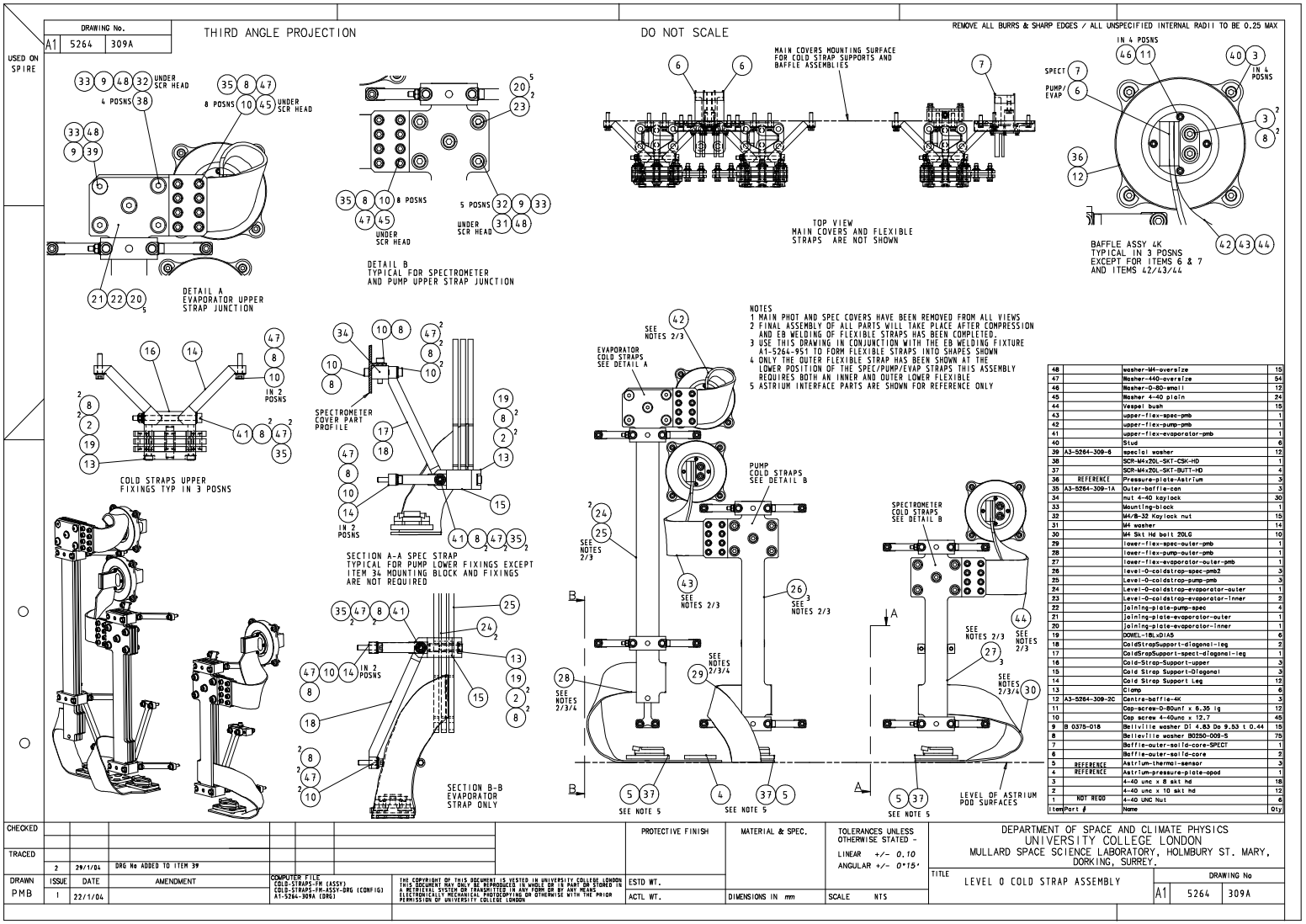
CHECKED
TRACED
DRAWN
PMB
5 2/2/04 SUPPORT PLATE FOR JFET BOXES ADDED
4 28/1/04 ASSEMBLY JIG PARTS REMOVED DUE TO SPACE LIMITATIONS
3 8/8/03 FRONT LIFT BRACKET REPLACED WITH FRONT LIFT STRAP
2 28/3/03
ISSUE DATE AMENDMENT
1 2/10/02
COMPUTER FILE
SPIRE-LIFT (ASSEMBLY)
CONFIG1-SPIRE-LIFT
A1-5264-404-SHT 6 and 7 (dwg)
PROTECTIVE FINISH
ESTD WT.
ACTL WT.
MATERIAL & SPEC.
DIMENSIONS IN mm
TOLERANCES UNLESS OTHERWISE STATED -
LINEAR +/- 0.10
ANGULAR +/- 0°15'
SCALE SEE VIEWS
DEPARTMENT OF SPACE AND CLIMATE PHYSICS
UNIVERSITY COLLEGE LONDON
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.
TITLE
SPIRE LIFTING FOR INSTALLATION
DRAWING No
A1 5264 404 SHT 7 OF 7



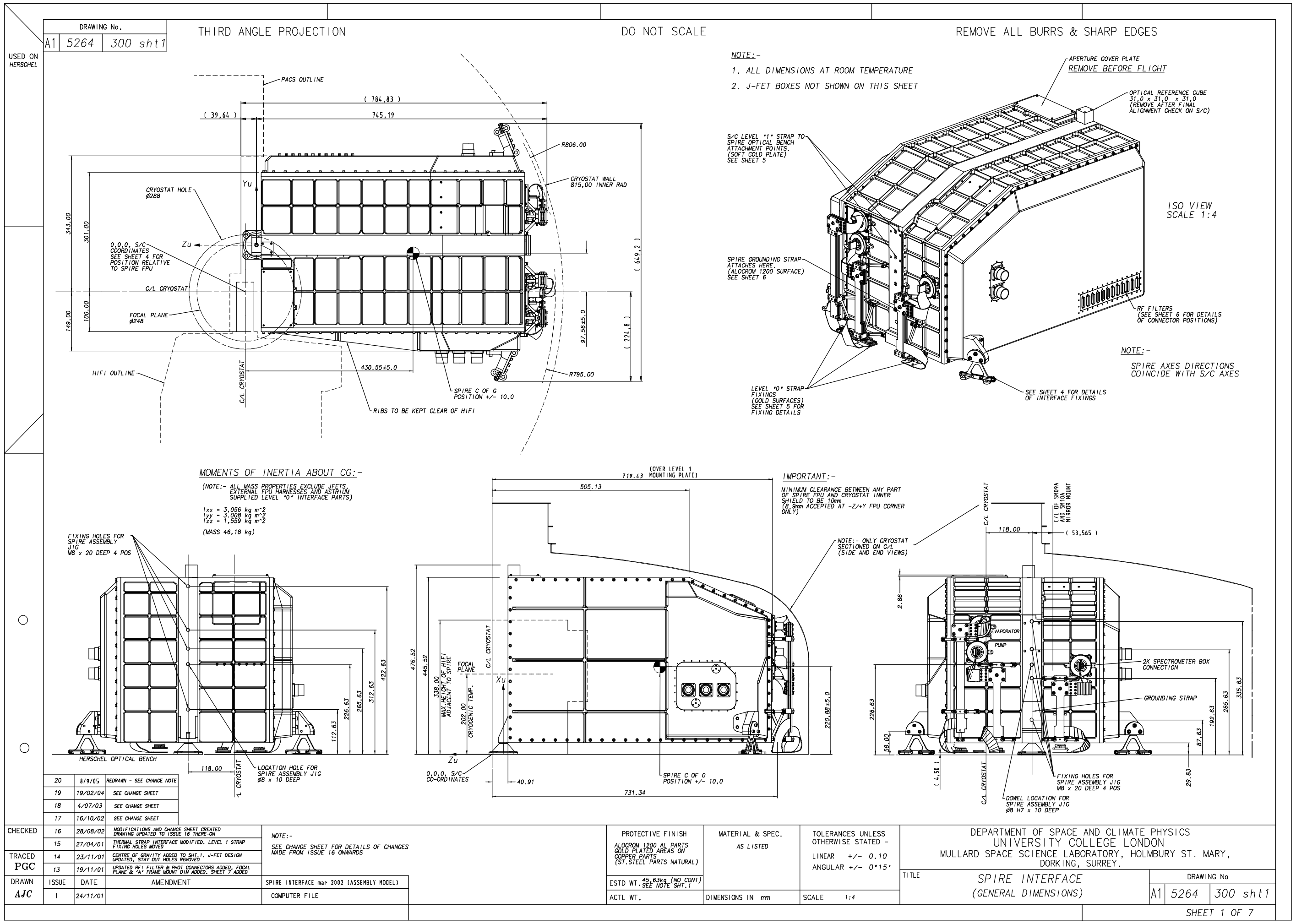
ANNEX B - L0 THERMAL STRAP ASSEMBLY

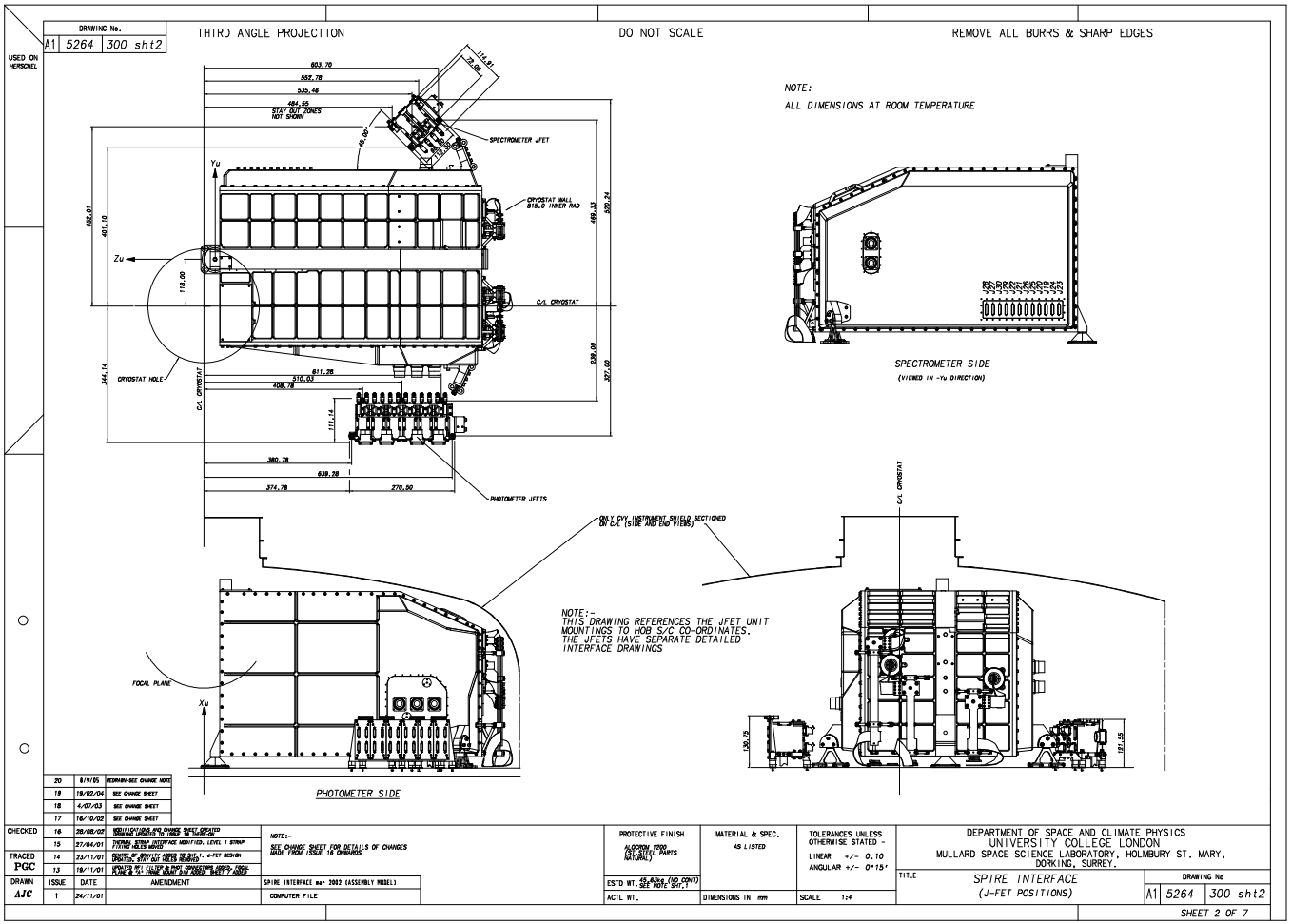


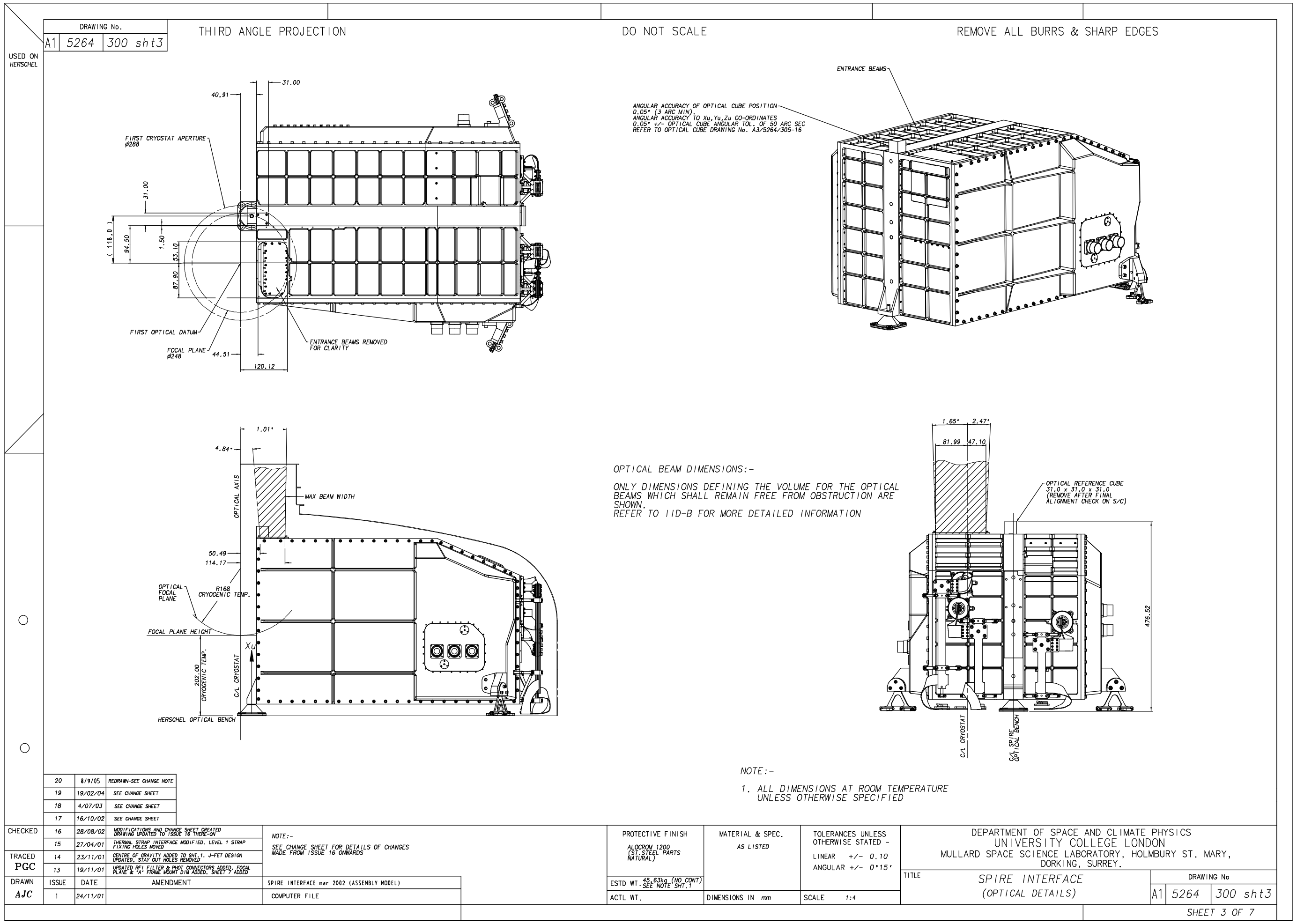
Item	Part #	Name	Qty
48		washer-M4-oversize	15
47		Washer-440-oversize	54
46		Washer-0-80-small	12
45		Washer 4-40 plain	24
44		Vespel bush	15
43		upper-flex-spec-pmb	1
42		upper-flex-pump-pmb	1
41		upper-flex-evaporator-pmb	1
40		Stud	6
39	A3-5264-309-6	special washer	12
38		SCR-M4x20L-SKT-CSK-HD	1
37		SCR-M4x20L-SKT-BUTT-HD	4
36	REFERENCE	Pressure-plate-Astrium	3
35	A3-5264-309-1A	Outer-baffle-can	3
34		nut 4-40 kaylock	30
33		Mounting-block	1
32		M4/B-32 Kaylock nut	15
31		M4 washer	14
30		M4 Skt Hd bolt 20LG	10
29		lower-flex-spec-outer-pmb	1
28		lower-flex-pump-outer-pmb	1
27		lower-flex-evaporator-outer-pmb	1
26		level-0-coldstrap-spec-pmb2	3
25		Level-0-coldstrap-pump-pmb	3
24		Level-0-coldstrap-evaporator-outer	1
23		Level-0-coldstrap-evaporator-inner	2
22		joining-plate-pump-spec	4
21		joining-plate-evaporator-outer	1
20		joining-plate-evaporator-inner	1
19		DOWEL-1BLxDIA5	6
18		ColdStrapSupport-diagonal-leg	2
17		ColdStrapSupport-spect-diagonal-leg	1
16		Cold-Strap-Support-upper	3
15		Cold Strap Support-Diagonal	3
14		Cold Strap Support Leg	12
13		Clamp	6
12	A3-5264-309-2C	Centre-baffle-4K	3
11		Cap-screw-0-80unf x 6.35 lg	12
10		Cap screw 4-40unc x 12.7	45
9	B 0375-018	Belleville washer DI 4.83 Do 9.53 t 0.44	15
8		Belleville washer B0250-009-S	75
7		Baffle-outer-sold-core-SPECT	1
6		Baffle-outer-sold-core	2
5	REFERENCE	Astrium-thermal-sensor	3
4	REFERENCE	Astrium-pressure-plate-opad	1
3		4-40 unc x 8 skt hd	18
2		4-40 unc x 10 skt hd	12
1	NOT REQD	4-40 UNC Nut	6

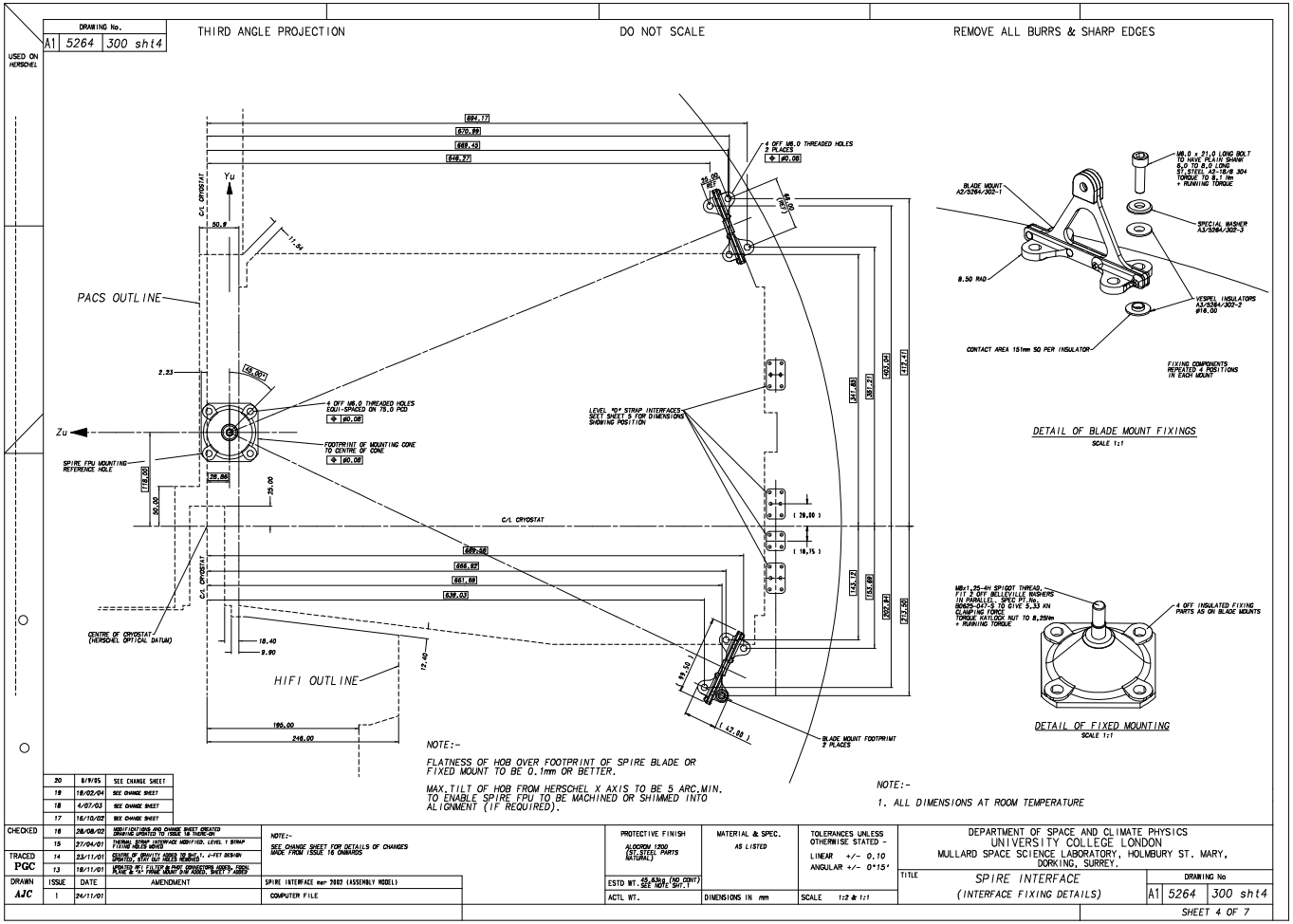
CHECKED							PROTECTIVE FINISH	MATERIAL & SPEC.	TOLERANCES UNLESS OTHERWISE STATED - LINEAR +/- 0.10 ANGULAR +/- 0°15'	DEPARTMENT OF SPACE AND CLIMATE PHYSICS UNIVERSITY COLLEGE LONDON MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.
TRACED										
	2	29/1/04	DRG No ADDED TO ITEM 39							
DRAWN PMB	ISSUE 1	DATE 22/1/04	AMENDMENT	COMPUTER FILE COLD-STRAPS-FM (ASSY) COLD-STRAPS-FM-ASSY-DRG (CONFIG) A1-5264-309A (DRG)			ESTD WT. ACTL WT.	DIMENSIONS IN mm	SCALE NTS	TITLE LEVEL 0 COLD STRAP ASSEMBLY — DRAWING No A1 5264 309A

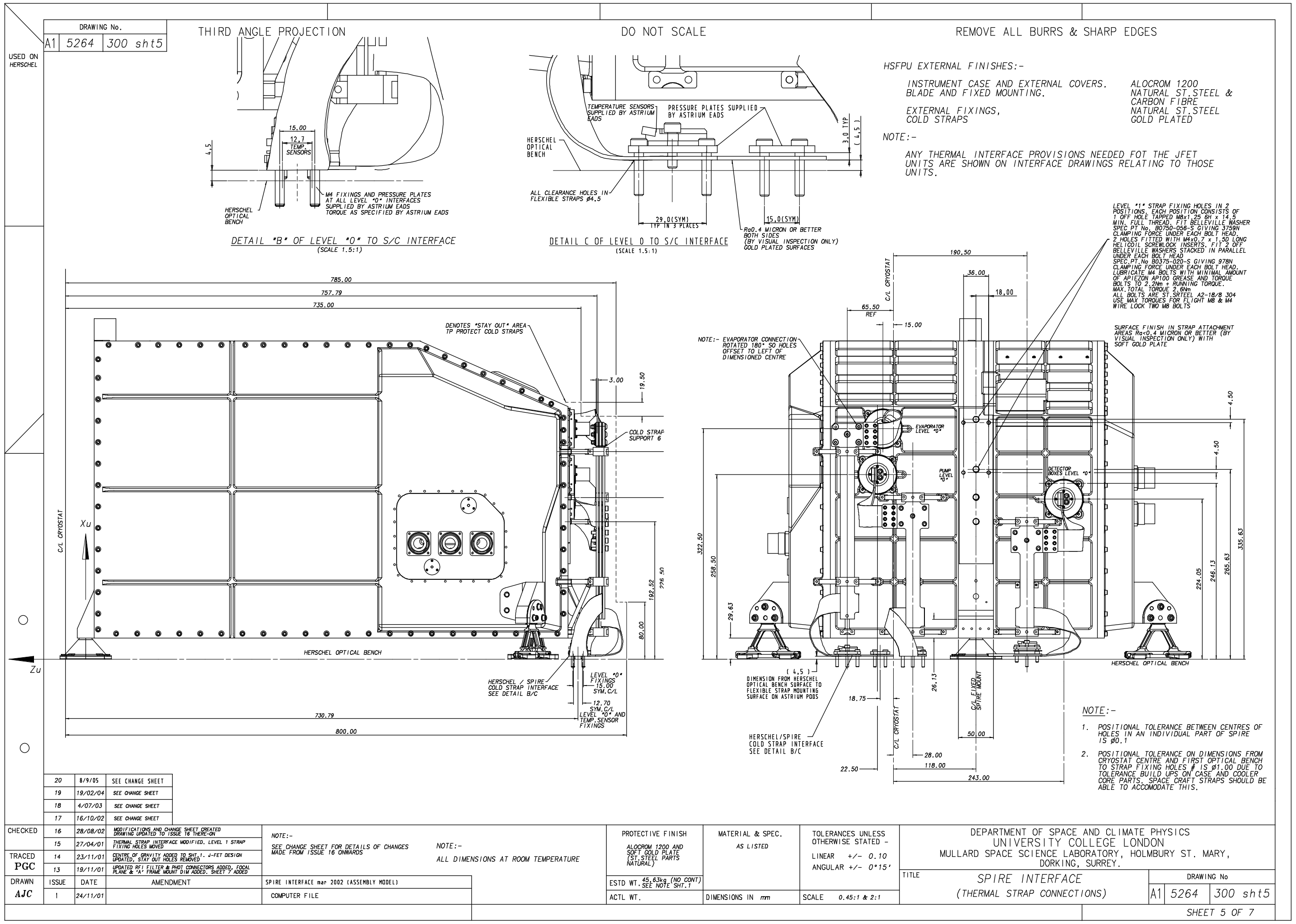
ANNEX C FPU INTERFACE DRAWING

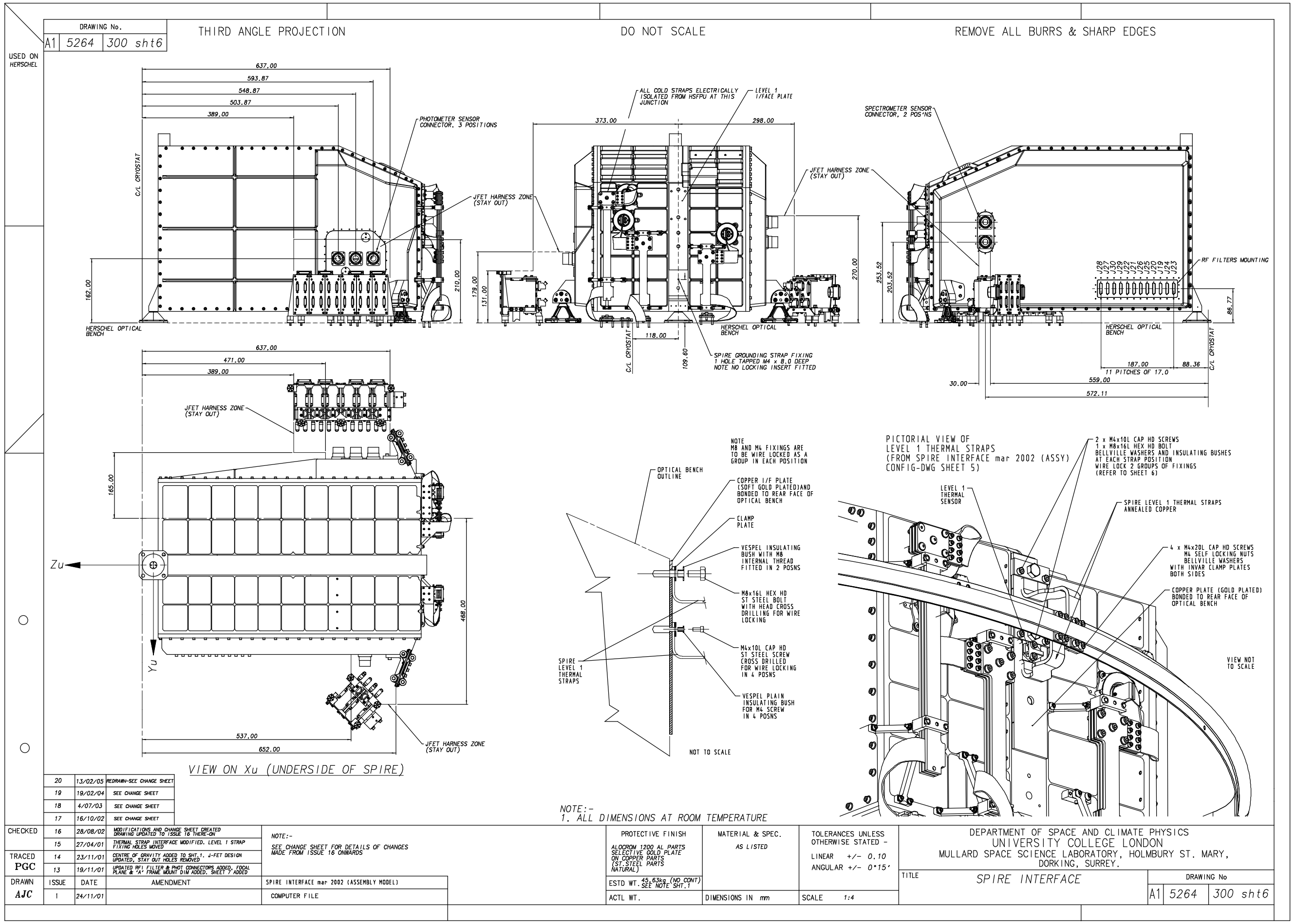

THIRD ANGLE PROJECTION
DO NOT SCALE
REMOVE ALL BURRS & SHARP EDGES
NOTE:-
1. ALL DIMENSIONS AT ROOM TEMPERATURE
2. J-FET BOXES NOT SHOWN ON THIS SHEET
ISO VIEW SCALE 1:4
SPIRE AXES DIRECTIONS COINCIDE WITH S/C AXES
MOMENTS OF INERTIA ABOUT CG:-
(MASS 46.18 kg)
IMPORTANT:-
DEPARTMENT OF SPACE AND CLIMATE PHYSICS
UNIVERSITY COLLEGE LONDON
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.
SPIRE INTERFACE
(GENERAL DIMENSIONS)
A1 5264 300 sht1
SHEET 1 OF 7


DRAWING No. A1 5264 300 sht2
THIRD ANGLE PROJECTION
DO NOT SCALE
REMOVE ALL BURRS & SHARP EDGES
USED ON HERSCHEL
NOTE:-
ALL DIMENSIONS AT ROOM TEMPERATURE
SPECTROMETER JFET
CRYOSTAT WALL B15.0 INNER RAD
C/L CRYOSTAT
CRYOSTAT HOLE
PHOTOMETER JFETS
SPECTROMETER SIDE
(VIEWED IN -Yu DIRECTION)
ONLY CRY. INSTRUMENT SHIELD SECTIONED ON C/L (SIDE AND END VIEWS)
NOTE:-
THIS DRAWING REFERENCES THE JFET UNIT MOUNTINGS TO HOB S/C CO-ORDINATES. THE JFETS HAVE SEPARATE DETAILED INTERFACE DRAWINGS
FOCAL PLANE
PHOTOMETER SIDE
CHECKED
TRACED PGC
DRAWN AJC
PROTECTIVE FINISH
MATERIAL & SPEC. AS LISTED
TOLERANCES UNLESS OTHERWISE STATED -
LINEAR +/- 0.10
ANGULAR +/- 0°15'
DEPARTMENT OF SPACE AND CLIMATE PHYSICS
UNIVERSITY COLLEGE LONDON
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.
TITLE
SPIRE INTERFACE (J-FET POSITIONS)
DRAWING No
A1 5264 300 sht2
SHEET 2 OF 7

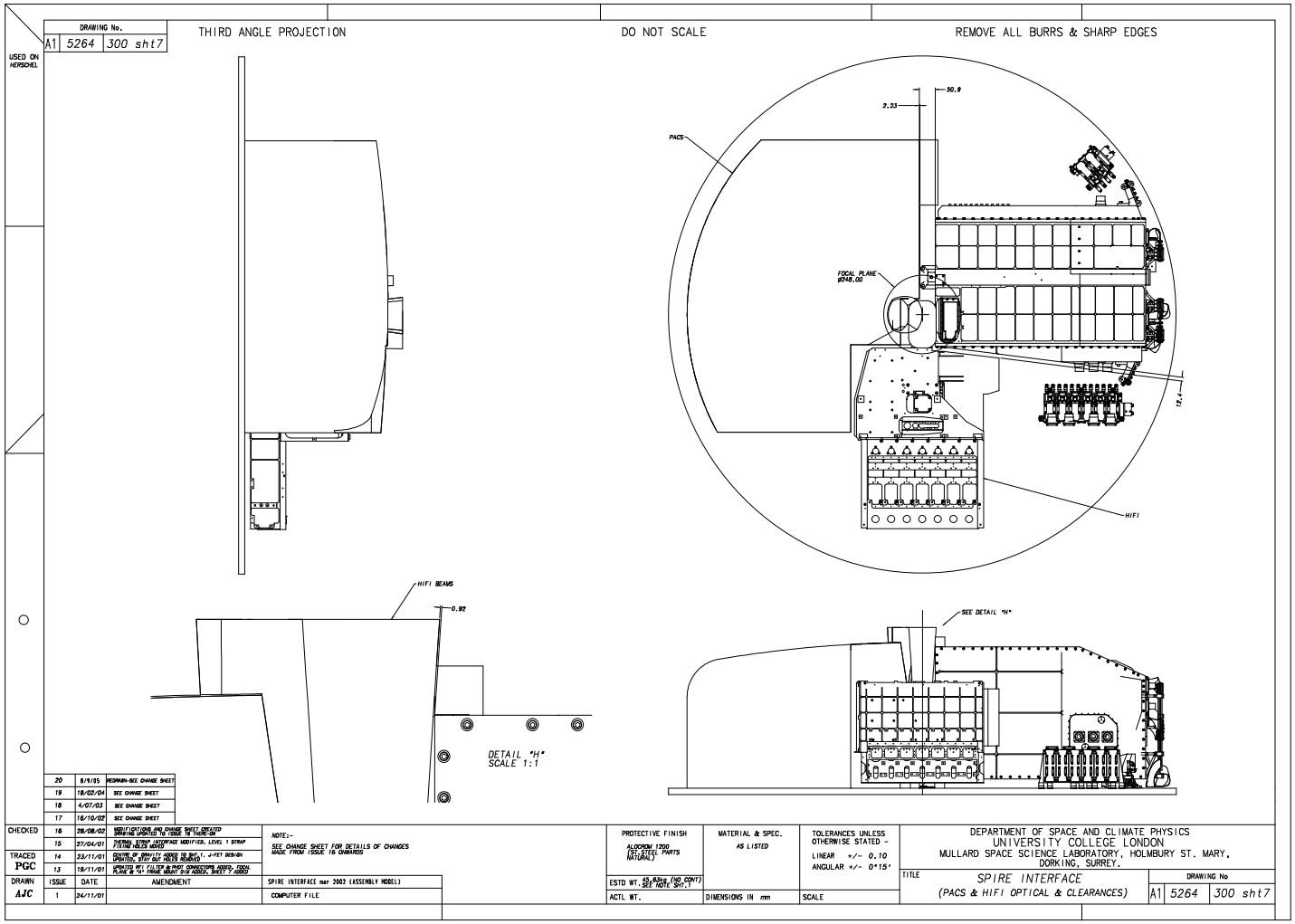

DRAWING No.
A1 5264 300 sht3
THIRD ANGLE PROJECTION
DO NOT SCALE
REMOVE ALL BURRS & SHARP EDGES
USED ON HERSCHEL
FIRST CRYOSTAT APERTURE Ø288
FIRST OPTICAL DATUM
FOCAL PLANE Ø248
ENTRANCE BEAMS REMOVED FOR CLARITY
ENTRANCE BEAMS
ANGULAR ACCURACY OF OPTICAL CUBE POSITION 0.05° (3 ARC MIN).
ANGULAR ACCURACY TO Xu,Yu,Zu CO-ORDINATES 0.05° +/- OPTICAL CUBE ANGULAR TOL. OF 50 ARC SEC
REFER TO OPTICAL CUBE DRAWING No. A3/5264/305-16
MAX BEAM WIDTH
OPTICAL AXIS
OPTICAL FOCAL PLANE
R168 CRYOGENIC TEMP.
FOCAL PLANE HEIGHT
C/L CRYOSTAT
HERSCHEL OPTICAL BENCH
OPTICAL BEAM DIMENSIONS:-
ONLY DIMENSIONS DEFINING THE VOLUME FOR THE OPTICAL BEAMS WHICH SHALL REMAIN FREE FROM OBSTRUCTION ARE SHOWN.
REFER TO IID-B FOR MORE DETAILED INFORMATION
OPTICAL REFERENCE CUBE 31.0 x 31.0 x 31.0 (REMOVE AFTER FINAL ALIGNMENT CHECK ON S/C)
C/L SPIRE OPTICAL BENCH
NOTE:-
1. ALL DIMENSIONS AT ROOM TEMPERATURE UNLESS OTHERWISE SPECIFIED
20 8/9/05 REDRAWN-SEE CHANGE NOTE
19 19/02/04 SEE CHANGE SHEET
18 4/07/03 SEE CHANGE SHEET
17 16/10/02 SEE CHANGE SHEET
16 28/08/02 MODIFICATIONS AND CHANGE SHEET CREATED DRAWING UPDATED TO ISSUE 16 THERE-ON
15 27/04/01 THERMAL STRAP INTERFACE MODIFIED. LEVEL 1 STRAP FIXING HOLES MOVED
14 23/11/01 CENTRE OF GRAVITY ADDED TO SHT.1. J-FET DESIGN UPDATED. STAY OUT HOLES REMOVED
13 19/11/01 UPDATED RFI FILTER & PHOT CONNECTORS ADDED. FOCAL PLANE & 'A' FRAME MOUNT DIM ADDED. SHEET 7 ADDED
1 24/11/01
CHECKED
TRACED PGC
DRAWN AJC
ISSUE DATE AMENDMENT
NOTE:- SEE CHANGE SHEET FOR DETAILS OF CHANGES MADE FROM ISSUE 16 ONWARDS
SPIRE INTERFACE mar 2002 (ASSEMBLY MODEL)
COMPUTER FILE
PROTECTIVE FINISH ALOCROM 1200 (ST.STEEL PARTS NATURAL)
ESTD WT. 45.63kg (NO CONT) SEE NOTE SHT.1
ACTL WT.
MATERIAL & SPEC. AS LISTED
DIMENSIONS IN mm
TOLERANCES UNLESS OTHERWISE STATED - LINEAR +/- 0.10 ANGULAR +/- 0°15'
SCALE 1:4
DEPARTMENT OF SPACE AND CLIMATE PHYSICS
UNIVERSITY COLLEGE LONDON
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.
TITLE SPIRE INTERFACE (OPTICAL DETAILS)
DRAWING No A1 5264 300 sht3
SHEET 3 OF 7


DRAWING No. A1 5264 300 sht4
THIRD ANGLE PROJECTION
DO NOT SCALE
REMOVE ALL BURRS & SHARP EDGES
USED ON HERSCHEL
PACS OUTLINE
HIFI OUTLINE
C/L CRYOSTAT
Yu
Zu
SPIRE FPU MOUNTING REFERENCE HOLE
CENTRE OF CRYOSTAT (HERSCHEL OPTICAL DATUM)
4 OFF M6.0 THREADED HOLES EQUI-SPACED ON 79.0 PCD
FOOTPRINT OF MOUNTING CONE TO CENTRE OF CONE
4 OFF M6.0 THREADED HOLES 3 PLACES
LEVEL "D" STRAP INTERFACES SEE SHEET 3 FOR DIMENSIONS SHOWING POSITION
BLADE MOUNT FOOTPRINT 3 PLACES
DETAIL OF BLADE MOUNT FIXINGS
SCALE 1:1
BLADE MOUNT A3/3264/302-1
SPECIAL WASHER A3/3264/302-3
VESPEL INSULATORS A3/3264/302-2 ø10.00
8.50 RAD
CONTACT AREA 151mm SQ PER INSULATOR
FIXING COMPONENTS REPEATED 2 POSITIONS IN EACH MOUNT
DETAIL OF FIXED MOUNTING
SCALE 1:1
4 OFF INSULATED FIXING PARTS AS OR BLADE MOUNTS
NOTE:-
FLATNESS OF HOB OVER FOOTPRINT OF SPIRE BLADE OR FIXED MOUNT TO BE 0.1mm OR BETTER.
MAX. TILT OF HOB FROM HERSCHEL X AXIS TO BE 5 ARC.MIN. TO ENABLE SPIRE FPU TO BE MACHINED OR SHIMMED INTO ALIGNMENT (IF REQUIRED).
NOTE:-
1. ALL DIMENSIONS AT ROOM TEMPERATURE
DEPARTMENT OF SPACE AND CLIMATE PHYSICS
UNIVERSITY COLLEGE LONDON
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.
TITLE SPIRE INTERFACE (INTERFACE FIXING DETAILS)
DRAWING No A1 5264 300 sht4
SHEET 4 OF 7


THIRD ANGLE PROJECTION
DO NOT SCALE
REMOVE ALL BURRS & SHARP EDGES
HSFPU EXTERNAL FINISHES:-
INSTRUMENT CASE AND EXTERNAL COVERS, BLADE AND FIXED MOUNTING.
ALOCROM 1200 NATURAL ST.STEEL & CARBON FIBRE
EXTERNAL FIXINGS, COLD STRAPS
NATURAL ST.STEEL GOLD PLATED
NOTE:-
ANY THERMAL INTERFACE PROVISIONS NEEDED FOT THE JFET UNITS ARE SHOWN ON INTERFACE DRAWINGS RELATING TO THOSE UNITS.
DETAIL "B" OF LEVEL "O" TO S/C INTERFACE
DETAIL C OF LEVEL 0 TO S/C INTERFACE
HERSCHEL OPTICAL BENCH
NOTE:-
1. POSITIONAL TOLERANCE BETWEEN CENTRES OF HOLES IN AN INDIVIDUAL PART OF SPIRE IS Ø0.1
2. POSITIONAL TOLERANCE ON DIMENSIONS FROM CRYOSTAT CENTRE AND FIRST OPTICAL BENCH TO STRAP FIXING HOLES IS Ø1.00 DUE TO TOLERANCE BUILD UPS ON CASE AND COOLER CORE PARTS. SPACE CRAFT STRAPS SHOULD BE ABLE TO ACCOMODATE THIS.
NOTE:-
SEE CHANGE SHEET FOR DETAILS OF CHANGES MADE FROM ISSUE 16 ONWARDS
NOTE:-
ALL DIMENSIONS AT ROOM TEMPERATURE
PROTECTIVE FINISH
MATERIAL & SPEC.
AS LISTED
TOLERANCES UNLESS OTHERWISE STATED -
LINEAR +/- 0.10
ANGULAR +/- 0°15'
DEPARTMENT OF SPACE AND CLIMATE PHYSICS
UNIVERSITY COLLEGE LONDON
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.
TITLE
SPIRE INTERFACE
(THERMAL STRAP CONNECTIONS)
DRAWING No
A1 5264 300 sht5
SHEET 5 OF 7
CHECKED
TRACED PGC
DRAWN AJC
SCALE 0.45:1 & 2:1
DIMENSIONS IN mm



THIRD ANGLE PROJECTION
DO NOT SCALE
REMOVE ALL BURRS & SHARP EDGES
VIEW ON Xu (UNDERSIDE OF SPIRE)
PICTORIAL VIEW OF LEVEL 1 THERMAL STRAPS (FROM SPIRE INTERFACE mar 2002 (ASSY) CONFIG-DWG SHEET 5)
NOTE:- 1. ALL DIMENSIONS AT ROOM TEMPERATURE
DEPARTMENT OF SPACE AND CLIMATE PHYSICS
UNIVERSITY COLLEGE LONDON
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.
SPIRE INTERFACE
A1 5264 300 sht6


DRAWING No.
A1 5264 300 sht7
USED ON HERSCHEL
THIRD ANGLE PROJECTION
DO NOT SCALE
REMOVE ALL BURRS & SHARP EDGES
PACS
FOCAL PLANE
HIFI
HIFI BEAMS
DETAIL "H"
SCALE 1:1
SEE DETAIL "H"
DEPARTMENT OF SPACE AND CLIMATE PHYSICS
UNIVERSITY COLLEGE LONDON
MULLARD SPACE SCIENCE LABORATORY, HOLMBURY ST. MARY, DORKING, SURREY.
SPIRE INTERFACE
(PACS & HIFI OPTICAL & CLEARANCES)
A1 5264 300 sht7