CCLRC Rutherford Appleton Laboratory	MINUTES OF MEETING (MoM)		PRODUCT ASSURANCE Space Science and Technology Department		
Spacecraft/Project	**HERSCEL**	**Document No**	**SPIRE-RAL-MoM-001846**		
Instrument/Model	**SPIRE**	**Issue No / Rev**	**1**	**Page**	1 of 6
Subsystem	**Test Cryoharness**	**Date**	**22 October 2003**		

Title / Subject	NRB for HR-SP-RAL-NCR-044 (Connector Plating Flaking off)	**Chairman**	Doug Griffin
Meeting Place	SPIRE PROJECT OFFICE	**Secretary**	Eric Clark

Participants (Print Name)	(Signature Required)	Agenda
Roy Blake	[signature]	• Visit CRYOLAB To View Problem RB & DG Discuss the following. • Possible Cause of Problem a.) Technical.. – b.) Procurement / PA • Usability • Remedial Actions • Rework? • Are any other Models effected I E Flight etc AOB
Doug Griffin	[signature]	
Mike Trower		
Eric Clark	[signature]	
Eric Sawyer	[signature]	
John Delderfield	[signature]	

Additional Distribution	Attachments
Bruce Swinyard DAVE KELSH	SPIRE-RAL-DOC-000966 issue 1.0 Test Cryoharness Specification SPIRE-RAL-PRJ-000608 issue 0.8 page 74 Relevant section of the Harness Definition. HR-SP-RAL-NCR-044.

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Action No	Title and Description	Action Responsibility	Action Deadline
1	Cadmium plated. - exact composition undetermined. - Roy Blake to ask Cinch for ~~exact~~ chemical composition specification. Connector body is aluminium alloy (unknown alloy?). Also ask. Procurement standard → COTS. Mil-Spec (not released). The failed connectors ~~all~~ are all on different harnesses.	RRB.	7/11/03

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Action No	Title and Description	Action Responsibility	Action Deadline
	Teledata have the CofCs for the batches. The connector bodies were sourced in the USA (cinch) and were plated in the UK. All 37-ways were in a single batch. ~~and all failures seem to be in this batch.~~ ~~(6 connectors out of 18)~~. ~~The 25-ways haven't failed.~~ The 25-ways were from ~~a~~ several batches. (~~2~~ 3 batches)		

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Action No	Title and Description	Action Responsibility	Action Deadline
2	Contact Jamie Bock about the stability of Teledata crich connectors over time/thermal cycling.	JD	27/10/03 COMPLETED 29/10/03.
	× Test harnesses to be used for next cool down → CQM cold balance prior to cold vibe. × Inspection + vacuum clean prior to mating connectors.		
3	× PA to produce check list for connector cleaning.	EAC.	7/11/03

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Action No	Title and Description	Action Responsibility	Action Deadline
4	* Witness sheet to be placed under connectors for next cooldown to collect debris.	EAC	7/11/03
5	* Discuss with RAL SSTD safety officer the HS implications & cleanup.	ECS	30/10/03
	* It was agreed that ~~no action~~ the current implementation of the flight harnesses ~~so~~ (i.e. ~~Al~~ Electroless Nickel) would be acceptable at present.		

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Action No	Title and Description	Action Responsibility	Action Deadline
6	x Action → Photograph each of the failed connectors.	DKG.	27/10/03
7	x Tekdata to send samples of the plating to Cinch for chemical analysis.	RRB.	27/10/03
8	x RAL to get an internal SEM ~~and~~ analysis composition.	JD.	7/11/03

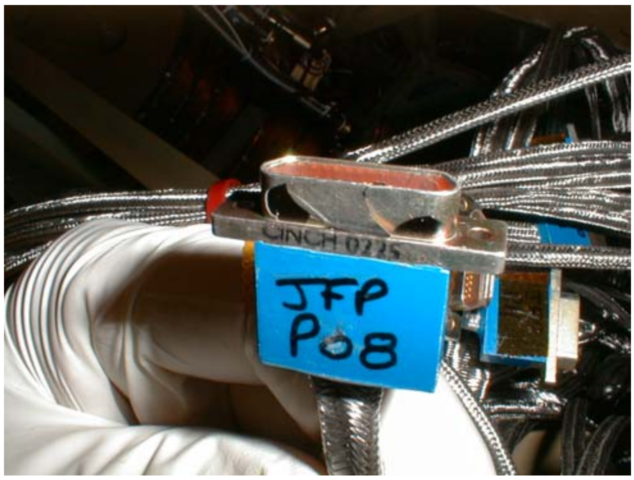

FPU
P24


FPU
P29


FPU J26


FPU
P21

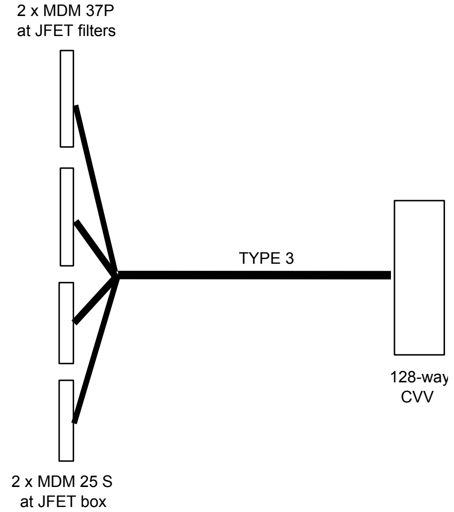

JFS
P06


CINCH 0225
JFP
P08

4.3 Cryogenic Harnesses

4.3.1 C1 CVV1 to HSJFS Type3

Overall Mechanical Drwg.

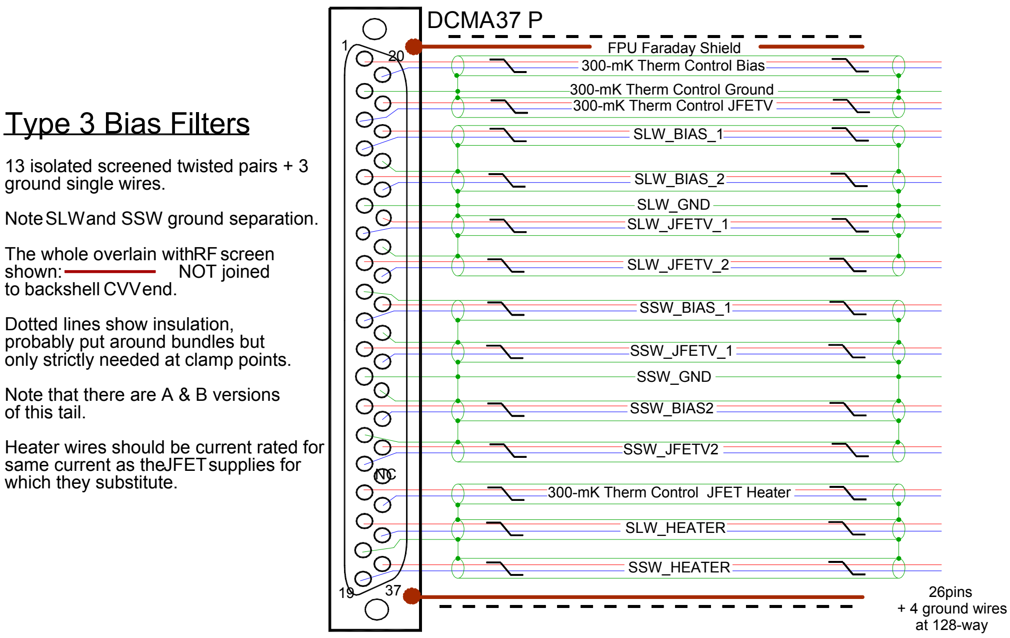


Connector/Backshell Details:

MDM 25 S + Glenair 507-145 M 25 H: interface to HSJFS J5
MDM 25 S + Glenair 507-145 M 25 H: interface to HSJFS J6
MDM 37 P + Glenair 507-145 M 37 H: interface to HSJFS J9 bias A
MDM 37 P + Glenair 507-145 M 37 H: interface to HSJFS J10 bias B

Harness Layup

Two 25way JFET bolometer tails, each as those in C4.
Two 37 way Spectrometer JFET Filter tails, each as follows:



Because the small SLW has no subgroups that might fail, EACH of the JFET bachharness leads is double-wired in this cryoharness, requiring linked across in the filters.

HERSCHEL SPIRE	Ref: SPIRE-RAL-DOC-000966 Author: D.L. Smith	Page: 1 Issue: 1.0 Date: 23-Nov-2001

SPIRE Test Cryoharness Specification

Checked By:

Doug Griffin (RAL) Date

Approval:

John Delderfield (RAL) Date

DIstribution

RAL	Doug Griffin	
	John Delderfield	
	Procurement Section 2A	

Document Change Record

Date	Index	Affected Pages	Changes
19-October-2001	Issue 0.1	All	First draft for comment
31-October-2001	Issue 0.2	6-9	Comments from John Delderfield and Doug Griffin incorporated Warm and Cold harness renamed to avoid confusion with flight harness.
22-Nov-2001	Issue 1.0	All	Formal Issue for procurement

Table of contents

1 Scope of the document

This document describes the requirements for the electrical harnesses to be used for cryogenic testing of the SPIRE instrument.

2 Documentation

2.1 Applicable Documents

	Title	Author	Reference	Date
AD 1	Herschel SPIRE Harness Definition	D. Griffin	SPIRE-RAL-PRJ-000608 Issue 0.8	

2.2 Reference Documents

	Title	Author	Reference	Date
RD 1	SPIRE Test Facility Requirements Specification	D.L. Smith	SPIRE-RAL-PRJ-000463 Issue 1.3	2-April-2001

3 Introduction

The Rutherford Appleton Laboratory is playing a key role in the development of the SPIRE (Spectral and Photometric Imaging REceiver) instrument on the European Space Agency's (ESA) Herschel far infrared space telescope mission due to be launched in 2007. Herschel is part of ESA's Horizons 2000 programme and will be implemented with the collaboration of NASA. Herschel will utilise a super fluid helium cryostat similar to the technology used on the successful ISO mission and will have a lifetime of approximately 3 years.

Prior to the launch of SPIRE, several development models of the instrument will be built which will require testing & qualification in a terrestrial environment. Part of the test & qualification programme will commence in August 2002 at the Rutherford Appleton Laboratory and will require a cryostat to emulate the SPIRE instrument's cryogenic environment as on the spacecraft.

The SPIRE calibration cryogenic system performs a critical role providing the necessary cooling for a low noise receiver instrument. It is vital for successful operation of the instrument that the cryogenic system provides appropriate thermal cooling capacity and stability, mechanical robustness and a high degree of reliability. It must be sufficiently simple to ensure minimum and straightforward instrument integration, operation and maintenance. Further details of the calibration facility requirements and the design concept are given in RD 1.

4 Test Cryoharness Description

The cryoharness is the internal harness between the warm SPIRE DRCU and the cold JFET boxes/FPU and is functionally representative of the flight harness. The harness will consist of two main sections. An airside section running from the cryostat wall to the warm electronics, and a vacuum side harness from the tank wall at 300K, through the 77K and 10K shields to the cold electronics at 4K. The design of the harness is simplified by separating the harness into a number of identical smaller items for the detector signals and a separate harness for power. Furthermore, thermal model calculations have shown that with adequate clamping arrangements, the heat load into the SPIRE instrument can be kept below a 5mW limit. Its design must be adequately representative of the flight model harness specification for calibration and functional tests to be valid.

5 Harness Specification

5.1 Cryogenic Harness

Harness between cryostat vacuum interface and SPIRE cold electronics. This is equivalent to the cold harness defined in AD 1, labelled C1 to C13. The warm end of the harness will be at room temperature (approximately 300K) and the cold end of the harness at 10K. To minimise the heat load at the instrument cold interface, the test harness will be heat-sunk at the 77K radiation shield and 10K shield before connecting to the instrument.

5.1.1 Definition

The definition of the layout and connector pin-outs required for the cryoharness is given in the instrument harness definition, AD 1.

5.1.2 Length

The overall length of the cryoharness will be between 3m and 3.5m to ensure that the line resistances are within the specified limits. The eventual lengthand routing of the harness will be specified by RAL.

5.1.3 Materials

The materials to be used for the test cryoharness are listed below. The contractor will supply all raw materials with the exception of the 128 way connectors which will be issued free of charge by RAL.

5.1.3.1 Wire

38AWG manganin will be used for lines with maximum resiststance ≥200Ω

38AWG brass will be used for all lines with maximum resistance 20Ω < R <200Ω

30AWG brass will be used for all lines with maximum resistances ≤ 20Ω

5.1.3.2 Connectors

The vacuum interface connectors will be 128 circular plug of 38999 series type, part no. 340105601B06G2535SNL. These will be supplied free issue by RAL (TBC).

The connectors at the instrument end shall be MIL-C-83513 MDM connectors to be supplied by the contractor. The number and type of connector to be used is defined in §4.3.1 to §4.3.13 of AD 1.

5.1.3.3 Other

All materials used for the cryoharness must be suitable for vacuum and low temperature use. Recommended vacuum materials include:

- Stainless Steel
- Aluminium
- Copper
- Gold
- Manganin
- Brass
- Glass and Quartz
- Teflon
- Polymide (Trade named Vespel)

- Viton
- Carbon Composites
- Crystalline Filter Materials (e.g. MgF, LiF etc)
- Solder
- Kynar

Where materials not on this list are to be used (e.g. black paint, adhesives), their outgassing properties must conform to ESA and NASA outgassing rates as referenced in the SPIRE PA plan. The contractor must specify and seek approval from RAL of the materials to be used in the construction of the test harness.

5.2 Air-Side Harness

Harness between cryostat vacuum interface and SPIRE warm electronics. This is equivalent to the intermediate harness defined in AD 1, labelled I1 to I13. For ground test purposes at RAL, harness will be at room temperature (approximately 300K).

5.2.1 Definition

The definition of the layout and connectors required for the air-side harness is given in the instrument harness definition, AD 1.

5.2.2 Length

The overall length of the air-side harness will be between 4m and 5m to ensure that the line resistances are within the specified limits. The eventual lengthand routing of the harness will be specified by RAL.

5.2.3 Materials

The materials to be used for the air-side harness are listed below. The contractor will supply all raw materials with the exception of the 128 way connectors which will be issued free of charge by RAL.

5.2.3.1 Wire

26AWG copper will be used for all harnesses.

5.2.3.2 Connectors

The vacuum interface connectors will be 128 way hermetic recepticle, of 38999 series type, part no. TVS07Y-25-35PN(W118). These will be supplied free issue by RAL.

The connectors at the instrument end shall be MIL-C-24308 D-type connectors to be supplied by the contractor. The number and type of connector to be used is defined in §4.2.1 to §4.2.13 of AD 1.

6 Testing

6.1 Electrical properties

Before delivery of the harness, the electrical resistance, capacitance and inductance must be demonstrated to conform to the requirements in the Annex of AD 1, and that there are no inter pin leakages present.

6.2 Thermal cycling

Each harness should be undergo at least two thermal cycles to 77K to relieve any internal stresses. The electrical properties must be measured before and after each cycle and any changes in performance noted. Significant (>5%) changes in the properties shall lead to a review board and could result in the harness being rejected.

6.3 Load testing

The harness will be disconnected from the SPIRE instrument a number of times during the lifetime of the harness. A test shall be performed on each harness to ensure that they are capable of withstanding light forces while being connected/disconnected. The electrical properties must be measured before and after the test and any changes in performance noted. Significant changes in the properties may lead to the harness being rejected.

A detailed design review shall take place prior to the manufacture with the supplier & members of the RAL SPIRE team present. Detailed manufacturing drawings will be supplied to RAL 1 week prior to the detail design review RAL will have the opportunity to comment & change the design as required.

7 Schedule

The SPIRE project has formally agreed milestone dates that have to be met if a launch in 2007 is to be achieved. Testing of the SPIRE instrument is planned to start August 2002 and requires a completed test harness. It is therefore necessary that the cryoharness be delivered to RAL by May 2002. The contractor should be able to demonstrate that they can meet this delivery date. A schedule showing the key activities and milestones will be provided by the contractor. The milestone dates should include the delivery of the materials, completion of the design drawings for review, start of manufacture, test and inspection points and final delivery.

8 Quality Assurance

SPIRE is an ISO9000 project and has to demonstrate that its quality control procedures are being followed as defined by the RAL product assurance dept. The SPIRE project does not require that the contractor is ISO9000 accredited, although the contractor should be able to demonstrate that quality control procedures are in place and being followed. The SPIRE project may wish to review the reports from key inspection points. The SPIRE project should be notified of all major non-conformances and changes to the agreed design. A certificate of conformance will be required as part of the delivery to RAL..

The final design of the harness shall be reviewed in detail by RAL prior to manufacture. Detailed manufacturing drawings will be supplied to RAL at least 2 weeks prior to the review so that RAL will have the opportunity to comment & change the design as required. Once the design has been accepted it will be placed under configuration control. If a change to the baseline design is required, an engineering change request must be submitted to RAL. A panel will consider the request and any likely repercussions to the project. If a requirement cannot be changed then a waiver may be requested.