UK Research and Innovation

Rutherford Appleton Laboratory
RAL Space
Harwell Campus, Harwell,
Oxfordshire OX11 0QX
United Kingdom.

PR18028 Electronic Beam Welding Specification.

MetOp Second Generation MWS Calibration Rig

EB Welding Requirements Specification

Issue 1.0

CHANGE LOG

Date	Issue	Revision	Pages	Reason for change
22 Jan 2018	0	1	All	New document created.
30 Apr. 2018	1	0	All	First issue

CONTENTS

TABLES

No table of figures entries found.

FIGURES

Applicable Documents

AD #	APPLICABLE DOCUMENT TITLE	DOCUMENT ID	ISSUE
1	Specification and qualification of welding procedures for metallic materials – Welding procedure specification – Part 3 Electron beam welding	BS EN ISO 15609-3	2004
2			
3			

Reference Documents

RD #	REFERENCE DOCUMENT TITLE	DOCUMENT ID	ISSUE
1	Welded subassembly drawing	KE-0265-400 (RD1)	A
2	Radiation shield drawing	KE-0265-310 (RD2)	A
3	Feedthrough flange assemblies drawing	KE-0265-224 (RD3)	A

Abbreviations and Definitions

EB	Electron Beam (welding)
MWS	Microwave Sounder
RAL	Rutherford Appleton Laboratories

1. INTRODUCTION

A number of parts require electron beam welding in accordance with AD1, followed by inspection and testing. This document explains the requirements needed of the contractor (the supplier contracted to carry out these tasks).

The parts requiring EB welding are:

Item	Drawing Number	Quantity
Welded subassembly	KE-0265-400 (RD1)	2
Radiation shield	KE-0265-310 (RD2)	2
Feedthrough flange assemblies	KE-0265-224 (RD3)	6

All assembly will be carried out by RAL Space. All welding, inspection and testing shall be carried out by the contractor, as well as any remedial work required should the component not pass inspection.

1.1 Schedule

The expected schedule of the items being handed over to EB welding contractors is:

Item	Expected delivery date (to EB welding contractors)
Welded subassembly 1	August 2018
Welded subassembly 2	August/September 2018
Radiation shield 1 & 2	August 2018
Feedthrough flange assemblies 1-6	August 2018

It is expected that the two welded subassemblies will be welded on different occasions, but the two radiation shields and the 6 feedthrough flange assemblies will be sent for welding simultaneously.

It should be noted that these dates are not fixed and so the contractor is asked to accommodate changes as required. RAL Space will keep the contractor updated with expected delivery dates as appropriate.

It is expected that each order can be turned around in 1 week, including welding, inspecting and testing.

Important note: reference question AW6.8. Delivery must be within 8 weeks of contract award.

1.2 Deliverables

For each item to be welded, it is required that the following documents are also produced and delivered by the contractor:

- Material/manufacturing/weld certificates of conformity (as appropriate)

- Evidence of test equipment calibration

2. WELDED SUBASSEMBLY

The welded subassembly consists of three components, as shown on the drawing (RD1):

Component	Drawing Number	Quantity	Material
Target Base	KE-0265-411	1	Aluminium 6082-T6
Target Baffle	KE-0265-412	1	Aluminium 6082-T6
1.6mm Filler Wire	-	1	Aluminium 4043

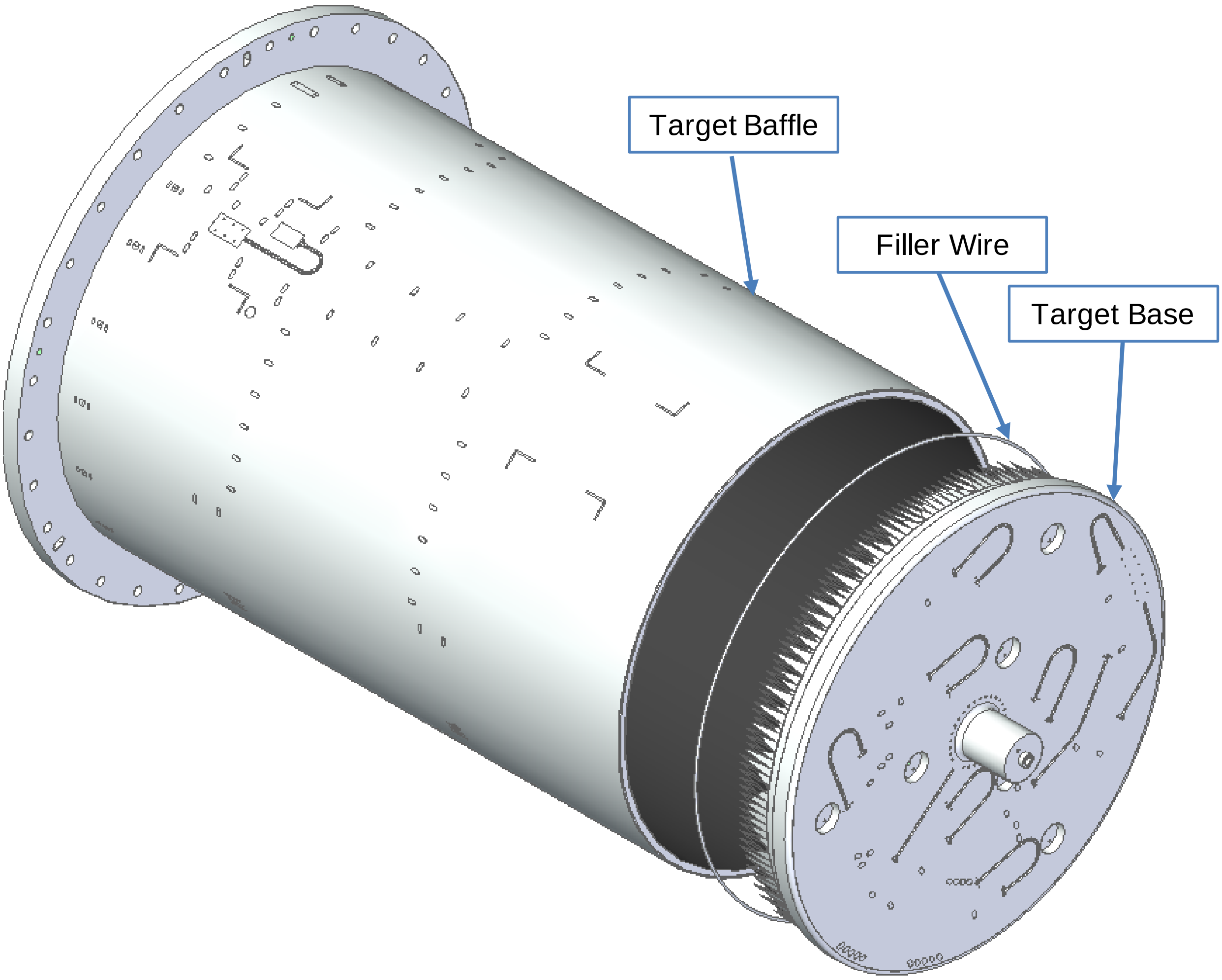

Figure 2-1 – Welded subassembly exploded view

2.1 Assembly

The assembly shall be carried out by RAL Space, before delivery to the contractor and shall consist of a heat shrink fit between the target base and target baffle.

2.2 Filler wire

The filler wire is added to a groove between the two components. This is used to prevent cracking in the weld joint and was found to be necessary during initial welding trials.

This stage is done by RAL Space.

2.3 Mounting during welding

The target base will have a transport frame attached upon delivery, which may remain attached during welding if this is useful for mounting during welding. Details of this can be discussed after contract award.

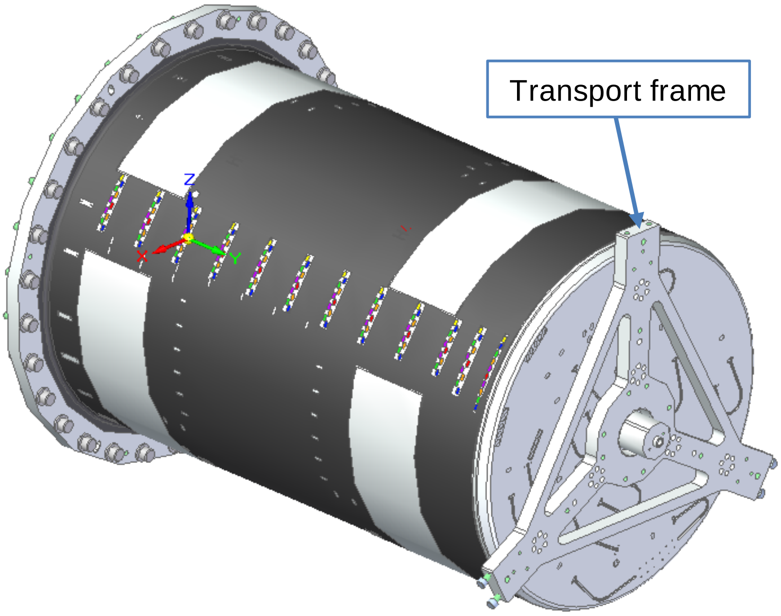

Figure 2-2 – Welded subassembly with transport frame

2.4 Test articles

Each delivery of welded subassembly to the contractor shall also include a test article, for the purposes of determining weld parameters on a representative component and performing destructive tests.

Figure 2-3 - Weld test article

The destructive testing may be determined by the contractor, but should give reassurance that the final weld will be as required. All results shall be shared with RAL Space.

2.5 Weld appearance

The weld bead should not protrude significantly (more than 2mm) from the surface of the component.

2.6 Transport

The welded subassembly will be supplied in a secure transport crate (supplied by RAL Space). The transport crate shall have castor wheels with a removable lid. The mass of the component will be approximately 65kg and include lifting points to allow for a 2 point lift with a crane.

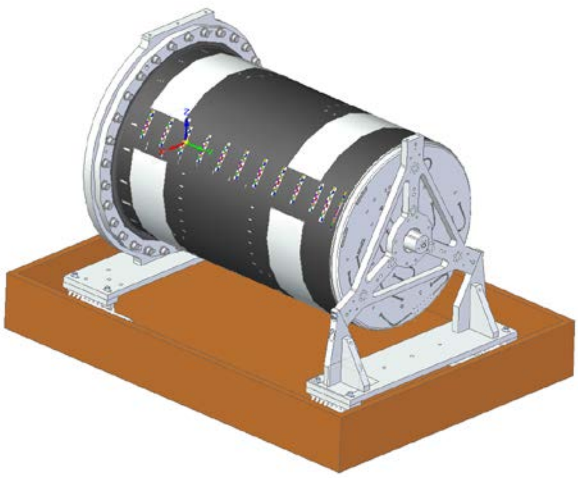

Figure 2-4 – Welded subassembly transport crate (lid not shown)

2.7 Inspection and testing

After welding, the contractors are to carry out:

1. A visual check
2. 3x temperature cycle from ambient to below -170°C
3. Non-destructive testing (contractor to suggest suitable method. Dye penetrant testing not allowed)
4. Helium leak test (detailed below)

Helium leak test:

The assembly should be leak tested in a clean room following EB welding using the following process:

1. Bag the welded assembly
2. Put the He leak detector in the bag with the welded assembly
3. Seal the bag
4. Evacuate the internal volume of the welded assembly. Pump and purge several times.
5. Pressurise the internal volume of the welded assembly with helium to 1 bar
6. Measure leak rate
7. Leave overnight and measure leak rate the following day

The leak rate should be less than $1x10^{-8}$mbar l/s. If the contractor's equipment is not able to measure to this rate, the leak rate should be at least $1x10^{-6}$mbar l/s, but it is preferable to be able to measure to $1x10^{-8}$mbar l/s.

A test cap for the flanged end of the component, with a suitable leak test fitting, shall be provided by RAL Space. All other equipment required for the leak test to be supplied by the contractor (including the bag and the leak detector).

A report shall be supplied by the contractors containing a description of the test procedure and the results from those tests, for all inspections and tests. The report shall also include a welding procedure specification (an example of which is shown in Annex A of AD1).

If the contractor does not have the capability to perform the He leak test to 10-8mbar l/s RAL shall perform this test on the contractor's behalf when delivered to RAL. Prior to delivery the contractor shall test to 1x10-6mbar l/s and supply the documents to RAL for review.
Any failure of the component to meet the He leak test at 10-8mbar l/s shall be rectified by the contractors.

3. RADIATION SHIELD

The radiation shield consists of three components, as shown on the drawing:

Component	Drawing Number	Quantity	Material
Radiation shield base	KE-0265-311	1	Aluminium 6082-T6
Radiation shield baffle	KE-0265-812	1	Aluminium 6082-T6
1.6mm Filler Wire	-	1	Aluminium 4043

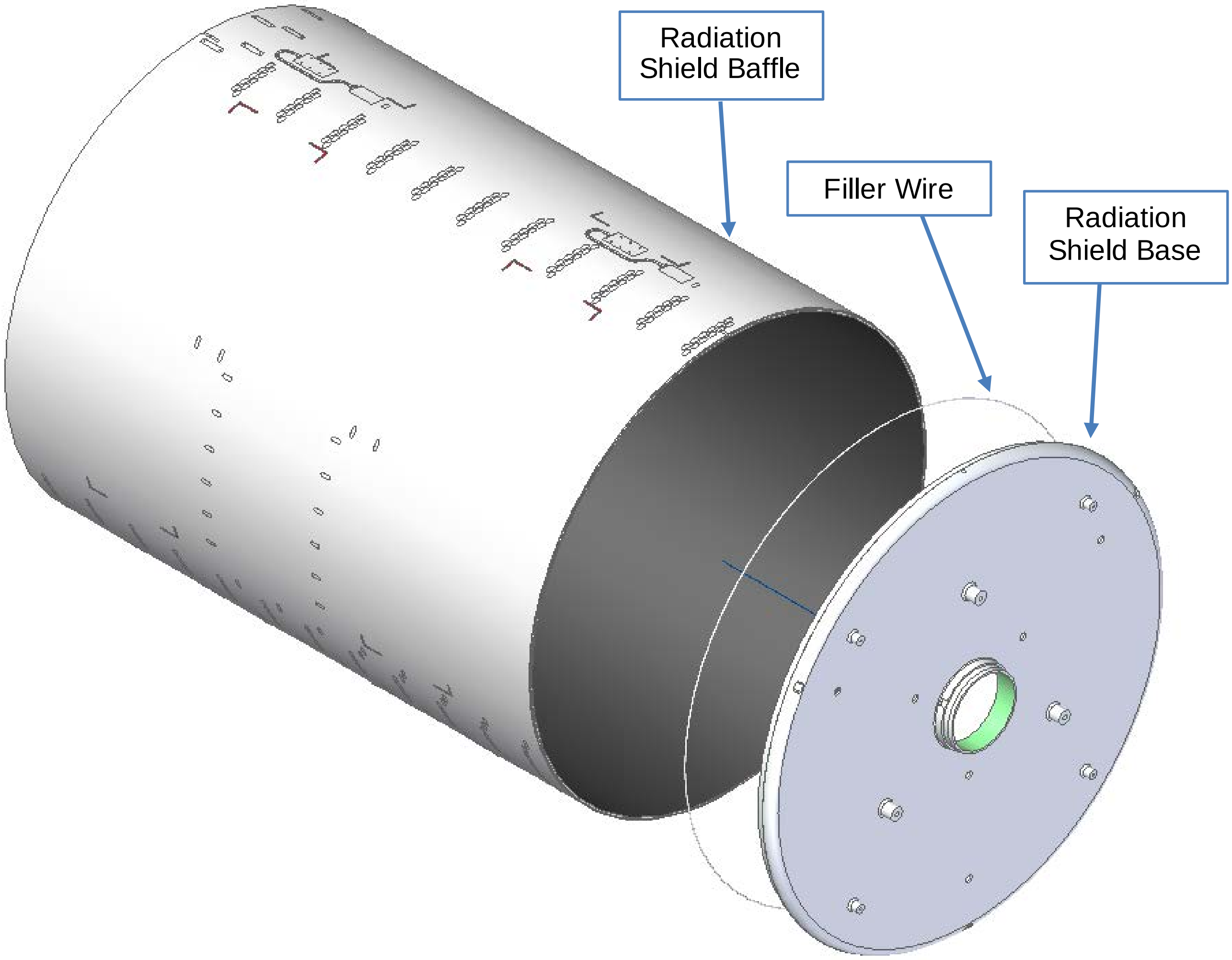

Figure 3-1 – Radiation Shield Welded Assembly (exploded view)

3.1 Assembly

The assembly shall be carried out by RAL Space, before delivery to the contractor and shall consist of a heat shrink fit between the radiation shield base and radiation shield baffle.

3.2 Filler wire

The filler wire is added to a groove between the two components. This is used to prevent cracking in the weld joint and was found to be necessary during initial welding trials.

This stage is done by RAL Space.

3.3 Mounting during welding

The target base will have a transport frame attached upon delivery, which may remain attached during welding if this is useful for mounting during welding. Details of this can be discussed after contract award.

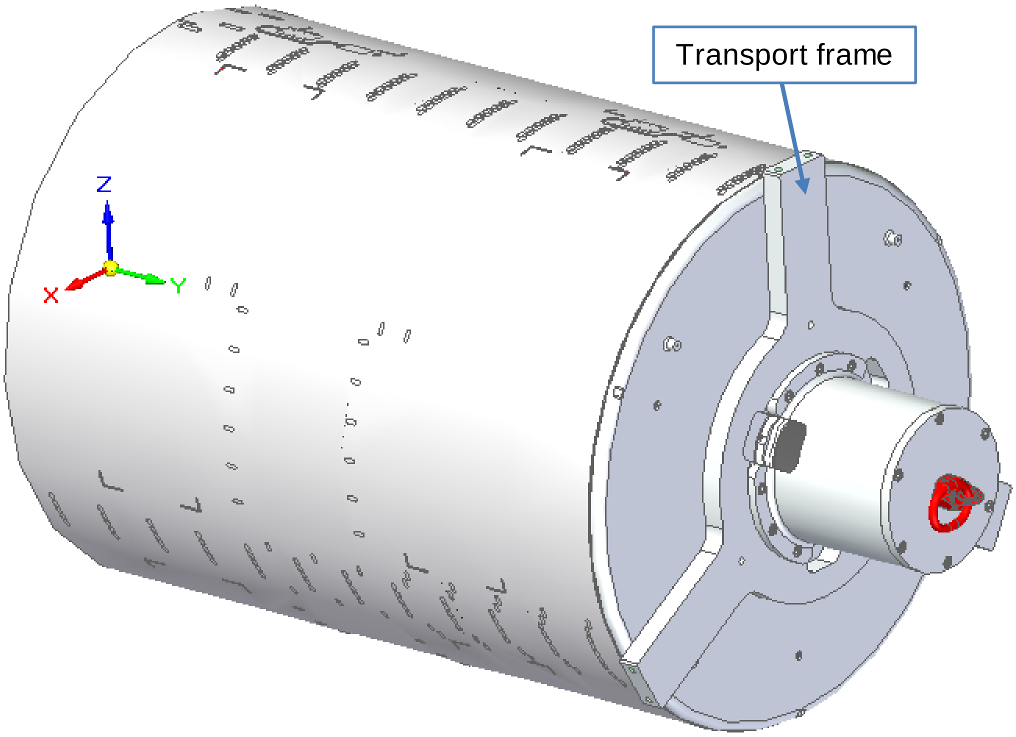

Figure 3-2 – Radiation shield with transport frame

3.4 Test articles

Each delivery of radiation shield assembly to the contractor shall also include a test article, for the purposes of determining weld parameters on a representative component and performing destructive tests.

Figure 3-3 – Radiation shield weld test article

The destructive testing may be determined by the contractor, but should give reassurance that the final weld will be as required. All results shall be shared with RAL Space.

3.5 Weld appearance

The weld bead should not protrude significantly (more than 2mm) from the surface of the component.

3.6 Transport

The radiation shield will be supplied in a secure transport crate (supplied by RAL Space). The transport crate shall have castor wheels with a removable lid. The mass of the component will be approximately 28kg (including lifting fixtures, or 11kg without) and include lifting points to allow for a 2 point lift with a crane.

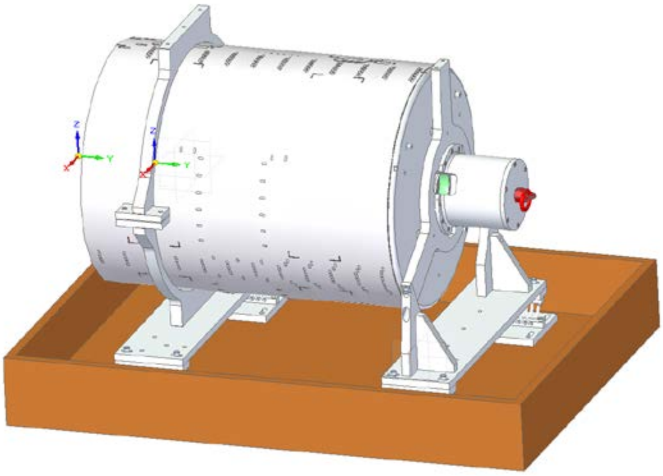

Figure 3-4 – Radiation shield transport crate (lid not shown)

3.7 Inspection and testing

After welding, the contractors are to carry out:

1. A visual check
2. 3x temperature cycle from ambient to below -170°C
3. Non-destructive testing (contractor to suggest suitable method. Dye penetrant testing not allowed)

A report shall be supplied by the contractors containing a description of the test procedure and the results from those tests, for all inspections and tests. The report shall also include a welding procedure specification (an example of which is shown in Annex A of AD1).

4. FEEDTHROUGH FLANGE ASSEMBLIES

The feedthrough flange assemblies consist of two components, as shown on the drawing:

Component	Drawing Number	Quantity	Material
Feedthrough flange	KE-0265-223	1	Stainless steel 304
Hermetic connector	233-103-H8-Z1-23-21-SN-03-585C or 233-103-H8-Z1-23-35-SN-03-585C	1	Stainless steel

Note: 2 alternative drawing numbers for hermetic connectors have identical geometry, but with different electrical pin layouts. This will not have any effect on the welding.

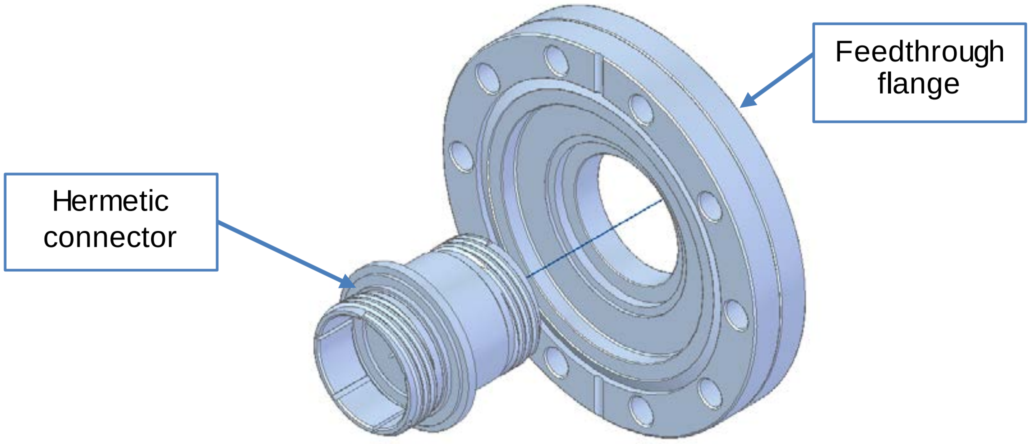

Figure 4-1 – Radiation Shield Welded Assembly (exploded view)

4.1 Assembly

The assembly shall be carried out by RAL Space, before delivery to the contractor and shall consist of a close-running fit between the connector and the flange. The connector should be protected on both sides at all times.

4.2 Mounting during welding

The assembly can be mounted via the flange. Any mounting arrangements should be agreed with RAL in advance.

4.3 Test articles

Each delivery of feedthrough flange assemblies to the contractor shall also include a test article, for the purposes of determining weld parameters on a representative component and performing destructive tests. This shall be using the same components, but with only a connector shell, with no pins.

The destructive testing may be determined by the contractor, but should give reassurance that the final weld will be as required. All results shall be shared with RAL Space.

4.4 Weld appearance

The weld bead should not protrude significantly (more than 2mm) from the surface of the component.

4.5 Transport

The connector assemblies will be supplied in a secure transport crate.

4.6 Inspection and testing

After welding, the contractors are to carry out:

1. A visual check
2. 3x temperature cycle from ambient to below -170°C
3. Non-destructive testing (contractor to suggest suitable method. Dye penetrant testing not allowed)
4. Helium leak test (detailed below)

Helium leak test:

The assembly should be leak tested in a clean room following EB welding using the following process:

1. Bag the welded assembly
2. Put the He leak detector in the bag with the welded assembly
3. Seal the bag
4. Evacuate the internal volume of the welded assembly. Pump and purge several times.
5. Pressurise the internal volume of the welded assembly with helium to 1 bar
6. Measure leak rate
7. Leave overnight and measure leak rate the following day

The leak rate should be less than $1x10^{-8}$mbar l/s. If the contractor's equipment is not able to measure to this rate, the leak rate should be at least $1x10^{-6}$mbar l/s, but it is preferable to be able to measure to $1x10^{-8}$mbar l/s.

A test cap for the flanged end of the component, with a suitable leak test fitting, shall be provided by RAL Space. All other equipment required for the leak test to be supplied by the contractor (including the bag and the leak detector).

A report shall be supplied by the contractors containing a description of the test procedure and the results from those tests, for all inspections and tests. The report shall also include a welding procedure specification (an example of which is shown in Annex A of AD1).

If the contractor does not have the capability to perform the He leak test to 10-8mbar l/s RAL shall perform this test on the contractor's behalf when delivered to RAL. Prior to delivery the contractor shall test to 1x10-6mbar l/s and supply the documents to RAL for review.
Any failure of the component to meet the He leak test at 10-8mbar l/s shall be rectified by the contractors.