JPL Hardware Requirements Certification Review (HRCR)-
Flight Spare (FS)
Spectrometer Long Wavelength (SLW) Bolometer Detector Assembly (BDA)
10209800-4 S/N 015

SPIRE Element
Herschel Space Observatory Project

May 26, 2005
Updated August 16, 2005

Change Log

Issue	Date	Section	Changes
1.0	26 May 05		Initial version (HRCR review)
1.1	16 Aug 05		Distributed PDF version
		1	Included signed HRCR form
		3	Updated ECR / NCR numbers in Issues, added RFW-022
		5	Corrected ECR / NCR numbering, included images of signed ECR/NCRs. Added ECR-003 for completeness.
		6	Added RFW-022 (BDA test Temperature), corrected numbering: 005->005v1, included images of signed versions.
		8	Added Spectrometer Filter change procedure and updated General handling document.
		9	Added RFW-022 reference
		10	Incorporated updated performance data, (v4)
		13	Added planned final electrical test
		14	Added alignment measurement summary, annotated feedhorn data.

CONTENTS

RAL EIDP Table Of Contents Vs. HRCR Contents

EIDP Section	EIDP	HRCR Box #	Comments/Notebook Section
1	Shipping Documents		Shipper and Final IR
2	Transportation, Packing, Handling & Integration Procedures	20	Section 8
3	Certificate of Conformance / Delivery Review Board MoM		HRCR form is the CofC
4	As Built Configuration Status List	1	
5	List of Waivers	16	Section 6
6	Copies of Waivers	16	Section 6
7	List of Non-Conformance Reports	17, 18	Section 5
8	Copies of Non-Conformance Reports	17, 18	
9	Cleanliness Statement	10	Final IR includes inspection for conformance with cleanliness requirement (particulates)
10	Operational Manual	20	
11	Top Level Drawings (inc. Family Tree)	14	Section 4
12	Interface Drawings	26	Section 13
13	Functional, Block & Mechanical Drawings	14	Section 4
14	Electrical Circuit Drawings		See Electrical Handling Doc.
15	Serialized Components List		In the build books – not shipped
16	Mass Properties/ Power Budget		Mass found in header of HRCR
17	Qualification Status List / Test Matrix	22	Qual. Report to be supplied later, Summary in Section 11
18	Test Reports		To be supplied later, Summaries in Sections 9 and 10
19	Open Work / Deferred Work / Open Tests	5	
20	Calibration Data		Section 10
21	Historical Record		Section 12
22	Manufacturing Logbook(s)	--	To be retained at JPL
23	Operating Time / Cycle Record	24	Section 12
24	Connector Mating Record	24	Section 12
25	Age Sensitive Items Record		NA for BDA
26	Pressure Vessels – History/Test Record		NA
27	Temporary Installation Record		Section 12
28	Reference List of EIDPs (Lower level)		300mK Filter EIDP - Section 14
29	Other Useful Information		Section 14

JPL Hardware Requirements Certification Review – SPIRE Element #D-32050

Assembly/Subsystem	PEM	Phone	Section	Date
SPIRE	Martin Herman	(818) 354-8541	386	26 May, 2005

Drawing/ Part No.	Dwg. Rev.	Nomenclature	Serial No.	Model	Type	Final IR No.	Mass (grams) As Meas. / Req.
10209800-4	B	Bolometer Detector Assembly	015	FS	SLW	926211	527 g / 550 g

Check applicable answer and give necessary explanation in remarks column	Yes	No	N/A	Remarks	Data Attachments (Package Sec. #)	Signature Approval & Date
1. Are all drawings and specifications complete, approved, released and frozen?	X				14. Latest Top Assembly Drawings ☒ Attached ☐ None (Sec. 4)	Cog E 5-26-05
2. Do the released drawings and specifications reflect all approved changes?	X				15. List of open ECRs ☒ Attached ☐ None (Sec. 5)	PEM Martin Herman 6/6/05
3. Is hardware identical to other hardware delivered? If no, provide difference list.		X		Previous Hardware was PFM SLW BDA S/N008. See difference list attached	16. Waivers ☒ Attached ☐ None (Sec. 6)	QA Engineer Scott Hughes 5/26/05
4 Does the hardware meet the requirement of its functional requirements, specifications, waivers and/or ICDs ? If no, provide difference list.	X			See Issues (section 3). See section 11 for detector performance matrix.	17. Open MRBs ☐ Attached ☒ None (N/A)	Environments/Reliability 5-26-05
5. Have all IR discrepancies and MRBs been dispositioned and agreed to by Engineering/ QA ?	X				18. Open P/FRs on this H/W ☐ Attached ☒ None (Sec. 7)	Mission Assurance Mgr. 5/26/05
6. Is complete as-built list information included in the build book?	X				19. Open P/FRs on similar H/W ☐ Attached ☒ None (Sec. 7)	Project 5/26/05
7. Have all required environmental tests & analyses been completed?	X			See section 9.	20. Handling Documents ☒ Attached ☐ None (Sec. 8)	PI James J Bock 5/27/05
8. Is all required assembly and/or subsystem level functional testing complete?	X				21. Shortage List ☐ Attached ☒ None (N/A)	
9. Have all piece parts, processes and materials been approved by JPL?	X			See MIUL coverpage in section 14.	22. Requirements Verification Matrix ☒ Attached ☐ None (Sec. 9)	
10. Does this hardware meet all contamination control requirements?	X				23. Qualification Status ☒ Attached ☐ None (Sec. 11)	
11. Are all required shipping containers, shipping procedures, and special handling procedures ready?	X			See section 8 for handling procedures.	24. Connector Mate / Demate Log ☒ Attached ☐ None (Sec. 12)	
12. Is additional work required to bring this hardware to flight readiness?		X			25. Operation Log ☒ Attached ☐ None (Sec. 12)	
13. Is this hardware acceptable for flight ?	X				26. ICDs ☒ Attached ☐ None (Sec. 13)	

Difference List

Part	**Previous hardware:** 10209800-4 PFM SLW SN 008	**Current hardware** 10209800-4 FS SLW SN015	**Notes:**
10209860 suspension assy.	no side screws into invar spacers	side spacer screws were used	screws had been eliminated in error when the vespel safety spacer was eliminated from the design. Units after SN009 (PFM SSW) have screws installed.
10209890 middle ring assy (part of suspension)	suspension Ring-A is pinned to flexure mounting plate with both old pins and smaller new invar pins.	suspension Ring-A is pinned to flexure mounting plate only new invar pins.	Old pins were partially machined away after assembly in early suspension units (up to suspension SN006). Final design used only the new pins.

JPL PDMS

***** INSPECTION REPORT *****
Printed Copies are for Reference Only - Please check with PDMS for official version

IR Number
926211

Action
BROWSE

Status "IR & IRDI Initiated"

IR Instructions

REFERS TO:

Part Number	Dash Number	Revision	Latest Rev	Serial Number	Quantity
10209800-4	(with part number)	B	B	015	1

Nomenclature:	**BOLOMETER DETECTOR ARRAY**		
Prgm/Project:	**HSO-PLANCK**	Inspection Date:	**06-APR-2005**
COGE:	**WEILERT, MARK A.**	ECO/ECI:	
QAE:	**HUGHES, SCOTT P.**	Reference Designator:	**SPIRE**
JPL/Mfr:	**JPL**	Lot No.:	
Type of Inspection:	**Final-Ship**	Insp. Std / Spec No.:	
Type of Item:	**Flight**	AIDS No.:	
Location:	**JPL**	Work Order No.:	
Manufacturer:	**JPL**	CAGE Code:	
Supplier:	**JPL**	Receipt No.:	
Parts received by:		Property / ID:	
Received date:		PO/CT No.:	
Qty Accepted:		Line No.:	
Qty Rejected:	**0**	Rel / Mod No.:	
QA Alert?		CAN Required?	
IMTE Code:	**None**	IMTE Number:	
IMTE Code No. 2:	**None**	IMTE Number No. 2:	
IMTE Code No. 3:	**None**	IMTE Number No. 3:	
IMTE Code No. 4:	**None**	IMTE Number No. 4:	
Orig Nomenclature:			

DISCREPANT ITEMS:

Item	Discrep Code	Qty	Zone	S/N	Description	Re-Work	Files

This IR has No Discrepant Items

Item	Disposition	Root Cause Code	Dispo Code	Disp. Appr.	Stamp Date

This IR has No Discrepant Items

Inspection Report Notes:

HARDWARE LISTED ABOVE HAS BEEN COMPLETED INSPECTIONS AND TESTING AND ACCEPTABLE TO DELIVER TO NEXT INTERGRATION RUTHERFORD APPLETON LABORATORY SPACE & SCIENCE TECHNOLOGY DEPT.
CHILTON, DIDCOT OXFORD, ENGLAND UNITED KINGDOM OX11 OQX ATTN: ERIC SAWYER PH#1235 44 6385

	Initiated by **VALENZUELA, LORRAINE V.**	Signed by COGE	Signed by QAE	Closed by
Number of Files Attached **0**	Date **17-MAY-2005**	Date	Date	Date

Reserved by	Reserved on	Reason

Issues

FS SLW BDA 10209800-4 S/N 015

Configuration / Processing:

- The maximum height of 300 mK stage exceeds ICD drawing 10209721 allowed range by 1.0 mm due to changes in the spectrometer 300 mK filter stack thickness. See attached ECR: HR-SP-JPL-ECR-007 in section 5. This change has been incorporated into Rev-C of the ICD drawing 10209721.

  Several other ECRs related to the BDA hardware have been incorporated into released drawings. These do not apply directly to the SLW BDA type, but they affect the same drawings. They are included for reference:

  - A focus position shift caused by an internal mechanical interference fix was incorporated into ICD drawing 10209721 Rev C per HR-SP-JPL-NCR-007 (attached in in section 5) This is applicable only to -2 PMW and -3 PSW BDAs.

  - A pixel map modification was incorporated into electrical schematic 10209725 Rev C per HR-SP-JPL-ECR-005v2 (attached in section 5). This is applicable only to -2 PMW and -3 PSW BDAs. This drawing revision also incorporated JPL ECR 1026751.

Environmental Test:

- Shake tests were performed with non-flight-like 8-32 mounting screws, instead of 6-32. See attached email regarding this issue: (M. Herman, 15 May 2003) -- *This same issue applied to all the previous BDAs.*

- Shake tests were performed in accordance with approved waivers HR-SP-JPL-RFW-005v1 (Sine Vibration Omission), HR-SP-JPL-RFW-006 (Vibration Test Levels), and HR-SP-JPL-RFW-022 (BDA Vibration Test Temperature). See Waiver List (section 6).

Date: Mon, 11 Aug 2003 16:34:04 -0700
From: Martin Herman <Martin.I.Herman@jpl.nasa.gov>
Subject: Waiver Request (vibration fastners)
X-Sender: miherman@pop.jpl.nasa.gov
To: Mark.A.Weilert@jpl.nasa.gov
Cc: Henry.Abakians@jpl.nasa.gov

Date: Thu, 15 May 2003 11:41:18 -0700
To: Matt Griffin <Matt.Griffin@astro.cf.ac.uk>, Eric Sawyer <e.c.sawyer@rl.ac.uk>, Chris Brockley-Blatt <cbb@mssl.ucl.ac.uk>, Berend Winter <bw@mssl.ucl.ac.uk>
From: Martin Herman <Martin.I.Herman@jpl.nasa.gov>
Subject: Waiver Request (vibration fastners)
Cc: Ben.A.Parvin@jpl.nasa.gov, Jamie Bock <jjb@astro.caltech.edu>, Gary Parks <Gary.S.Parks@jpl.nasa.gov>, kalyani@squid.jpl.nasa.gov
Bcc:
X-Attachments:

Dear Matt and SPIRE Team,

To refresh everyone's memory. We requested the following information:

What type of fasteners will be used in Europe to mount the BDA? In our ICD, 6-32 fasteners are called for. However, the current test hardware uses 8-32 fasteners. We are looking to be consistent with the flight implementation.

The answer (Thanks Chris) was 6-32. Our current test fixture uses 8-32 and we are getting ready for vibration testing of the CQM next week. Therefore, we had a mechanical engineer look into this issue. His (Paul MacNeal) response was:

> It will acceptable to use four #8-32 fasteners for the vibration tests at JPL. The reasons are....
>
> 1) The test fixture has already been built using #8-32 tapped holes,
> 2) The use of #6-32 fasteners torqued to full value should be able to resist over 200 G's of lateral force before allowing slippage, and therefore is not a critical component of the vibration test, and
> 3) The test is primarily performed to verify integrity of the flexures, braid, and other components, and not the interface fasteners.

Based on this information, we are requesting a waiver for the CQM PLW vibration and for future QM, CQM, PFM and FS tests. The change for future test is small, but the fiscal situation is extremely challenging and no technical risk to the program is evident with the existing approach.

Thanks,
Marty

REVISIONS

LTR	ZONE	DESCRIPTION		DWN	CHK	STRUCT	MATL	THRM CONT			ENGR	DSGN SUPV	DATA MGT	RELEASE DATE
A		INITIAL RELEASE	CODE B	SEE TITLE BLOCK									RGB	03/15/04
B		ADDED ITEM 51, ADDED VIEW SH4, MOVED VIEW FROM SH2 TO SH4	B											

14. ALTERNATE OR EQUIVALENT ITEMS MAY BE USED FOR THIS ITEM WITH PRIOR ENGINEERING APPROVAL.

13. SEAL SHIPPING CONTAINER USING ITEMS 28, LID, 30, SCREWS, 31, O-RING, AND ITEM 32, PLUG. TORQUE ITEM 30, SCREWS TO 1.9 N*M PLUS RUNNING TORQUE PER JPL SPEC ES517040. TORQUE ITEM 32, PLUG TO 7.3 N*M PLUS RUNNING TORQUE PER JPL SPEC ES517040.

12. SECURE FLEXURE RING OF ITEM 1 OR 2, TO ITEM 26, USING ITEM 29, NUTS. TIGHTEN NUTS HALF TURN PAST FINGER TIGHT.

11. INSTALL ITEMS 26, MOUNT, INTO ITEM 27, SHIPPING BASE. TORQUE TO 200 N*MM PLUS RUNNING TORQUE PER JPL SPEC ES517040.

10. FOR -7 CONFIGURATION, SECURE ITEM 39, UNION NUT, TO ITEM 35, MASS SIMULATOR USING ITEM 40, SET SCREW, AND ITEM 25 ADHESIVE. TORQUE TO 1.7-2.2 N*M PER JPL SPEC ES517040. SECURE ITEM 33, ACCELEROMETER, TO ITEM 39, UNION NUT AND TORQUE TO 1.7-2.2 N*M PER JPL SPEC ES517040.

9. FOR -6, -7 AND -9 CONFIGURATION, SECURE ITEM 10, OR 36, ACCELEROMETER MOUNT, OR ITEM 43, ACCELEROMETER SIMULATOR, TO ITEM 9 OR 35, MASS SIMULATOR USING ITEM 22, SCREW. TORQUE TO 200 N*MM PLUS RUNNING TORQUE PER JPL SPEC ES517040.

8. FOR -7 CONFIGURATION, SECURE ITEM 33, ACCELEROMETER, TO ITEM 36, ACCELEROMETER MOUNT. TORQUE ITEM 33, ACCELEROMETER, TO 1.7-2.2 N*M PER JPL SPEC ES517040. CONNECT ITEM 34, CABLE, TO ITEM 33, ACCELEROMETER.

7. FOR -6 CONFIGURATION, BOND ITEM 37, ACCELEROMETER, TO ITEM 10, ACCELEROMETER MOUNT, USING ITEM 25, EPOXY.

6. FOR ALL CONFIGURATIONS EXCEPT -6, -7, AND -9, INSTALL ITEM 17, SCREW, INTO ITEM 11 OR 49, CAN. TORQUE TO 425 N*MM PER JPL SPEC ES517040.

5. FOR ALL CONFIGURATIONS EXCEPT -6 AND -7, SECURE ITEM 11, 42, OR 49, CAN AND ITEM 45, LIGHT SEAL TO FLEXURE RING OF ITEM 1 OR 2, USING ITEM 24, SCREW, AND ITEM 21, SPRING WASHER. TORQUE TO 200 N*MM PER JPL SPEC ES517040.

4. FOR ALL CONFIGURATIONS EXCEPT -6, -7, -8, AND -9, SECURE ITEM 12, 13, 14, 15, OR 16, FILTER, TO ITEM 1 OR 2, USING ITEM 23 OR 48, SCREW, ITEM 19, NUT, AND ITEM 21, SPRING WASHER. TORQUE TO 200 N*MM PER JPL SPEC ES517040.

3. FOR ALL CONFIGURATIONS EXCEPT -6, -7, AND -9, BEND THERMAL STRAP ON ITEM 3, 4, 5, 6, 7, OR 8 AND FASTEN TO ITEM 1 OR 2. FOR -9 CONFIGURATION SECURE ITEM 44, THERMAL STRAP SIMULATOR IN PLACE OF THERMAL STRAP. USE ITEM 22, SCREW, AND ITEM 46, WASHER AND TORQUE TO 100 N*MM FOR TEMPORARY INSTALLATION ONLY.

2. SECURE ITEM 3, 4, 5, 6, 7, 8, 9, OR 35, TO ITEM 1 OR 2 USING ITEM 19, NUT. FOR ALL CONFIGURATIONS EXCEPT -6 AND -7, SECURE CONNECTOR BRACKET OF ITEM 3, 4, 5, 6, 7, 8, OR 41 TO FLEXURE RING OF ITEM 1 OR 2, USING ITEM 18, SCREW, AND ITEM 21, SPRING WASHER. TORQUE TO 200 N*MM PER JPL SPEC ES517040. SPOT BOND ITEM 19, NUT USING ITEM 25, EPOXY ON ALL CONFIGURATIONS EXCEPT -6 AND -7.

1. FOR CONFIGURATIONS -7 AND -9, SECURE ITEM 33, ACCELEROMETER, TO ITEM 35, MASS SIMULATOR, ROTATING CONNECTOR TO ALLOW CABLE TO EXIT TOWARD TOP OF MASS SIMULATOR. TORQUE ITEM 38, SET SCREW, AGAINST ITEM 33, ACCELEROMETER, TO 1.7-2.2 N*M PER JPL SPEC ES517040. CONNECT ITEM 34, CABLE, TO ITEM 33, ACCELEROMETER.

NOTES: UNLESS OTHERWISE SPECIFIED

16. FOR -2 AND -3 CONFIGURATIONS, SECURE CONNECTOR BRACKETS OF ITEM 5 OR 6, TO ITEM 49, CAN, USING ITEM 50, SCREW. TORQUE TO 180 N*MM PER JPL SPEC ES517040.

15. FOR CONFIGURATIONS EXCEPT -6, -7, AND -9, MARK AS SHOWN WITH ITEM 47, EPOXY INK, USE APPROPRIATE DASH NO., S/N, MODEL (CQM/PFM) AND TYPE (P/LW, S/LW, ETC.).

PARTS LIST

-9	-8	-7	-6	-5	-4	-3	-2	-1	ITEM NO	REF DES	CAGE NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATERIAL OR NOTE	ZONE
						1	1		51			10209903-1	RING, SPACER			
						4	4		50			NA0070-016004	SCREW, MACHINE FLUSH HEAD	NA0070	A-286 CRES	
						1	1		49			10209805-2	CAN, LIGHT			
				6	6				48			NA0068A016012	SCREW, MACHINE PAN HEAD	NA0068	A-286 CRES	
	AR			AR	AR	AR	AR	AR	47				EPOXY INK, BLACK			
	2			2	2	2	2	2	46			ST12259-020	WASHER, COUNTERSUNK, LUBRICATED	ST12259	A-286 CRES	
	1			1	1	1	1	1	45			10209807-1	SEAL, LIGHT			
1									44			10209847-1	SIMULATOR, THERMAL STRAP			
1									43			10209744-1	MASS SIMULATOR, ACCELEROMETER			
1									42			10217688-1	CAN, LIGHT, STM			
1									41			10217680-1	DUMMY BOLOMETER			
		1							40		OE328	92313A829	SET SCREW, 10-32 UNF X 1/2"		MCMASTER CARR △14	
		1							39		OE328	90977A021	UNION NUT, 10-32 UNF		MCMASTER CARR △14	
1		1							38		OE328	92313A824	SET SCREW, 10-32 UNF X 3/16"		MCMASTER CARR △14	
			1						37				ACCELEROMETER, THREE AXIS			
		1							36			10209746-2	MOUNT, ACCELEROMETER			
1		1							35			10209745-2	MASS SIMULATOR			
1		3							34			6011 A10	CABLE, ACCELEROMETER		DYTRAN	
1		3							33			3031 B5	ACCELEROMETER, SINGLE AXIS		DYTRAN	
1	1	1	1	1	1	1	1	1	32		SE027	2 P50N	PLUG, O-RING		PARKER FLUID CONNECTORS △14	
1	1	1	1	1	1	1	1	1	31		OE328	9262K331	O-RING, 114.5mm ID X 3mm WIDTH		MCMASTER CARR △14	
8	8	8	8	8	8	8	8	8	30			MS5197-50	SCREW, #8-32 UNC X 1.25"	MS5197	△14	
4	4	4	4	4	4	4	4	4	29			NA0034C040	NUT, SELF LOCKING, HEX EXTENDED WASHER, 1100 MPa	NA0034	A-286 CRES △14	
1	1	1	1	1	1	1	1	1	28			10209809-1	CONTAINER, SHIPPING, LID			
1	1	1	1	1	1	1	1	1	27			10209808-1	CONTAINER, SHIPPING, BASE			
4	4	4	4	4	4	4	4	4	26		OE328	9217K32	MOUNT, NATURAL RUBBER, SANDWICH, M4 X 0.7		MCMASTER CARR △14	
AR	AR	AR	AR	AR	AR	AR	AR	AR	25			EC 2216 A/B	EPOXY			
4				4	4	4	4	4	24			NA0069-016010	SCREW, CAP, SOCKET HEAD. FULL THREAD, 1100 MPa	NA0069	A-286 CRES	
						6	6	6	23			NA0068A016010	SCREW, MACHINE PAN HEAD	NA0068	A-286 CRES	
6	2	4	4	2	2	2	2	2	22			NA0069-020010	SCREW, CAP, SOCKET HEAD. FULL THREAD, 1100 MPa	NA0069	A-286 CRES	
20	20			20	20	20	20	20	21			B0187-010-S	BELLEVILLE SPRING WASHER			
									20							
4	4	4	4	6	6	6	6	6	19			934-A2 M1.6 X 0.35	NUT	DIN 934	A-286 CRES	
4	4			4	4	4	4	4	18			NA0069-016004	SCREW, CAP, SOCKET HEAD. FULL THREAD, 1100 MPa	NA0069	A-286 CRES	
	2			2	2	2	2	2	17			NA0069-040008	SCREW, CAP, SOCKET HEAD. FULL THREAD, 1100 MPa	NA0069	A-286 CRES	
				1					16			S/SW FILTER	S/SW FILTER			
					1				15			S/LW FILTER	S/LW FILTER			
						1			14			P/SW FILTER	P/SW FILTER			
							1		13			P/MW FILTER	P/MW FILTER			
								1	12			P/LW FILTER	P/LW FILTER			
	1			1	1			1	11			10209805-1	CAN, LIGHT			
			1						10			10209746-1	MOUNT, ACCELEROMETER			
			1						9			10209745-1	MASS SIMULATOR			
				1					8			10209850-1	DETECTOR ASSEMBLY, SPECTROMETER SHORT WAVE			
					1				7			10209840-1	DETECTOR ASSEMBLY, SPECTROMETER LONG WAVE			
						1			6			10209830-1	DETECTOR ASSEMBLY, PHOTOMETER SHORT WAVE			
							1		5			10209820-1	DETECTOR ASSEMBLY, PHOTOMETER MEDIUM WAVE			
	1								4			10209810-2	DETECTOR ASSEMBLY, PHOTOMETER LONG WAVE SIMULATOR			
								1	3			10209810-1	DETECTOR ASSEMBLY, PHOTOMETER LONG WAVE			
								1	2			10209860-2	SUSPENSION ASSEMBLY			
1	1	1	1	1	1	1	1		1			10209860-1	SUSPENSION ASSEMBLY			

QTY REQD

MATERIAL

METRIC

THIRD ANGLE PROJECTION

NEXT ASSEMBLY	USED ON
	SPIRE

APPLICATION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN MILLIMETERS
LINEAR TOLERANCES:
0-6 ± 0.1
OVER 6-30 ± 0.2
OVER 30-120 ± 0.3
OVER 120-315 ± 0.5
OVER 315-1000 ± 0.8
OVER 1000 ± 1.2
ANGULAR TOLERANCES:
± 0.5°
MACHINE FINISH (MICROMETERS) 3.2
DO NOT SCALE DRAWING
INTERPRET DWG PER ASME Y14.100M

CONTRACT NO 1244858
APPD DATE

DWN	D. CRUMB	03/11/04
CHK	R MCNABB	03/11/04
STRUCT	P MACNEAL	03/11/04
MATL	M KNOPP	03/15/04
THRM CONT		
ENGR	M WEILERT	03/11/04
DSGN SUPV		

JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CA 91109
RELEASED THROUGH EDMG

BOLOMETER
DETECTOR ASSEMBLY

SIZE	CAGE NO		REV
A1	23835	10209800	B

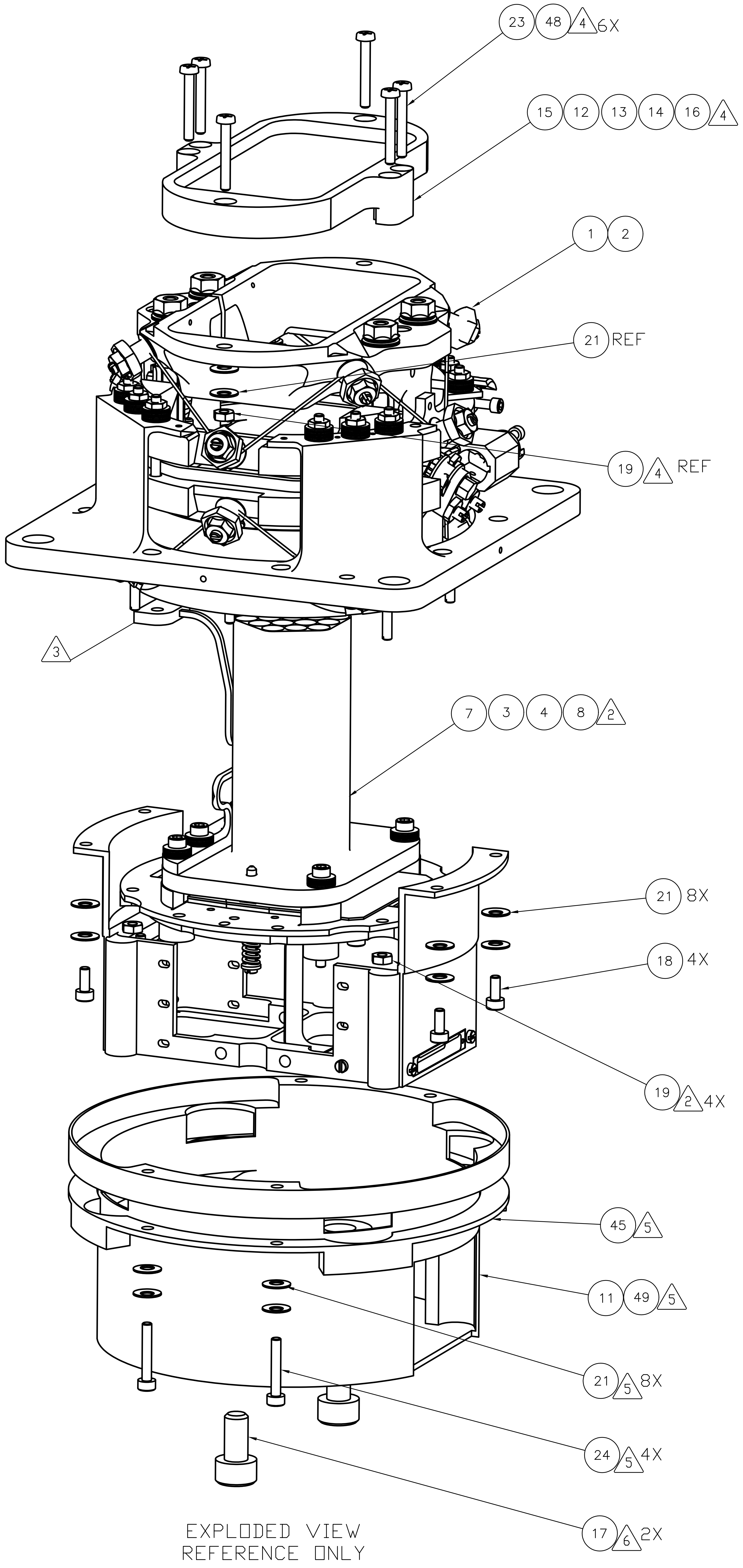
SCALE NONE UNCLASSIFIED SHEET 1 OF 4

A1 10209800

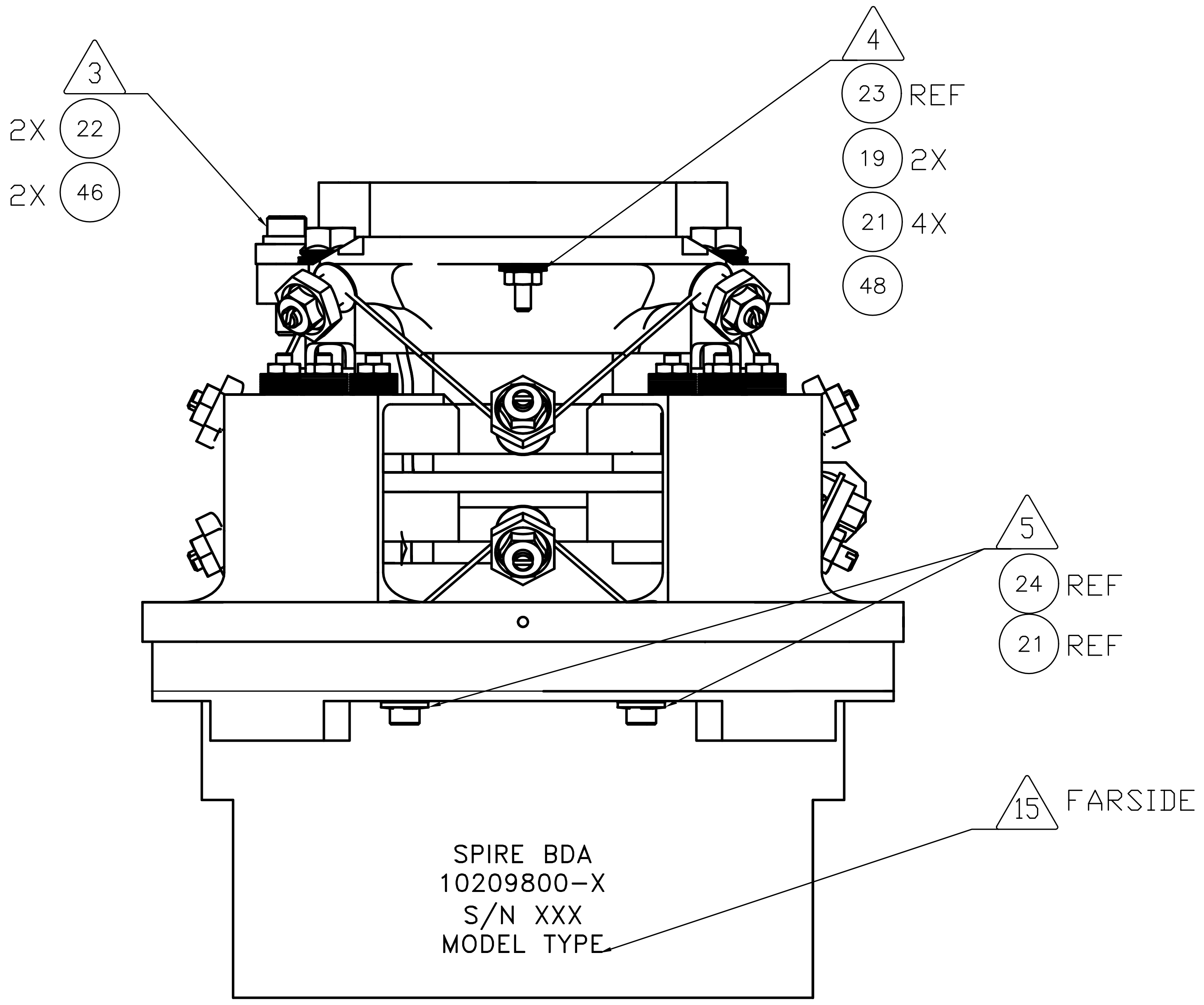
AutoCAD GENERATED

REV 2/00

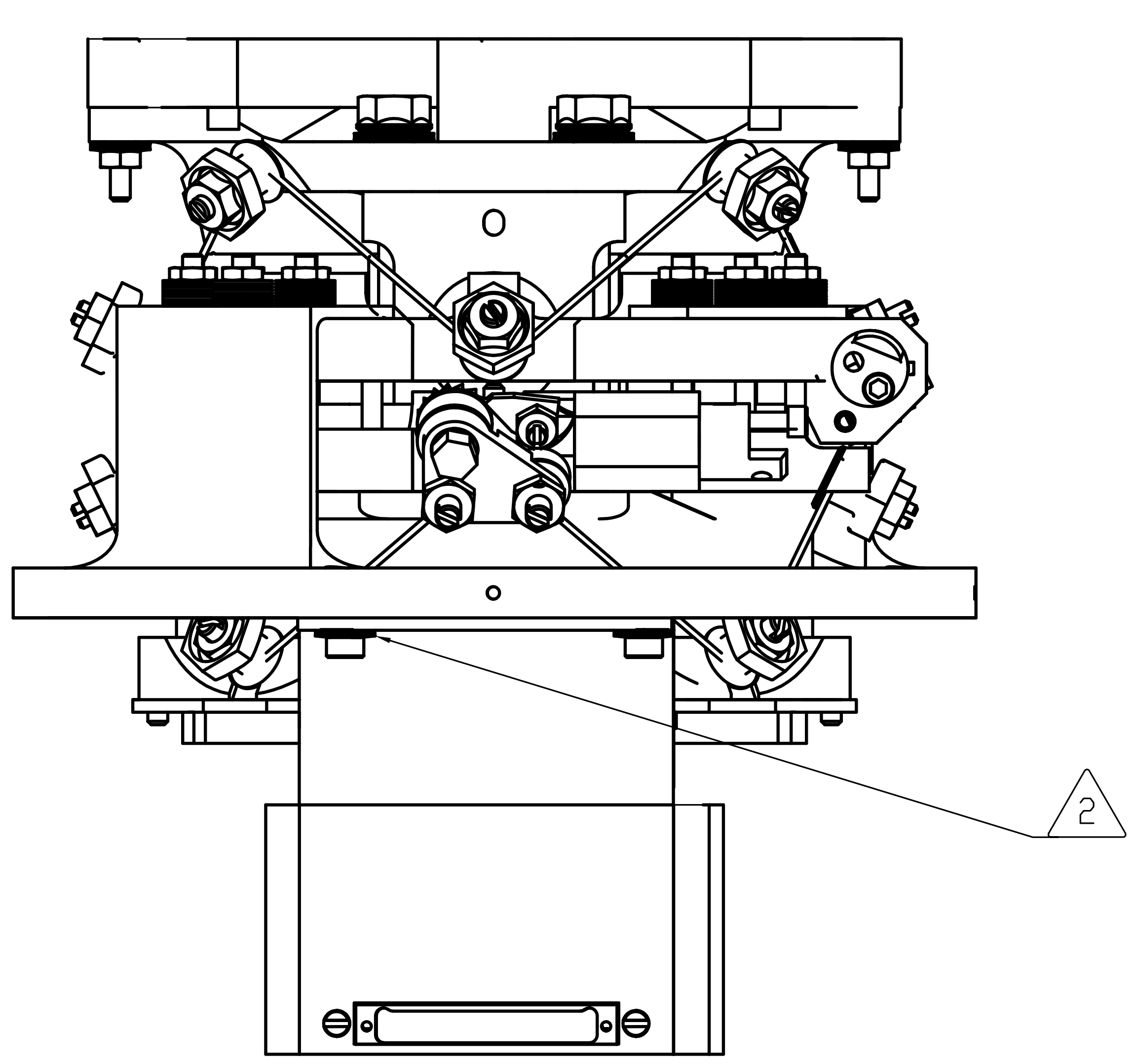
Released on DEC-09-2004 by Richard G Bannister and signed by Richard S Mcnabb CHK, Paul D Macneal STRU, Michael D Knopp MATL, Dustin J Crumb DEGN, Mark A Weilert COGE, Richard G Bannister



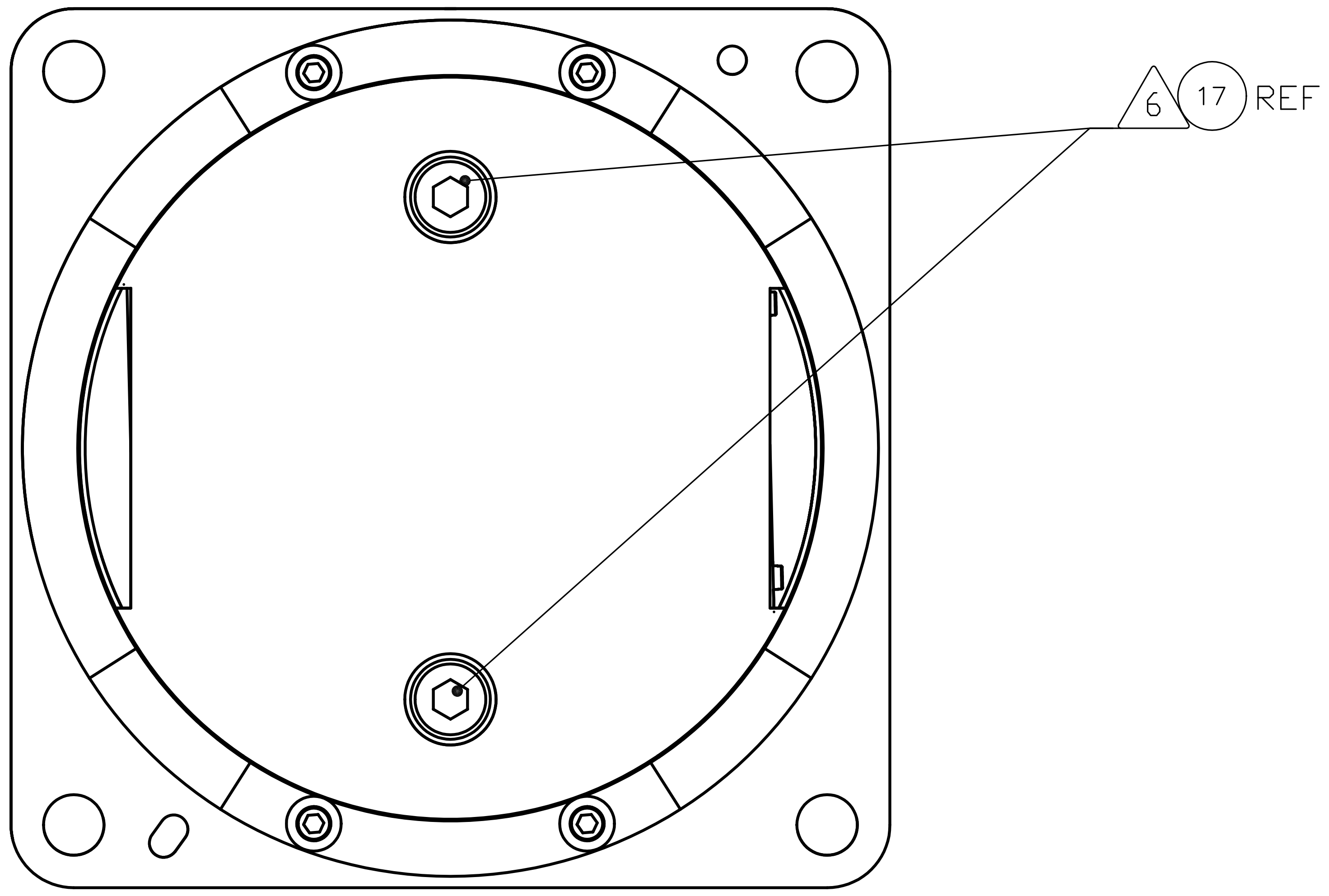
EXPLODED VIEW
REFERENCE ONLY
-4 CONFIGURATION SHOWN
-1, -5 CONFIGURATIONS ARE SIMILAR
-8 CONFIGURATION SIMILAR WITHOUT FILTER



-4 CONFIGURATION SHOWN
-1, -2, -3, -5 CONFIGURATIONS ARE SIMILAR
-8 CONFIGURATION SIMILAR WITHOUT FILTER



COMPONENTS REMOVED FOR CLARITY
-4 CONFIGURATION SHOWN
-1, -2, -3, -5 CONFIGURATIONS ARE SIMILAR
-8 CONFIGURATION SIMILAR WITHOUT FILTER



-4 CONFIGURATION SHOWN
-1 AND -5 CONFIGURATIONS ARE SIMILAR
-8 CONFIGURATION SIMILAR WITHOUT FILTER

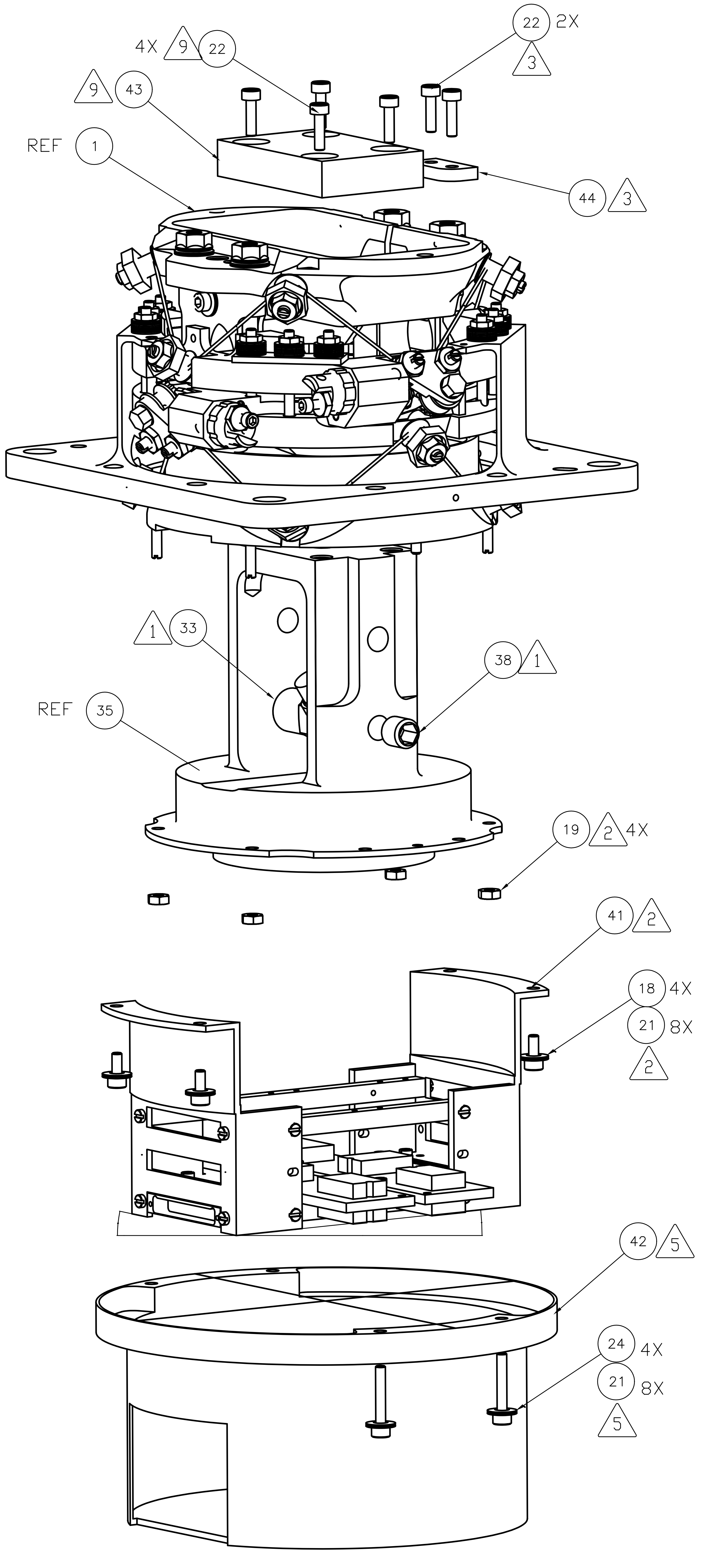
SIZE	CAGE NO		REV
A1	23835	10209800	B
SCALE NONE	UNCLASSIFIED	SHEET 2 OF 4	

REV 2/00

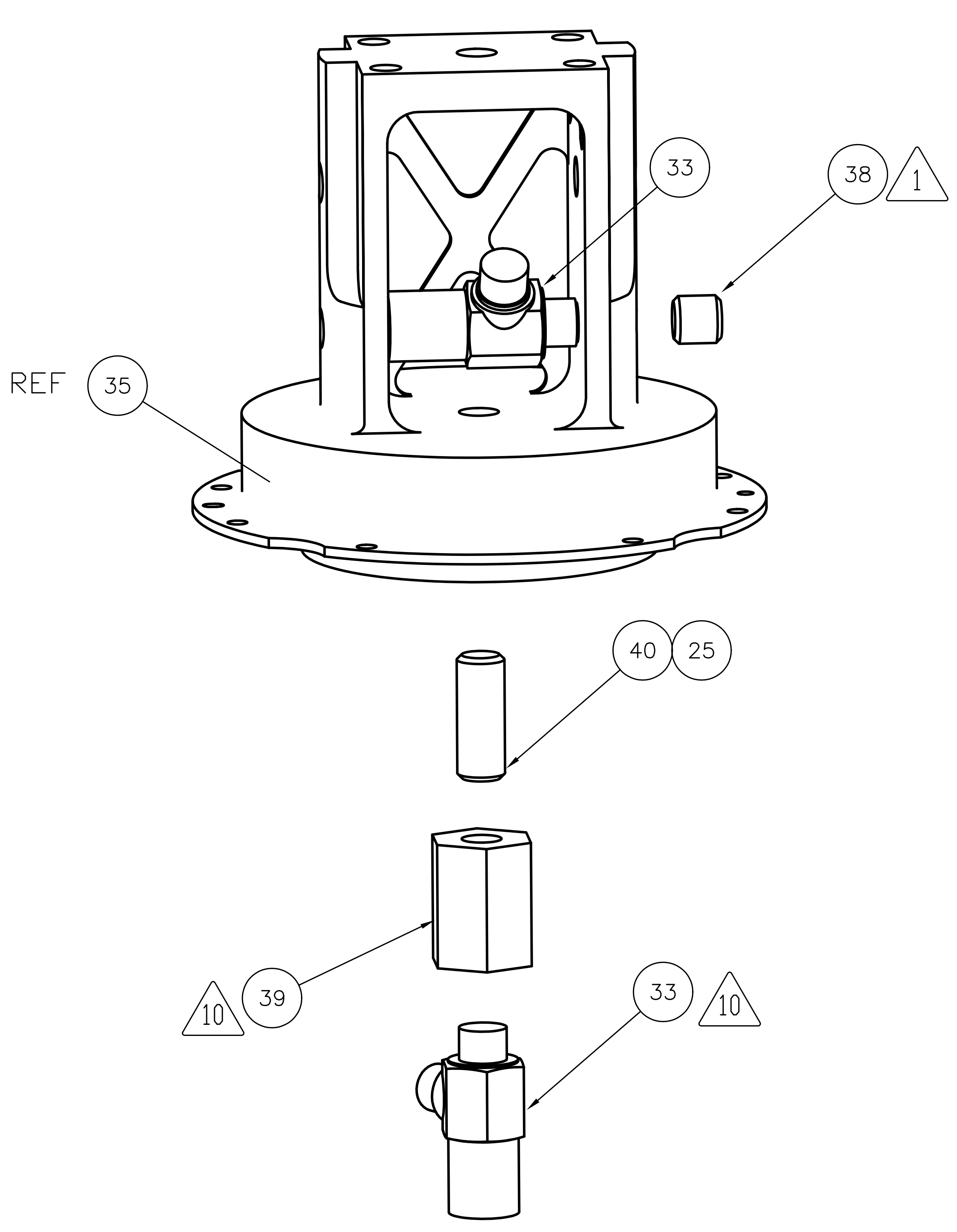
AutoCAD GENERATED

A1 10209800

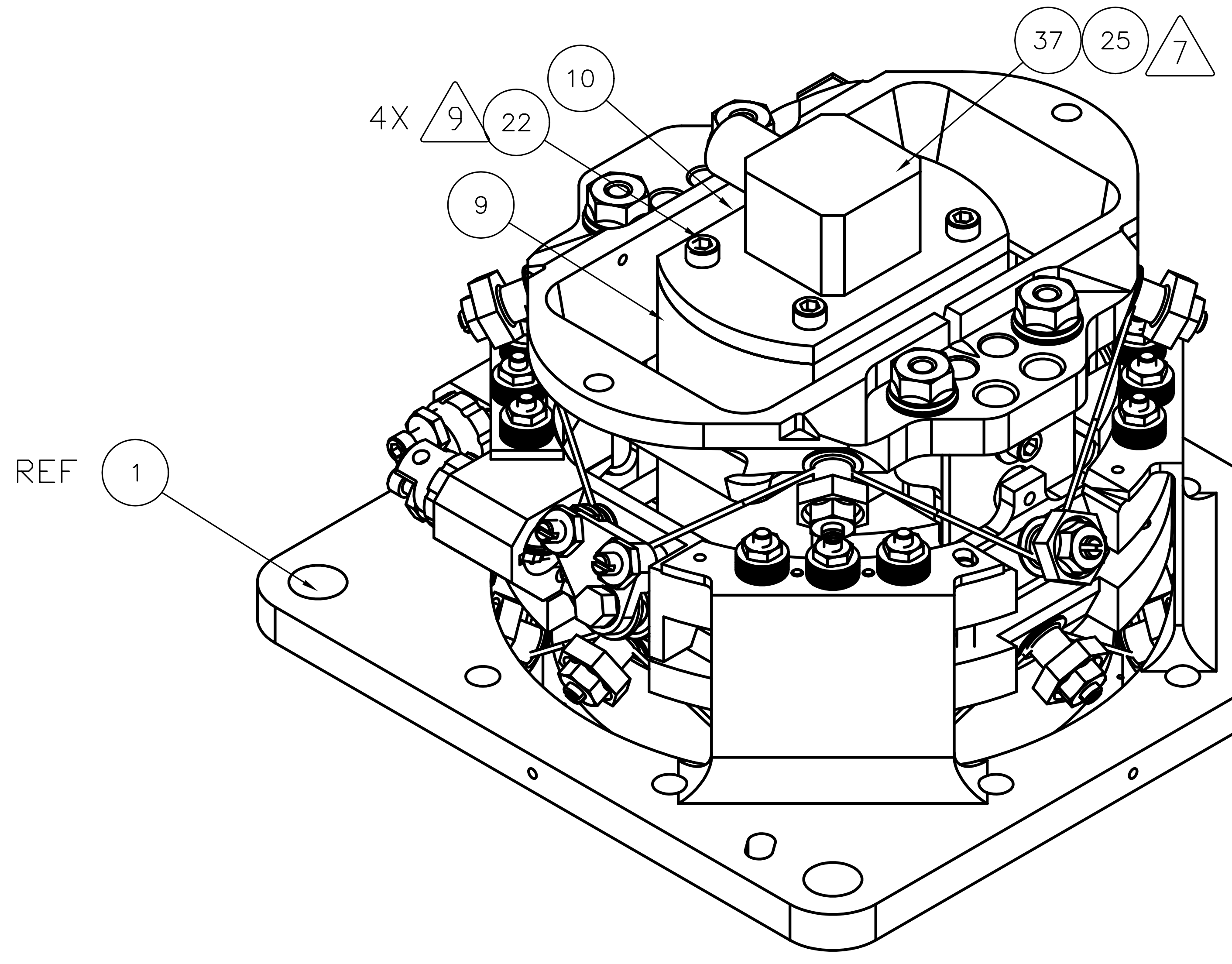
Released on DEC-09-2004 by Richard G Bannister and signed by Richard S Mcnabb CHK, Paul D Macneal STRU, Michael D Knopp MATL, Dustin J Crumb DEGN, Mark A Weilert COGE, Richard G Bannister



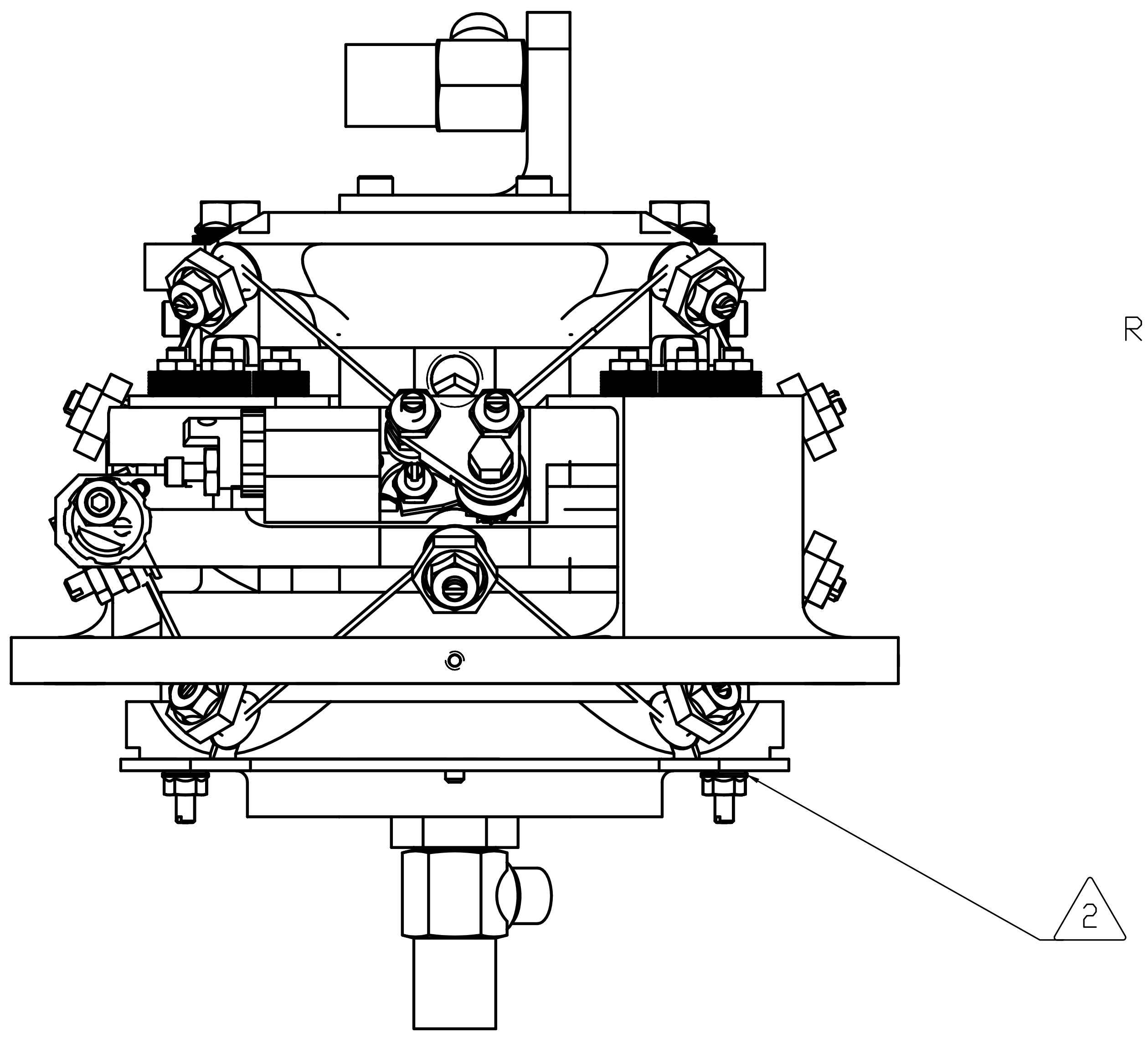
GENERAL VIEW
REFERENCE ONLY
SCALE: NONE
-9 CONFIGURATION,



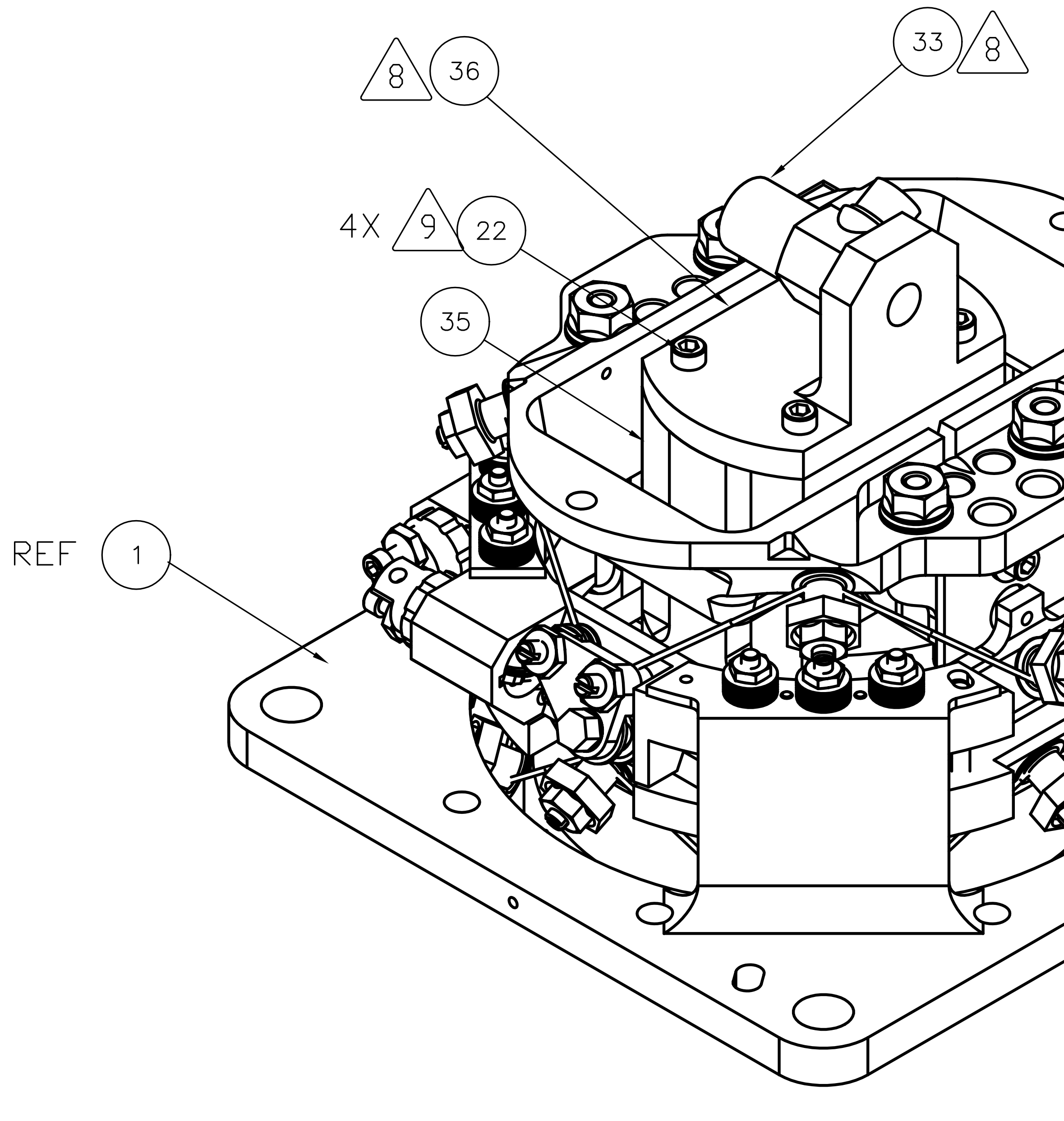
GENERAL VIEW
REFERENCE ONLY
SCALE: NONE
-7 CONFIGURATION,
ONLY ACCELEROMETERS AND
MASS SIMULATOR SHOWN



GENERAL VIEW
REFERENCE ONLY
SCALE: NONE
-6 CONFIGURATION



-7 CONFIGURATION



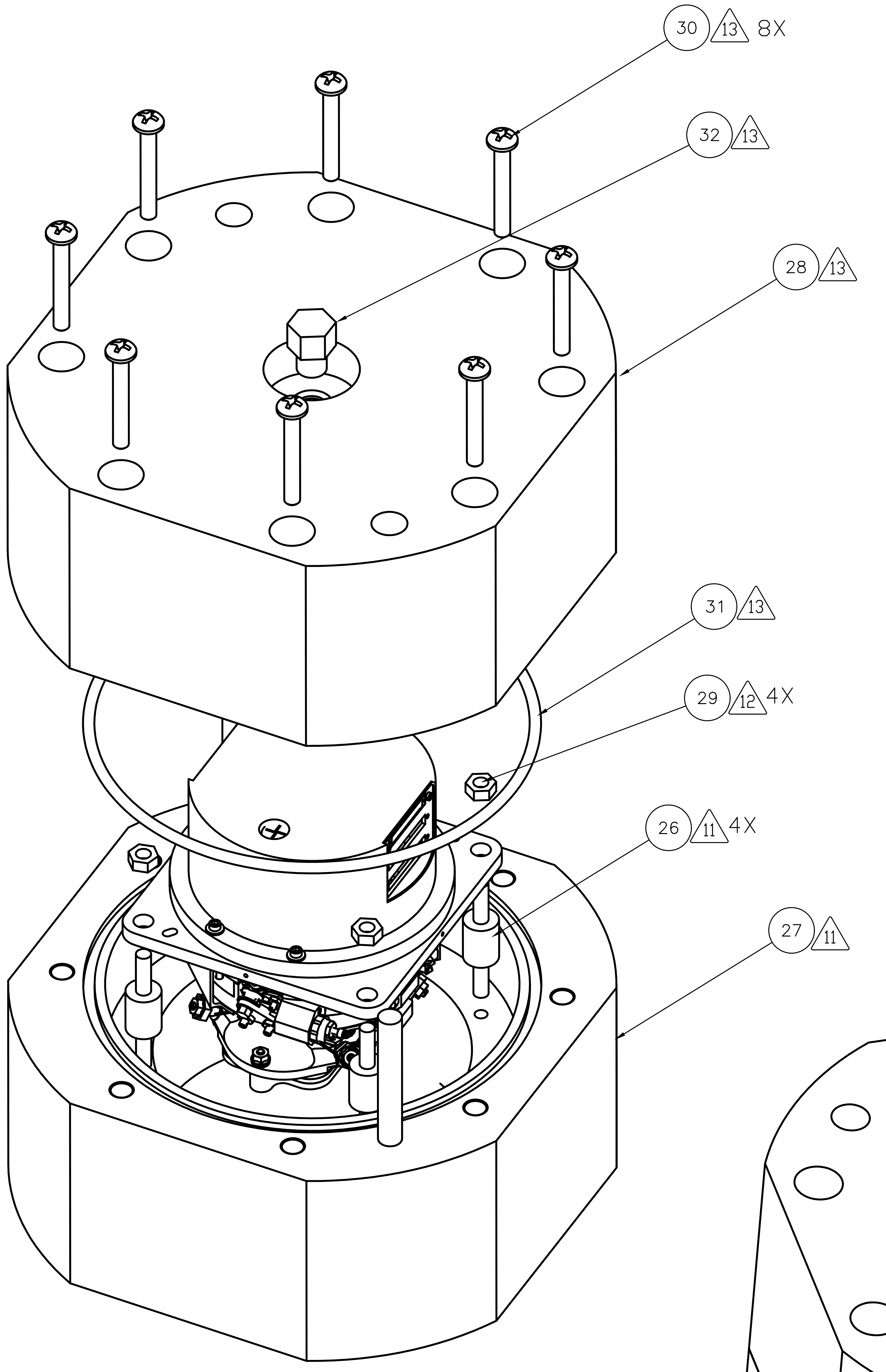
GENERAL VIEW
REFERENCE ONLY
SCALE: NONE
-7 CONFIGURATION

SIZE	CAGE NO		REV
A1	23835	10209800	B
SCALE NONE	UNCLASSIFIED	SHEET 3 OF 4	

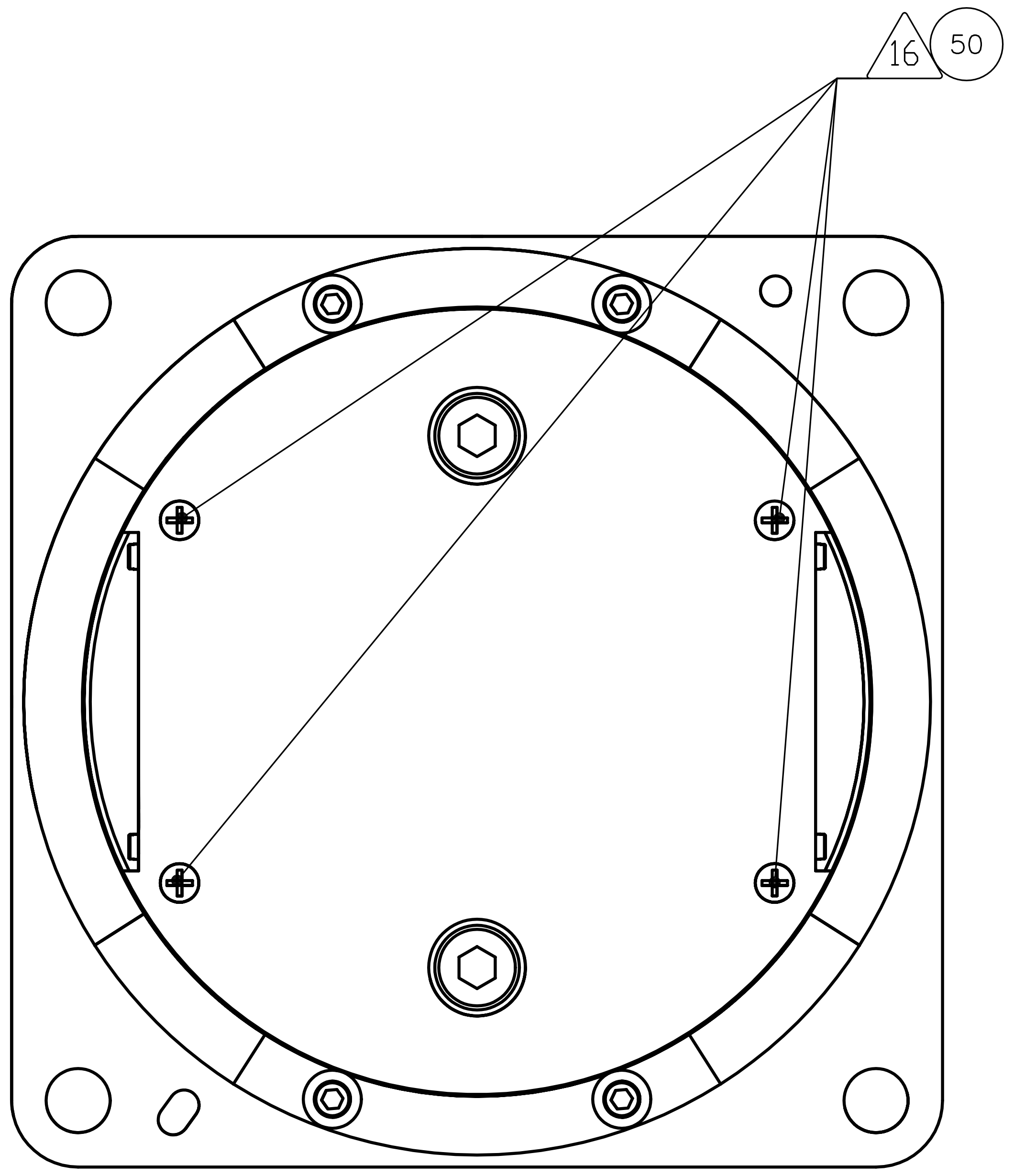
10209800 A1

AutoCAD GENERATED

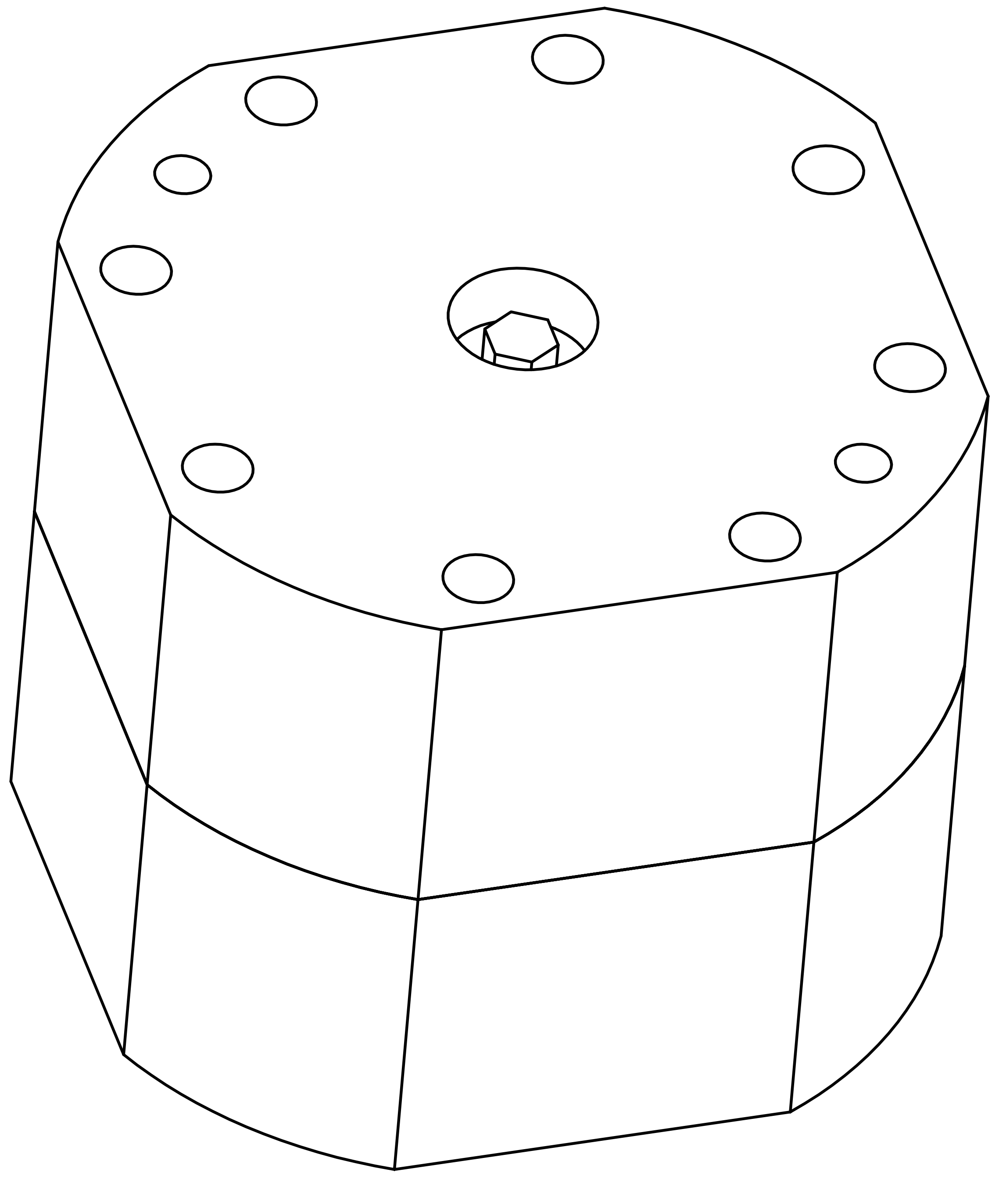
REV 2/00



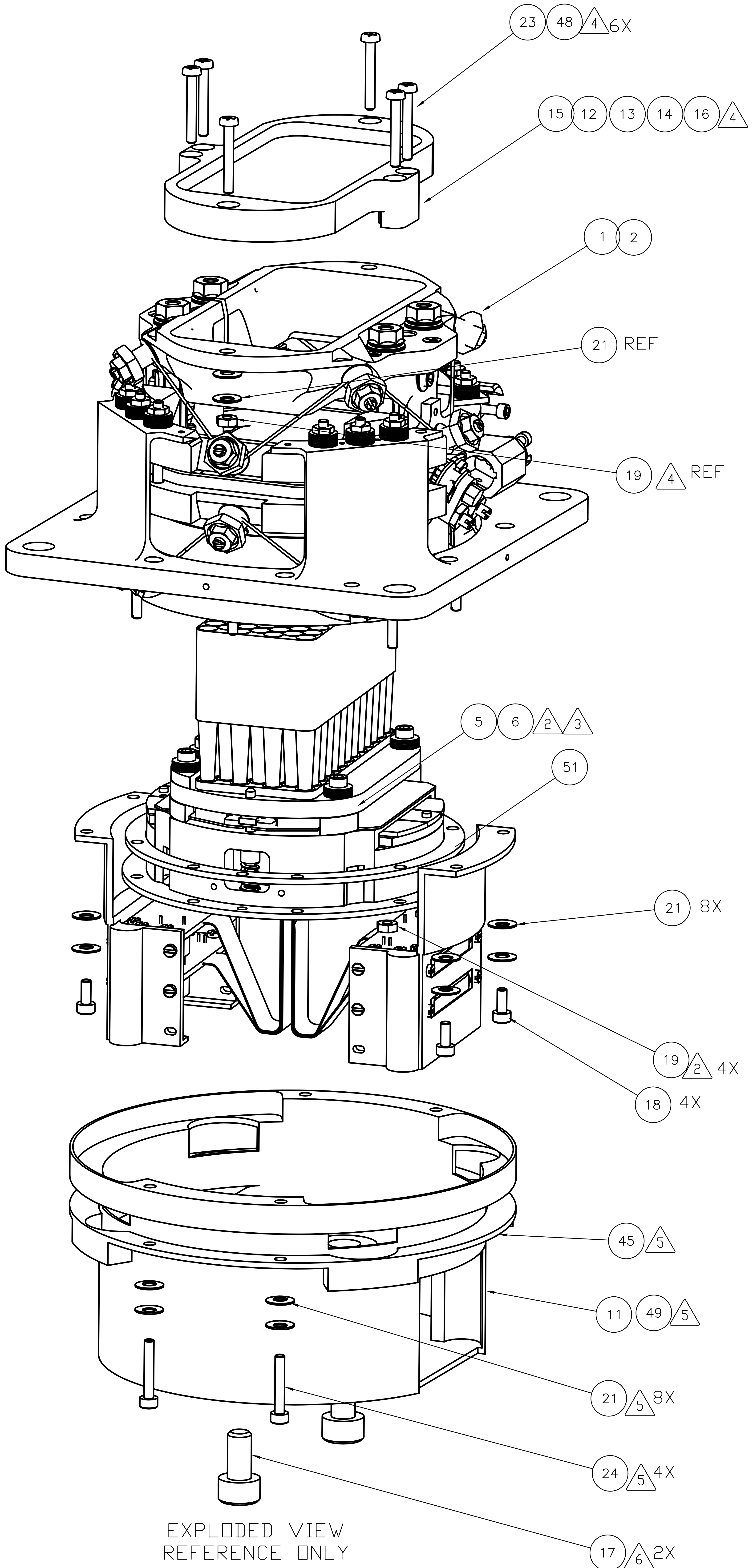
EXPLODED VIEW
REFERENCE ONLY
-5 CONFIGURATION
-1,-2,-3,-4, -8 AND -9 SIMILAR
-6 AND -7 SIMILAR WITH NO CAN



-2 CONFIGURATION SHOWN
-3 CONFIGURATION IS SIMILAR



GENERAL VIEW
REFERENCE ONLY
SCALE: NONE
ALL CONFIGURATIONS



EXPLODED VIEW
REFERENCE ONLY
-2 CONFIGURATION SHOWN
-3 CONFIGURATIONS SIMILAR

SIZE	CAGE NO		REV
A1	23835	10209800	B
SCALE NONE	UNCLASSIFIED	SHEET 4 OF 4	

REV 2/00

AutoCAD GENERATED

10209800 A1

ECR/NCR List

FS SLW BDA 10209800-4 S/N 015

All of these have been incorporated into released drawings.

1. HR-SP-JPL-ECR-003 – Changes to the 300mK filter clamp fixing holes.

2. HR-SP-JPL-ECR-007 – Spectrometer BDA Envelope Height

NOTE: The following ECRs do not apply directly to the SLW BDA type, but they represent changes to the applicable ICDs and top level drawing so they are included here for reference.

3. HR-SP-JPL-ECR-005v2 – 300mK Stage Assembly – BDA Kapton cable routing design error. (applies only to PMW and PSW BDAs)

4. HR-SP-JPL-NCR-007 – PMW and PSW focal position shift

Rutherford Appleton Laboratory	**Document / Engineering Change Request**	**PRODUCT ASSURANCE** **Space Science and Technology Department**

DOCUMENT /ENGINEERING CHANGE REQUEST NO.: HR-SP-JPL-ECR-003

PROJECT:	**SPIRE**	**ORIGINATOR:**	**Martin Herman, JPL**
SYSTEM:	**FPU**	**SIGNATURE**	
SUB-SYSTEM:	**300mK Filter Stacks**	**DATE**	**22nd May 2003**

1) TITLE OF CHANGE: **Changes to the 300mK filter clamp fixing holes.**

2) AFFECTED ITEMS / WORK PACKAGES: **300mK Filters**

3) CLASSIFICATION OF CHANGE: (Highlight as required)	**URGENT**	ROUTINE

4) DOCUMENTS AFFECTED (TITLE, NUMBER, ISSUE, PARAGRAPH):
Filters – Interface Control Document - SPIRE-UCF-PRJ-001151 issue 2.2
Figure 13 – "Filter assembly GA" – drawing number BDA.01.006
Figure 14 – "BDA upper filter ring" – drawing number BDA.01.003

5) DESCRIPTION OF CHANGE:

1. **The drawings BDA.01.006 and BDA.01.003 will be combined into one interface drawing. Title will be "300mK Filter ICD", drawing number will be "Filt-CQM/PFM-200"**
2. **Add missing dimension for length of projecting mounting legs – 2.75 ± 0.02mm in sector H8**
3. **Add box for total stack thickness and mass per channel in sector A8**
4. **Change existing callout in sector D4 from "*6 x 2.00mm thru*" to "*6 x 2.00mm thru. Counterbore 3.8mm dia., 1.00mm deep. Countersink 2.40mm dia., 45°*"**
5. **Modify existing parts in accordance with the new ICD - FILT-CQM/PFM-200**

(Figure 1. may be used for reference)

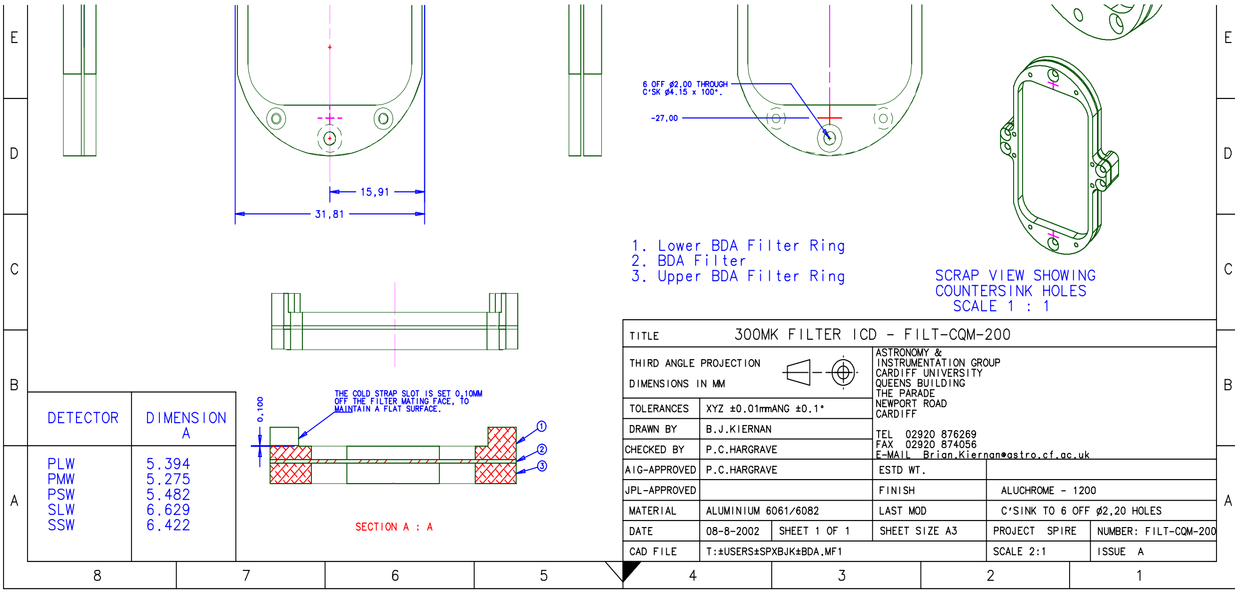
6) RELATED FACTORS: (Highlight as required)

SPACECRAFT	PERFORMANCE	POWER	OTHERS (SPECIFY)
GROUND SEGMENT	ELECT INTERFACES	WEIGHT	
LAUNCH VEHICLE	**MECH. INTERFACES**	**SCHEDULE**	
PAYLOAD	TEST/VERIFICATION	**COST**	

7) NEED / JUSTIFICATION FOR CHANGE:
Late specification of fixtures to be used by JPL

SPIRE-UCF-PRJ-001151 issue 3 Issued accordingly ECR Closed

ATTACHMENTS: **Draft version of new ICD – incomplete – for reference only** *300MK_FILTER_ICD_170403_weilert.doc* **Shown as figure 1.**	DISTRIBUTION:	CHANGE APPROVED SIGNATURE: DATE:	Digitally signed by Eric Clark Date: 2005.07.13 11:17:10 +01'00'



DETECTOR	DIMENSION A
PLW	5.394
PMW	5.275
PSW	5.482
SLW	6.629
SSW	6.422

TITLE 300MK FILTER ICD - FILT-CQM-200

THIRD ANGLE PROJECTION
DIMENSIONS IN MM

ASTRONOMY &
INSTRUMENTATION GROUP
CARDIFF UNIVERSITY
QUEENS BUILDING
THE PARADE
NEWPORT ROAD
CARDIFF

TEL 02920 876269
FAX 02920 874056
E-MAIL Brian.Kiernan@astro.cf.ac.uk

TOLERANCES	XYZ ±0.01mmANG ±0.1°				
DRAWN BY	B.J.KIERNAN				
CHECKED BY	P.C.HARGRAVE				
AIG-APPROVED	P.C.HARGRAVE		ESTD WT.		
JPL-APPROVED			FINISH	ALUCHROME - 1200	
MATERIAL	ALUMINIUM 6061/6082		LAST MOD	C'SINK TO 6 OFF ø2,20 HOLES	
DATE	08-8-2002	SHEET 1 OF 1	SHEET SIZE A3	PROJECT SPIRE	NUMBER: FILT-CQM-200
CAD FILE	T:±USERS±SPXBJK±BDA.MF1			SCALE 2:1	ISSUE A

Figure 1 Preliminary draft of new ICD for reference only. Additional proposed changes to this drawing will be implemented by Cardiff, and sent to JPL for approval.

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Rutherford Appleton Laboratory

DOCUMENT / ENGINEERING CHANGE REQUEST (ECR)

PRODUCT ASSURANCE
Space Science and Technology Department

DCR / ECR Number:	HR-SP-JPL-ECR-007

Spacecraft / Project	**HERSCHEL**	**Originator's Name**	Martin Herman	
System / Experiment / Model	**SPIRE /**	**Signature**		
Sub-System		**Date**	November 20,2003	
Assembly		**Classification**	**Urgent**	**Routine**
Sub-Assembly		**Ref. Doc. / Drwg No.**	JPL dwg 10209721	
Item	Bolometer Detector Assembly (BDA)	**Reference**		

ECR/DCR Title	**Spectrometer BDA Envelope Height**

ECR Description

On the ICD Drawing 10209721 sheet 2, zone H4, the current maximum height dimension is 42.5 mm from the BDA mounting plate. This dimension needs to be changed to 43.6 to encompass the two spectrometer BDA types, SLW and SSW. Photometer BDA types do not require this change. The current dimension will be replaced with a note giving the two BDA type dependent values. The allowed 300mK stage shift given in note 9 will remain.

Need / Justification For Change

The Spectrometer BDA (types SLW and SSW) 300mK filter stacks were at some point increased in thickness due to the addition of a lens. This change was not flowed down into the BDA ICD. The SLW BDA S/N008 maximum height was measured at 44.04 mm from the mounting plate, which is 1.04 mm higher than the current allowed ICD range. The nominal 42.5 mm height plus the 0.5mm allowed displacement of the 300mK stage (see ICD note 9) gives the current 43.0 mm max height.

Affected Items / Work package (Title, Number, Issue, Para)

ICD drawing 10209721 rev B

Related Factors (Highlight as applicable)

Spacecraft	Performance	Power	Others (Specify)
Ground Segment	Elect. Interfaces	Weight	
Launch Vehicle	==Mech. Interfaces==	Schedule	
Payload	Test/Verification	Cost	

Attachments	Distribution

Change Approved Project	? Signature Not Verified Eric Sawyer Digitally signed by Eric Sawyer Date: 2005.07.22 13:26:54 +01'00'	**Change Approved Customer**	N/A
Project Closure	Digitally signed by Eric Clark Date: 2005.07.22 14:19:40 +01'00'	**Customer Closure**	N/A

CCLRC
Rutherford Appleton Laboratory

DOCUMENT / ENGINEERING CHANGE REQUEST (ECR)

PRODUCT ASSURANCE
Space Science and Technology Department

DCR / ECR Number:	HR-SP-JPL-ECR-005v2

Spacecraft / Project	**HERSCHEL**	**Originator's Name**	Anthony Turner
System / Experiment / Model	**SPIRE /**	**Signature**	
Sub-System		**Date**	1/19/2004
Assembly	10209800 -2 and -3	**Classification**	Urgent Routine
Sub-Assembly	10209820 and 10209830	**Ref. Doc. / Drwg No.**	10209775
Item	Kapton cables assemblies, 10217706 and 10209825	**Reference**	

ECR/DCR Title	**300-mK Stage Assembly-BDA Kapton cable routing design error**

ECR Description

Kapton cable right (10217705) was designed for a length of 73.93mm and Kapton cable left (10209824) was designed for a length of 68.87mm. This length designation forces the shorter cable to route into connector positions J01 and J02 on the 10209820 and 10209830 Detector Assembly-BDA builds while the longer cable will route into the J03 and J04 connector positions. This routing will cause a swap in the pixel maps for each connector denoted in wiring schematic 10209725-A under the 10209800-2 and 10209800-3 columns. Below is the correct switch in pixel maps for each column (only the first pixel of the original column is denoted for all connectors but the entire column should be switched accordingly):

10209800-2 P/MW: J01 – first pixel A7, J02 – first pixel E7, J03- first pixel A13, J04 – first pixel R1

10209800-3 P/SW: J01 – first pixel D6, J02 – first pixel F12, J03- first pixel R1, J04 – first pixel E1

In order to:

1. **maintain the existing pixel allocation, and**
2. **ensure that the readout of the PTC Channels is carried out on DCU J22**

the JFET-BDA harnesses need to be swapped and physically relabelled as follows:

JFP J37 → JFP J39
JFP J39 → JFP J37
JFP J40 → JFP J38
JFP J38 → JFP J40
JFP J29 → JFP J31
JFP J31 → JFP J29
JFP J30 → JFP J32
JFP J32 → JFP J30

The SPIRE Block Diagram (Issue 5.8) needs to be updated to reflect this change.

JPL drawing (10209725 Rev B) needs to be updated.

SPIRE Block Diagram (Issue 5.8) needs to be updated.

The re-labelling of the connectors (MDM 51S) will mean that the corresponding BDA-JFET harnesses will have a 180° twist in them between the FPU wall and the JFET rack.

Need / Justification For Change

The current flex cable assembly/routing will not correctly map to the pixel locations denoted in 10209725-A wiring schematic, SPIRE. The current schedule/budget will not allow for an acquisition of replacement cables which may have at least a 12-20 week lead from the manufacture. All sub-assembly builds (10209820 and 10209830) would have to be placed on hold until the new cables arrive. The schedule impact could be up to 6 months. The above pixel map designation change would have a minimal effect on the software side, save from rebuilding flex kapton cables and keep the project on its current schedule.

Affected Items / Work package (Title, Number, Issue, Para)

All 10209820 and 10209830 sub assemblies.
Drawing 10209775-A
SPIRE Block Diagram (Issue 5.8)

DCR / ECR Number:	HR-SP-JPL-ECR-005v2

SPIRE Block Diagram (Issue 5.8)
JPL drawing (10209725 Rev B

Related Factors (Highlight as applicable)			
Spacecraft	Performance	Power	Others (Specify)
Ground Segment	Elect. Interfaces	Weight	
Launch Vehicle	Mech. Interfaces	Schedule	
Payload	Test/Verification	Cost	

Attachments	**Distribution**

Ref SPIRE-RAL-MoM-002462v1 NRB ECR Closed

Change Approved Project		**Change Approved Customer**	
Project Closure		**Customer Closure**	

CCLRC Rutherford Appleton Laboratory	**NON-CONFORMANCE REPORT (NCR)**	**PRODUCT ASSURANCE** **Space Science and Technology Department**

NCR Number:	HR-SP-JPL-NCR-007

Spacecraft / Project	**Herschel**	**Originator's Name**	Martin Herman	
Experiment / Model	SPIRE / PFM+FS	**Signature**		
Sub-System		**Date**	July 1, 2004	
Assembly		**Level** (Highlight if applicable)	Major	Minor
Sub-Assembly				
Item	PMW and PSW BDA (10209800 -2 and -3)	**NRB Reference**		
Serial Number	11, 12, 14,15 (TBC)			

NCR Occurred During (Highlight if applicable)	[✓ Manufacture]	Inspection	Test	Integration	Other

NCR Title	**PMW and PSW focal position shift**

NCR Description

An internal mechanical interference problem discovered during the manufacture of the PMW BDA has required a shift of the feedhorn and detector position with respect to the exterior envelope of the BDA. The exterior BDA envelope is unchanged. This NCR applies to PFM and FS models of the PMW and PSW BDAs.

This problem causes a non-conformance with the focus position specified in the ICD drawing 10209721 (see sheet 2, zone G3, and values tabulated on sheets 5-7). The PMW nominal focus position is changed by 1.0mm from 33.2mm to 32.2mm. The PSW focus position is changed by 1.2mm from 25mm to 23.8mm.

Front-short and back-short distances at the detectors are not affected by this change. The distance from the 300mK filter to the feedhorn entrance plane is increased by the shifts given above.

Other effects of this NCR are a small mass increase (approximately 4 grams) and a slight CG shift (estimated z-cg decrease of ~0.5mm). (Note that the PFM PMW, which is the only affected unit yet assembled, has a mass of 605g including the mass increase. This is still less than the 632g ICD limit.)

Cause of NCR

Disposition / Corrective Action

USE AS IS

Closed ref SPIRE-RAL-MoM-002462v1 NRB

Document or Drawing Affected (Title, Number & Issue)

Estimated COST OF NCR (cost of : correction, Materials, Resource, and delay to Project etc.)

NCR CLOSED **(Signatures Required)**	**PA Manager (Or Deputy)**	**Project Manager (Or Deputy)**	**Date**
	Digitally signed by Eric Clark Date: 2005.07.18 11:18:22 +01'00'	Closed ref SPIRE-RAL-MoM-002462v1 NRB	

Waiver List

1) **HR-SP-JPL-RFW-005v1 (Sine Vibration Omission)**

2) **HR-SP-JPL-RFW-006 (Vibration Test Levels)**

3) **HR-SP-JPL-RFW-022 (BDA Vibration Test Temperature)**

CCLRC Rutherford Appleton Laboratory

REQUEST FOR WAIVER / DEVIATION (RFW/RFD)

PRODUCT ASSURANCE
Space Science and Technology Department

RFW/RFD Number:	HR-SP-JPL-RFW-005v1

Spacecraft / Project	Herschel	**Originator's Name**	Kalyani Sukhatme	
System / Experiment / Model	SPIRE	**Signature / Date**		
Sub-System	detectors	**Request Type** (Highlight applicable request)	[✓ Waiver (RFW)]	Deviation (RFD)
Assembly		**Organisation**	Jet Propulsion Laboratory	
Sub-Assembly		**Ref. Doc. / Drwg No.**	SPIRE-JPL-PRJ-000456	
Item		**References**		
Serial No.				

RFW/RFD Title	**BDA and JFET module sine test deletion**

End Items(s) Affected (Hardware, Software)

Name	CI-Number	Model(s)
Bolometric Detector Assemblies JFET Modules		CQM, PFM, FS CQM, PFM, FS

Requirement / Interface Documents Affected

Specification/Drawing Title	Number	Issue	Date	App. Paragraph
BDA-SSSD (SPIRE-JPL-PRJ-000456)		3.2	Jan 7, 2003	BDA-DES-10, JFET-DES-07

Description of Deviation / Discrepancy / Non-Conformance

High Level Sine- Vibe Test is not performed on these units

Other Items or Requirements (Potentially) Affected

Need for RFW/RFD and Rationale for Acceptance

The hardware has to be qualified under a cold vibration test and is installed in the cold vibration facility for the purpose of the test. The high level sine vibration test configuration will put the hardware and the personnel at risk since the cold vibration facility is not structurally capable of withstanding the high levels. Obtaining additional resources (cost and schedule) for developing a new set-up is not feasible at this time.

Up issue RFW to 5v1 with this note added

There is no Requirement to do a high level sine test on previously Qualified units, Only Random Acceptance level test are required.

	Approved	Rejected	Name	Date
Engineering:	**REF SPIRE – RAL-MOM-002250**		Digitally signed by Eric Clark Date: 2004.12.22 08:57:49 Z	**20 December 04**
Product Assurance:				**20 December 04**
CCB-Chairman:				
Principle Investigator				
Product Assurance:				
Co-Investigator				
Prime Contractor				
ESA Project Office				

CCLRC Rutherford Appleton Laboratory	**REQUEST FOR WAIVER / DEVIATION (RFW/RFD)**	**PRODUCT ASSURANCE Space Science and Technology Department**

RFW/RFD Number:	HR-SP-JPL-RFW-006

Spacecraft / Project	**Herschel**	**Originator's Name**	Martin Herman	
System / Experiment / Model	**SPIRE/ All**	**Signature / Date**		
Sub-System	Detector	**Request Type** **(Highlight applicable request)**	Waiver (RFW)	Deviation (RFD)
Assembly	BDA	**Organisation**	Jet Propulsion Laboratory	
Sub-Assembly		**Ref. Doc. / Drwg No.**		
Item		**References**		
Serial No.				

RFW/RFD Title	**Random vibration test levels not the same.**

End Items(s) Affected (Hardware, Software)

Name	CI-Number	Model(s)
BDA		QM, CQM, PFM, FS

Requirement / Interface Documents Affected

Specification/Drawing Title	Number	Issue	Date	App. Paragraph
BDA-SSSD	BDA-DES-10	3.2	Jan 7, 03	

Description of Deviation / Discrepancy / Non-Conformance

1) **Random Vibration Test Levels are not the same as given in the BDA-SSSD (Issue 3.2), BDA-Des-10**
2) **There are five different flavours of the BDA. The qualification vibration test is done on only one QM unit which is of the PLW type.**

Other Items or Requirements (Potentially) Affected

Need for RFW/RFD and Rationale for Acceptance

1. **The random vibration test levels are as specified by Berend Winter (MSSL) in an email on May 2, 2003, which superseded the BDA-SSSD**
2. **The qualification test program in using the PLW flavour as the only Qual Model, is given in Interoffice Memorandum, Oct. 3, 2003, Henry Abakians, Subject: SPIRE BDA Random Vibration Test Program [IOM 5132-03-167]**

	Approved	Rejected	Name	Date
Engineering:	**REF SPIRE – RAL-MOM-002250**		Digitally signed by Eric Clark Date: 2004.12.21 09:09:53 Z	**20 December 04**
Product Assurance:				**20 December 04**
CCB-Chairman:				
Principle Investigator				
Product Assurance:				
Co-Investigator				
Prime Contractor				
ESA Project Office				

JPL

INTEROFFICE MEMORANDUM
5132-03-167
October 3, 2003
Project: Herschel/Planck

TO: Martin Herman

FROM: Henry Abakians

SUBJECT: SPIRE BDA random vibration test program

This IOM outlines the random vibration test program for Herschel/Planck project's SPIRE element. Due to schedule and cost constrains, our proposed test program does not strictly conform to JPL's standard random vibration program; however, it maintains a medium to low risk posture.
The recommendations will concentrate on the vibration environment since that is the source of highest stresses on the unit. The SPIRE qualification program also includes thermal cycling and accelerated aging, but it will not be addressed in this IOM.

The SPIRE element of the JPL Herschel/Planck project has several Bolometer Detector Assemblies (BDA). These BDAs are identical in their outer housing, and primarily vary in a thermally isolated suspension which contains the bolometer array and the feedhorn (the suspension is held on to the housing via two rows of braided Kevlar strings). There are five flavors to these suspensions: PSW, PMW, PLW, SSW, SLW (P: photometer, S: spectrometer, LW: long wave, MW: medium wave, SW: short wave). The suspensions also vary in their mass and center of gravity (PLW the heaviest, SSW the lightest).

In a traditional JPL Qual/FA test program, a Qual unit for each BDA flavor would be tested (3-axis, 2 min. per axis), and all subsequent flight units would be FA tested (3-axis test, FA levels, 1 min. per axis). In a traditional Protoflight program, all flight units would be protoflight tested (3-axis test, Qual levels, 1 min. per axis).

The SPIRE element has evolved into a Qual/FA/Protoflight test program. We have built and successfully tested a qual unit (CQM, PLW). It was random vibrated at Qual levels and durations (2 minutes) in three axes. This unit successfully passed the random vibration test, and remained within the specifications (performance or otherwise). Our proposed test program for all subsequent BDAs is as follows:

BDA type	test program	random vibe axis	duration
PSW	PF	x	2 min
PMW	PF	x	2 min
PLW	Qual/PF	3 axis Qual	2min/axis
		PF-x axis only	1 min
SSW	PF	x	2 min
SLW	PF	x	2 min

The test program deviates from a standard JPL program; however, we believe it maintains an acceptable risk posture for the following reasons:

1-The vibration in the z-direction is substantially more benign than x and y. Therefore, we can eliminate the random vibration test in the z-direction for all flight units (this is based on the CQM test results).

2-There is sufficient cross-talk between x and y (based on CQM test results). Therefore, we can eliminate the y direction shake and perform the test in the x-direction for an additional 1 minute (x is the more severe direction; moreover, since we are not concerned with low cycle fatigue failure – substantiated by the CQM test - we feel justified in extending the x-direction test duration to 2 minutes, thus indirectly testing for y-direction).
While it is clearly more desirable to test in y-direction directly, eliminating this test is primarily driven by cost and schedule constraints: all our test are performed at or below 100K, thus a one axis vibration will require a minimum of 3 work days; however, extending a 1 minute test to 2 minutes will not impact schedule, cost, or the safety of the hardware.

3-We have tested the heaviest assembly (PLW) for our qualification program. This ensures that our design is validated for the highest possible stresses in the Kevlar string.

4- Force transducers will be utilized in 3 directions. Their responses will be correlated with the CQM results providing additional assurance on hardware workmanship, reliability and robustness.

Concurrence: ________________________
John Forgrave,
Environmental requirements Engineering, Group Supervisor

Concurrence: ________________________
Paul MacNeal, Dynamics Engineer
Herschel/Planck

Concurrence: ________________________ for
Tim Larson, Mission Assurance Manager
Herschel/Planck

Distribution:
Bill McAlpine
Margaret Frerking
Michael O'Connell
Gary Parks
Kalyani Sukhatme
Mark Weilert

CCLRC
Rutherford Appleton Laboratory

REQUEST FOR WAIVER / DEVIATION (RFW/RFD)

PRODUCT ASSURANCE
Space Science and Technology Department

RFW/RFD Number:	HR-SP-JPL-RFW-022

Spacecraft / Project	**Herschel**	**Originator's Name**	Mark Weilert	
System / Experiment / Model	**SPIRE / CQM, PFM, FS**	**Signature / Date**	22 July 2005	
Sub-System	**Detectors**	**Request Type** **(Highlight applicable request)**	[✓ Waiver (RFW)]	Deviation (RFD)
Assembly		**Organisation**	Jet Propulsion Laboratory	
Sub-Assembly	**BDA**	**Ref. Doc. / Drwg No.**	SPIRE-JPL-PRJ-000456; Herschel-Planck ERD, JPL D-19155 Rev B.	
Item	10209800 -1 thru -5	**References**		
Serial No.	6,8,9 & 12 thru 19			

RFW/RFD Title	**BDA vibration test temperature.**

End Items(s) Affected (Hardware, Software)

Name	**CI-Number**	**Model(s)**
Bolometric Detector Assemblies (all types)		CQM, PFM, FS

Requirement / Interface Documents Affected

Specification/Drawing Title	**Number**	**Issue**	**Date**	**App. Paragraph**
BDA-SSSD (SPIRE-JPL-PRJ-000456)		3.2	Jan 7, 2003	BDA-DES-10

Description of Deviation / Discrepancy / Non-Conformance

BDA Cold vibration tests were performed with the BDA temperature at T < 100K instead of T < 90K as required in the SSSD sec. 3.4. Note that the Herschel-Planck Environmental Requirements Document (ERD), JPL D-19155 Rev B lists 100K for the required test temperature.

Other Items or Requirements (Potentially) Affected

Need for RFW/RFD and Rationale for Acceptance

The hardware is tested in the cold vibration facility which contains a liquid nitrogen cooled cold plate which typically reaches 81K minimum. The BDA temperature is measured on the Kevlar-isolated portion of the BDA, which cools down extremely slowly below about 120K. The 100K maximum test temperature used is the lowest that can be practically obtained without waiting an excessive amount of time during the test. The difference in vibration behaviour between 100K and 90K will be minimal, so this change does not affect the validity of the test results. Also note that the temperature of the mounting flange and other non-suspended parts of the BDA are likely less than 90K since they have much better thermal contact to the cold plate.

	Name	**Approved (Sign & Date)**	**Rejected (Sign & Date)**
Engineering:	**Eric Sawyer**	Signature Not Verified Eric Sawyer Digitally signed by Eric Sawyer Date: 2005.07.22 12:17:10 +01'00'	
Product Assurance:	**Eric Clark**	Digitally signed by Eric Clark Date: 2005.07.22 09:04:15 +01'00'	
CCB-Chairman:			
Principle Investigator			
Product Assurance:			
Co-Investigator			
Prime Contractor			
ESA Project Office			

Open Problem / Failure Report (PFR) List

Open PFR's on This Hardware (FS SLW BDA 10209800-4 S/N 015):

NONE

Open PFR's on Similar Hardware:

NONE

SPIRE
Bolometer Detector Assembly
Handling Document

Prepared by
Mark Weilert

20 August, 2003
revised 20 Nov. 03
revised 9 August, 05

WARNINGS

BDA is Contamination Sensitive: Open red shipping container only in an ISO 14644-1 class 7 (FED-STD-209 Class 10000) or cleaner cleanroom. Handle BDA with approved[1] nitrile or polyurethane ESD safe cleanroom gloves only. (See end of document for notes and JPL approved products).

BDA is ESD Sensitive: Handle with approved[2] wrist straps, ESD-safe gloves and ESD smocks at an approved ESD protected workstation[3]. All personnel within 1 meter of unprotected ESD sensitive hardware shall be certified for ESD awareness[4]. Note that no connector savers or other connector protection are shipped with the BDA, per the business agreement. Refer to attached electrical handling document for other important safety precautions. Follow all instructions for the use of wrist straps, ESD smocks, static protected work areas, ionizers, packing/unpacking and cable handling per JPL standard D-1348, rev. F (This document is available through the public domain by the following URL: http://standards.jpl.nasa.gov/contractor/docs/d1348f.html.)

> **ESD - Ionizer**: Prior to mate or demate of any connector, turn on an ionizer approved[5] for ESD sensitive components in clean room environment at least 5 minutes in advance and place/hold both sides of the connections in front of the ionized air stream for a minimum of 10 seconds before mating/demating operation. Position the ionizer near the hardware within the required distance per manufacturer's manual. Different makes and models of ionizers have different positioning requirements. During the mating/demating operations, it is necessary to follow the requirements for handling ESD sensitive hardware.
>
> **ESD - Connection to GSE**: It is essential to ensure that all signal and bias lines of the GSE are grounded prior to mating the BDA hardware to the GSE. A

safe-to-mate check *must* be performed prior to connecting the BDA to the GSE. No excessive voltages and currents on all signal and bias lines shall be observed while the hardware is connected.

QA Oversight: Quality Assurance personnel should witness all handling, electrical testing, operation and integration of BDA flight hardware. At a minimum, a "two person" rule should be invoked at all times, where oversight by an independent party is provided to ensure hardware safety during handling, test and integration operations.

BDA is Fragile: Do not drop or otherwise shock. Take care to avoid applying unnecessary force to the Kevlar suspended portion of the BDA. In particular, do not torque the thermal strap interface fasteners to greater than 320 N*mm. The BDA is preferably held/supported either by its square mounting flange, or by the light-seal can which holds the electrical connectors. Note that the red shipping container provides only minimal shock isolation, and should be treated as equally fragile while the BDA is inside. Because the Kevlar tension is higher at room temperature than cold, **DO NOT SHAKE TEST AT ANY TEMPERATURE ABOVE 100K** (except for low-level survey shakes, 0.25g typical). A full level shake at room temperature risks **catastrophic** failure. Avoid touching Kevlar braid with anything, it is sensitive to abrasion or cutting by seemingly smooth objects.

BDA is Humidity Sensitive: The Kevlar tension increases with moisture absorption. Keep in a dry environment when possible during storage or while not being handled. While being actively handled, hardware should be placed in a humidity-controlled cleanroom. Maintain humidity level at 35%-50% RH typical, for ESD safety.

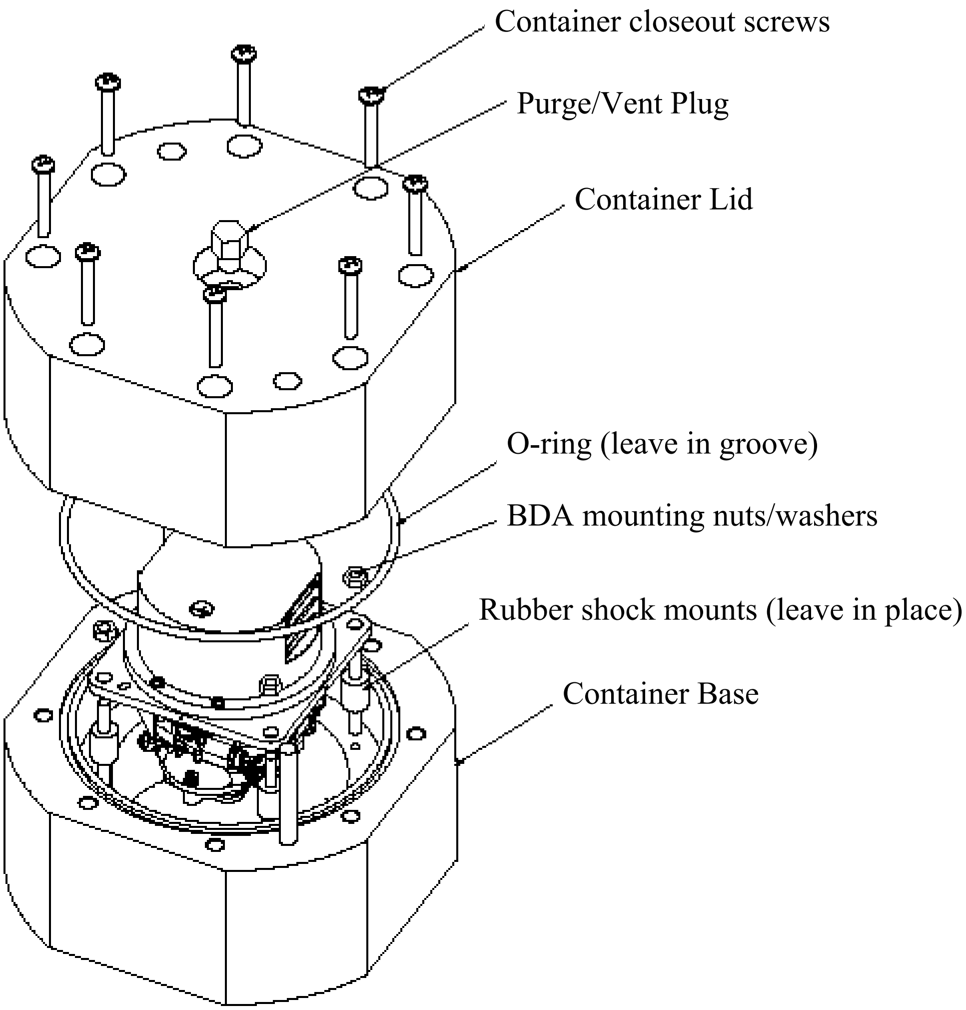
BDA is Temperature Sensitive: The Kevlar tension and creep increases at high temperatures, **DO NOT BAKE OUT AT ABOVE 80°C.**

Unpacking Procedure:

The BDA is shipped in a multi-layer container, a custom shipping container (red) inside a case inside a case. The case should be opened only in a reasonably clean area in order to protect the red shipping container, which should only be opened in a class 10000 or better clean room at an ESD-safe workstation. The red shipping container has three shock-monitors attached to the top, labeled 10g, 20g and 50g. The monitors have steel balls and springs which are contained between plastic rails if the unit has not seen the marked shock level. If the monitors have experienced their specified shock, some of the balls will be loose in the bottom. Please note the state of the three shock monitors and report the result to JPL. These monitors may need to be removed from the top of the red shipping container before it is opened, since they probably obstruct access to the vent plug. They are attached with a double-stick tape adhesive and may be pulled off by applying force to the white base. (Avoid just pulling on the clear case, as this will likely open up the monitor and spill the contents.) **NOTE: The cases holding the red shipping container must be returned to JPL for use in future shipments.**

Opening the Red Shipping Container:

An exploded view of the container is shown below. The top is the side with the vent plug in the center. Make sure the area around the plug is clean, then remove the plug to equalize the pressure. The 8 closeout screws are next loosened alternately (with a 1/8"



hex key) to relieve pressure on the o-ring seal, and then backed off completely to disengage the screws from the base. The container lid is then lifted straight up to open the container. Two guide pins prevent significant sideways motion of the lid until it is high enough to clear the BDA The BDA is removed from the shipping container base by removing the mounting nuts and washers from the rubber shock mounts and lifting the BDA straight up.

For re-installation of the BDA into the red container, note that the light can must be up, as shown, to prevent the container lid from hitting the BDA. Also, the epoxy terminations of the Kevlar braids should be oriented towards the cutouts in the container base.

NOTES:

---

[1] JPL approved ESD safe cleanroom gloves are:

Nitrile:	
Ansell-Edmont Nitrilite	http://www.ansellpro.com/ce/products3.asp?pid=87
Ansell-Edmont Nitrilite Silky	http://www.ansellpro.com/ce/products3.asp?pid=149
Ansell-Edmont Silky Ultra-Clean	http://www.ansellpro.com/ce/products3.asp?pid=150
Safeskin Critical (white)	http://www.safeskin.com/crit_nt_glv.asp
Polyurethane:	
Wilshire Technology DuraCLEAN	call in US, 323-259-6469 for ordering information

[2] JPL approved wrist straps are:
Speidel Twist-o-Flex ™ brand metal expansion bracelet wrist straps
3M model 4600 adjustable molded thermoplastic wrist straps

[3] All work areas shall be certified and operated in compliance with the requirements of the following subsections sections of JPL-STD D-1348 rev. F section 2.3: subsections: 6, 8-11, 14-19, 21, 23 – 27, 29 – 36, 38 – 43 and 45.

[4] All personnel shall be trained and certified to the requirements of section 2.3.3 of JPL STD_D-1348 rev. F.

[5] The ionizer performance shall be verified to comply with the requirements of JPL-STD-D-1348 rev. F, Table 1 for devices with human body model ESD sensitivity less than 50 volts. The ionizer shall discharge from ± 1000 volts to less than ± 20 volts in less than 20 seconds and have a float potential of less than ± 20 volts.

SPIRE

Subject: Spectrometer BDA Filter Replacement Procedure
Prepared by: Mark Weilert

Document No: D-31978

Issue: 1 **Date: 4-May-05**

Checked by: ……………………………………. **Date:……………………**

Approved by:…………………………………… **Date:……………………**

Distribution

RAL SPIRE:	Doug Griffin, Bruce Swinyard, Eric Sawyer and Eric Clark
JPL SPIRE:	Jamie Bock, Jim Newell, and Martin Herman

Change Record

Issue	Date
1 (initial issue)	4-May-05

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Attachments

10209800-B.pdf (BDA top-level assembly Drawing, as included in HRCR package)

1 Introduction

The removal and replacement of the BDA filter is in principle a simple procedure, consisting of removing the screws, removing the filter, replacing the filter, replacing the screws, torquing the screws, and staking the screws. This procedure applies to both SSW and SLW BDA's, part #'s 10209800-5 and 10209800-4, respectively.

The difficulty is due to the drive for the screws, which is an offset-cruciform drive ("Torq-set" drive, per NA0025). The driver we use is a commercially available part, but the filter screws use a very small size and we tried a couple of different drives before finding a good one.

Also, since the filter removal and re-installation applies significant force to the suspended portion of the BDA, if the unit were at JPL we would perform metrology measurements before and after the process to see if the suspended portion of the BDA had shifted. This worry can be reduced somewhat by trying to hold the BDA by the top ring (to which the filter attaches) during the screw removal and torquing.

Detailed procedures follow below. Item numbers refer to the parts list in drawing 10209800, which is included in the HRCR package and attached. See sheet 2 of the drawing for the filter installation detail, which is reproduced in figure 1 below.

2 Warnings

The BDA is shock, ESD, and contamination sensitive. Handle in accordance with the general handling requirements listed in the SPIRE BDA Handling Document, JPL D-26653, included in the HRCR package.

This procedure could cause a shift in the location of the suspended portion of the BDA. Checking the position of the suspended portion with respect to the mounting flange before and after is recommended.

All procedures should be performed with QA witness, and a calibrated torque wrench should be used.

3 Filter Removal

3.1 Remove the 6x item 48 screws, 2x item 19 nuts and 4x item 21 Belleville washers holding filter to the top ring of the BDA.

The two end screws are held into nuts which must be held to loosen the screws. The loosening torque can be applied to the screw or the nut as desired.

Note that the screws are staked with epoxy. This epoxy will break away when the screws are loosened. Take care to contain the epoxy bits so they do not fall into the BDA assembly.

3.2 Retain all screws, nuts, and washers for later re-installation.

3.3 Lift the filter off the top ring.

4 Filter Installation

4.1 Place new filter into position on the BDA top ring. Note that the filter will only go on in one orientation due to the clearance slot for the thermal strap.

4.2 Attach the filter using the 6x item 48 NA0068A016012 screws removed during disassembly. Use an item 19, nut, and two item 21 Belleville spring washers in series (<>) at each of the two thru-hole locations. Finger tighten screws in an alternating pattern, such as that suggested in figure 1 below.

Note that residual staking epoxy must be cleaned from the parts before re-use. This can easily be accomplished by heating the screws, washers or nuts slightly with a heat gun, which softens the epoxy enough for removal with a sharp tool. **Do not use a heat gun on the assembled unit.**

ALTERNATE OPTION:
If you have sufficient clearance above the top of the BDA in the next level of assembly, it is acceptable to use NA0069-016012 socket-head cap screws for the filter installation instead of the NA0068 screws which were originally installed. This will avoid the problems with the offset-cruciform drive, but will leave the heads of the screws extending above the top of the filter. Make sure that the screws are not longer than 12mm (measuring from under the head), because the clearance from the end of the screw to the bottom of the threaded holes is a bit tight. The location of the washers and nuts, as well as the torquing and staking in the following steps is unchanged.

4.3 Torque all item 48 screws to 200N*mm in the same pattern as above.

The end screws must have the nuts held with a small closed-ended wrench during torquing. Torque is applied to the screws in all cases.

4.4 Stake the six filter screws using item 25, 2216A/B epoxy.

The four central screws are staked at the heads, while the end screws are staked at the nut such that epoxy connects the screw to the nut. See figure 2 for pictures of typical staking.

4.5 Cure epoxy for 24 hours minimum at room temperature.

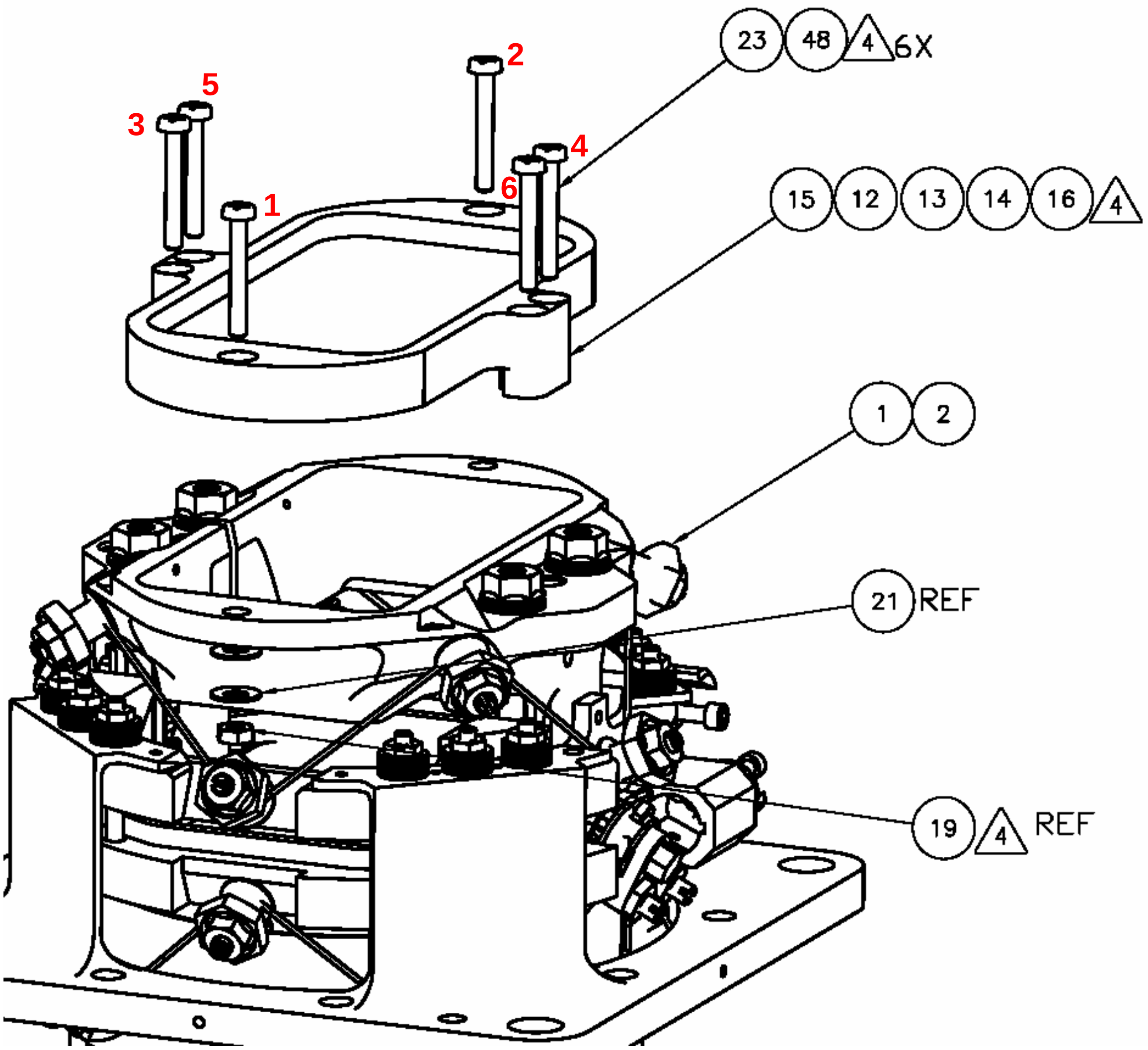

Figure 1

Filter Detail from Drawing 10209800 rev B, showing suggested screw tightening pattern in red. See attached full drawing for part number references.

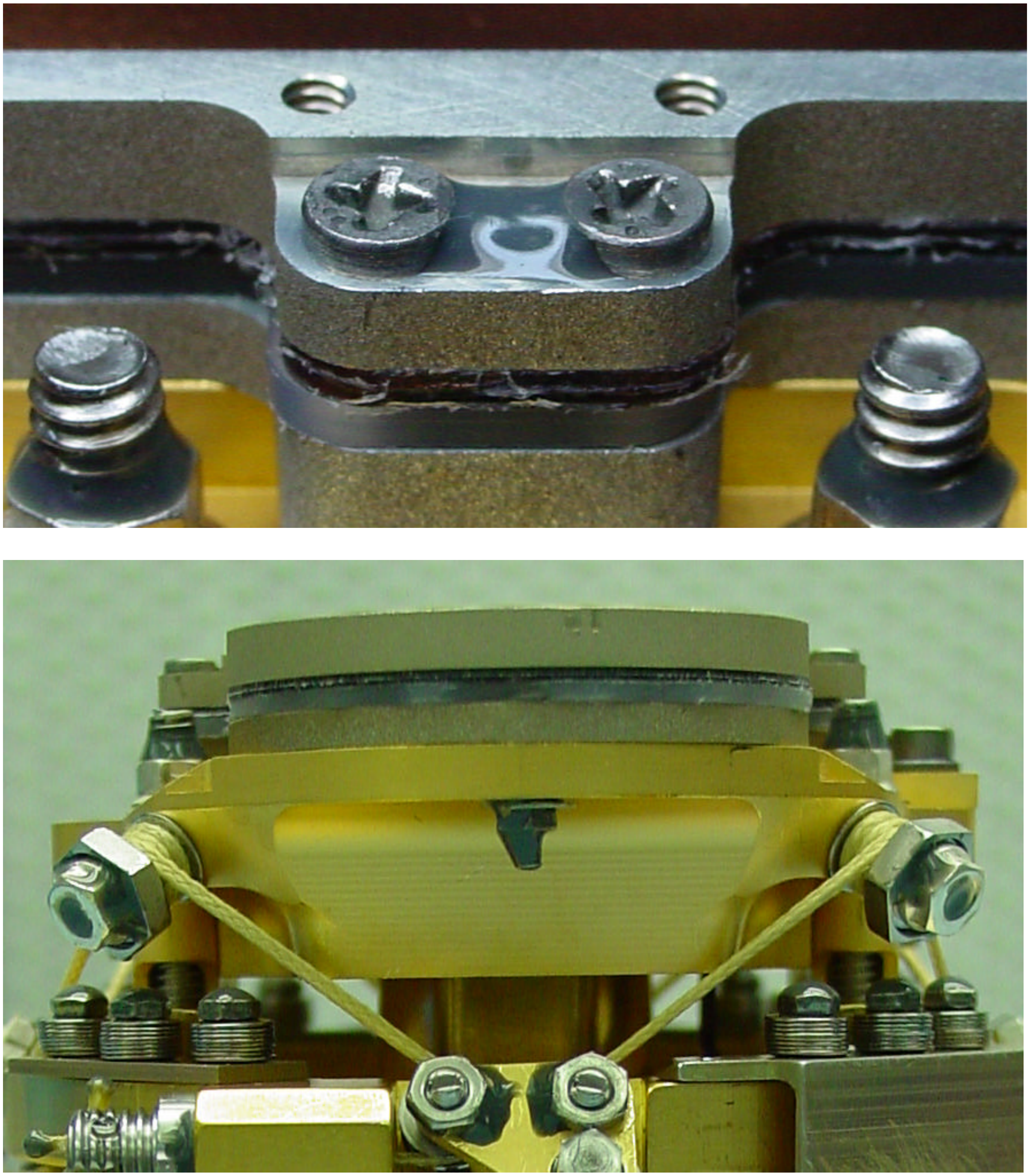

Figure 2

Typical Fastener Staking.

SPIRE

Subject: BDA Electronic Handling Procedure, SPIRE S/LW-FS

Prepared by: Anthony Turner

Document No:

Issue: Draft   **Date: 5/24/05**

Checked by: ……………………………………….   **Date:……………………**

Approved by:………………………………………   **Date:……………………**

Distribution

Change Record

Issue	Date

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Glossary

1. Introduction:

This document provides the Electronic Handling Procedure for the Flight Spare-Spectrometer Long Wavelength Bolometer Detector Array.

2. Handling:

1. **BDA is Contamination Sensitive**: Handle BDA with Gloves only in a FED-STD-209 Class 10000 clean room (ISO 14644-1 class 7) or better.

2. **BDA is ESD Sensitive**: Electronic parts included in the S/LW-FS science instrument are subject to electro-static discharge failures. Please handle with appropriate ESD hardware handling procedures. Handle with grounding straps, ESD-safe gloves, ESD smocks at an ESD-safer workstation.

3. Signal Requirements:

The interface circuit for the BDA contains a series of resistive networks as depicted in figure 1. Two high resistive load resistors (~ 6-14 MΩ) are coupled to a NTD Ge thermistor (R_{bolo}) through a lithographed metalization circuit and provide the bias circuitry for the device. The maximum DC input voltage for the bias lines V+ and V- lines is +/- 1 V, and the maximum AC input voltage is 100mV rms.

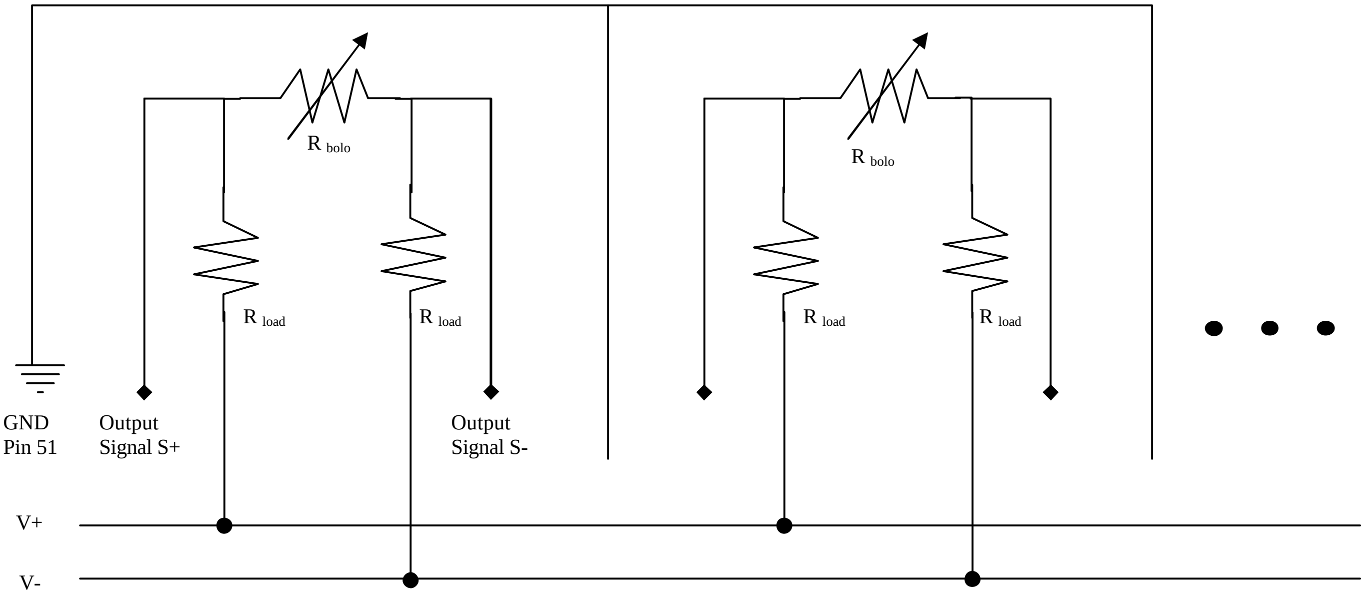


Figure 1: Interface circuit of the Bolometer Detector Array

DC Voltage-Current Limits for Room Temperature Detector Values Check:

Signal	Pin	Nominal Value	Max Value
V+	25	+50mV	+1 V
V-	50	-50mV	-1 V
I+,I-	25,50	10µA	25µA

DC Voltage-Current Limits for room temperature Load Resistor-Detector Continuity Check:

Signal	Pin	Nominal Value	Max Value
V+	25	+50mV	+1 V
V-	50	-50mV	-1 V
I+, I-	25,50	<0.5µA	1µA

4. Device Isolation Check:

The 300mK stage Kevlar suspended portion of the detector chassis is grounded directly to the electronic ground on pin 51 of the nanonics 51-pin connectors on each side. A resistance of less than 200Ω can be checked from the thermal strap of the 300mK stage to electrical ground pin 51. The 2K stage is electrically isolated from the electronic ground via the Kevlar supports. Measuring from pin 51 to any metal section of the 2K stage will yield an open circuit.

5. Room Temperature Detector Values Check

The final measured DC resistance value for each of the bolometer detector at room temperature is shown in the Table 1. The measurements bypass the load resistors in the circuit measuring directly through the output signal pins on the two nanonics 51-pin connectors. All measurements were performed with a Fluke 87 True RMS multi-meter set in the 4kΩ range. All measurements are in kΩ unless designated otherwise. Channels that are out of range are re-measured using the 40MΩ range to determine their value. The failure mode of any particular channel is also designated in table 1. The designation for the failure modes are open- Channel open at 300mK, short-channel shorted at 300mK, and float- channel floating at 300mK.

Table 1: S/LW-FS Room Temperature DC Detector Measurements J05 connector

Connector Label	Signal	Nanonics Pin From	Nanonics Pin To	Detector Label	Resistance (kohms)	Failure Mode
J05	1	1	26	R1	4.52M	
	2	2	27	T1	1.583	
	3	3	28	C1	1.944	
	4	4	29	DK1	110.4k	open
	5	5	30	B1	1.943	
	6	6	31	D1	1.863	
	7	7	32	E1	1.789	
	8	8	33	A1	1.893	
	9	9	34	C2	1.81	
	10	10	35	D2	1.769	
	11	11	36	B2	1.784	
	12	12	37	E2	1.691	
	13	13	38	A2	1.813	
	14	14	39	C3	1.813	
	15	15	40	D3	1.817	
	16	16	41	B3	1.898	
	17	17	42	E3	1.841	
	18	18	43	C4	1.946	
	19	19	44	DK2	1.927	
	20	20	45	D4	1.975	
	21	21	46	C5	2.018	
	22	22	47	B4	2.083	
	23	23	48	A3	2.135	
	24	24	49	T2	1.673	
	V+ to V-	25	50		0.747M	
	V- to gnd	50	51		>30M	
	V+ to gnd	25	51		>30M	
	Chassis to gnd				68.0 ohms	

note: DK1 has an almost open circuit on the web lead of the detector. Deemed an open circuit.

6. Load Resistor-Detector Continuity Check

A DC continuity check of the load resistors in series with the bolometer detectors will complete the electrical checkout at room temperature. The test can be performed with a Fluke 87 True RMS multi-meter set on the 40MΩ scale. The data set measures from V+ to output signal S+ and V- to output signal S- for each channel. The nominal value read for the live bolometer channels (room temp detector DC resistance ~ 1.5-2.0 kΩ) should read approximately 5-8MΩ. Channels with open bolometer channels will give values 10MΩ or higher. The Data sets for the S/LW-FS for the final test through the entire circuit are shown in Table 3.

Table 3: S/LW-FS Load Resistor- Detector DC Continuity Check J05 connector

Connector Label	Signal	Detector Label	Resistance V+ to S+ (Mohms)	Resistance V- to S- (Mohms)
J05	1	R1	5.68	5.68
	2	T1	4.67	4.68
	3	C1	4.68	4.68
	4	DK1	4.64	4.72
	5	B1	4.66	4.68
	6	D1	4.64	4.68
	7	E1	4.63	4.64
	8	A1	4.6	4.6
	9	C2	4.6	4.6
	10	D2	4.6	4.61
	11	B2	4.6	4.6
	12	E2	4.6	4.6
	13	A2	4.6	4.6
	14	C3	4.6	4.6
	15	D3	4.6	4.6
	16	B3	4.56	4.58
	17	E3	4.6	4.58
	18	C4	4.52	4.56
	19	DK2	4.56	4.56
	20	D4	4.6	4.56
	21	C5	4.6	4.52
	22	B4	4.62	4.52
	23	A3	4.55	4.52
	24	T2	4.52	4.51

EIDP Coverpage For SLW BDA (SN015)

Unit Identfication	
Name	SLW BDA
Part #	10209800-4
S/N	#015

Environmemtal Testing	Axes Tested	Temperature	Duration or Number of Cycles	Pass/Fail	Requirement	Source	Waiver #
Random Vibration Test	X	100 K	2 min per axis	P	X, Y, Z at 90 K 1 min per axis	SSSD Sec # 3.4	HR-SP-JPL-RFW-006, HR-SP-JPL-RFW-022
High Level Sine Vibe Test	None	NA	NA	NA	X, Y, Z at 90 K	SSSD Sec # 3.4	HR-SP-JPL-RFW-005v1
Bakeout	NA	NA	NA	NA	None (other than as part of the assembly procedure)	D-20549	
Thermal Cycles	NA	RoomT to ~ 6 K	2	P	1 thermal cycle roomT to 77 K (max 5)	D-20549	

Other Testing	Frequency [Hz]						
	Pre-full level	Post-full level			Minimum Performance	Source	Waiver #
Lowest Resonant Frequency	268 Hz	268 Hz			> 200 Hz (Goal: >250 Hz)	SSSD Sec # 3.1.3	NA
Metrology Measurements were performed before and after the Vibration Test and the Thermal Cycles							
	Motion in X/Y	Motion in Z		Meets Goal ?	Performance Goal	Source	Waiver #
Maximum motion due to Random Vibration Test	23 μm	32 μm		Y	125 μm in X/Y and 500 μm in Z	SSSD Sec # 3.1.1	NA
Maximum motion due to the 1st thermal cycle	13 μm	10 μm		Y	125 μm in X/Y and 500 μm in Z	SSSD Sec # 3.1.1	NA
Maximum motion due to the 2nd thermal cycle	11 μm	8 μm		Y	125 μm in X/Y and 500 μm in Z	SSSD Sec # 3.1.1	NA
Cumulative Maximum motion	48 μm	67 μm		Y	125 μm in X/Y and 500 μm in Z	SSSD Sec # 3.1.1	NA
Cold Continuity Measurements were made during each of the thermal cycles							
				Pass/Fail	Requirement	Source	Waiver #
Cold Continuity Test (1st Thermal Cycle)				P	None	NA	NA
Cold Continuity Test (2nd Thermal Cycle)				P	None	NA	NA

8/7/2005

JPL

ENVIRONMENTAL TEST AUTHORIZATION AND SUMMARY (ETAS)

AUTHORIZATION SECTION

PROJECT Herschel	LOG NO. HS038

SUBSYSTEM/ASSEMBLY TITLE S SLW BDA SN015	DATE ISSUED 03/07/2005

REFERENCE DESIGNATION NUMBER	PART NO. (IF MULTIPLE, ATTACH LIST) 10209800	REV.	SERIAL NO. 015

HARDWARE TYPE
☐ EM QUAL ☒ FLIGHT ☐ FLIGHT SPARE ☐ OTHER

PRE-ENVIRONMENTAL INSPECTION REPORT NUMBER (ATTACH IR)

WIRING HARNESS
☐ EM QUAL ☐ FLIGHT ☐ EM ☐ SE

PART NO. REV. SERIAL NO.

TEST DESCRIPTION (CHECK ALL APPLICABLE)
☐ SINE VIBRATION ☐ PYROSHOCK ☐ ACOUSTIC ☐ EMC ☐ OTHER ______
☒ RANDOM VIBRATION ☒ THERMAL VAC. ☐ THERMAL ATMOSPHERE

TYPE OF TEST
☐ QUALIFICATION ☐ FLIGHT ACCEPTANCE
☒ PROTO FLIGHT ☐ RETEST

WILL ALL TESTS/LEVES/DURATIONS REQUIRED BY THE PROJECT DOCUMENTS BE PERFORMED ON THIS UNIT?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) ENTER PROJ. DOC. NO. AND REV. _____

HAS THE UNIT PASSED ALL PRE-ENVIRONMENTAL FUNCTIONAL TESTS?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

HAVE ALL DESIGN ANALYSES BEEN COMPLETED AND REQUIRED CHANGES BEEN IMPLEMENTED?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

IS THE TEST ARTICLE IDENTICAL TO OTHER FLIGHT UNITS?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

ARE ALL PFRs AGAINST THIS UNIT CLOSED?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

HAVE ALL WAIVERS AND ECRs BEEN APPROVED AND ARE THEY INCORPORATED?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

TEST AUTHORIZED BY

COGNIZANT ENGINEER	DATE	TECHNICAL MGR./INSTR MRG./PI PREP REP	DATE	ENVIRONMENTAL REQUIREMENTS ENG.	DATE
	3/8/05		3/8/05	Lorraine Valenzuela For T. Newell	3-8-05

SUMMARY SECTION

TEST AGENCY (IF MULTIPLE, ATTACH SUMMARY AND TEST DATES) JPL Building 144	TEST INITIATION DATE 03/08/05	ACCUMULATED OPERATING HOURS PRIOR TO FIRST ENVIRONMENTAL TEST
SERIAL NUMBERS ACTUALLY TESTED	TEST TERMINATION DATE	OPERATING HOURS DURING ENVIRONMENTAL EXPOSURE

TEST DESCRIPTION

VIBRATION
AXES: X Y Z
SINE VIBRATION ☐ ☐ ☐
RANDOM VIBRATION ☒ ☐ ☐

ACOUSTIC
☐

PYROSHOCK SHOCK
AXES: X Y Z
☐ ☐ ☐
SHOCKS/AXIS:

☒ THERMAL VACUUM
PRESSURE: <1E-5 mbar, 290K to 7K
NO OF CYCLES: 2

☐ TEMPERATURE ATMOSPHERE
NO OF CYCLES:

☐ OTHER
______

EMC
☐ COND. SUSC. ☐ COND. EMIS. ☐ ISOLATION
☐ ESD ☐ RAD. SUSC. ☐ RAD. EMIS. ☐ MAGNETICS

TEMP. LEVEL (°c) AND ACCUMULATED DURATION (HRS.)
HOT: ______°c, ______h COLD: ______°c, ______h
HOT: ______°c, ______h COLD: ______°c, ______h

WERE THERE ANY PFRs GENERATED DURING ENVIRONMENTAL TESTS?
☐ YES ☒ NO (IF NO, ATTACH EXCEPTIONS LIST)
LIST PFR NOS. / BRIEF EXPLANATION

ARE THE POST ENVIRONMENTAL DAMAGE INSPECTIONS COMPLETE?
☒ YES ☐ NO (IF YES, ATTACH A COPY OF THE INSPECTION REPORTS. IF NO, ATTACH EXPLANATION)
LIST PFR NOS. / BRIEF EXPLANATION

WERE ALL PLANNED TESTS/LEVELS/DURATIONS ACHIEVED?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST)
LIST PFR NOS. / BRIEF EXPLANATION

☐ TESTS HAVE NOT BEEN SUCCESSFULLY COMPLETED. SEE THE ATTACHED SUMMARY FOR ACTIONS THAT NEED TO BE TAKEN.

COGNIZANT ENGINEER	DATE	TECHNICAL MGR./INSTR MRG./PI PREP REP	DATE	ENVIRONMENTAL REQUIREMENTS ENG.	DATE

HARDWARE HAS SUCCESSFULLY COMPLETED THE ENVIRONMENTAL TESTS LISTED ON THIS FORM OR REMAINING ACTIONS HAVE BEEN TAKEN, INCLUDING RETEST.

COGNIZANT ENGINEER	DATE	TECHNICAL MGR./INSTR MRG./PI PREP REP	DATE	ENVIRONMENTAL REQUIREMENTS ENG.	DATE
	5/23/05				5-23-05

ENVIRONMENTAL TEST AUTHORIZATION AND SUMMARY (ETAS)

OTHER AUTHORIZATION PROVISIONS AND EXPLANATIONS

T[illegible]s a 1-axis cold vibration test (100 K) done on the BDA. The test will be done with the BDA unit mounted inside a cold vibration facility. 3 force transducers will be mounted in the BDA load path in order to measure the BDA response. After the vibration test, 2 thermal cycles will be completed in a vacuum environment from 290K to 7K.

ENVIRONMENTAL TES UTHORIZATION AND SUMMARY (ETAS)

ENVIRONMENTAL TEST SUMMARY

HARDWARE	S/N	ETAS	TEST ENVIRONMENT LEVELS & DURATION	DATE TEST PERFORMED	TEST AGENCY	PASS/ FAIL	COMMENTS
BDA (10209800)	15	38	**LATERAL** 2 minute Random Vibe +3dB/octave 20-100Hz 0.06 g^2/Hz 100-138.5 Hz +36dB/octave 138.5-170 Hz 0.7 g^2/Hz 170-200 Hz -48dB/octave 200-220 Hz .1 g^2/Hz 220-300 Hz -9 dB/octave 300-2000 Hz Total Input: 8.0 Grms Spectrum to be notched in order to get 15 g's response RMS **LONGITUDINAL (not done on this unit)** 2 minute Random Vibe +3dB/octave 20-100Hz 0.08g^2/Hz 100-400Hz -12dB/octave 400-2000Hz Total Input: 6.2 Grms Spectrum to be notched in order to get 15 g's response RMS Each axis1/4 g sine sweep 20-2000 Hz each axisT ~ 100 K 2 Thermal cycles from 290K to 7K				

Sine

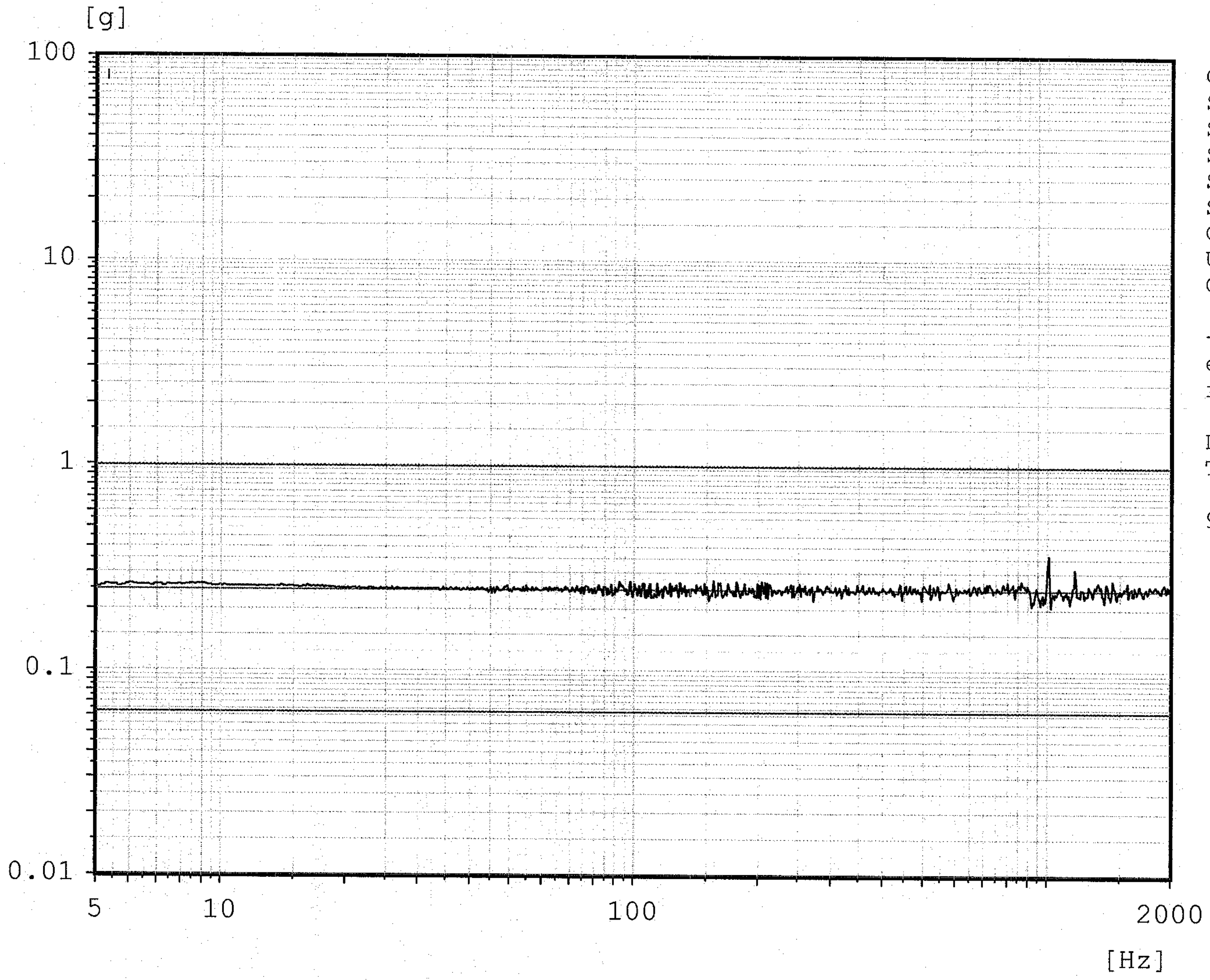
101713, Run #3, axis

Spire BDA

P/N 10209800-, S/N : 015

Control channel

Before Shake, Cold



Chan.type: X
Sweep type: logarithmic
Sweeps done: 1
Sweeps req.: 1
Sweep direct.: up
Sweep rate: 4.00 Oct/min
Contr.strat.: Maximum
Unit: g
Contr.strat.: Closed loop

-- Testing time --
elapsed: 000:02:09
remaining: 000:00:00

Date: 03-08-05
Time: 12:57:23

964#2/Amp #1/ M+P #2

C:\VcpNT\Daten\m+p\SPIRE\BDA\101713 run 3 xax.rsn

Sine

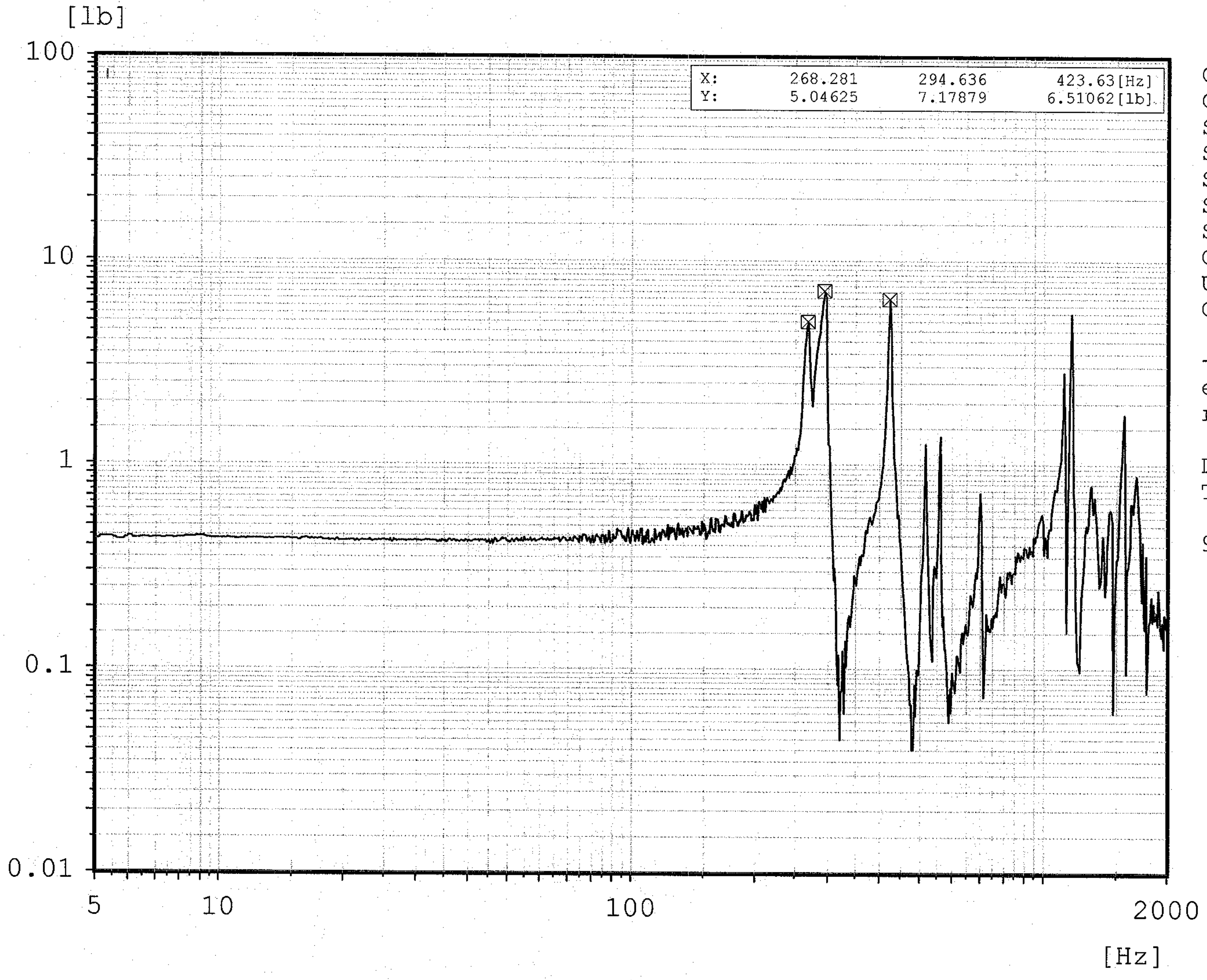
101713, Run # , axis

Spire BDA

P/N 10209800-, S/N : 015

Force Sum X

Before Shake, Cold



Chan.no: 6
Chan.type: W RMS
Sweep type: logarithmic
Sweeps done: 1
Sweeps req.: 1
Sweep direct.: up
Sweep rate: 4.00 Oct/min
Contr.strat.: Maximum
Unit: lb
Contr.strat.: Closed loop

-- Testing time --
elapsed: 000:02:09
remaining: 000:00:00

Date: 03-08-05
Time: 12:57:23

964#2/Amp #1/ M+P #2

C:\VcpNT\Daten\m+p\SPIRE\BDA\101713 run 3 xax.rsn

Sine

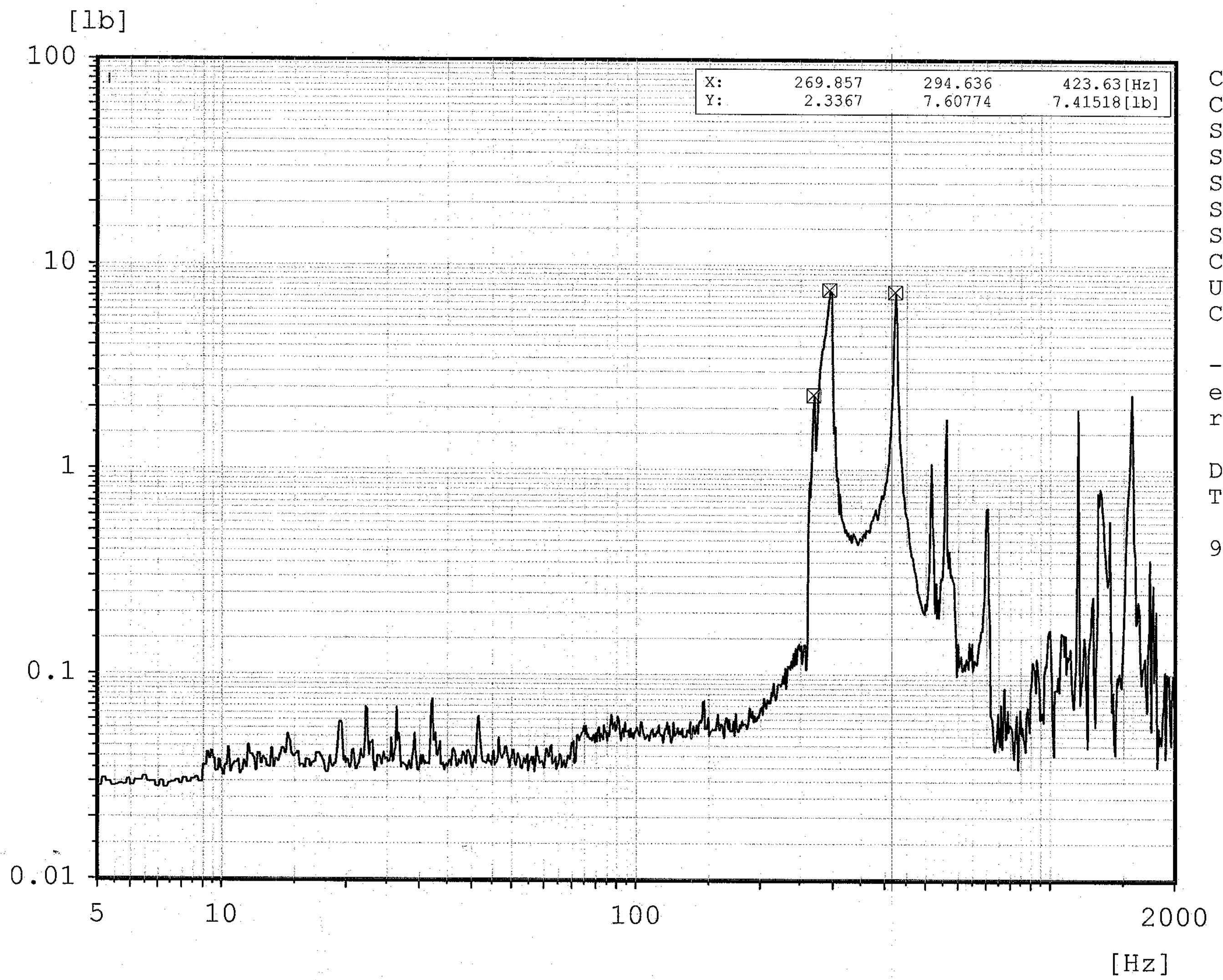
101713, Run # , axis

Spire BDA

P/N 10209800-, S/N : 015

Force Sum Y

Before Shake, Cold



Chan.no: 7
Chan.type: W RMS
Sweep type: logarithmic
Sweeps done: 1
Sweeps req.: 1
Sweep direct.: up
Sweep rate: 4.00 Oct/min
Contr.strat.: Maximum
Unit: lb
Contr.strat.: Closed loop

-- Testing time --
elapsed: 000:02:09
remaining: 000:00:00

Date: 03-08-05
Time: 12:57:23

964#2/Amp #1/ M+P #2

C:\VcpNT\Daten\m+p\SPIRE\BDA\101713 run 3 xax.rsn

Sine

101713, Run # , axis

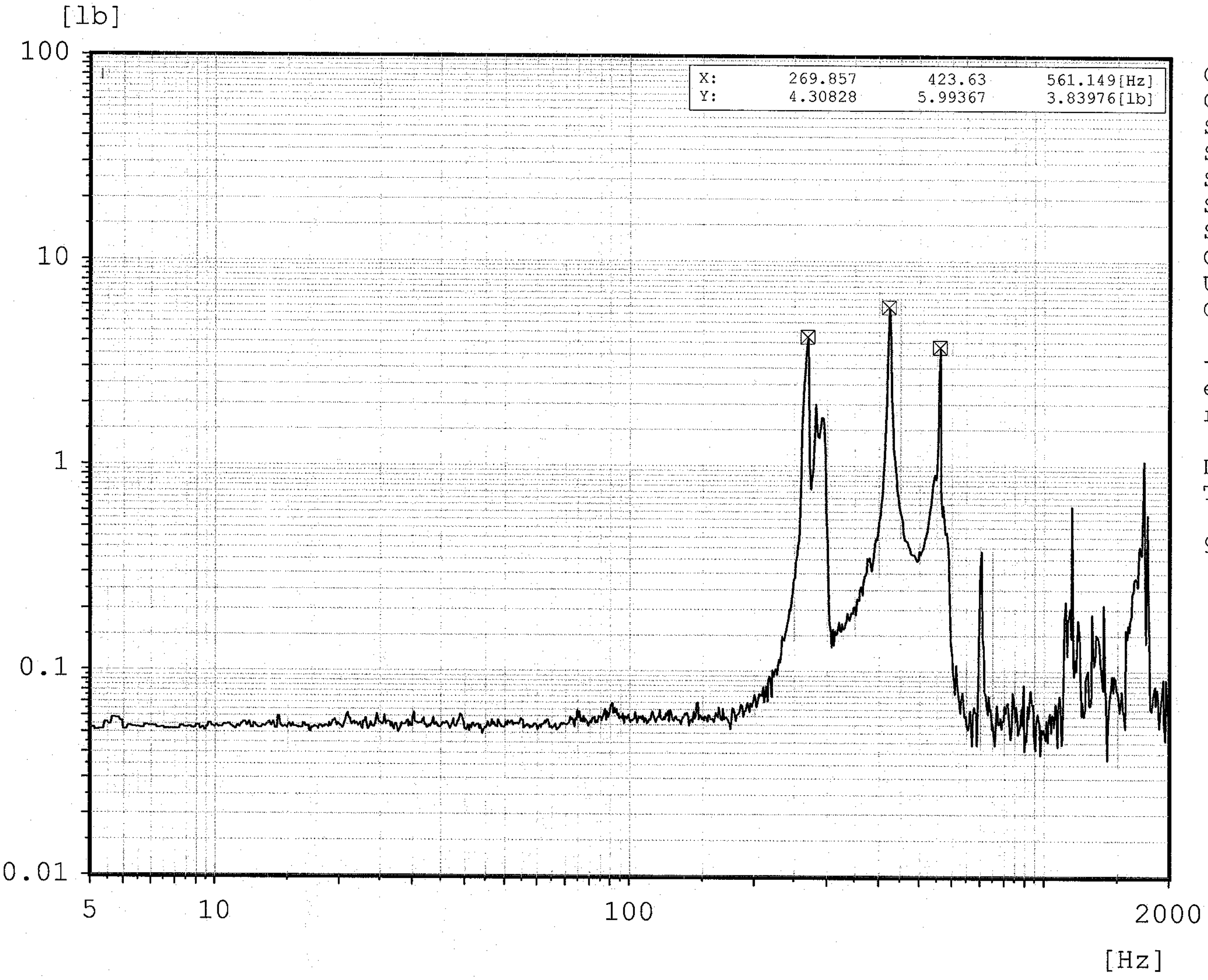
Spire BDA

P/N 10209800-, S/N : 015

Force Sum Z

Before Shake, Cold

JPL



Chan.no: 8
Chan.type: W RMS
Sweep type: logarithmic
Sweeps done: 1
Sweeps req.: 1
Sweep direct.: up
Sweep rate: 4.00 Oct/min
Contr.strat.: Maximum
Unit: lb
Contr.strat.: Closed loop

-- Testing time --
elapsed: 000:02:09
remaining: 000:00:00

Date: 03-08-05
Time: 12:57:23

964#2/Amp #1/ M+P #2

C:\VcpNT\Daten\m+p\SPIRE\BDA\101713 run 3 xax.rsn

Random

101713, Run # 4, X axis

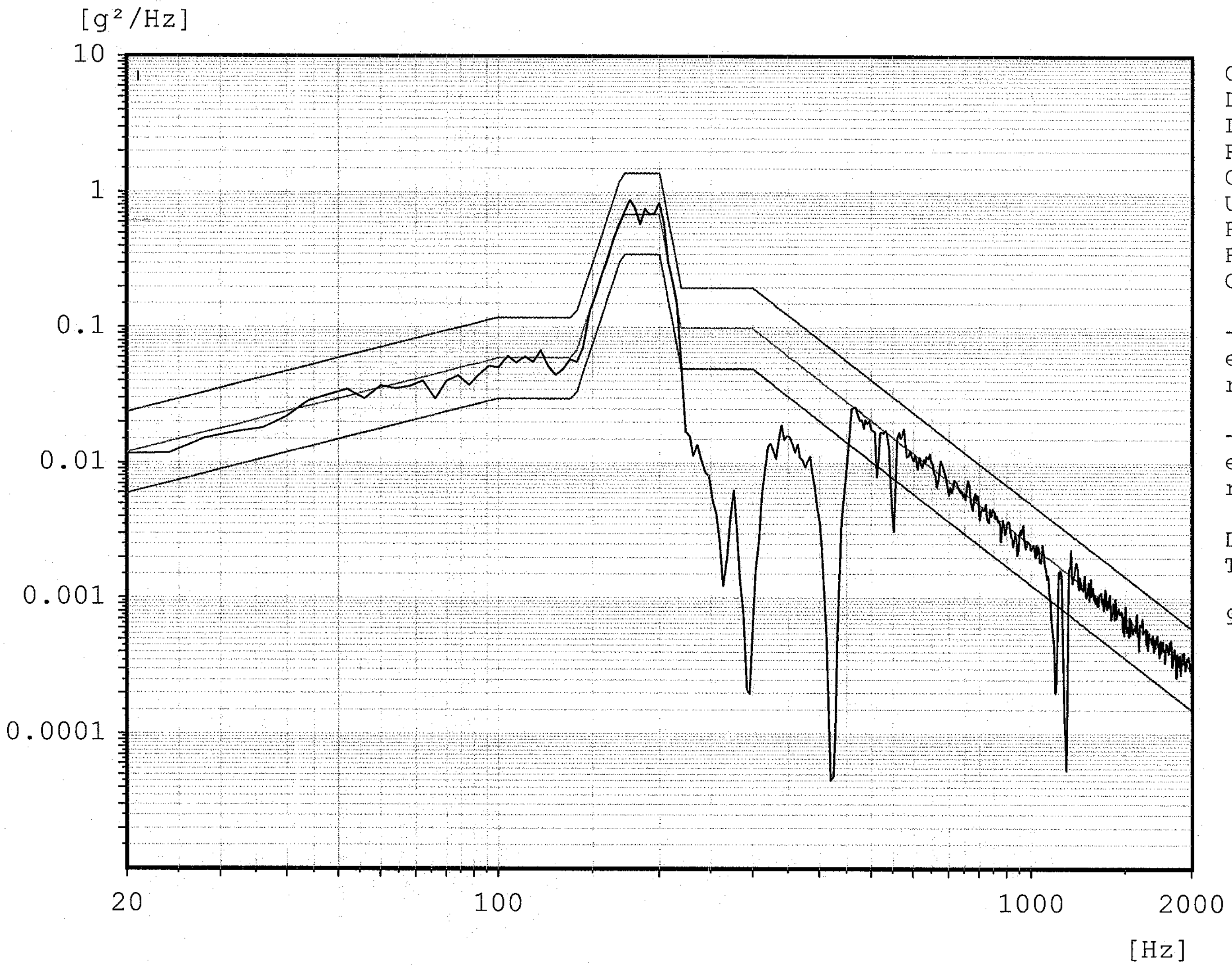
SPIRE BDA

P/N 10209800-, S/N : 015

Control channel

0dB, Cold

JPL



Chan.type:	X
DOF:	180
Level:	0.0 dB
Resolution:	4 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	7.036 g
RMS (req.):	7.945 g
Contr.strat.:	Closed loop

-- Time on act. level --

elapsed:	000:02:00
remaining:	000:00:00

-- Time total --

elapsed:	000:03:06
remaining:	000:00:00

Date:	03-08-05
Time:	13:16:46

964#2/ Amp#1/ M+P#2

C:\VcpNT\Daten\m+p\SPIRE\BDA\101713 run 4 xax.rrn

Random

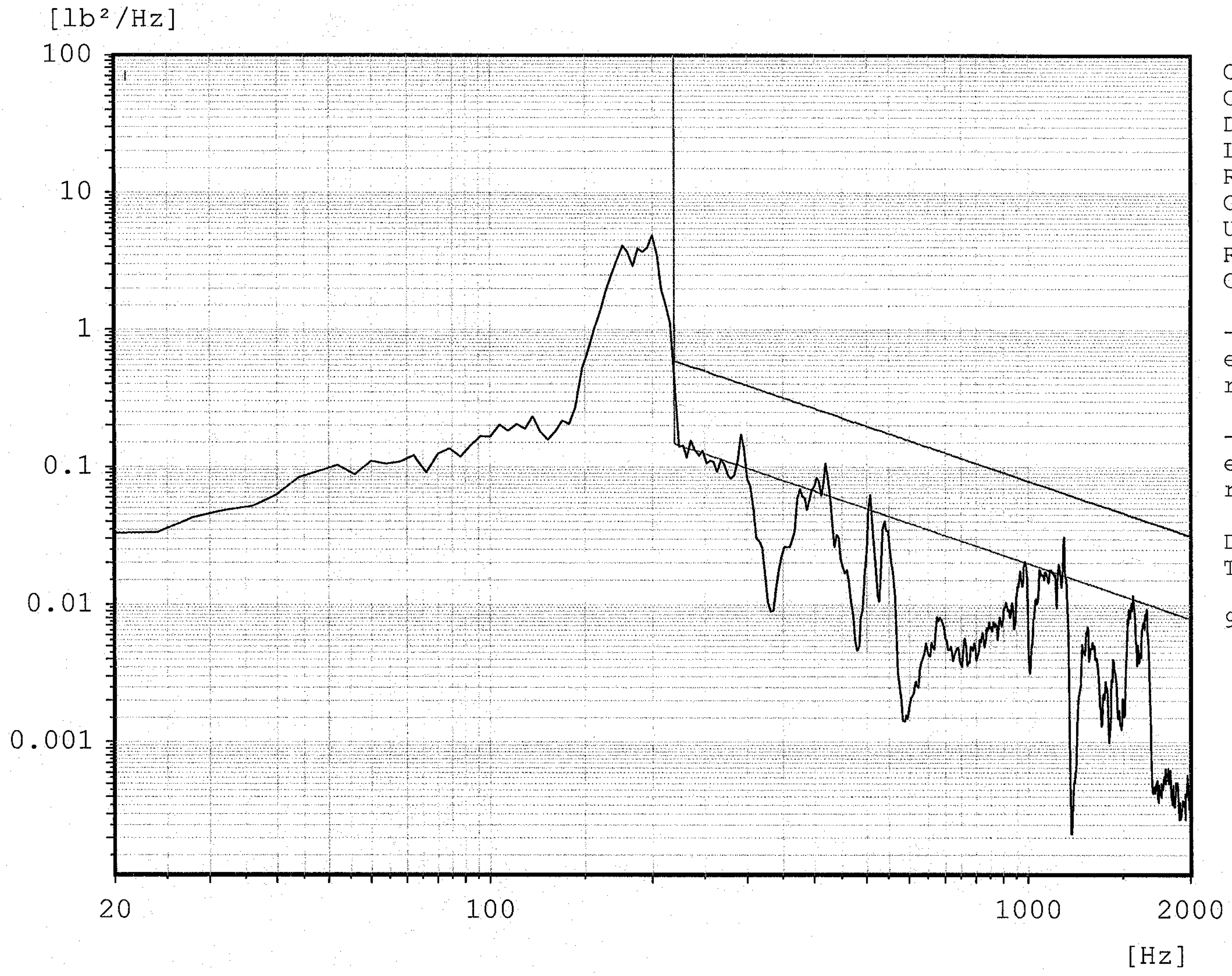
101713, Run # 4, X axis

SPIRE BDA

P/N 10209800-, S/N : 015

Force Sum X

0dB, Cold



Chan.no: 6
Chan.type: W
DOF: 90
Level: 0.0 dB
Resolution: 4 Hz
Contr.strat.: Maximum
Unit: lb²/Hz
RMS (act.): 15.31 lb
Contr.strat.: Closed loop

-- Time on act. level --
elapsed: 000:02:00
remaining: 000:00:00

-- Time total --
elapsed: 000:03:06
remaining: 000:00:00

Date: 03-08-05
Time: 13:16:46

964#2/ Amp#1/ M+P#2

C:\VcpNT\Daten\m+p\SPIRE\BDA\101713 run 4 xax.rrn

Random

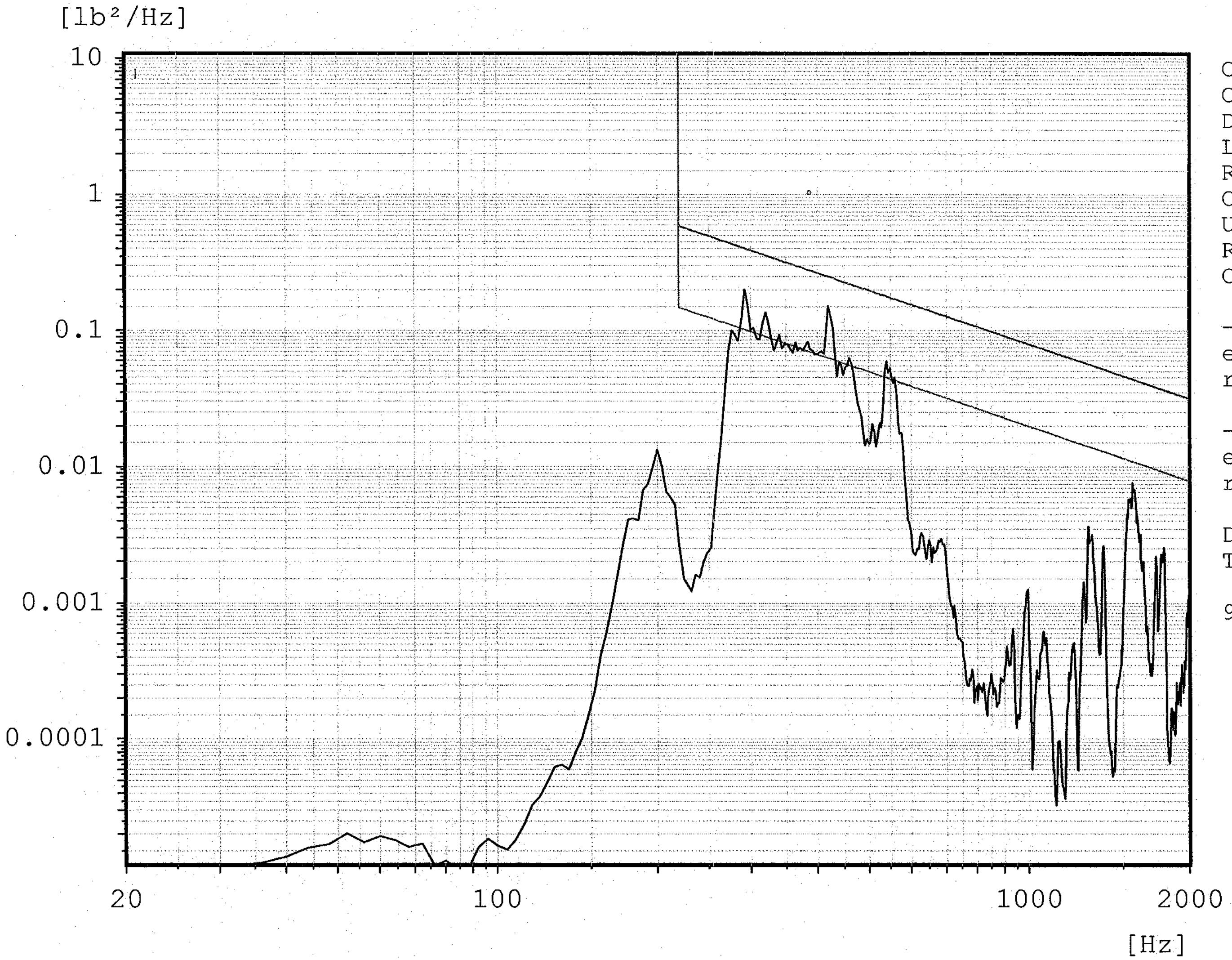
101713, Run # 4, X axis

SPIRE BDA

P/N 10209800-, S/N : 015

Force Sum Y

0dB, Cold



Chan.no: 7
Chan.type: W
DOF: 90
Level: 0.0 dB
Resolution: 4 Hz
Contr.strat.: Maximum
Unit: lb²/Hz
RMS (act.): 4.762 lb
Contr.strat.: Closed loop

-- Time on act. level --
elapsed: 000:02:00
remaining: 000:00:00

-- Time total --
elapsed: 000:03:06
remaining: 000:00:00

Date: 03-08-05
Time: 13:16:46

964#2/ Amp#1/ M+P#2

C:\VcpNT\Daten\m+p\SPIRE\BDA\101713 run 4 xax.rrn

Random

101713, Run # 4, X axis

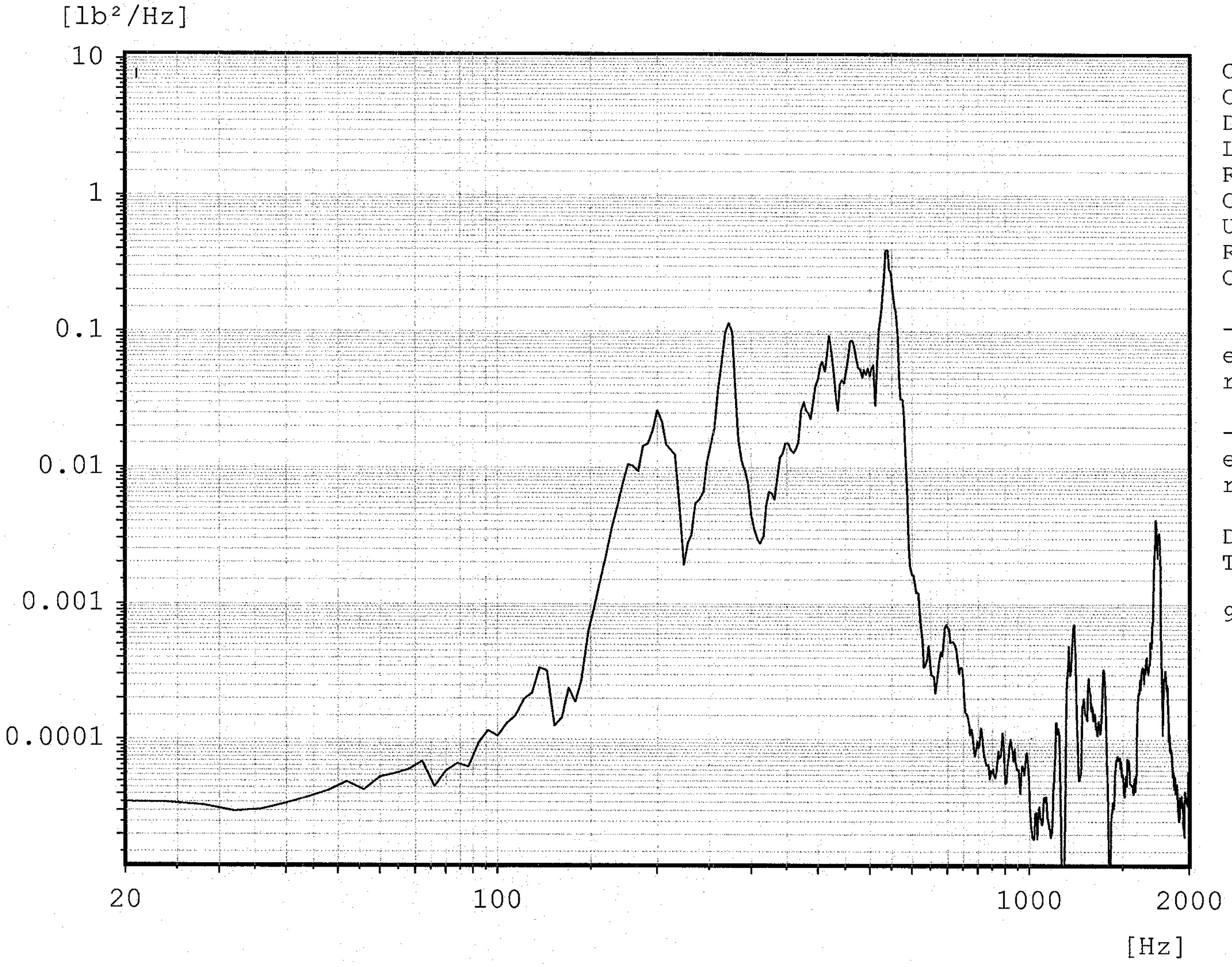
SPIRE BDA

P/N 10209800-, S/N : 015

Force Sum Z

0dB, Cold

JPL



Chan.no:	8
Chan.type:	W
DOF:	90
Level:	0.0 dB
Resolution:	4 Hz
Contr.strat.:	Maximum
Unit:	lb²/Hz
RMS (act.):	4.77 lb
Contr.strat.:	Closed loop

-- Time on act. level --

elapsed:	000:02:00
remaining:	000:00:00

-- Time total --

elapsed:	000:03:06
remaining:	000:00:00

Date:	03-08-05
Time:	13:16:46

964#2/ Amp#1/ M+P#2

C:\VcpNT\Daten\m+p\SPIRE\BDA\101713 run 4 xax.rrn

Sine

101713, Run # 6, X axis

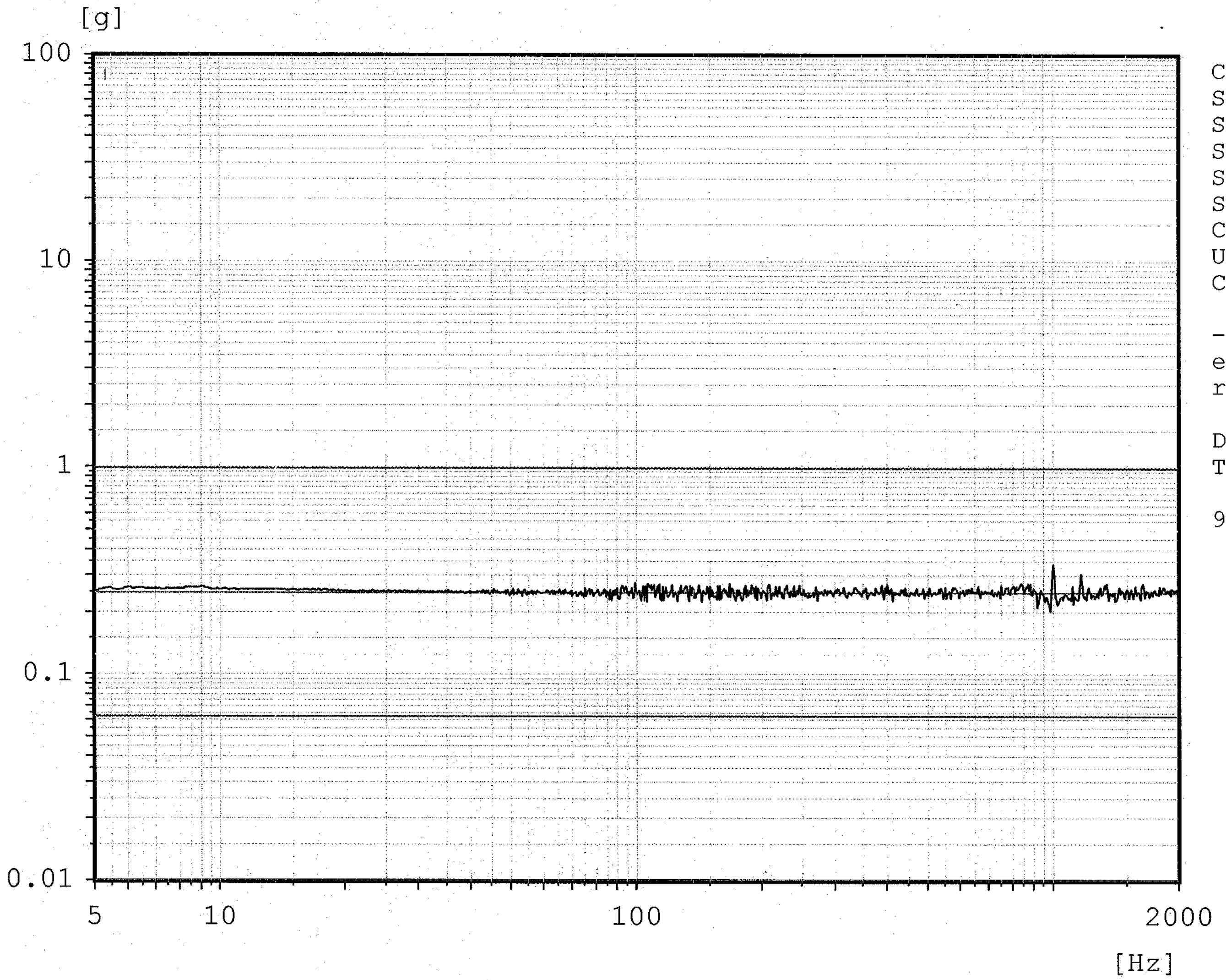
Spire BDA

P/N 10209800-, S/N : 015

Control channel

After Shake, Cold

JPL



Chan.type: X
Sweep type: logarithmic
Sweeps done: 1
Sweeps req.: 1
Sweep direct.: up
Sweep rate: 4.00 Oct/min
Contr.strat.: Maximum
Unit: g
Contr.strat.: Closed loop

-- Testing time --
elapsed: 000:02:09
remaining: 000:00:00

Date: 03-08-05
Time: 13:30:26

964#2/Amp #1/ M+P #2

C:\VcpNT\Daten\m+p\SPIRE\BDA\101713 run 6 xax.rsn

Sine

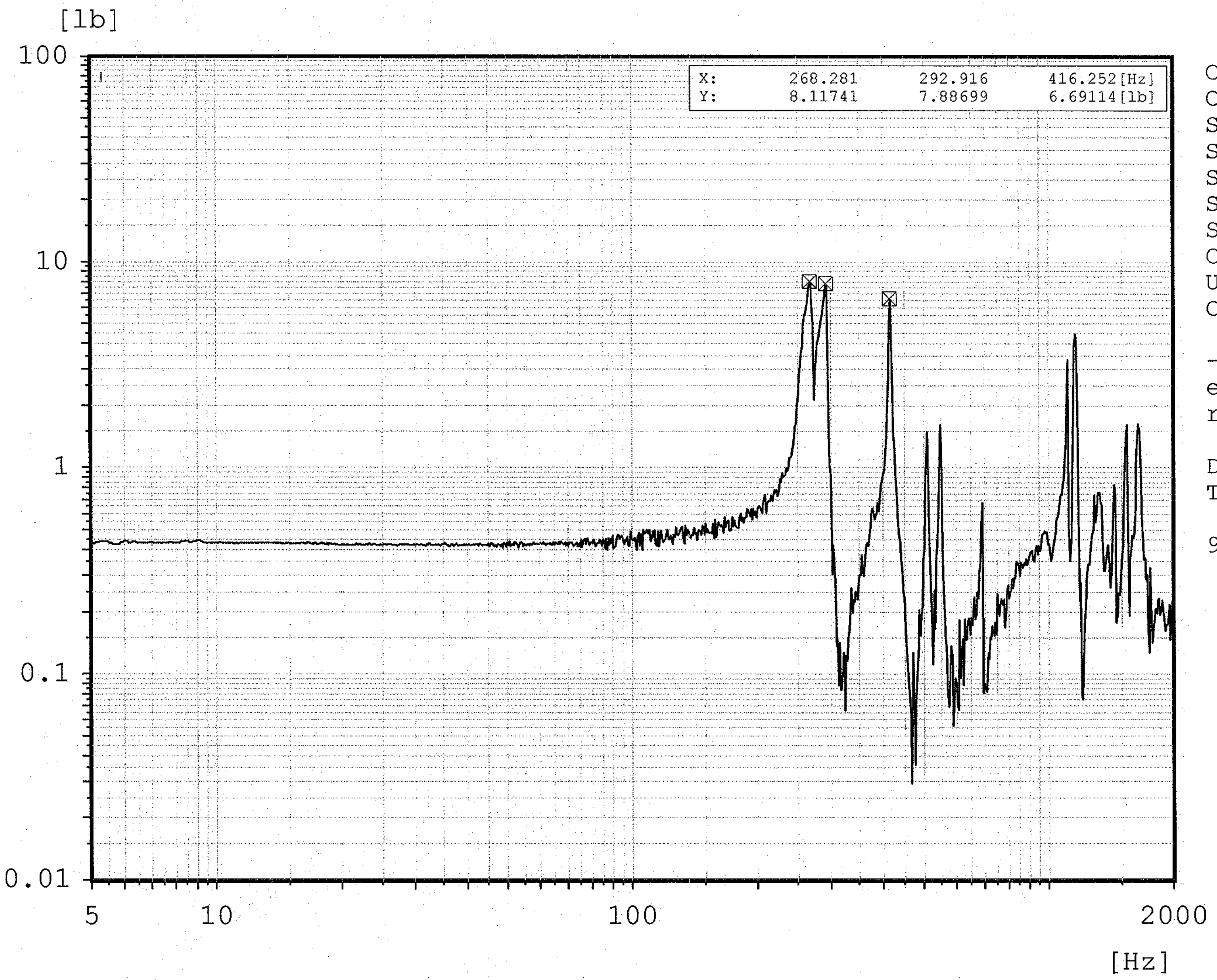
101713, Run # 6, X axis

Spire BDA

P/N 10209800-, S/N : 015

Force Sum X

After Shake, Cold



Chan.no: 6
Chan.type: W RMS
Sweep type: logarithmic
Sweeps done: 1
Sweeps req.: 1
Sweep direct.: up
Sweep rate: 4.00 Oct/min
Contr.strat.: Maximum
Unit: lb
Contr.strat.: Closed loop

-- Testing time --
elapsed: 000:02:09
remaining: 000:00:00

Date: 03-08-05
Time: 13:30:26

964#2/Amp #1/ M+P #2

C:\VcpNT\Daten\m+p\SPIRE\BDA\101713 run 6 xax.rsn

Sine

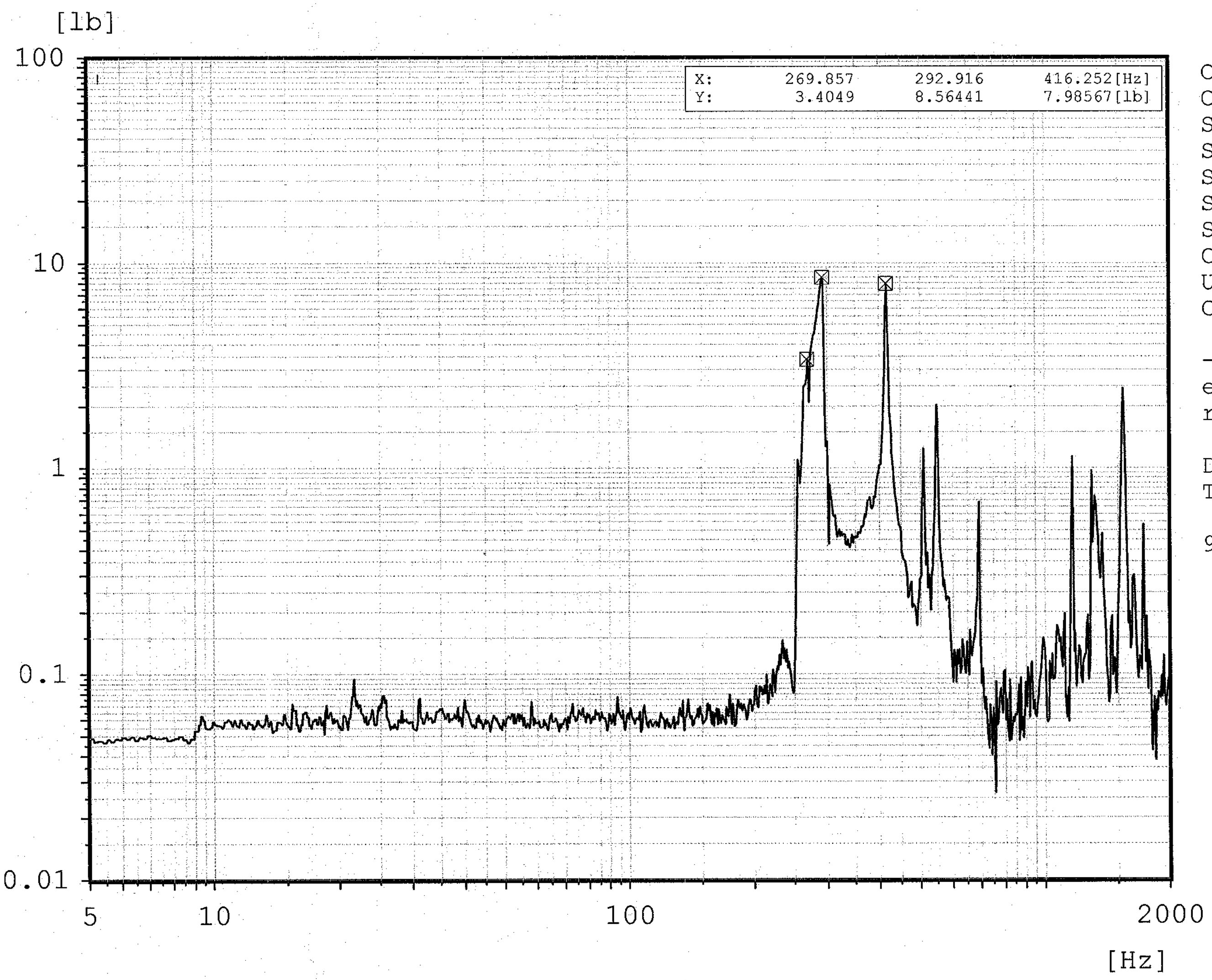
101713, Run # 6, X axis

Spire BDA

P/N 10209800-, S/N : 015

Force Sum Y

After Shake, Cold



Chan.no: 7
Chan.type: W RMS
Sweep type: logarithmic
Sweeps done: 1
Sweeps req.: 1
Sweep direct.: up
Sweep rate: 4.00 Oct/min
Contr.strat.: Maximum
Unit: lb
Contr.strat.: Closed loop

-- Testing time --
elapsed: 000:02:09
remaining: 000:00:00

Date: 03-08-05
Time: 13:30:26

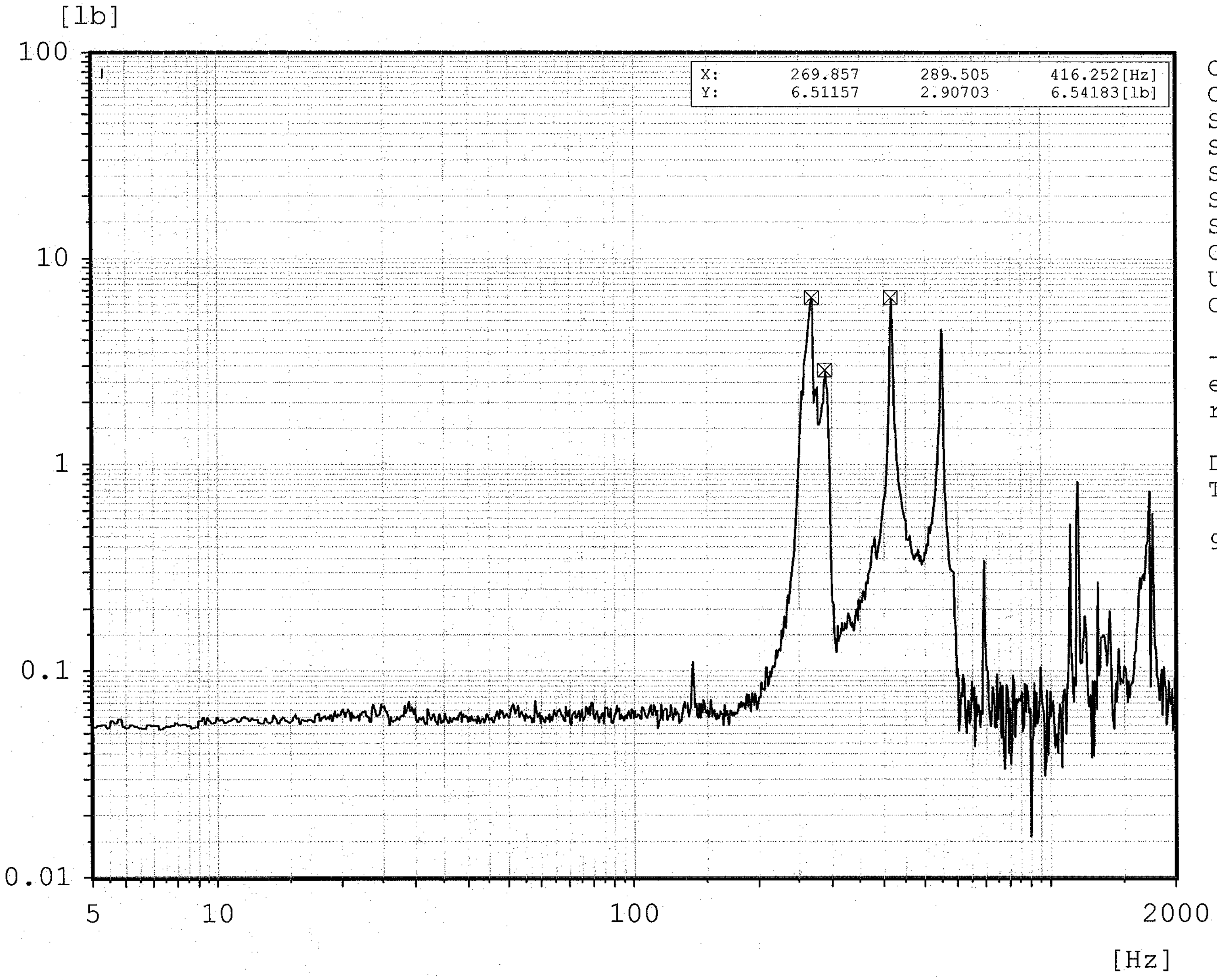
964#2/Amp #1/ M+P #2

C:\VcpNT\Daten\m+p\SPIRE\BDA\101713 run 6 xax.rsn

Sine
101713, Run # 6, X axis
Spire BDA
P/N 10209800-, S/N : 015

Force Sum Z

After Shake, Cold



Chan.no: 8
Chan.type: W RMS
Sweep type: logarithmic
Sweeps done: 1
Sweeps req.: 1
Sweep direct.: up
Sweep rate: 4.00 Oct/min
Contr.strat.: Maximum
Unit: lb
Contr.strat.: Closed loop

-- Testing time --
elapsed: 000:02:09
remaining: 000:00:00

Date: 03-08-05
Time: 13:30:26

964#2/Amp #1/ M+P #2

C:\VcpNT\Daten\m+p\SPIRE\BDA\101713 run 6 xax.rsn

PERFORMANCE VERIFICATION MATRIX - FS SLW BDA - 10209800-4 S/N 015

BDA Performance

Item	D. Value	Min Perf	Measured Median	Unit	Reference	Note
Number of bad optical pixels	= 2	= 5	1		BDA-PER-01	mod. noisy detector
(NEPphoton/NEPtotal)^2 (derived)	> 0.60	> 0.50	0.645		BDA-PER-02	at 30 mVrms bias
Optical efficiency*	> 0.7		0.82		BDA-PER-05	
Detector time constant	< 4.2	< 14	4.0	ms	BDA-PER-07	at 20 mV bias
Vmax***	< 17***		11.0	mVrms	BDA-DRCU-22	
Calibration uniformity**	> 0.99	> 0.99	N/M		BDA-PER-08	
Cross-talk (n-n)**	< 0.01	< 0.05	N/M		BDA-PER-09	
Cross-talk (non n-n)**	< 0.001	< 0.001	N/M		BDA-PER-09	
1/f knee frequency	< 30	< 100	64	mHz	BDA-PER-10	at 21.2 mV bias
Average conducted heat load from 1.7 K	< 1.6	< 3.0	< 1.4	uW	BDA-TEC-06	

BDA Design Values (at 300 mK)

Item	Target	Measured Median	Unit	Reference	Note
R0	180.0	105.7	Ohms	BDA-SSSD	
Delta	41.8	42.8	K	BDA-SSSD	
R300	24.0	16.7	MOhms	BDA-SSSD	
G300	170.0	205.8	pW/K	BDA-SSSD	
Beta	1.50	1.49		BDA-SSSD	
C300	1.00	0.95	pJ/K	BDA-SSSD	
Rlr	10.0	8.2	MOhms	BDA-SSSD	room temp
Dark Sdc	4.1	3.2	e8 V/W	BDA-SSSD	at 21.2 mV bias
Dark NEP (model), incl 9 nV/rtHz amp. noise		5.5	e-17 W/rtHz		at 21.2 mV bias
Dark NEP (1 Hz), incl 9 nV/rtHz amp. noise	5.6	5.6	e-17 W/rtHz	derived	at 21.2 mV bias
Dark NEP (0.1 Hz), incl 9 nV/rtHz amp. noise	5.6	6.8	e-17 W/rtHz	derived	at 21.2 mV bias
Vmax	10.3	9.5	mVrms	BDA-SSSD	SSSD value in error
BDA temperature rise from 1.7 K	< 10	10.2	mK	BDA-HCO-1	
BDA thermal time constant	~ 100	130	s	BDA-HCO-2	

*assumes νlower = 1.02 νcutoff

**not tested

***Thermistor values are not included

T1 saturates (> 17mVrms) at **46.4** mVrms bias

T1 saturates (> 17mVrms) at **44.0** mVrms bias

Problem Channels

			Pixel functional at			
	Pixel	**Diagnosis**	**300 K**	**4 K**	**0.3 K**	**Notes**
	DK1	BDA Dead	No	No	No	Pixel Dead in Fabrication
	DK2	not dark	Yes	Yes	Yes	Light leaks into dark channel
	D4	Moderately BDA noisy	Yes	Yes	Yes	BoDAC channel was quiet from previous units

Pixel Performance

Item	DV	MP								
BDA connector			J05	J05	J05	J05	J05	J05	J05	J05
BDA pins			1,26	2,27	3,28	4,29	5,30	6,31	7,32	8,33
BoDAC Connector			4	4	4	4	4	4	4	4
Channel ID			**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Detector ID			**R1**	**T1**	**C1**	**DK1**	**B1**	**D1**	**E1**	**A1**
BDA Pixel Operability			Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
BoDAC channel Operability	N/A	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Noisy BoDAC channel	N/A	N/A	No	No	No	No	No	No	No	No
(NEPphoton/NEPtotal)^2 (derived)	> 0.60	> 0.50	N/M	N/A	0.62	N/M	0.64	0.64	0.64	0.62
Optical efficiency*	> 0.7		N/M	N/A	0.83	N/M	0.84	0.85	0.81	0.82
Detector time constant	< 4.2	< 14	N/M	N/A	4.19	N/M	4.50	3.50	3.85	4.63
Calibration uniformity**	> 0.99	> 0.99	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cross-talk (n-n)**	< 0.01	< 0.05	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cross-talk (non n-n)**	< 0.001	< 0.001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1/f knee frequency	< 30	< 100	< 30	73	< 100	N/A	64	55	82	82

Pixel Design Values

Item	Target								
R0	180.0	5.60E+06	89.60	92.12	N/M	102.90	113.62	99.70	89.25
Delta	41.8	0.00	40.04	42.56	N/M	42.92	42.69	43.03	42.67
G300	170	N/A	N/A	211.26	N/M	208.75	207.07	208.81	202.42
Beta	1.5	N/A	N/A	1.49	N/M	1.49	1.48	1.48	1.52
C300	1.00	N/A	N/A	1.03	N/M	1.08	0.83	0.93	1.10
Gamma	1 (fixed)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
R300	24.1	5.7	9.3	13.7	N/M	16.1	17.2	15.8	13.5
Rlr+	10.0	8.2	8.1	8.0	8.1	8.2	8.2	8.2	8.1
Rlr-	10.0	8.1	8.0	8.1	8.2	8.1	8.1	8.1	8.2
Dark Sdc	2.2	N/A	N/A	3.0	N/M	3.2	3.2	3.2	3.0
Dark NEP (model), incl 9 nV/rtHz amp. noise		N/A	N/A	5.7	N/M	5.5	5.5	5.5	5.6
Dark NEP (1 Hz), incl 9 nV/rtHz amp. noise	5.6	N/A	N/A	5.79	N/M	5.84	6.21	5.39	5.56
Dark NEP (0.1 Hz), incl 9 nV/rtHz amp. noise	5.6	N/A	N/A	9.74	N/M	7.31	7.99	6.49	7.31
Vmax	11.4	N/A	***	8.62	N/M	9.26	9.55	9.18	8.39

*assumes νlower = 1.02 νcutoff

**not tested

***T1 saturates (> 17mVrms) at **46.4** mVrms bias

***T1 saturates (> 17mVrms) at **44.0** mVrms bias

Pixel Performance										
Item										
BDA connector	J05	J05	J05	J05	J05	J05	J05	J05	J05	J05
BDA pins	9,34	10,35	11,36	12,37	13,38	14,39	15,40	16,41	17,42	18,43
BoDAC Connector	4	4	4	4	4	4	4	4	4	4
Channel ID	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
Detector ID	**C2**	**D2**	**B2**	**E2**	**A2**	**C3**	**D3**	**B3**	**E3**	**C4**
BDA Pixel Operability	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BoDAC channel Operability	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Noisy BoDAC channel	No	No	No	No	No	No	Yes	No	No	No
(NEPphoton/NEPtotal)^2 (derived)	0.63	0.65	0.63	0.62	0.65	0.66	0.65	0.65	0.65	0.67
Optical efficiency*	0.83	0.82	0.82	0.85	0.82	0.71	0.80	0.83	0.81	0.78
Detector time constant	3.95	3.75	4.00	3.79	4.50	3.82	3.70	4.22	3.83	5.15
Calibration uniformity**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cross-talk (n-n)**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cross-talk (non n-n)**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1/f knee frequency	73	55	73	64	55	55	46	64	73	92
Pixel Design Values										
Item										
R0	99.53	122.63	94.74	94.79	110.53	130.70	118.65	106.39	108.19	199.12
Delta	42.49	43.26	42.66	42.15	43.11	43.30	43.29	43.22	43.10	41.59
G300	207.96	208.06	212.78	204.96	207.25	208.72	205.95	205.62	203.51	164.95
Beta	1.49	1.48	1.48	1.48	1.50	1.50	1.49	1.50	1.48	1.71
C300	0.96	0.88	0.99	0.91	1.07	0.89	0.86	1.00	0.90	0.97
Gamma	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
R300	14.7	20.1	14.3	13.3	17.8	21.6	19.6	17.4	17.4	25.8
Rlr+	8.2	8.2	8.2	8.2	8.2	8.4	8.2	8.2	8.2	8.2
Rlr-	8.1	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Dark Sdc	3.1	3.4	3.0	3.0	N/M	3.5	3.4	3.3	3.3	4.1
Dark NEP (model), incl 9 nV/rtHz amp. noise	5.6	5.4	5.7	5.6	5.5	5.4	5.4	5.4	5.4	4.8
Dark NEP (1 Hz), incl 9 nV/rtHz amp. noise	5.31	5.43	5.45	5.69	5.53	5.61	7.40	5.45	5.48	5.57
Dark NEP (0.1 Hz), incl 9 nV/rtHz amp. noise	6.84	6.30	6.70	7.06	6.80	6.38	8.10	6.60	6.74	7.60
Vmax	8.86	10.30	8.83	8.40	9.68	10.69	10.11	9.53	9.48	11.03
*assumes νlower = 1.02 νcutoff										
**not tested										
***T1 saturates (> 17mVrms) at **46.4** mVrms bias										
***T1 saturates (> 17mVrms) at **44.0** mVrms bias										

Pixel Performance

Item							Unit	Reference
BDA connector	J05	J05	J05	J05	J05	J05		
BDA pins	19,44	20,45	21,46	22,47	23,48	24,49		
BoDAC Connector	4	4	4	4	4	4		
Channel ID	**19**	**20**	**21**	**22**	**23**	**24**		
Detector ID	**DK2**	**D4**	**C5**	**B4**	**A3**	**T2**		
BDA Pixel Operability	Yes	M. Noisy	Yes	Yes	Yes	Yes		
BoDAC channel Operability	Yes	Yes	Yes	Yes	Yes	Yes		
Noisy BoDAC channel	No	No	No	No	No	No		
(NEPphoton/NEPtotal)^2 (derived)	0.67	0.63	0.64	0.66	0.65	N/A		BDA-PER-02
Optical efficiency*	N/M	0.84	0.83	0.85	0.79	N/A		BDA-PER-05
Detector time constant	3.28	3.65	4.26	4.07	5.28	N/A	ms	BDA-PER-07
Calibration uniformity**	N/A	N/A	N/A	N/A	N/A	N/A		BDA-PER-08
Cross-talk (n-n)**	N/A	N/A	N/A	N/A	N/A	N/A		BDA-PER-09
Cross-talk (non n-n)**	N/A	N/A	N/A	N/A	N/A	N/A		BDA-PER-09
1/f knee frequency	82	137	73	27	37	64	mHz	BDA-PER-10

Pixel Design Values

Item							Unit	Reference
R0	189.99	96.29	97.52	122.59	111.12	104.95	Ohms	BDA-SSSD
Delta	41.56	42.74	42.99	43.37	43.41	39.72	K	BDA-SSSD
G300	172.37	203.05	202.37	203.62	202.24	N/A	pW/K	BDA-SSSD
Beta	1.66	1.50	1.51	1.50	1.50	N/A		BDA-SSSD
C300	0.64	0.87	1.00	0.94	1.22	N/A	pJ/K	BDA-SSSD
Gamma	1.0	1.0	1.0	1.0	1.0	1.0		
R300	24.6	14.7	15.4	20.4	18.6	10.4	MOhms	BDA-SSSD
Rlr+	8.3	8.3	8.2	8.2	8.3	8.3	MOhms	BDA-SSSD
Rlr-	8.2	8.2	8.2	8.3	8.3	8.2	MOhms	BDA-SSSD
Dark Sdc	3.9	3.1	3.2	3.5	3.4	N/A	e8 V/W	BDA-SSSD
Dark NEP (model), incl 9 nV/rtHz amp. noise	4.9	5.5	5.5	5.3	5.4	N/A		
Dark NEP (1 Hz), incl 9 nV/rtHz amp. noise	4.91	8.74	5.39	7.28	6.88	N/A	-17 W/rtH	derived
Dark NEP (0.1 Hz), incl 9 nV/rtHz amp. noise	6.57	15.57	6.64	8.27	8.34	N/A	-17 W/rtH	derived
Vmax	10.65	8.75	8.93	10.27	9.77	***	mVrms	BDA-DRCU-22

*assumes νlower = 1.02 νcutoff

**not tested

***T1 saturates (> 17mVrms) at **46.4** mVrms bias

***T1 saturates (> 17mVrms) at **44.0** mVrms bias

Pixel Performance	
Item	**Note**
BDA connector	
BDA pins	
BoDAC Connector	
Channel ID	
Detector ID	
BDA Pixel Operability	
BoDAC channel Operability	
Noisy BoDAC channel	
(NEPphoton/NEPtotal)^2 (derived)	at 30 mV bias
Optical efficiency*	
Detector time constant	at 28 mV bias
Calibration uniformity**	
Cross-talk (n-n)**	
Cross-talk (non n-n)**	
1/f knee frequency	at 21.2 mV bias
Pixel Design Values	
Item	**Note**
R0	
Delta	
G300	
Beta	
C300	
Gamma	
R300	
Rlr+	room temp
Rlr-	room temp
Dark Sdc	at 21.2 mV bias
Dark NEP (model), incl 9 nV/rtHz amp. noise	
Dark NEP (1 Hz), incl 9 nV/rtHz amp. noise	at 21.2 mV bias
Dark NEP (0.1 Hz), incl 9 nV/rtHz amp. noise	at 21.2 mV bias
Vmax	
*assumes νlower = 1.02 νcutoff	
**not tested	
***T1 saturates (> 17mVrms) at **46.4** mVrms bias	
***T1 saturates (> 17mVrms) at **44.0** mVrms bias	

Symbol	Units	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
T0	K	0.3	Base Temperature				Note: Corrected for sqrt(2) demodulation factor							
Vn	nV/rtHz	9	Amplifier Voltage Noise				corrected for ETF in Johnson and load resistor terms							
Q	pW	0	Absorbed Power Onto Bolometer				assumes only first harmonic of amplifier, Johnson, and LR propagates							
NEP$_{photon}$	1e-17 W/rtHz	0.00	Noise in Absorbed Optical Power				added 2 more iterations of the recursion solver							
Vbias	mV	21.2	Bias Across Bolometer & Load Resistors				added variable gain to scale measured noise							
Gain		81000					NEPs checked with standard spreadsheet							
Detector ID		**Target**	**R1**	**T1**	**C1**	**DK1**	**B1**	**D1**	**E1**	**A1**	**C2**	**D2**	**B2**	**E2**
Pthermal	pW	5.440	N/A	#VALUE!	6.234	#VALUE!	6.433	6.508	6.393	6.100	6.242	6.628	6.205	6.031
Pelec+Q	pW	5.440	N/A	#VALUE!	6.234	#VALUE!	6.433	6.508	6.393	6.100	6.242	6.628	6.205	6.031
Tbolo	K	0.32975	N/A	#VALUE!	0.32759	#VALUE!	0.32874	0.32929	0.32857	0.32810	0.32803	0.32965	0.32729	0.32753
T/T0		1.099	N/A	#VALUE!	1.092	#VALUE!	1.096	1.098	1.095	1.094	1.093	1.099	1.091	1.092
Rbolo	Ω	1.40E+07	5.07E+06	#VALUE!	8.21E+06	#VALUE!	9.44E+06	1.00E+07	9.30E+06	8.00E+06	8.73E+06	1.16E+07	8.60E+06	8.01E+06
Vbolo	mV	8.72	5.03	#VALUE!	7.15	#VALUE!	7.79	8.07	7.71	6.99	7.38	8.76	7.31	6.95
Ibolo	nA	0.62	0.99	#VALUE!	0.87	#VALUE!	0.83	0.81	0.83	0.87	0.85	0.76	0.85	0.87
A		-5.63	N/A	#VALUE!	-5.70	#VALUE!	-5.71	-5.69	-5.72	-5.70	-5.69	-5.73	-5.71	-5.67
C	pJ/K	1.10	N/A	#VALUE!	1.13	#VALUE!	1.19	0.91	1.02	1.21	1.04	0.97	1.08	0.99
G	pW/K	195.9	N/A	#VALUE!	240.8	#VALUE!	239.2	237.6	239.0	231.9	237.6	239.3	242.1	233.4
Z/R		0.357	1.000	#VALUE!	0.379	#VALUE!	0.363	0.357	0.364	0.373	0.374	0.350	0.382	0.382
τ	ms	5.175	N/A	#VALUE!	4.090	#VALUE!	4.420	3.444	3.780	4.499	3.862	3.732	3.912	3.691
Sdc	V/W	4.12E+08	N/A	#VALUE!	2.99E+08	#VALUE!	3.19E+08	3.27E+08	3.17E+08	3.04E+08	3.09E+08	3.44E+08	3.03E+08	3.00E+08
NEP$_{johnson}$	1e-17 W/rtHz	2.276	N/A	#VALUE!	2.703	#VALUE!	2.598	2.557	2.605	2.658	2.655	2.472	2.698	2.693
NEP$_{phonon}$	1e-17 W/rtHz	3.174	N/A	#VALUE!	3.515	#VALUE!	3.506	3.496	3.504	3.448	3.492	3.509	3.524	3.460
NEP$_{load}$	1e-17 W/rtHz	1.814	N/A	#VALUE!	1.846	#VALUE!	1.892	1.913	1.882	1.782	1.856	1.979	1.873	1.800
NEP$_{amp}$	1e-17 W/rtHz	2.182	N/A	#VALUE!	3.013	#VALUE!	2.825	2.755	2.837	2.963	2.916	2.613	2.972	2.996
NEP$_{det}$	1e-17 W/rtHz	4.828	N/A	#VALUE!	5.669	#VALUE!	5.532	5.478	5.537	5.560	5.585	5.401	5.660	5.607
DQE		0.000	N/A	#VALUE!	0.000	#VALUE!	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Vn(det)	nV/rtHz	19.9	12.13	#VALUE!	16.9	#VALUE!	17.6	17.9	17.6	16.9	17.2	18.6	17.1	16.8
Vn(total)	nV/rtHz	19.9	12.1	#VALUE!	16.9	#VALUE!	17.6	17.9	17.6	16.9	17.2	18.6	17.1	16.8
Vn(measured) at 1Hz (no T/C)			12.6	15.6	17.3	N/M	18.6	20.3	17.1	16.9	16.4	18.7	16.5	17.1
NEP(measured) at 1Hz (no T/C)			N/A	N/M	5.79	N/M	5.84	6.21	5.39	5.56	5.31	5.43	5.45	5.69
Vn(measured) at 0.1Hz (no T/C)			13.7	19.5	29.1	N/M	23.3	26.1	20.6	22.2	21.1	21.7	20.3	21.2
NEP(measured) at 0.1Hz (No T/C)			N/A	N/M	9.74	N/M	7.31	7.99	6.49	7.31	6.84	6.30	6.70	7.06
Vn(measured) at 1Hz (T/C)			12.6	17.2	18.3	N/M	21.8	22.1	18	18.1	17.4	18.8	17.6	18.5
NEP(measured) at 1Hz (T/C)			N/A	N/M	6.13	N/M	6.84	6.76	5.67	5.96	5.64	5.46	5.81	6.16
Vn(measured) at 0.1Hz (T/C)			13.7	22.1	29.9	N/M	87.8	27.9	28	26.9	22.7	22.5	26.9	27.8
NEP(measured) at 0.1Hz (T/C)			N/A	N/M	10.01	N/M	27.56	8.54	8.83	8.86	7.36	6.53	8.88	9.26

Symbol	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
T0												
Vn												
Q												
NEP_{photon}												
Vbias												
Gain												
Detector ID	**A2**	**C3**	**D3**	**B3**	**E3**	**C4**	**DK2**	**D4**	**C5**	**B4**	**A3**	**T2**
Pthermal	6.487	6.628	6.596	6.442	6.426	6.784	6.730	6.142	6.285	6.599	6.461	#VALUE!
Pelec+Q	6.487	6.628	6.596	6.442	6.426	6.784	6.730	6.142	6.285	6.599	6.461	#VALUE!
Tbolo	0.32915	0.32954	0.32979	0.32917	0.32941	0.33710	0.33548	0.32822	0.32892	0.33011	0.32970	#VALUE!
T/T0	1.097	1.098	1.099	1.097	1.098	1.124	1.118	1.094	1.096	1.100	1.099	#VALUE!
Rbolo	1.03E+07	1.24E+07	1.12E+07	1.01E+07	1.00E+07	1.33E+07	1.30E+07	8.70E+06	9.00E+06	1.17E+07	1.07E+07	#VALUE!
Vbolo	8.18	9.07	8.60	8.06	8.03	9.49	9.34	7.31	7.52	8.77	8.31	#VALUE!
Ibolo	0.79	0.73	0.77	0.80	0.80	0.72	0.72	0.84	0.84	0.75	0.78	#VALUE!
A	-5.72	-5.73	-5.73	-5.73	-5.72	-5.55	-5.57	-5.71	-5.72	-5.73	-5.74	#VALUE!
C	1.17	0.98	0.95	1.10	0.98	1.09	0.72	0.95	1.10	1.03	1.34	#VALUE!
G	238.1	240.3	237.1	236.2	233.8	201.3	207.4	232.4	232.4	235.0	233.1	#VALUE!
Z/R	0.357	0.352	0.348	0.356	0.354	0.286	0.300	0.370	0.361	0.344	0.349	#VALUE!
τ	4.437	3.808	3.674	4.162	3.771	5.097	3.248	3.567	4.164	4.047	5.216	#VALUE!
Sdc	3.31E+08	3.51E+08	3.43E+08	3.30E+08	3.32E+08	4.05E+08	3.93E+08	3.13E+08	3.19E+08	3.50E+08	3.42E+08	#VALUE!
$NEP_{johnson}$	2.540	2.447	2.474	2.539	2.527	2.141	2.207	2.624	2.584	2.438	2.482	#VALUE!
NEP_{phonon}	3.498	3.515	3.493	3.485	3.468	3.220	3.269	3.454	3.455	3.477	3.462	#VALUE!
NEP_{load}	1.922	2.020	1.950	1.898	1.883	1.818	1.852	1.820	1.830	1.952	1.901	#VALUE!
NEP_{amp}	2.718	2.562	2.622	2.724	2.709	2.220	2.291	2.871	2.819	2.568	2.634	#VALUE!
NEP_{det}	5.456	5.384	5.385	5.441	5.413	4.815	4.923	5.511	5.469	5.333	5.357	#VALUE!
DQE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	#VALUE!
Vn(det)	18.1	18.9	18.5	18.0	18.0	19.5	19.3	17.3	17.5	18.7	18.3	#VALUE!
Vn(total)	18.1	18.9	18.5	18.0	18.0	19.5	19.3	17.3	17.5	18.7	18.3	#VALUE!
Vn(measurec	18.3	19.8	25.9	18	18.2	22.6	19.9	27.4	17.2	25.5	25.5	16.4
NEP(measur	5.53	5.64	7.55	5.45	5.48	5.57	5.07	8.74	5.39	7.28	7.46	N/M
Vn(measurec	22.9	22.4	27.8	21.8	22.4	32.2	29.9	48.8	21.2	29	29	19.6
NEP(measur	6.92	6.38	8.10	6.60	6.74	7.94	7.61	15.57	6.64	8.27	8.49	N/M
Vn(measurec	19	19.7	25.4	18.4	19	22.8	19.3	27.6	18.7	26.5	23.5	17.4
NEP(measur	5.74	5.61	7.40	5.57	5.72	5.62	4.91	8.81	5.86	7.56	6.88	N/M
Vn(measurec	22.5	24.9	35	22.7	28.4	30.8	25.8	71.8	46.8	32.8	28.5	21.4
NEP(measur	6.80	7.09	10.20	6.87	8.55	7.60	6.57	22.91	14.66	9.36	8.34	N/M

Symbol	Value	Value	Value	Value	Value	Value	Value
T0							
Vn							
Q							
NEP_{photon}							
Vbias							
Gain							
Detector ID							
Pthermal	Power as function of Temperature	$P_{thermal} = [G300/(1+\beta)][T/0.3]^{\beta}T$ evaluated from To to Tb					
Pelec+Q	Electrical + Absorbed Power	$P_e + Q = [V_{bias}/(2R_L + R_B)]^2R_B + Q$					
Tbolo	Bolometer Temperature	Solve for Tb using Newtonian recursion such that $P_{thermal} = P_e + Q$					
T/T0		$T/To = Tbolo/To$					
Rbolo	Bolometer Resistance	$Rbolo = (Ro)exp[(\Delta/Tb)^{1/2}]$					
Vbolo	Voltage across Bolometer	$Vbolo = [Vbias/(2R_L + R_B)]R_B$					
Ibolo	Current through Bolometer	$Ibolo = Vbias/(2R_L + R_B)$					
A		$A = (T/R)(dR/dT) = -(1/2)[(\Delta/Tb)^{1/2}]$					
C	Dynamic Heat Capacity	$C = C300[(T/0.3)^{\gamma}]$					
G	Dynamic Thermal Conductance	$G = G300[(T/0.3)^{\beta}]$					
Z/R		$Z/R = (I/V)(dV/dI) = [-1 - GTb/(P_eA)] / [1 - GTb/(P_eA)]$					
τ	Electrical Time Constant	$\tau = [C/2G][(Z/R + 1)(1 + 2R_L/R_B)] / [Z/R + 2R_L/R_B]$					
Sdc	Electrical Responsivity at 0 Hz	$Sdc = (1/2)[R_B/P_e]^{1/2} [1 - Z/R] / [1 + (Z/R)(R_B/2R_L)$					
$NEP_{johnson}$	Johnson Noise Prior to Demodulation	$NEP_{johnson} = [(4k(Tb)^3G^2)/(P_eA^2)]^{1/2}$					
NEP_{phonon}	Phonon Noise Prior to Demodulation	$=\{[(4kTo^2G)(\beta+1)((T/To)^{2\beta+3}-1)]/[(2\beta+3)(T/To)^{\beta}((T/To)^{\beta+1}-1)]\}^{1/2}$					
NEP_{load}	Johnson Noise from R_L Prior to Demod.	$NEP_{load} = [4kTo/2R_L]^{1/2} \vert 2(Z/R)R_BIbolo/[(Z/R) - 1]\vert$					
NEP_{amp}	Amplifier Noise Prior to Demodulation	$NEP_{amp} = Vn / Sdc$					
NEP_{det}	Detector Noise after Demodulation	$NEP_{det} = [2NEP_{john}{}^2+NEP_{phon}{}^2+2NEP_{load}{}^2+2NEP_{amp}{}^2]^{1/2}$					
DQE	BLIP Figure-of-Merit for Detector	$DQE = NEP_{photon}{}^2 / (NEP_{photon}{}^2 + NEP_{det}{}^2)$					
Vn(det)	Voltage Noise of Detector After Demod.	$Vn(det) = NEP_{det}Sdc$					
Vn(total)	Total Noise after Demodulation	$Vn(total) = [NEP_{det}{}^2 + NEP_{photon}{}^2]^{1/2}Sdc$					
Vn(measure							
NEP(measur							
Vn(measure							
NEP(measur							
Vn(measure							
NEP(measur							
Vn(measure							
NEP(measur							

Symbol	Units	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
T0	K	0.3	Base Temperature			Note: Corrected for sqrt(2) demodulation factor					
Vn	nV/rtHz	10	Amplifier Voltage Noise			corrected for ETF in Johnson and load resistor terms					
Q	pW	10.3	Absorbed Power Onto Bolometer			assumes only first harmonic of amplifier, Johnson, and LR propagates					
NEP_{photon}	1e-17 W/rtHz	10.50	Noise in Absorbed Optical Power			added 2 more iterations of the recursion solver					
Vbias	mV	30	Bias Across Bolometer & Load Resistors			added variable gain to scale measured noise					
Gain		81000				NEPs checked with standard spreadsheet					
Detector ID		**Target**	**R1**	**T1**	**C1**	**DK1**	**B1**	**D1**	**E1**	**A1**	**C2**
Pthermal	pW	18.188	N/A	#VALUE!	19.025	#VALUE!	19.557	19.788	19.457	18.693	19.106
Pelec+Q	pW	18.188	N/A	#VALUE!	19.025	#VALUE!	19.557	19.788	19.457	18.693	19.106
Tbolo	K	0.38713	N/A	#VALUE!	0.37541	#VALUE!	0.37798	0.37940	0.37766	0.37677	0.37668
T/T0		1.290	N/A	#VALUE!	1.251	#VALUE!	1.260	1.265	1.259	1.256	1.256
Rbolo	Ω	5.86E+06	5.07E+06	#VALUE!	3.88E+06	#VALUE!	4.37E+06	4.59E+06	4.31E+06	3.74E+06	4.08E+06
Vbolo	mV	6.80	7.12	#VALUE!	5.82	#VALUE!	6.36	6.60	6.28	5.60	5.99
Ibolo	nA	1.16	1.41	#VALUE!	1.50	#VALUE!	1.46	1.44	1.46	1.50	1.47
A		-5.20	N/A	#VALUE!	-5.32	#VALUE!	-5.33	-5.30	-5.34	-5.32	-5.31
C	pJ/K	1.29	N/A	#VALUE!	1.29	#VALUE!	1.37	1.05	1.17	1.39	1.20
G	pW/K	249.2	N/A	#VALUE!	294.8	#VALUE!	294.5	293.0	293.9	286.2	291.9
Z/R		0.404	1.000	#VALUE!	0.409	#VALUE!	0.386	0.377	0.389	0.414	0.403
τ	ms	4.202	N/A	#VALUE!	3.491	#VALUE!	3.696	2.858	3.171	3.842	3.273
Sdc	V/W	2.30E+08	N/A	#VALUE!	1.79E+08	#VALUE!	1.91E+08	1.96E+08	1.90E+08	1.78E+08	1.85E+08
$NEP_{johnson}$	1e-17 W/rtHz	3.766	N/A	#VALUE!	4.028	#VALUE!	3.937	3.903	3.941	4.018	3.994
NEP_{phonon}	1e-17 W/rtHz	3.778	N/A	#VALUE!	4.060	#VALUE!	4.069	4.066	4.064	4.001	4.045
NEP_{load}	1e-17 W/rtHz	1.795	N/A	#VALUE!	1.766	#VALUE!	1.819	1.843	1.807	1.718	1.781
NEP_{amp}	1e-17 W/rtHz	4.351	N/A	#VALUE!	5.575	#VALUE!	5.233	5.102	5.259	5.604	5.419
NEP_{det}	1e-17 W/rtHz	7.114	N/A	#VALUE!	8.179	#VALUE!	7.921	7.823	7.935	8.156	8.054
DQE		0.685	N/A	#VALUE!	0.622	#VALUE!	0.637	0.643	0.636	0.624	0.630
Vn(det)	nV/rtHz	16.4	12.89	#VALUE!	14.7	#VALUE!	15.1	15.3	15.1	14.6	14.9
Vn(total)	nV/rtHz	29.2	12.9	#VALUE!	23.9	#VALUE!	25.1	25.7	25.0	23.7	24.4

Symbol	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**
T0												
Vn												
Q												
$\mathrm{NEP}_{\mathrm{photon}}$												
Vbias												
Gain												
Detector ID	**D2**	**B2**	**E2**	**A2**	**C3**	**D3**	**B3**	**E3**	**C4**	**DK2**	**D4**	**C5**
Pthermal	20.310	19.058	18.608	19.804	20.496	20.160	19.658	19.601	20.695	20.579	18.882	19.162
Pelec+Q	20.310	19.058	18.608	19.805	20.496	20.160	19.658	19.601	20.695	20.579	18.882	19.162
Tbolo	0.38081	0.37507	0.37600	0.37923	0.38104	0.38094	0.37927	0.37989	0.39682	0.39360	0.37736	0.37855
T/T0	1.269	1.250	1.253	1.264	1.270	1.270	1.264	1.266	1.323	1.312	1.258	1.262
Rbolo	5.22E+06	4.06E+06	3.76E+06	4.72E+06	5.57E+06	5.06E+06	4.61E+06	4.57E+06	5.56E+06	5.52E+06	4.03E+06	4.14E+06
Vbolo	7.23	5.96	5.59	6.70	7.53	7.06	6.56	6.52	7.60	7.53	5.88	6.06
Ibolo	1.39	1.47	1.49	1.42	1.35	1.40	1.43	1.43	1.37	1.37	1.46	1.46
A	-5.33	-5.33	-5.29	-5.33	-5.33	-5.33	-5.34	-5.33	-5.12	-5.14	-5.32	-5.33
C	1.12	1.24	1.14	1.35	1.13	1.10	1.26	1.13	1.28	0.84	1.09	1.27
G	296.3	296.4	286.2	294.3	298.9	293.9	292.0	288.8	265.8	270.3	286.7	287.2
Z/R	0.358	0.408	0.420	0.376	0.354	0.361	0.378	0.378	0.329	0.336	0.406	0.394
τ	3.030	3.328	3.174	3.662	3.058	2.992	3.447	3.129	3.850	2.495	3.024	3.502
Sdc	2.08E+08	1.83E+08	1.78E+08	1.99E+08	2.13E+08	2.06E+08	1.97E+08	1.97E+08	2.21E+08	2.18E+08	1.85E+08	1.88E+08
$\mathrm{NEP}_{\mathrm{johnson}}$	3.820	4.018	4.037	3.888	3.798	3.830	3.891	3.883	3.736	3.754	3.980	3.944
$\mathrm{NEP}_{\mathrm{phonon}}$	4.095	4.070	4.004	4.072	4.111	4.078	4.056	4.038	3.913	3.939	4.010	4.018
$\mathrm{NEP}_{\mathrm{load}}$	1.910	1.789	1.725	1.854	1.952	1.886	1.831	1.818	1.893	1.897	1.753	1.767
$\mathrm{NEP}_{\mathrm{amp}}$	4.806	5.471	5.617	5.036	4.687	4.856	5.072	5.067	4.534	4.578	5.403	5.311
$\mathrm{NEP}_{\mathrm{det}}$	7.623	8.114	8.176	7.778	7.556	7.644	7.789	7.769	7.308	7.360	8.011	7.939
DQE	0.655	0.626	0.623	0.646	0.659	0.654	0.645	0.646	0.674	0.671	0.632	0.636
Vn(det)	15.9	14.8	14.6	15.4	16.1	15.7	15.4	15.3	16.1	16.1	14.8	14.9
Vn(total)	27.0	24.3	23.7	25.9	27.6	26.7	25.8	25.8	28.2	28.0	24.4	24.8

Symbol	Value	Value	Value	Value	Value	Value	Value	Value	Value
T0									
Vn									
Q									
NEP_{photon}									
Vbias									
Gain									
Detector ID	**B4**	**A3**	**T2**						
Pthermal	20.230	19.774	#VALUE!	Power as function of Temperature	$P_{thermal} = [G300/(1+\beta)][T/0.3]^{\beta}T$ evaluated from To to Tb				
Pelec+Q	20.230	19.774	#VALUE!	Electrical + Absorbed Power	$P_e + Q = [V_{bias}/(2R_L + R_B)]^2 R_B + Q$				
Tbolo	0.38189	0.38074	#VALUE!	Bolometer Temperature	Solve for Tb using Newtonian recursion such that $P_{thermal} = P_e + Q$				
T/T0	1.273	1.269	#VALUE!		T/To = Tbolo/To				
Rbolo	5.21E+06	4.82E+06	#VALUE!	Bolometer Resistance	$Rbolo = (Ro)\exp[(\Delta/Tb)^{1/2}]$				
Vbolo	7.19	6.76	#VALUE!	Voltage across Bolometer	$Vbolo = [Vbias/(2R_L + R_B)]R_B$				
Ibolo	1.38	1.40	#VALUE!	Current through Bolometer	$Ibolo = Vbias/(2R_L + R_B)$				
A	-5.33	-5.34	#VALUE!		$A = (T/R)(dR/dT) = -(1/2)[(\Delta/Tb)^{1/2}]$				
C	1.19	1.55	#VALUE!	Dynamic Heat Capacity	$C = C300[(T/0.3)^{\gamma}]$				
G	292.2	289.3	#VALUE!	Dynamic Thermal Conductance	$G = G300[(T/0.3)^{\beta}]$				
Z/R	0.357	0.371	#VALUE!		$Z/R = (I/V)(dV/dI) = [-1 - GTb/(P_eA)] / [1 - GTb/(P_eA)]$				
τ	3.273	4.278	#VALUE!	Electrical Time Constant	$\tau = [C/2G][(Z/R + 1)(1 + 2R_L/R_B)] / [Z/R + 2R_L/R_B]$				
Sdc	2.09E+08	2.03E+08	#VALUE!	Electrical Responsivity at 0 Hz	$Sdc = (1/2)[R_B/P_e]^{1/2} [1 - Z/R] / [1 + (Z/R)(R_B/2R_L)$				
$NEP_{johnson}$	3.804	3.848	#VALUE!	Johnson Noise Prior to Demodulation	$NEP_{johnson} = [(4k(Tb)^3G^2)/(P_eA^2)]^{1/2}$				
NEP_{phonon}	4.069	4.043	#VALUE!	Phonon Noise Prior to Demodulation	$=\{[(4kTo^2G)(\beta+1)((T/To)^{2\beta+3}-1)]/[(2\beta+3)(T/To)^{\beta}((T/To)^{\beta+1}-1)]\}^{1/2}$				
NEP_{load}	1.894	1.842	#VALUE!	Johnson Noise from R_L Prior to Demod.	$NEP_{load} = [4kTo/2R_L]^{1/2} \lvert 2(Z/R)R_B Ibolo/[(Z/R) - 1]\rvert$				
NEP_{amp}	4.775	4.935	#VALUE!	Amplifier Noise Prior to Demodulation	$NEP_{amp} = Vn / Sdc$				
NEP_{det}	7.577	7.675	#VALUE!	Detector Noise after Demodulation	$NEP_{det} = [2NEP_{john}^2+NEP_{phon}^2+2NEP_{load}^2+2NEP_{amp}^2]^{1/2}$				
DQE	0.658	0.652	#VALUE!	BLIP Figure-of-Merit for Detector	$DQE = NEP_{photon}^2 / (NEP_{photon}^2 + NEP_{det}^2)$				
Vn(det)	15.9	15.6	#VALUE!	Voltage Noise of Detector After Demod.	$Vn(det) = NEP_{det}Sdc$				
Vn(total)	27.1	26.4	#VALUE!	Total Noise after Demodulation	$Vn(total) = [NEP_{det}^2 + NEP_{photon}^2]^{1/2}Sdc$				

Version	**Issue Date**	**Sheet**	**Changes from Previous Version**
SLW-FS 1	5/26/2005		Update to Current Format (from old format)
		Pixel	Update the Heat Capacity
		Mather Dark	Update the noise (noise from v.0 was not enter correctly)
SLW-FS 4	5/27/2005		
		BDA	BDA ID and Serial No.
			Added thermistor saturation voltages
			Declared D4 bad and removed it from medians
		Problem Channels	Add C1 and D4 on the list of noisy channel
		Pixel	Update the DQE
			Fixed QE requirements
			Update the 1/f knee (at sqrt(2) x flat noise)
			Fixed A3 DQE reference
			NEP derived from best of two noise data sets
		Mather Dark	Made final Vn and NEP depend on adjustable gain
		Mather Optical	Corrected the optical loading and photon NEP values, reoptimized the bias
			Fixed A3 column references

EIDP Coverpage For QM PLW BDA

Unit Identfication

Name : QM PLW BDA
Part # : 10209800 -8
S/N : #007

Environmemtal Testing

	Axes Tested	Temperature	Duration or Number of Cycles	Pass/Fail	Requirement	Source	Waiver #
Random Vibration Test	X, Y, Z	100 K	2 min per axis	P	X, Y, Z at 90 K 1 min per axis	SSSD Sec # 3.4	HR-SP-JPL-RFW-006
High Level Sine Vibe Test	None	NA	NA	NA	X, Y, Z at 90 K	SSSD Sec # 3.4	HR-SP-JPL-RFW-005
Bakeout	NA	80 C	5 days as part of the assembly procedures	P	None (other than as part of the assembly procedure)	D-20549	
Thermal Cycles	NA	RoomT to ~ < 10 K	27	P	Min15 from RmT to < 77 K	D-20549	

Other Testing

	Frequency (Hz)	Note		Minimum Performance	Source	Waiver #
Lowest Resonant Frequency (X-axis)	283 Hz	Cold		> 200 Hz (Goal: >250 Hz)	SSSD Sec # 3.1.3	NA
Lowest Resonant Frequency (Y-axis)	281 Hz	Cold		> 200 Hz (Goal: >250 Hz)	SSSD Sec # 3.1.3	NA
Lowest Resonant Frequency (Z-axis)	276 Hz	Cold		> 200 Hz (Goal: >250 Hz)	SSSD Sec # 3.1.3	NA

Metrology Measurements were performed before and after the Vibration Test and the Thermal Cycles

	Motion in X/Y	Motion in Z		Meets Goal ?	Performance Goal	Source	Waiver #
Maximum motion due to Random Vibration Test 1st axis (X)	21 μm	40 μm		Y	125 μm in X/Y and 500 μm in Z	SSSD Sec # 3.1.1	NA
Maximum motion due to Random Vibration Test 2nd axis (Y)	22 μm	8.6 μm		Y	125 μm in X/Y and 500 μm in Z	SSSD Sec # 3.1.1	NA
Maximum motion due to Random Vibration Test 3rd axis (Z)	9.5 μm	11 μm		Y	125 μm in X/Y and 500 μm in Z	SSSD Sec # 3.1.1	NA
Cumulative Maximum motion	34 μm	56 μm		Y	125 μm in X/Y and 500 μm in Z	SSSD Sec # 3.1.1	NA

Cold Continuity Measurements : In Process

				Pass/Fail	Requirement	Source	Waiver #
Cold Continuity Test (1st Thermal Cycle)				P	None	NA	NA
Cold Continuity Test (2nd Thermal Cycle)				P	None	NA	NA

ENVIRONMENTAL TEST AUTHORIZATION AND SUMMARY (ETAS)

AUTHORIZATION SECTION

PROJECT Herschel		LOG NO. HS013	
/STEM/ASSEMBLY TITLE SPIRE Qual BDA S/N007			DATE ISSUED 7/23/2003
REFERENCE DESIGNATION NUMBER	PART NO. (IF MULTIPLE, ATTACH LIST) 10209800-8	REV.	SERIAL NO. 007

HARDWARE TYPE
☒ EM QUAL ☐ FLIGHT ☐ FLIGHT SPARE ☐ OTHER

PRE-ENVIRONMENTAL INSPECTION REPORT NUMBER (ATTACH IR)

WIRING HARNESS
☐ EM QUAL ☐ FLIGHT ☐ EM ☐ SE

PART NO. REV. SERIAL NO.

TEST DESCRIPTION (CHECK ALL APPLICABLE)
☒ SINE VIBRATION ☐ PYROSHOCK ☐ ACOUSTIC ☐ EMC ☐ OTHER ______
☒ RANDOM VIBRATION ☐ THERMAL VAC. ☐ THERMAL ATMOSPHERE

TYPE OF TEST
☐ QUALIFICATION ☐ FLIGHT ACCEPTANCE
☐ PROTO FLIGHT ☐ RETEST

WILL ALL TESTS/LEVES/DURATIONS REQUIRED BY THE PROJECT DOCUMENTS BE PERFORMED ON THIS UNIT?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) ENTER PROJ. DOC. NO. AND REV. _____

HAS THE UNIT PASSED ALL PRE-ENVIRONMENTAL FUNCTIONAL TESTS?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

HAVE ALL DESIGN ANALYSES BEEN COMPLETED AND REQUIRED CHANGES BEEN IMPLEMENTED?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

IS THE TEST ARTICLE IDENTICAL TO OTHER FLIGHT UNITS?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

ARE ALL PFRs AGAINST THIS UNIT CLOSED?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

HAVE ALL WAIVERS AND ECRs BEEN APPROVED AND ARE THEY INCORPORATED?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

TEST AUTHORIZED BY

COGNIZANT ENGINEER	DATE	TECHNICAL MGR./INSTR MRG./PI PREP REP	DATE	ENVIRONMENTAL REQUIREMENTS ENG.	DATE
Sukhatme	7/25/03		7-25-03		7/28/03

SUMMARY SECTION

TEST AGENCY (IF MULTIPLE, ATTACH SUMMARY AND TEST DATES) JPL Building 144	TEST INITIATION DATE 07/30/03	ACCUMULATED OPERATING HOURS PRIOR TO FIRST ENVIRONMENTAL TEST
SERIAL NUMBERS ACTUALLY TESTED S/N 007	TEST TERMINATION DATE 8/7/03	OPERATING HOURS DURING ENVIRONMENTAL EXPOSURE

TEST DESCRIPTION

VIBRATION
AXES: X Y Z
SINE VIBRATION ☒ ☒ ☒
RANDOM VIBRATION ☒ ☒ ☒

ACOUSTIC ☐

PYROSHOCK SHOCK
AXES: X Y Z
☐ ☐ ☐
SHOCKS/AXIS:

☐ THERMAL VACUUM
PRESSURE:
NO OF CYCLES:

☐ TEMPERATURE ATMOSPHERE
NO OF CYCLES:

☐ OTHER

EMC ☐ COND. SUSC. ☐ COND. EMIS. ☐ ISOLATION
☐ ESD ☐ RAD. SUSC. ☐ RAD. EMIS. ☐ MAGNETICS

TEMP. LEVEL (°c) AND ACCUMULATED DURATION (HRS.)
HOT: _____°c, _____h COLD: _____°c, _____h
HOT: _____°c, _____h COLD: _____°c, _____h

WERE THERE ANY PFRs GENERATED DURING ENVIRONMENTAL TESTS?
☐ YES ☒ NO (IF NO, ATTACH EXCEPTIONS LIST)
LIST PFR NOS. / BRIEF EXPLANATION

ARE THE POST ENVIRONMENTAL DAMAGE INSPECTIONS COMPLETE?
☒ YES ☐ NO (IF YES, ATTACH A COPY OF THE INSPECTION REPORTS. IF NO, ATTACH EXPLANATION)
LIST PFR NOS. / BRIEF EXPLANATION

WERE ALL PLANNED TESTS/LEVELS/DURATIONS ACHIEVED?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST)
LIST PFR NOS. / BRIEF EXPLANATION

☐ TESTS HAVE NOT BEEN SUCCESSFULLY COMPLETED. SEE THE ATTACHED SUMMARY FOR ACTIONS THAT NEED TO BE TAKEN.

COGNIZANT ENGINEER	DATE	TECHNICAL MGR./INSTR MRG./PI PREP REP	DATE	ENVIRONMENTAL REQUIREMENTS ENG.	DATE

☒ ARDWARE HAS SUCCESSFULLY COMPLETED THE ENVIRONMENTAL TESTS LISTED ON THIS FORM OR REMAINING ACTIONS HAVE BEEN TAKEN, INCLUDING RETEST.

COGNIZANT ENGINEER	DATE	TECHNICAL MGR./INSTR MRG./PI PREP REP	DATE	ENVIRONMENTAL REQUIREMENTS ENG.	DATE
	2/18/04		3/17/05		2-18-04

OTHER AUTHORIZATION PROVISIONS AND EXPLANATIONS

This is a cold vibration test (<110 K) done on the Qual BDA. The unit is identical to the flight design. Response accelerometers will be mounted onto the suspended mass and force transducers will be mounted under the interface fixture in order to provide redundant response measurements. This test will be a cold 3-axis test with metrology before, in between, and after each axis.

ENVIRONMENTAL TEST THORIZATION AND SUMMARY (ETAS)

ENVIRONMENTAL TEST SUMMARY

HARDWARE	S/N	ETAS	TEST ENVIRONMENT LEVELS & DURATION	DATE TEST PERFORMED	TEST AGENCY	PASS/ FAIL	COMMENTS
Qual BDA (10209800-8)	7	HSO13	**LATERAL** 2 minute Random Vibe +3dB/octave 20-100Hz 0.06 g^2/Hz 100-138.5 Hz +36dB/octave 138.5-170 Hz 0.7 g^2/Hz 170-200 Hz -48dB/octave 200-220 Hz .1 g^2/Hz 220-300 Hz -9 dB/octave 300-2000 Hz Total Input: 8.0 Grms Spectrum to be notched in order to get 15 g's response RMS **LONGITUDINAL** 2 minute Random Vibe +3dB/octave 20-100Hz 0.08g^2/Hz 100-400Hz -12dB/octave 400-2000Hz Total Input: 6.2 Grms Spectrum to be notched in order to get 15 g's response RMS Each axis1/4 g sine sweep 20-2000 Hz each axisT ~ 100 K				

JPL

ENVIRONMENTAL TEST AUTHORIZATION AND SUMMARY (ETAS)

AUTHORIZATION SECTION

PROJECT: Herschel
LOG NO.: HS017

[illegible]TEM/ASSEMBLY TITLE: S[illegible] Qual BDA SN007
DATE ISSUED: 9/2/2003

REFERENCE DESIGNATION NUMBER:
PART NO. (IF MULTIPLE, ATTACH LIST): 10209800
REV.:
SERIAL NO.: 007

HARDWARE TYPE: ☒ EM QUAL ☐ FLIGHT ☐ FLIGHT SPARE ☐ OTHER
PRE-ENVIRONMENTAL INSPECTION REPORT NUMBER (ATTACH IR):

WIRING HARNESS: ☐ EM QUAL ☐ FLIGHT ☐ EM ☐ SE
PART NO.:
REV.:
SERIAL NO.:

TEST DESCRIPTION (CHECK ALL APPLICABLE): ☐ SINE VIBRATION ☐ PYROSHOCK ☐ ACOUSTIC ☐ EMC ☐ OTHER ______ ☐ RANDOM VIBRATION ☒ THERMAL VAC. ☐ THERMAL ATMOSPHERE

TYPE OF TEST: ☒ QUALIFICATION ☐ FLIGHT ACCEPTANCE ☐ PROTO FLIGHT ☐ RETEST

WILL ALL TESTS/LEVES/DURATIONS REQUIRED BY THE PROJECT DOCUMENTS BE PERFORMED ON THIS UNIT?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) ENTER PROJ. DOC. NO. AND REV. ____

HAS THE UNIT PASSED ALL PRE-ENVIRONMENTAL FUNCTIONAL TESTS?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

HAVE ALL DESIGN ANALYSES BEEN COMPLETED AND REQUIRED CHANGES BEEN IMPLEMENTED?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

IS THE TEST ARTICLE IDENTICAL TO OTHER FLIGHT UNITS?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

ARE ALL PFRs AGAINST THIS UNIT CLOSED?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

HAVE ALL WAIVERS AND ECRs BEEN APPROVED AND ARE THEY INCORPORATED?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

TEST AUTHORIZED BY

COGNIZANT ENGINEER	DATE	TECHNICAL MGR./INSTR MRG./PI PREP REP	DATE	ENVIRONMENTAL REQUIREMENTS ENG.	DATE
	10/9/03		10-16-03		10/9/03

SUMMARY SECTION

TEST AGENCY (IF MULTIPLE, ATTACH SUMMARY AND TEST DATES): JPL Building 183
TEST INITIATION DATE: 9/2/03
ACCUMULATED OPERATING HOURS PRIOR TO FIRST ENVIRONMENTAL TEST:

SERIAL NUMBERS ACTUALLY TESTED:
TEST TERMINATION DATE: 11/11/03
OPERATING HOURS DURING ENVIRONMENTAL EXPOSURE:

TEST DESCRIPTION

VIBRATION — AXES: X Y Z
SINE VIBRATION ☐ ☐ ☐
RANDOM VIBRATION ☐ ☐ ☐

ACOUSTIC ☐

PYROSHOCK SHOCK — AXES: X Y Z ☐ ☐ ☐
SHOCKS/AXIS:

☒ THERMAL VACUUM
PRESSURE: <1E-5 mbar, 290K to 7K
NO OF CYCLES: 27

☐ TEMPERATURE ATMOSPHERE
NO OF CYCLES:

☐ OTHER ____

EMC ☐ COND. SUSC. ☐ COND. EMIS. ☐ ISOLATION ☐ ESD ☐ RAD. SUSC. ☐ RAD. EMIS. ☐ MAGNETICS

TEMP. LEVEL (°c) AND ACCUMULATED DURATION (HRS.)
HOT: ____°c, ____h COLD: ____°c, ____h
HOT: ____°c, ____h COLD: ____°c, ____h

WERE THERE ANY PFRs GENERATED DURING ENVIRONMENTAL TESTS?
☐ YES ☒ NO (IF NO, ATTACH EXCEPTIONS LIST)
LIST PFR NOS. / BRIEF EXPLANATION

ARE THE POST ENVIRONMENTAL DAMAGE INSPECTIONS COMPLETE?
☒ YES ☐ NO (IF YES, ATTACH A COPY OF THE INSPECTION REPORTS. IF NO, ATTACH EXPLANATION)
LIST PFR NOS. / BRIEF EXPLANATION

WERE ALL PLANNED TESTS/LEVELS/DURATIONS ACHIEVED?
☒ YES ☐ NO (IF NO, ATTACH EXCEPTIONS LIST)
LIST PFR NOS. / BRIEF EXPLANATION

☐ TESTS HAVE NOT BEEN SUCCESSFULLY COMPLETED. SEE THE ATTACHED SUMMARY FOR ACTIONS THAT NEED TO BE TAKEN.

COGNIZANT ENGINEER	DATE	TECHNICAL MGR./INSTR MRG./PI PREP REP	DATE	ENVIRONMENTAL REQUIREMENTS ENG.	DATE

[illegible]RDWARE HAS SUCCESSFULLY COMPLETED THE ENVIRONMENTAL TESTS LISTED ON THIS FORM OR REMAINING ACTIONS HAVE BEEN TAKEN, INCLUDING RETEST.

COGNIZANT ENGINEER	DATE	TECHNICAL MGR./INSTR MRG./PI PREP REP	DATE	ENVIRONMENTAL REQUIREMENTS ENG.	DATE
☒	2/18/04	Martin H	3/17/05		2-18-04

ENVIRONMENTAL TEST AUTHORIZATION AND SUMMARY (ETAS)

OTHER AUTHORIZATION PROVISIONS AND EXPLANATIONS

Thermal cycles will be performed on the BDA SN7 in order to fully qualify the design for flight.

ENVIRONMENTAL TEST AUTHORIZATION AND SUMMARY (ETAS)

ENVIRONMENTAL TEST SUMMARY

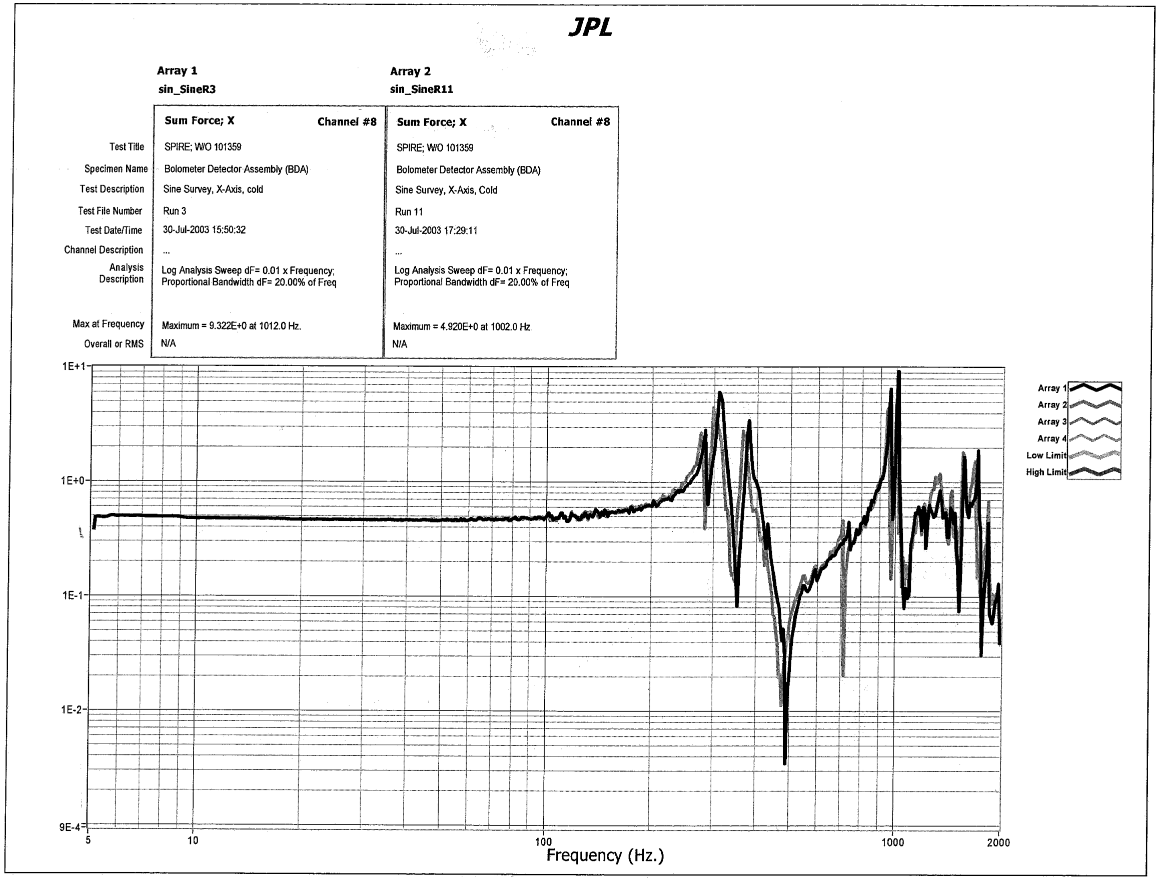
HARDWARE	S/N	ETAS	TEST ENVIRONMENT LEVELS & DURATION	DATE TEST PERFORMED	TEST AGENCY	PASS/ FAIL	COMMENTS
Qual BDA (10209800)	7	HSO17	27 Thermal cycles from 290K to 7K				

QM BDA Random Vibration Test

P/N 10209800-8

S/N 007

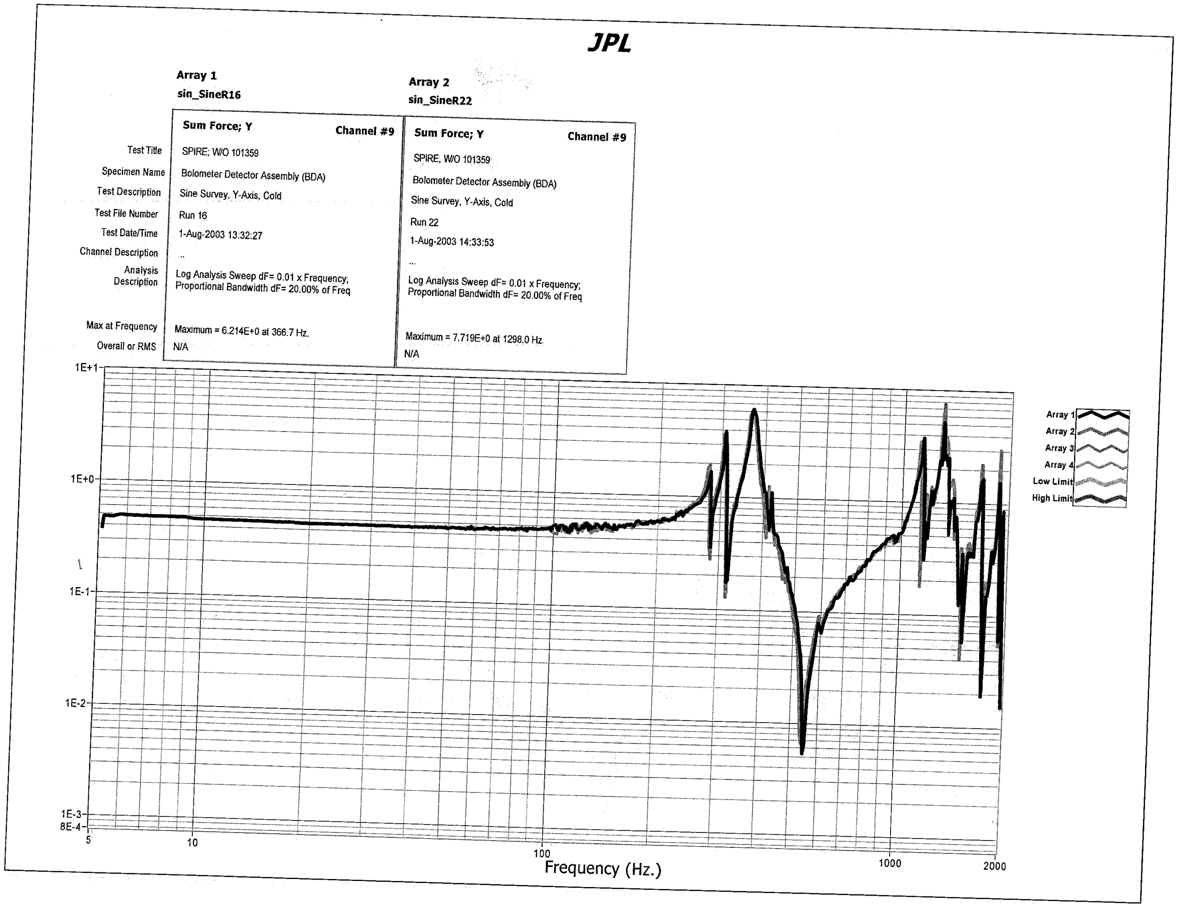
X-axis Shake, Cold, Sine Surveys (Before and After 0 dB Random Vibe)



JPL

	Array 1 **sin_SineR3**	**Array 2** **sin_SineR11**
	Sum Force; X **Channel #8**	**Sum Force; X** **Channel #8**
Test Title	SPIRE; W/O 101359	SPIRE; W/O 101359
Specimen Name	Bolometer Detector Assembly (BDA)	Bolometer Detector Assembly (BDA)
Test Description	Sine Survey, X-Axis, cold	Sine Survey, X-Axis, Cold
Test File Number	Run 3	Run 11
Test Date/Time	30-Jul-2003 15:50:32	30-Jul-2003 17:29:11
Channel Description	...	...
Analysis Description	Log Analysis Sweep dF= 0.01 x Frequency; Proportional Bandwidth dF= 20.00% of Freq	Log Analysis Sweep dF= 0.01 x Frequency; Proportional Bandwidth dF= 20.00% of Freq
Max at Frequency	Maximum = 9.322E+0 at 1012.0 Hz.	Maximum = 4.920E+0 at 1002.0 Hz.
Overall or RMS	N/A	N/A

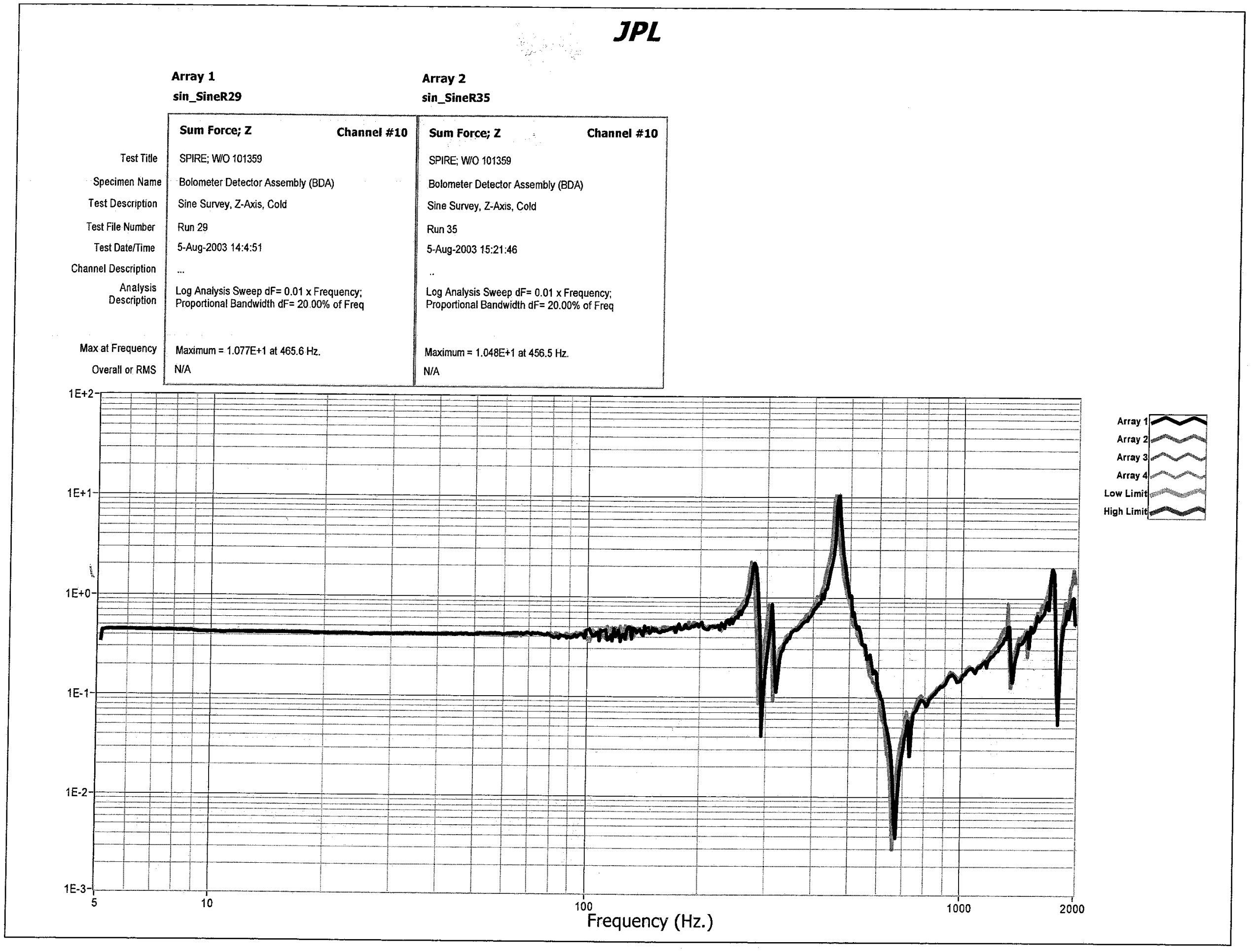
Y-axis Shake, Cold, Sine Surveys (Before and After 0 dB Random Vibe)



JPL

	Array 1 **sin_SineR16**	**Array 2** **sin_SineR22**
	Sum Force; Y **Channel #9**	**Sum Force; Y** **Channel #9**
Test Title	SPIRE; W/O 101359	SPIRE, W/O 101359
Specimen Name	Bolometer Detector Assembly (BDA)	Bolometer Detector Assembly (BDA)
Test Description	Sine Survey, Y-Axis, Cold	Sine Survey, Y-Axis, Cold
Test File Number	Run 16	Run 22
Test Date/Time	1-Aug-2003 13:32:27	1-Aug-2003 14:33:53
Channel Description	..	...
Analysis Description	Log Analysis Sweep dF= 0.01 x Frequency, Proportional Bandwidth dF= 20.00% of Freq	Log Analysis Sweep dF= 0.01 x Frequency; Proportional Bandwidth dF= 20.00% of Freq
Max at Frequency	Maximum = 6.214E+0 at 366.7 Hz.	Maximum = 7.719E+0 at 1298.0 Hz
Overall or RMS	N/A	N/A

Z-axis Shake, Cold, Sine Surveys (Before and After 0 dB Random Vibe)



JPL

	Array 1 **sin_SineR29**	**Array 2** **sin_SineR35**
	Sum Force; Z **Channel #10**	**Sum Force; Z** **Channel #10**
Test Title	SPIRE; W/O 101359	SPIRE; W/O 101359
Specimen Name	Bolometer Detector Assembly (BDA)	Bolometer Detector Assembly (BDA)
Test Description	Sine Survey, Z-Axis, Cold	Sine Survey, Z-Axis, Cold
Test File Number	Run 29	Run 35
Test Date/Time	5-Aug-2003 14:4:51	5-Aug-2003 15:21:46
Channel Description	...	..
Analysis Description	Log Analysis Sweep dF= 0.01 x Frequency; Proportional Bandwidth dF= 20.00% of Freq	Log Analysis Sweep dF= 0.01 x Frequency; Proportional Bandwidth dF= 20.00% of Freq
Max at Frequency	Maximum = 1.077E+1 at 465.6 Hz.	Maximum = 1.048E+1 at 456.5 Hz.
Overall or RMS	N/A	N/A

Hardware ID FS SLW BDA, 10209800-4 S/N 015

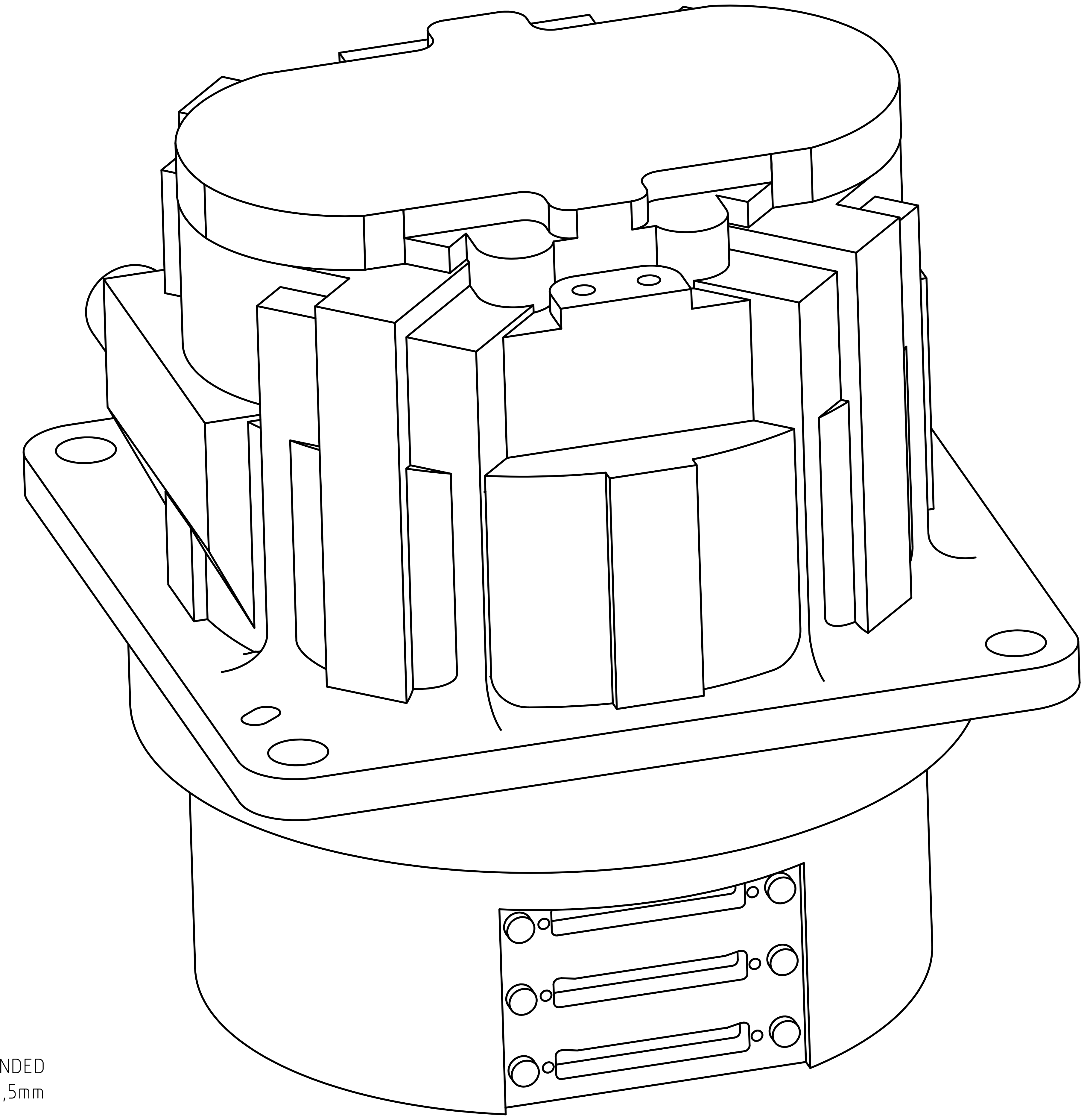
Date	Time	AIDS	Power	Mate	Demate	Transport	Notes
							Assembly Process Connector Mates
30-Sep-2004		243275		J05	J05		kapton cable sub-assembly test
9-Feb-2005		244743		J05	J05		kapton cable post-installation test
15-Feb-2005		244743		J05	J05		load resistor test
22-Feb-2005		244743		J05	J05		detector test
25-Feb-2005		244743		J05	J05		detector test, after feedhorn installation
							Assembly Complete
2-Mar-2005		244960		J05	J05		assembly complete electical test (pre-bakeout)
3-Mar-2005		244960				x	103 -> MDL -> 103, for optical metrology
3-Mar-2005		244960					Filter installation
4-Mar-2005		244960				x	103 -> bld 158 for Vacuum Bakeout (80C, 24 hrs, 10^-5 torr)
7-Mar-2005		244960				x	bld 158 -> 170 -> 103 for metrology
7-Mar-2005		244960		J05	J05		post-bakeout, pre-vibe electrical test
7-Mar-2005		244960				x	103 -> 183 delivery to environmental test
7-Mar-2005		245002					Install into Shake facility
8-Mar-2005		245002				x	183->144 shake lab
8-Mar-2005		245002					pump out, go cold, complete 2 min 90K shake
8-Mar-2005		245002					warm overnight
9-Mar-2005		245002					complete warm low-level shake
9-Mar-2005		245002				x	144->183 for removal from shake facility
9-Mar-2005		245002				x	183->170->103 for metrology
9-Mar-2005		245010		J05	J05		post-shake electrical test
10-Mar-2005		245010				x	103 -> 183 for performance test
10-Mar-2005		245015		J05			Installation in BODAC
10-Mar-2005		245015					pumpout
11-Mar-2005		245015					cooldown
interim			x				performance testing
29-Mar-2005		245015					finish warmup, vent
29-Mar-2005		245015					pump, cooldown

Hardware ID FS SLW BDA, 10209800-4 S/N 015

Date	Time	AIDS	Power	Mate	Demate	Transport	Notes
interim			x				performance testing
12-Apr-2005		245051					finish warmup
12-Apr-2005		245051					vent
12-Apr-2005		245051			J05		Removal from BODAC
18-Apr-2005		245284				x	183 -> 103 for installation of temporary optical targets
19-Apr-2005		245141				x	103->170->183 for post-BODAC metrology
19-Apr-2005		245141		J05			Install into Cold Alignment Facility for TS1, J05
19-Apr-2005		245141	x				Take continuity data.
19-Apr-2005		245141					pump out
20-Apr-2005		245141					Cooler on
21-Apr-2005		245141	x				Take continuity data.
21-Apr-2005		245141					Cooler off
25-Apr-2005		245141	x				Take continuity data.
25-Apr-2005		245141			J05		Remove from Cold Alignment Facility
25-Apr-2005		245141				x	183->170->183 for metrology
25-Apr-2005		245145		J05			Install into Cold Alignment Facility for TS2, J05
25-Apr-2005		245145	x				Take continuity data.
25-Apr-2005		245145					pump out
26-Apr-2005		245145					Cooler on
27-Apr-2005		245145	x				Take continuity data.
27-Apr-2005		245145					Cooler off
28-Apr-2005		245145	x				Take continuity data.
28-Apr-2005		245145			J05		Remove from Cold Alignment Facility
28-Apr-2005		245145				x	183->170->103 for metrolgy and storage
Aug-2005		245858		J05	J05		Pre-Ship electrical test (planned)

REVISIONS

LTR	ZONE	DESCRIPTION	CODE	DWN	CHK	STRUCT	MATL	THRM CONT	PEM		ENGR	DSGN SUPV	DATA MGT	RELEASE DATE
A		INITIAL RELEASE	CODE B	SEE TITLE BLOCK									RTN	12/7/01
B		UPDATED: MASS & CG'S, FILTER SHAPE,VOLUME NEED AROUND CAPSTANS, CONN. POSITIONS. REMOVED MODES AND MASS PARTICIPATION; ROTATED PIXEL MAP 180°.	B	DJC	MAW				MIH		MAW		RGB	09/08/04
C		INCORPORATED ECR HR-SP-JPL-ECR-003; CHANGED FOCUS FOR -2 &-3; CHANGED DP TO DK	B											



GENERAL VIEW
REFERENCE ONLY

△9 ALL DIMENSIONS SHOWN FOR THE 300mK STAGE ARE FOR THE NOMINAL SUSPENDED POSITION. THE SUSPENDED UNIT MAY BE SHIFTED FROM NOMINAL POSITION ±0,5mm IN ANY AXIS.

△8 ONLY PIXELS, DOWEL PIN HOLES, AND SLOTS VISIBLE. ALL OTHER FEATURES OMITTED FOR CLARITY.

7. FOR PHOTOMETER AND SPECTROMETER SUBSYSTEM INTERFACE DATA AND LAYOUT CONFIGURATION, SEE SHEETS 5-7.

6. DIMENSIONS IN {} ARE CALCULATED FOR OPERATING TEMPERATURE AND ARE PROVIDED FOR REFRENCE ONLY. ALL OTHED DIMENSIONS ARE BASED ON AN ASSEMBLY TEMPERATURE OF 20° C.

△5 INDICATES CONNECTOR POSITION. CONNECTORS INSTALLED ARE NANONIC STM 051 M6SN.

△4 REFER TO TABLES ON SHEETS 5, 6, AND 7 FOR DIFFERENCES BETWEEN DETECTOR ARRAYS.

△3 ASSEMBLY REFERENCE DESIGNATOR, TITLE, PART NUMBER, REVISION LETTER, AND SERIAL NUMBER TO APPEAR AS SHOWN IN THIS AREA.

2. THIS IS THE INTERFACE CONTROL DRAWING FOR THE BOLOMETER DETECTOR ARRAY, JPL PART NUMBER 10209800. JPL DRAWING NUMBER 10209800 SHALL CONTAIN THE FOLLOWING NOTE: THIS ASSEMBLY MEETS THE INTERFACE REQUIREMENTS OF JPL INTERFACE CONTROL DRAWING 10209721.

1. THIS TECHNICAL DATA IS EXPORT CONTROLLED UNDER U.S. LAW AND IS BEING TRANSFERRED BY JPL TO PPARC PURSUANT TO THE NASA / PPARC LETTER OF AGREEMENT WHICH ENTERED INTO FORCE ON DECEMBER 2, 1999. THIS TECHNICAL DATA IS TRANSFERRED TO PPARC FOR USE EXCLUSIVELY ON THE NASA/PPARC SPIRE ON FIRST COOPERATIVE PROJECT, MAY NOT BE USED FOR ANY OTHER PURPOSE, AND SHALL NOT BE RE-TRANSFERRED OR DISCLOSED TO ANY OTHER PARTY WITHOUT THE PRIOR WRITTEN APPROVAL OF NASA.

NOTES: UNLESS OTHERWISE SPECIFIED

INTERFACE DRAWING

QTY REQD		ITEM NO	REF DES	CAGE NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATERIAL OR NOTE	ZONE

PARTS LIST

MATERIAL

METRIC
THIRD ANGLE PROJECTION

NEXT ASSEMBLY	USED ON
	SPIRE

APPLICATION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN MILLIMETERS
LINEAR TOLERANCES:

0–6	± 0.1
OVER 6–30	± 0.2
OVER 30–120	± 0.3
OVER 120–315	± 0.5
OVER 315–1000	± 0.8
OVER 1000	± 1.2

ANGULAR TOLERANCES:
± 0.5°
MACHINE FINISH (MICROMETERS) 3.2 √
DO NOT SCALE DRAWING
INTERPRET DWG PER ASME Y14.100M

CONTRACT NO 1244858
APPD ______ DATE ______

DWN	D CRUMB	11/9/01
CHK	B BURDICK	11/14/01
STRUCT	K BROWNING	11/19/01
MATL	M KNOPP	11/19/01
THRM CONT		
MSSL	A. J. COKER	11/7/01
PEM	G. LILENTHAL	12/13/01
ENGR	L. HUSTED	11/19/01
DSGN SUPV		

JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CA 91109
RELEASED THROUGH EDMG

BOLOMETER DETECTOR
ARRAY,
SPIRE

SIZE	CAGE NO		REV
A1	23835	10209721	C

SCALE NONE
UNCLASSIFIED
SHEET 1 OF 7

REV 2/00

A1 10209721

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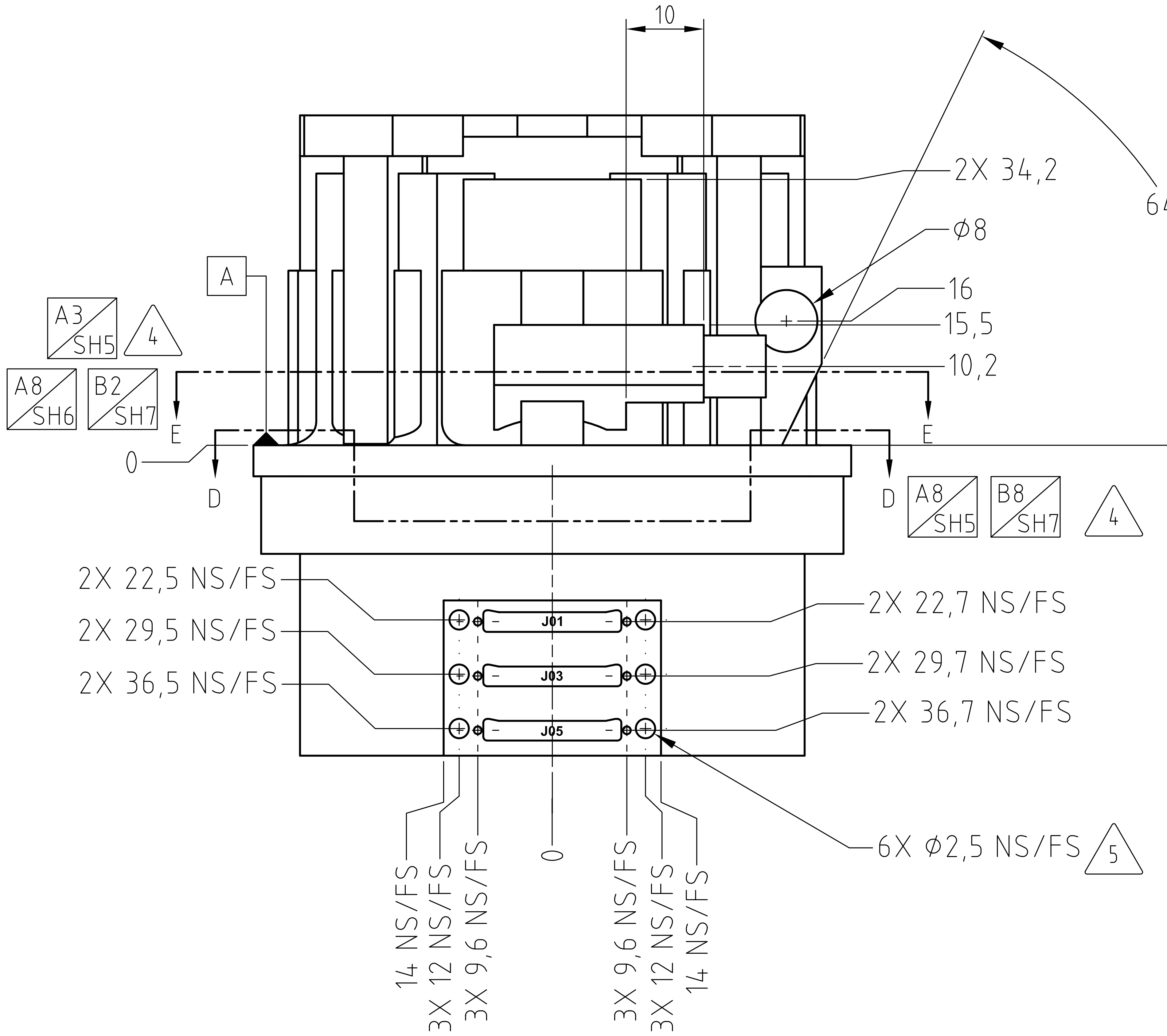

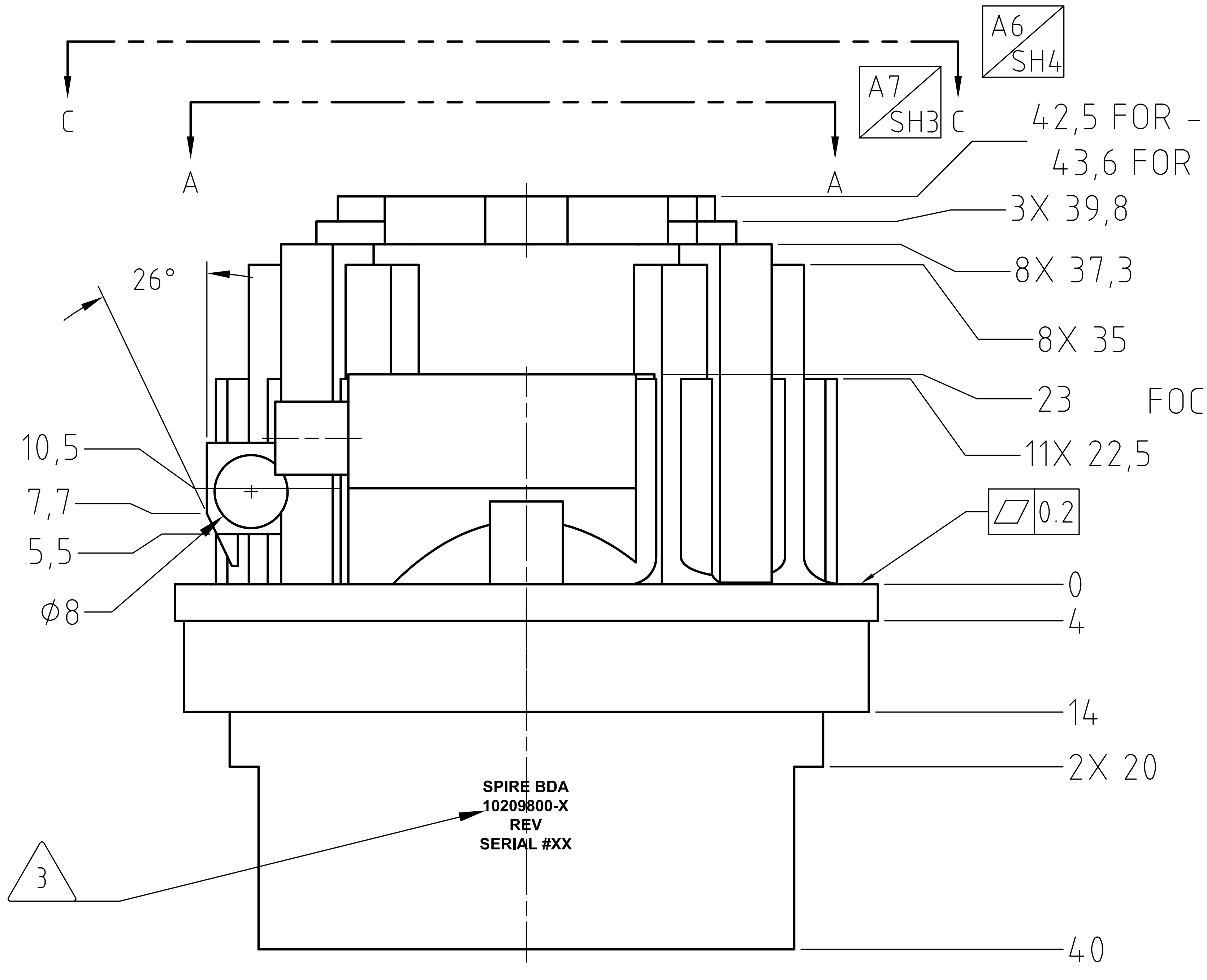

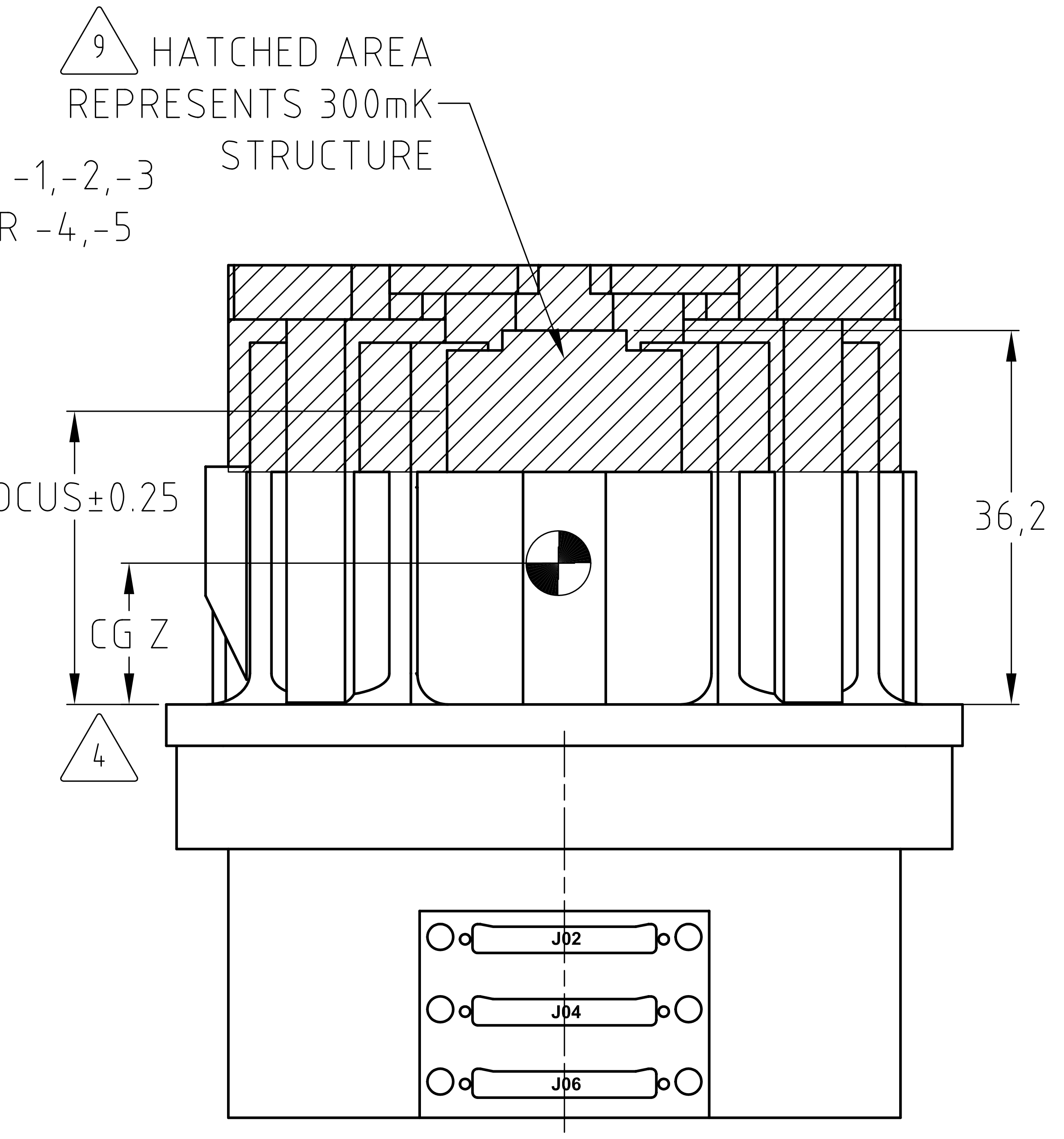

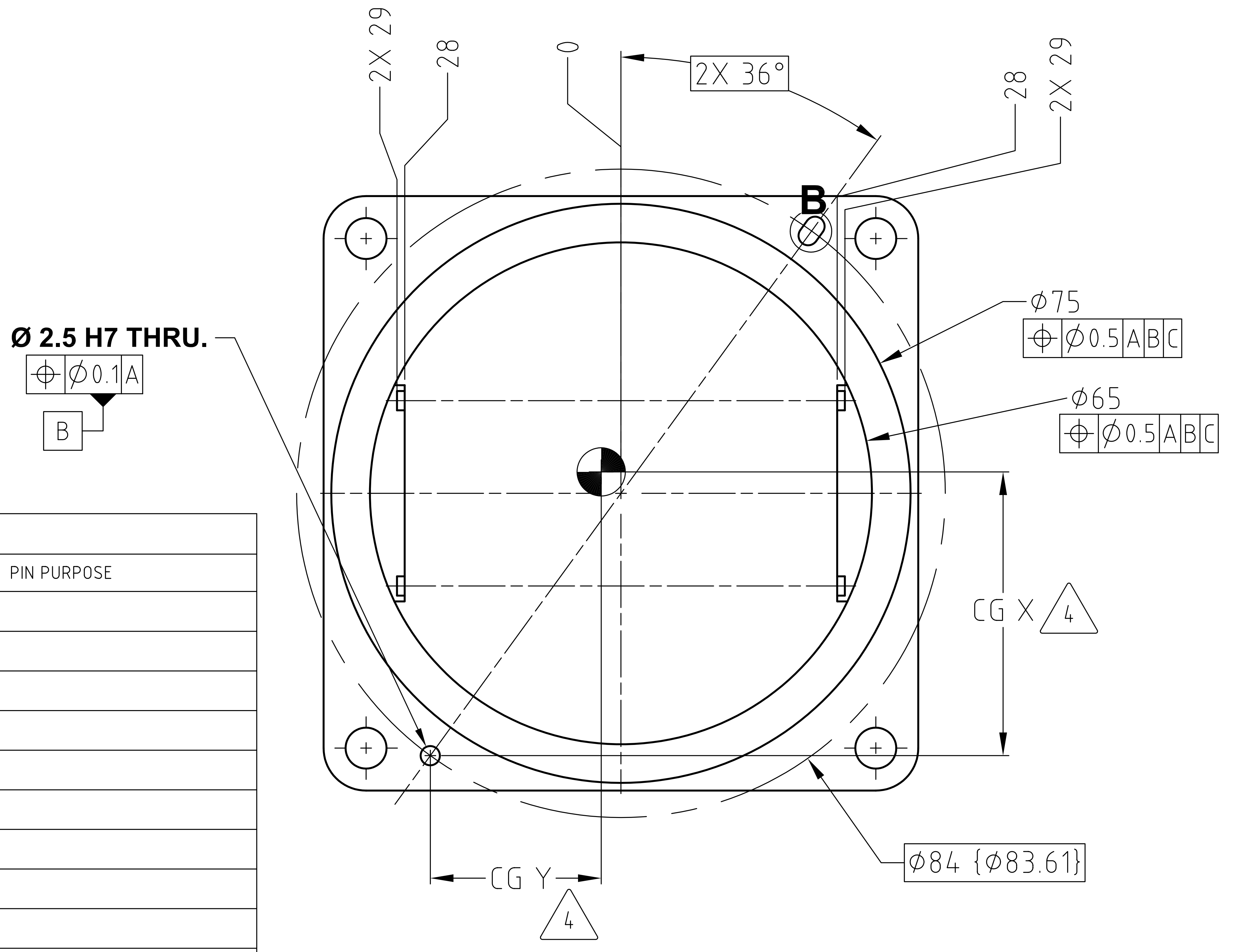

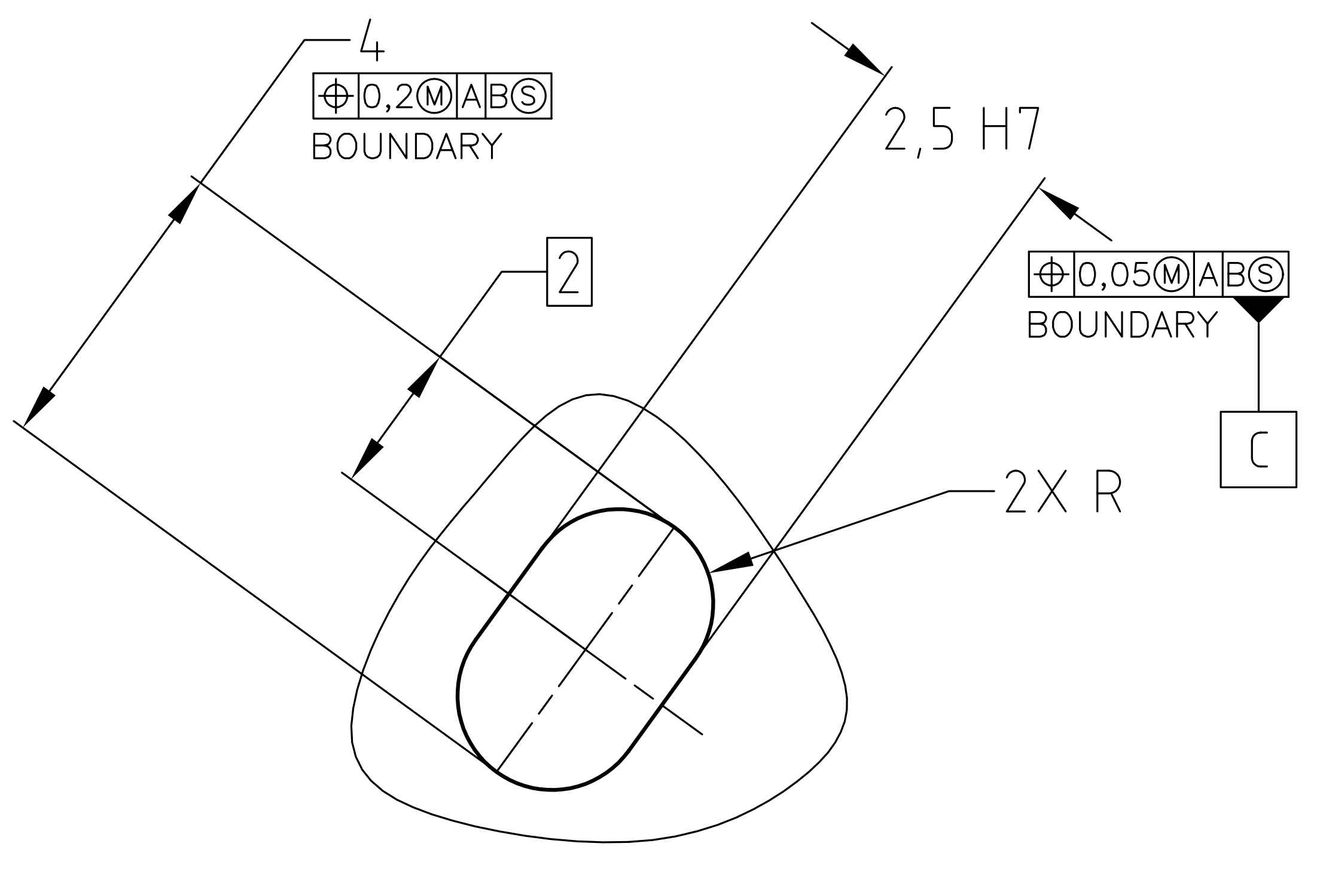

VIEW B
SCALE: 10:1

ALL CONNECTORS					
PIN #	PIN PURPOSE	PIN #	PIN PURPOSE	PIN #	PIN PURPOSE
1	SIGNAL A+	18	SIGNAL T+	35	SIGNAL J-
2	SIGNAL B+	19	SIGNAL U+	36	SIGNAL K-
3	SIGNAL C+	20	SIGNAL V+	37	SIGNAL L-
4	SIGNAL D+	21	SIGNAL W+	38	SIGNAL M-
5	SIGNAL E+	22	SIGNAL X+	39	SIGNAL N-
6	SIGNAL F+	23	SIGNAL Y+	40	SIGNAL P-
7	SIGNAL G+	24	SIGNAL Z+	41	SIGNAL R-
8	SIGNAL H+	25	SIGNAL BIAS V+	42	SIGNAL S-
9	SIGNAL I+	26	SIGNAL A-	43	SIGNAL T-
10	SIGNAL J+	27	SIGNAL B-	44	SIGNAL U-
11	SIGNAL K+	28	SIGNAL C-	45	SIGNAL V-
12	SIGNAL L+	29	SIGNAL D-	46	SIGNAL W-
13	SIGNAL M+	30	SIGNAL E-	47	SIGNAL X-
14	SIGNAL N+	31	SIGNAL F-	48	SIGNAL Y-
15	SIGNAL P+	32	SIGNAL G-	49	SIGNAL Z-
16	SIGNAL R+	33	SIGNAL H-	50	SIGNAL BIAS V-
17	SIGNAL S+	34	SIGNAL I-	51	SIGNAL BIAS GND

A1 10209721

AutoCAD GENERATED

SIZE A1
CAGE NO 23835
10209721
REV C
SCALE 2:1
UNCLASSIFIED
SHEET 2 OF7
REV 2/00

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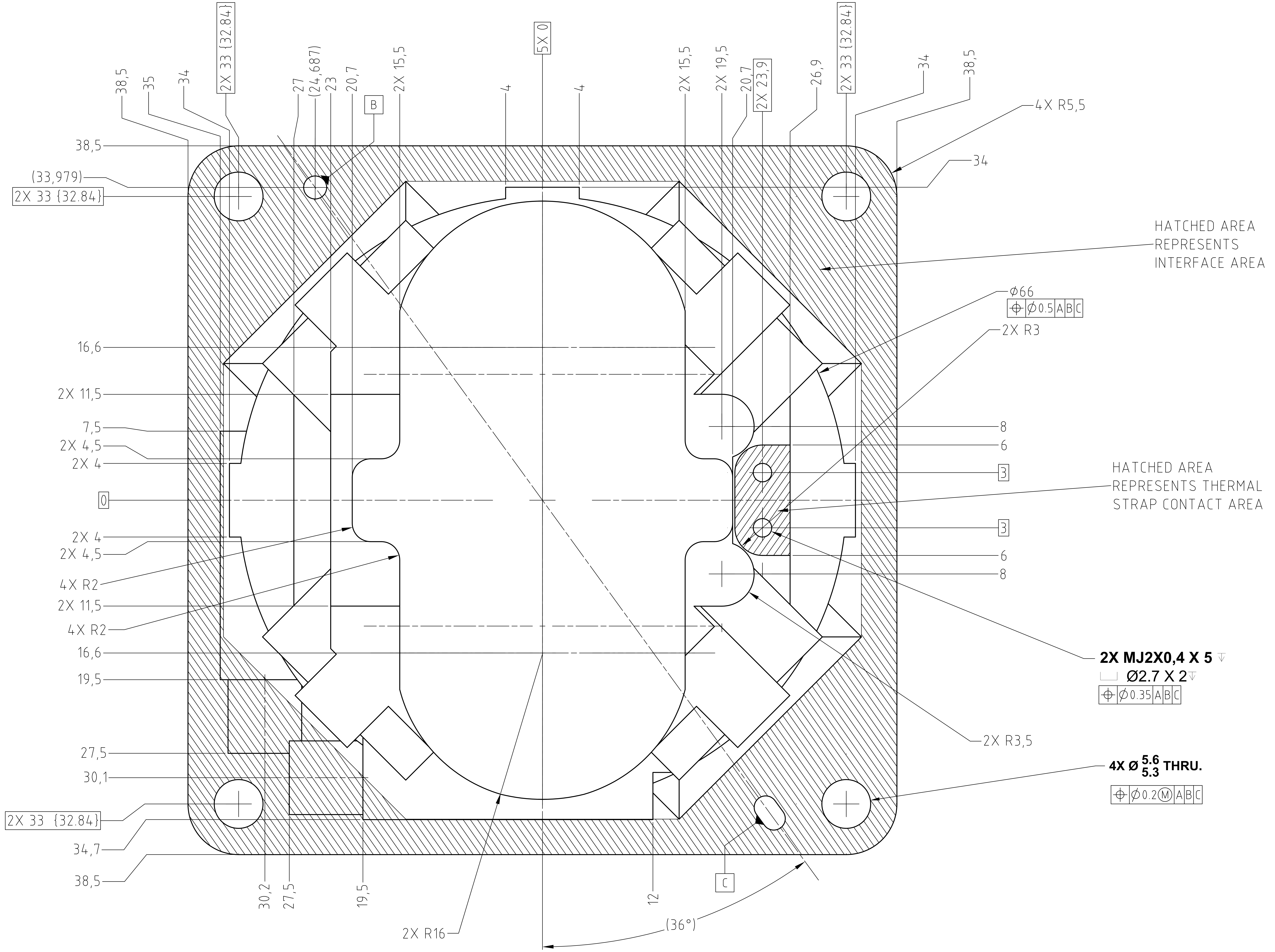

VIEW A-A

H4/SH2

SIZE	CAGE NO		REV
A1	23835	10209721	C
SCALE 2:1		UNCLASSIFIED	SHEET 3 OF 7

REV 2/00

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A1 10209721

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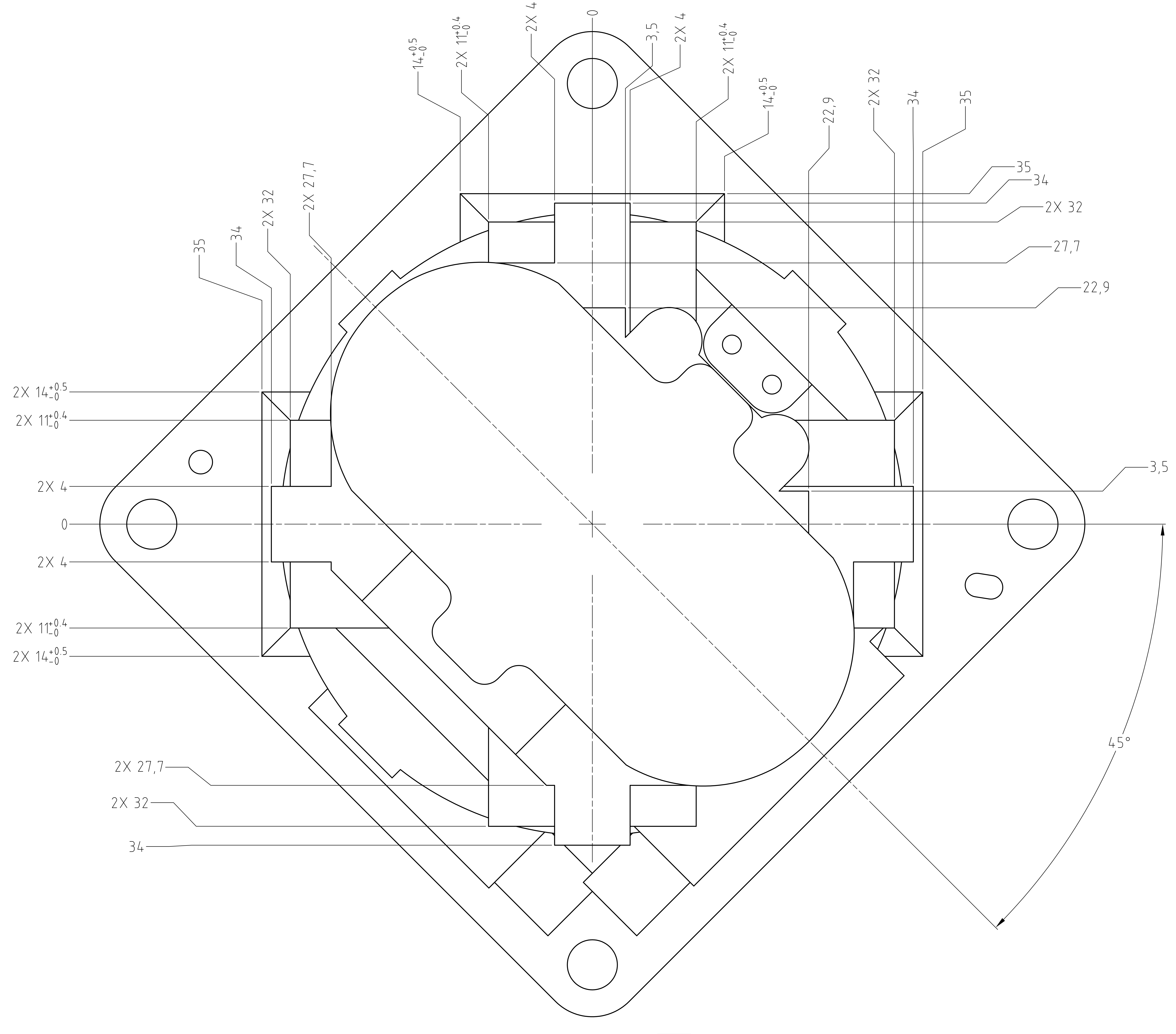

VIEW C-C ROTATED 45° CCW H4/SH2

SIZE	CAGE NO		REV
A1	23835	10209721	C
SCALE 2:1	UNCLASSIFIED	SHEET4 OF7	

REV 2/00

AutoCAD GENERATED

A1 10209721

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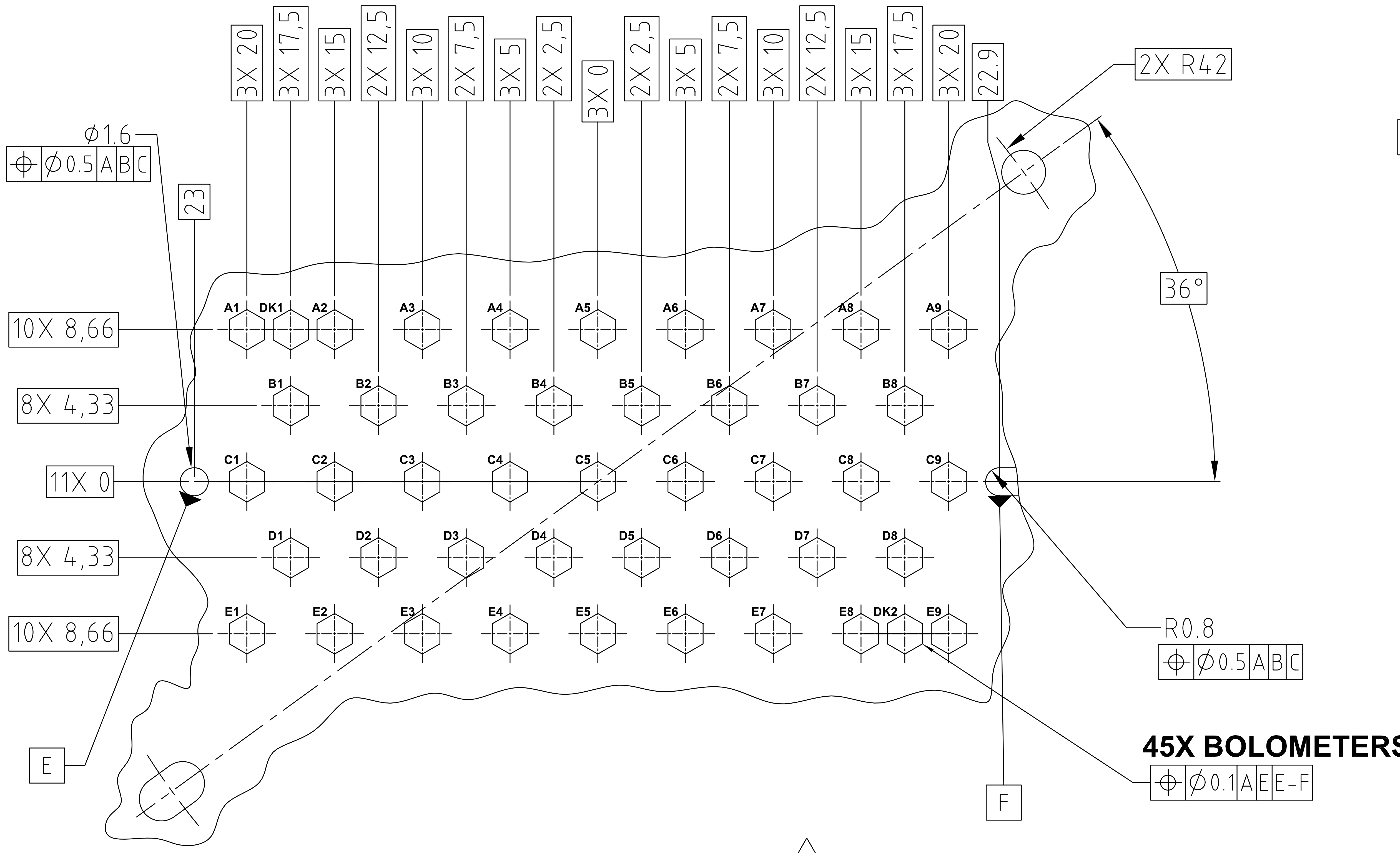
SUBSYSTEM INTERFACE DATA

UNIT: P/LW			
NUMBER: 10209800–1			
FOCUS: 32.8			
CONNECTOR POSITIONS USED: J05, J06			
MECHANICAL CHARACTERISTICS			
MASS: 632 g			
C.O.G. LOCATION W.R.T. LOCATION HOLE:	X 34.4	Y 24.3	Z 6
MOMENT OF INERTIA:	I_x 772 Kg*mm^2	I_Y 1,145 Kg*mm^2	I_Z 1,423 Kg*mm^2
MECHANICAL INTERFACE MATERIAL: 7075 AL			
SURFACE FINISH DESCRIPTION: CHEM FILM GOLD			
TOTAL CONTACT AREA: 1783 mm^2			
R.M.S. ROUGHNESS OF CONTACT AREA: 3.2 uM			
THERMAL STRAP INTERFACE MATERIAL: CU 99.999% PURE			
THERMAL STRAP SURFACE FINISH DESCRIPTION: GOLD PLATED			
THERMAL STRAP CONTACT AREA: 57.5 mm^2			
THERMAL STRAP R.M.S. ROUGHNESS OF CONTACT AREA: 3.2 uM			

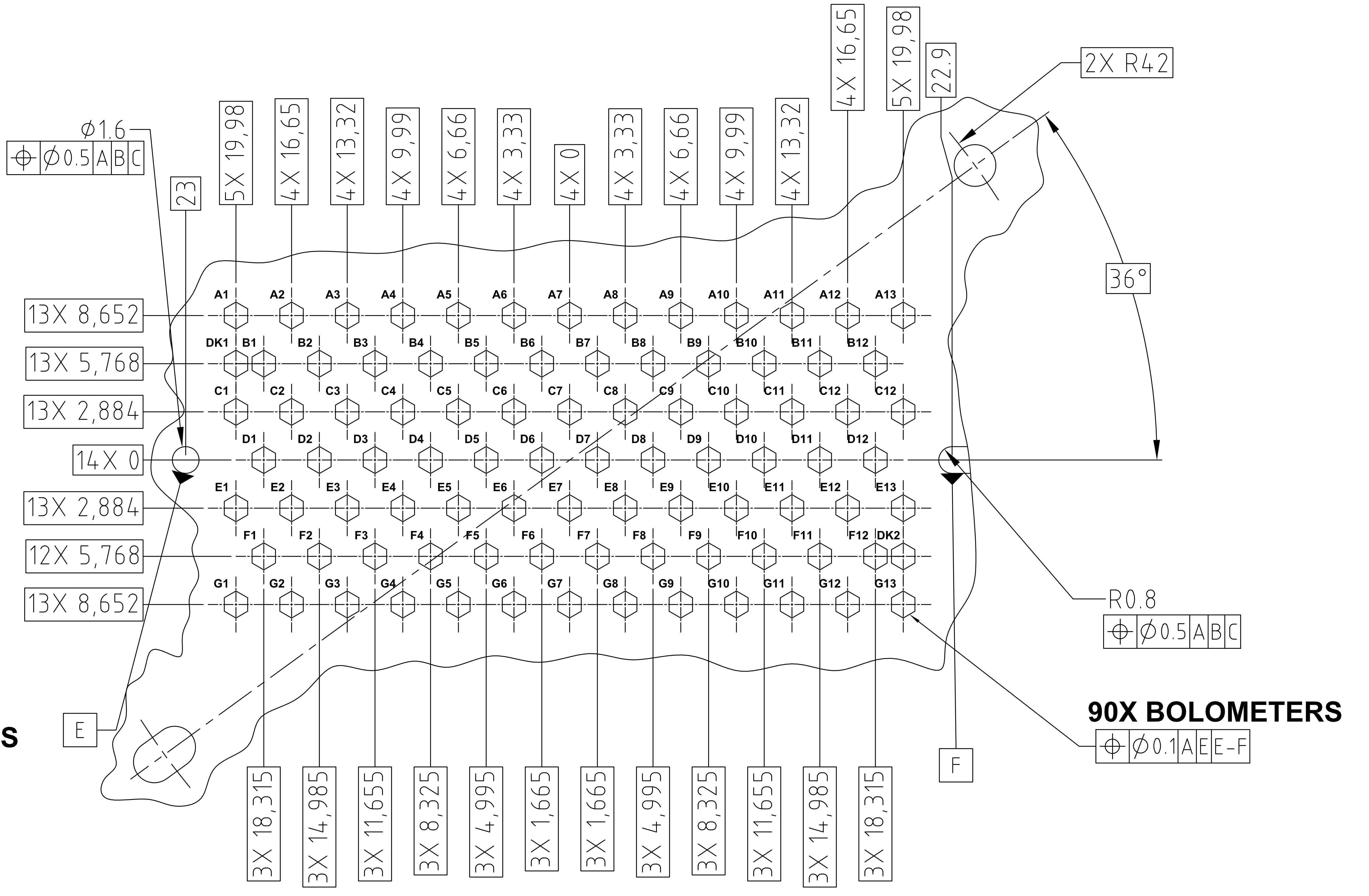
SUBSYSTEM INTERFACE DATA

UNIT: P/MW			
NUMBER: 10209800–2			
FOCUS: 32.2			
CONNECTOR POSITIONS USED: J01, J02, J03, J04			
MECHANICAL CHARACTERISTICS			
MASS: 632 g			
C.O.G. LOCATION W.R.T. LOCATION HOLE:	X 34.4	Y 24.3	Z 8.5
MOMENT OF INERTIA:	I_x 764 Kg*mm^2	I_Y 1,152 Kg*mm^2	I_Z 1,428 Kg*mm^2
MECHANICAL INTERFACE MATERIAL: 7075 AL			
SURFACE FINISH DESCRIPTION: CHEM FILM GOLD			
TOTAL CONTACT AREA: 1783 mm^2			
R.M.S. ROUGHNESS OF CONTACT AREA: 3.2 uM			
THERMAL STRAP INTERFACE MATERIAL: CU 99.999% PURE			
THERMAL STRAP SURFACE FINISH DESCRIPTION: GOLD PLATED			
THERMAL STRAP CONTACT AREA: 57.5 mm^2			
THERMAL STRAP R.M.S. ROUGHNESS OF CONTACT AREA: 3.2 uM			



SECTION D–D 8
PHOTOMETER LONG WAVE
SCALE: 5:1

F9/SH2



SECTION E–E 8
PHOTOMETER MEDIUM WAVE
SCALE: 5:1

G12/SH2

SIZE	CAGE NO		REV
A1	23835	10209721	C
SCALE NOTED	UNCLASSIFIED	SHEET5 OF7	

REV 2/00

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A1 10209721

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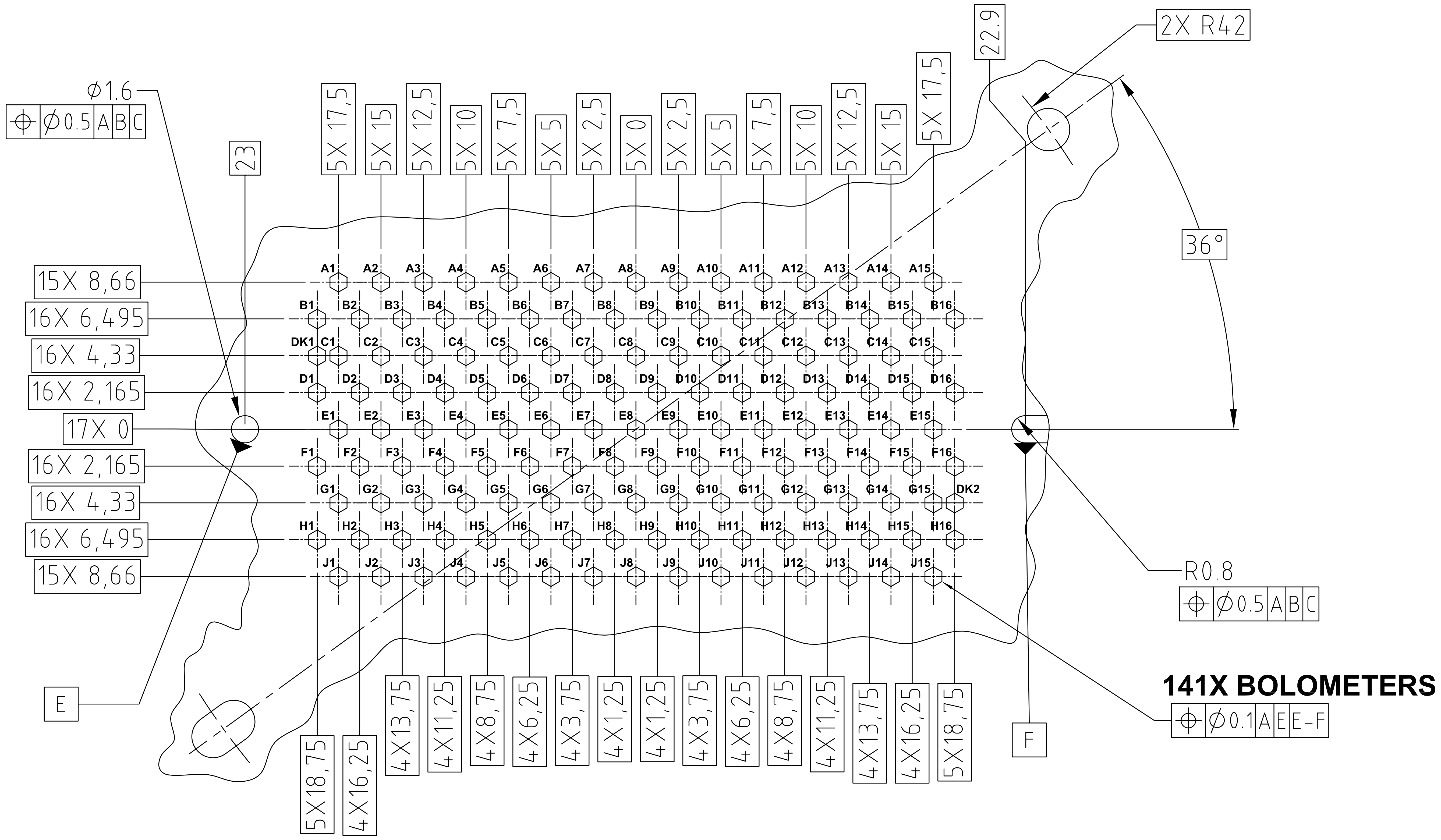
SUBSYSTEM INTERFACE DATA			
UNIT: P/SW			
NUMBER: 10209800–3			
FOCUS: 23.8			
CONNECTOR POSITIONS USED: J01, J02, J03, J04, J05, J06			
MECHANICAL CHARACTERISTICS			
MASS: 600 g			
C.O.G. LOCATION W.R.T. LOCATION HOLE:	X 34.5	Y 24.3	Z 6.5
MOMENT OF INERTIA:	I_X 712 Kg*mm^2	I_Y 1,074 Kg*mm^2	I_Z 1,364 Kg*mm^2
MECHANICAL INTERFACE MATERIAL: 7075 AL			
SURFACE FINISH DESCRIPTION: CHEM FILM GOLD			
TOTAL CONTACT AREA: 1783 mm^2			
R.M.S. ROUGHNESS OF CONTACT AREA: 3.2 uM			
THERMAL STRAP INTERFACE MATERIAL: CU 99.999% PURE			
THERMAL STRAP SURFACE FINISH DESCRIPTION: GOLD PLATED			
THERMAL STRAP CONTACT AREA: 57.5 mm^2			
THERMAL STRAP R.M.S. ROUGHNESS OF CONTACT AREA: 3.2 uM			



SECTION E–E ⑧
PHOTOMETER SHORT WAVE
SCALE: 5:1

G12/SH2

SIZE	CAGE NO		REV
A1	23835	10209721	C
SCALE NOTED		UNCLASSIFIED	SHEET 6 OF 7

REV 2/00

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A1 10209721

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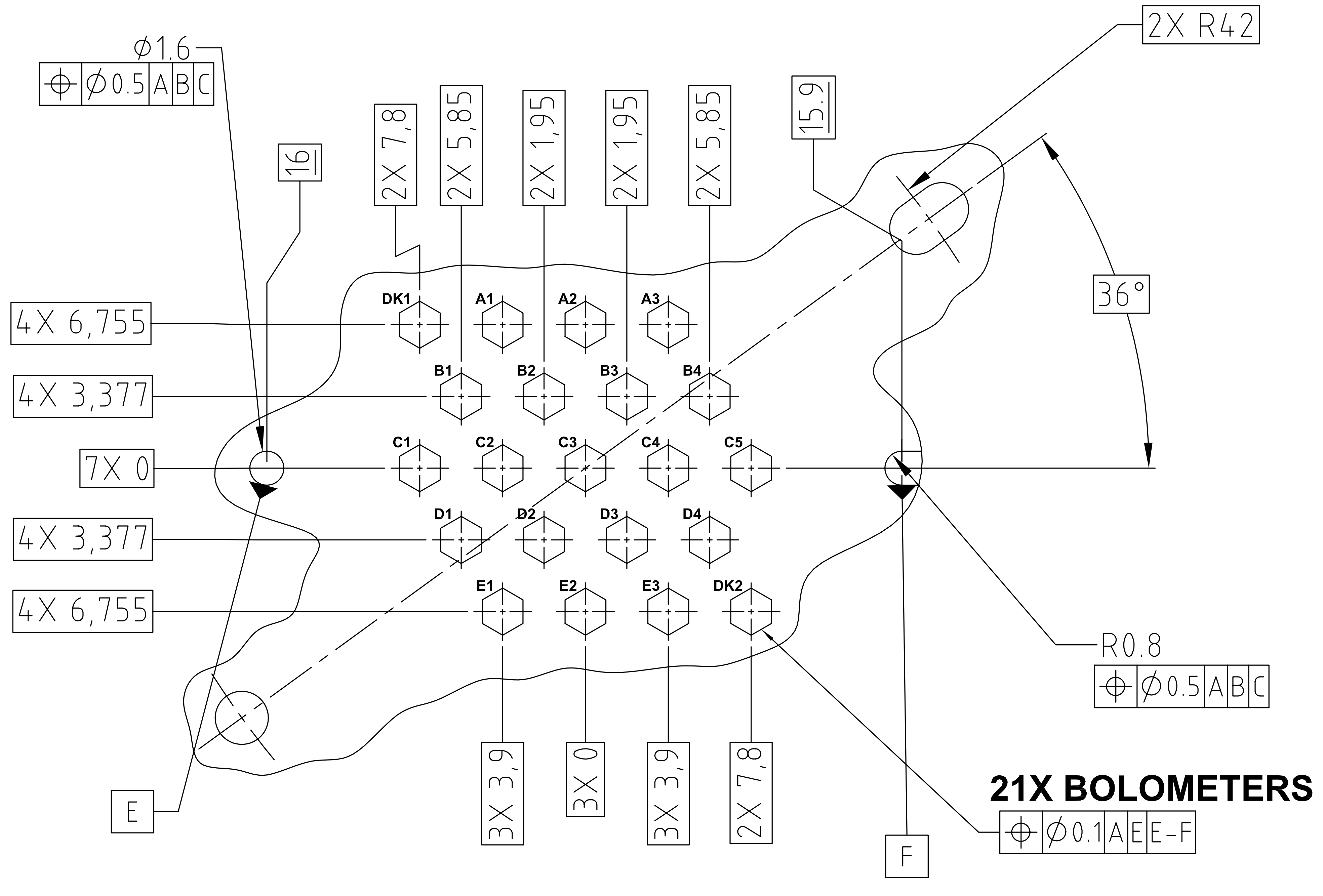
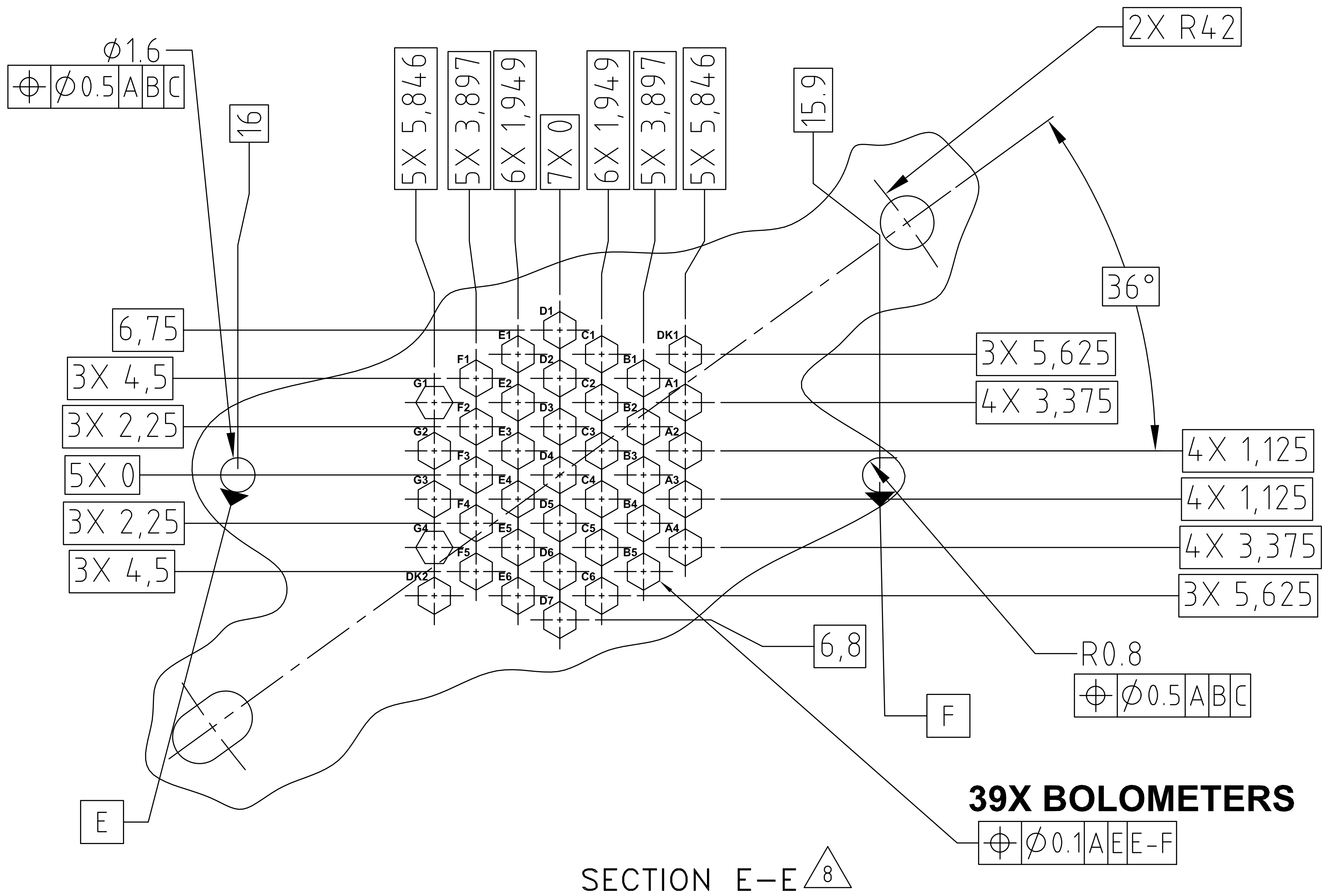
SUBSYSTEM INTERFACE DATA			
UNIT: S/LW			
NUMBER: 10209800-4			
FOCUS: 36.9			
CONNECTOR POSITIONS USED: J05			
MECHANICAL CHARACTERISTICS			
MASS: 550 g			
C.O.G. LOCATION W.R.T. LOCATION HOLE:	X 34.5	Y 24.1	Z 4.4
MOMENT OF INERTIA:	I_X 665 Kg*mm^2	I_Y 990 Kg*mm^2	I_Z 1,239 Kg*mm^2
MECHANICAL INTERFACE MATERIAL: 7075 AL			
SURFACE FINISH DESCRIPTION: CHEM FILM GOLD			
TOTAL CONTACT AREA: 1783 mm^2			
R.M.S. ROUGHNESS OF CONTACT AREA: 3.2 uM			
THERMAL STRAP INTERFACE MATERIAL: CU 99.999% PURE			
THERMAL STRAP SURFACE FINISH DESCRIPTION: GOLD PLATED			
THERMAL STRAP CONTACT AREA: 57.5 mm^2			
THERMAL STRAP R.M.S. ROUGHNESS OF CONTACT AREA: 3.2 uM			

SUBSYSTEM INTERFACE DATA			
UNIT: S.SW			
NUMBER: 10209800-5			
FOCUS: 26.7			
CONNECTOR POSITIONS USED: J05, J06			
MECHANICAL CHARACTERISTICS			
MASS: 510 g			
C.O.G. LOCATION W.R.T. LOCATION HOLE:	X 34.6	Y 24.2	Z 6
MOMENT OF INERTIA:	I_X 628 Kg*mm^2	I_Y 936 Kg*mm^2	I_Z 1,189 Kg*mm^2
MECHANICAL INTERFACE MATERIAL: 7075 AL			
SURFACE FINISH DESCRIPTION: CHEM FILM GOLD			
TOTAL CONTACT AREA: 1783 mm^2			
R.M.S. ROUGHNESS OF CONTACT AREA: 3.2 uM			
THERMAL STRAP INTERFACE MATERIAL: CU 99.999% PURE			
THERMAL STRAP SURFACE FINISH DESCRIPTION: GOLD PLATED			
THERMAL STRAP CONTACT AREA: 57.5 mm^2			
THERMAL STRAP R.M.S. ROUGHNESS OF CONTACT AREA: 3.2 uM			



SECTION D-D ⚠8
SPECTROMETER LONG WAVE
SCALE: 5:1

F9/SH2



SECTION E-E ⚠8
SPECTROMETER SHORT WAVE
SCALE: 5:1

G12/SH2

10209721 A1

SIZE A1	CAGE NO 23835	10209721	REV C
SCALE 5:1	UNCLASSIFIED	SHEET 7 OF 7	

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REV 2/00

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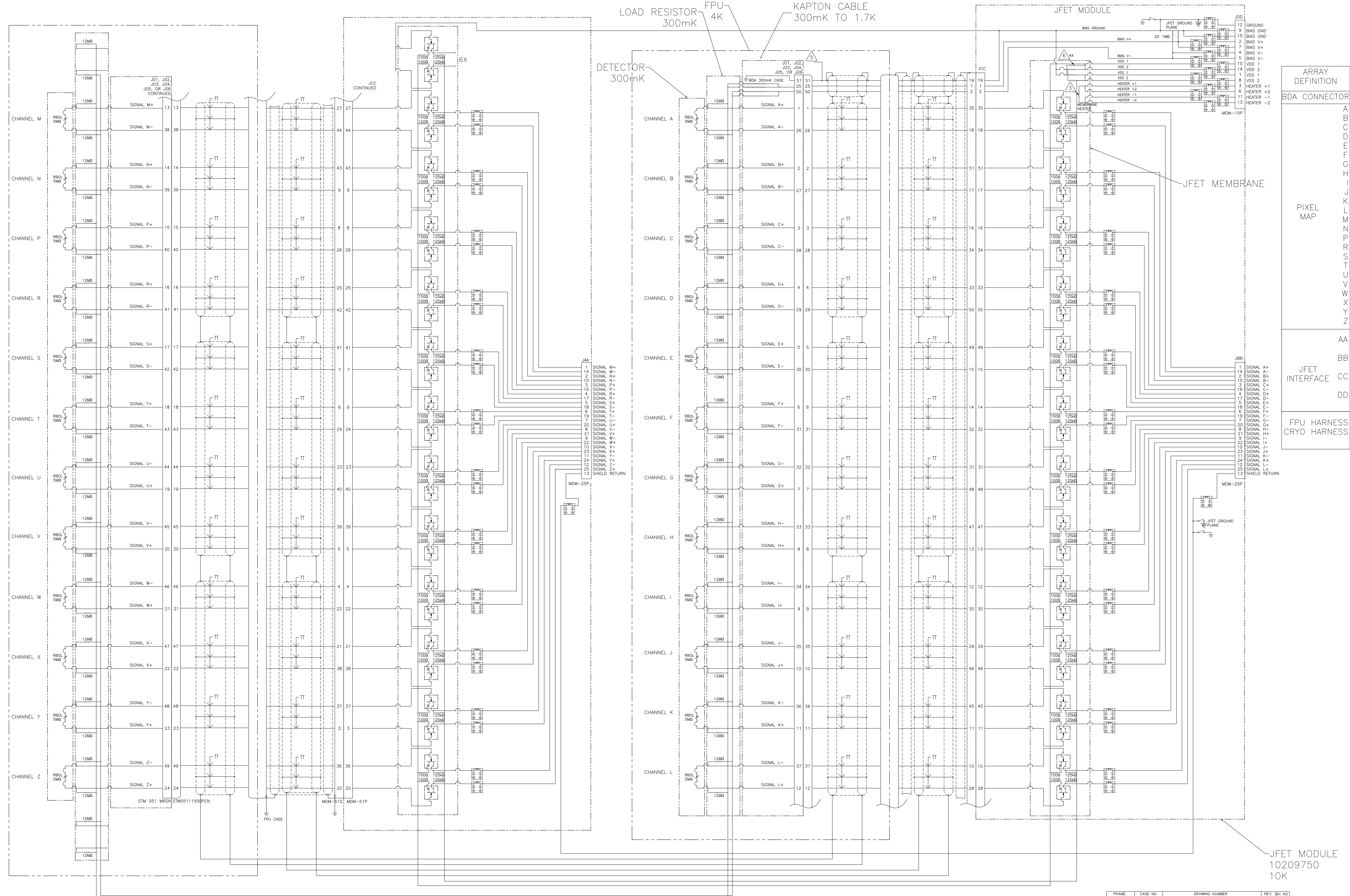
REVISIONS														
LTR	ZONE	DESCRIPTION	CODE	DWN	CHK	STRUCT	MATL	THRM CONT			ENGR	DSGN SUPV	DATA MGT	RELEASE DATE
A	—	INITIAL RELEASE	C	SEE TITLE BLOCK									RGB	3/18/03
B		INCORPORATED ECR 102651	D	DJC							MAW		RGB	07/12/04
C		INCORPORATED RAL ECR HR-SP-JPL-ECR-005	B											



ARRAY DEFINITION		10209800−1 P/LW		10209800−2 P/MW				10209800−3 P/SW						10209800−4 S/LW	10209800−5 S/SW	
BDA CONNECTOR		J05	J06	J01	J02	J03	J04	J01	J02	J03	J04	J05	J06	J05	J05	J06
PIXEL MAP	A	R1	E1	A7	E7	A13	R1	D6	F12	R1	E1	D11	G5	R1	R1	–
	B	A8	E2	A6	D7	T1	G1	B6	J11	D16	F1	A10	H6	T1	A4	–
	C	A7	E3	B6	F7	B12	T2	C5	E12	T1	T2	E10	J6	C1	A3	–
	D	A6	E4	C7	E8	C13	E1	A5	H12	B16	H1	C10	F6	DK1	A2	–
	E	A9	D1	A5	G8	A12	D1	E5	G12	C15	G1	B10	G6	B1	A1	–
	F	C9	D2	B5	F8	D12	F1	B5	F13	A15	J1	D10	H7	D1	DK1	–
	G	B8	D3	C6	E9	C12	E2	D5	E13	D15	H2	A9	F7	E1	B3	G3
	H	B7	D4	D6	G9	B11	G2	C4	J12	B15	F2	E9	J7	A1	B2	G4
	I	C7	C1	B4	D9	A11	F2	A4	H13	C14	J2	C9	G7	C2	B1	DK2
	J	B5	C3	C5	F9	E13	G3	D4	G13	D14	G2	B9	H8	D2	C3	F5
	K	B6	C5	D4	E10	D11	E3	B4	F14	A14	H3	D9	F8	B2	C2	F4
	L	A5	T2	A4	G10	C11	D3	C3	E14	A13	J3	A8	G8	E2	C1	E6
	M	T1	E5	C4	F10	B10	F3	B3	J13	B14	E2	C8	J8	A2	D3	E5
	N	B4	C6	B3	E11	A10	G4	A3	H14	C13	F3	E8	F9	C3	D2	E4
	P	C4	C8	C3	G11	D10	E4	A2	G14	B13	G3	D8	H9	D3	D1	D7
	R	B3	D5	B2	F11	B9	F4	D3	J14	D13	H4	B8	G9	B3	E3	D6
	S	C2	D6	D2	E12	C10	E5	C2	F15	A12	J4	C7	J9	E3	E2	D5
	T	B2	D7	A3	G12	C9	D5	B2	H15	C12	E3	E7	F10	C4	E1	D4
	U	B1	D8	A2	F12	A9	F5	D2	J15	D12	F4	A7	H10	DK2	F3	C6
	V	A3	E7	C2	G13	B8	G5	A1	G15	B12	G4	D7	G10	D4	F2	C5
	W	A4	E6	B1	DK2	A8	E6	C1	H16	E11	H5	B7	F11	C5	F1	C4
	X	A1	E8	A1	T/C	D8	G6	B1	DK2	A11	E4	C6	J10	B4	G1	B5
	Y	DK1	DK2	DK1	T/C	C8	F6	DK1	F16	C11	J5	E6	H11	A3	T1	B4
	Z	A2	E9	C1	T/C	B7	G7	D1	E15	B11	F5	A6	G11	T2	G2	T2
JFET INTERFACE	AA	HSJFP07 J14	HSJFP08 J16	HSJFP11 J22	HSJFP12 J24	HSJFP09 J18	HSJFP10 J20	HSJFP03 J06	HSJFP04 J08	HSJFP01 J02	HSJFP02 J04	HSJFP05 J10	HSJFP06 J12	HSJFS03 J06	HSJFS01 J02	HSJFS02 J04
	BB	HSJFP07 J13	HSJFP08 J15	HSJFP11 J21	HSJFP12 J23	HSJFP09 J17	HSJFP10 J19	HSJFP03 J05	HSJFP04 J07	HSJFP01 J01	HSJFP02 J03	HSJFP05 J09	HSJFP06 J11	HSJFS03 J05	HSJFS01 J01	HSJFS02 J03
	CC	HSJFP07 J35	HSJFP08 J36	HSJFP11 J39	HSJFP12 J40	HSJFP09 J37	HSJFP10 J38	HSJFP03 J31	HSJFP04 J32	HSJFP01 J29	HSJFP02 J30	HSJFP05 J33	HSJFP06 J34	HSJFS03 J13	HSJFS01 J11	HSJFS02 J12
	DD	HSJFP07 J47	HSJFP08 J48	HSJFP11 J51	HSJFP12 J52	HSJFP09 J49	HSJFP10 J50	HSJFP03 J43	HSJFP04 J44	HSJFP01 J41	HSJFP02 J42	HSJFP05 J45	HSJFP06 J46	HSJFS03 J17	HSJFS01 J15	HSJFS02 J16
FPU HARNESS		7	8	11	12	9	10	3	4	1	2	5	6	15	13	14
CRYO HARNESS		6	6	4	4	5	5	8	8	9	9	7	7	1	2	2

7. INFORMATION IN THIS DOCUMENT IS ALSO CONTAINED IN THE HARNESS DEFINITION DOCUMENT, RAL DOCUMENT SPIRE−RAL−PRJ−000608. IN AREAS WHERE THERE ARE CONFLICTS, THE HARNESS DEFINITION DOCUMENT TAKES PRECEDENCE.

6. ESD PROTECTION RESISTORS ARE 7 TIMES THE SOURCE RESISTOR.

5. GROUND WIRE TO BE TERMINATED AT INSTRUMENT INTEGRATION. WIRE WILL HAVE A MINIMUM LENGTH OF 150MM.

4. UNLESS OTHERWISE NOTED, ⏚ IS JFET CHASSIS GROUND.

3. JFET MEMBRANE HEATER IS 0.0204 TIMES THE SOURCE RESISTOR.

2. ALL RESISTORS HAVE A TOLERANCE OF ±40%.

1. THIS TECHNICAL DATA IS EXPORT CONTROLLED UNDER U.S. LAW AND IS BEING TRANSFERRED BY JPL TO PPARC PURSUANT TO THE NASA / PPARC LETTER OF AGREEMENT WHICH ENTERED INTO FORCE ON DECEMBER 2, 1999. THIS TECHNICAL DATA IS TRANSFERRED TO PPARC FOR USE EXCLUSIVELY ON THE NASA/PPARC SPIRE ON FIRST COOPERATIVE PROJECT, MAY NOT BE USED FOR ANY OTHER PURPOSE, AND SHALL NOT BE RE−TRANSFERRED OR DISCLOSED TO ANY OTHER PARTY WITHOUT THE PRIOR WRITTEN APPROVAL OF NASA.

NOTES: UNLESS OTHERWISE SPECIFIED

QTY REQD		ITEM NO	REF DES	CAGE NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATERIAL OR NOTE	ZONE

PARTS LIST

MATERIAL

METRIC

THIRD ANGLE PROJECTION

NEXT ASSEMBLY	USED ON
	SPIRE

APPLICATION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN MILLIMETERS
LINEAR TOLERANCES:

0−6	± 0.1
OVER 6−30	± 0.2
OVER 30−120	± 0.3
OVER 120−315	± 0.5
OVER 315−1000	± 0.8
OVER 1000	± 1.2

ANGULAR TOLERANCES:
± 0.5°
MACHINE FINISH (MICROMETERS) 3.2
DO NOT SCALE DRAWING
INTERPRET DWG PER ANSI Y14.100M

CONTRACT NO 1244858
APPD ______ DATE ______

DWN	D CRUMB	2/26/03
CHK	J BOCK	3/17/03
STRUCT		
MATL	D GRIFFIN	2/11/03
THRM CONT	B SWINYARD	2/11/03
RAL	J DELDERFIELD	2/10/03
PEM	G LILIENTHAL	3/17/03
ENGR	L HUSTED	2/26/03
DSGN SUPV		

JET PROPULSION LABORATORY
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CA 91109
RELEASED THROUGH EDMG

WIRING SCHEMATIC, SPIRE

SIZE	CAGE NO		REV
A1X3	23835	10209725	C

SCALE NONE UNCLASSIFIED SHEET 1 OF 1

REV 2/00

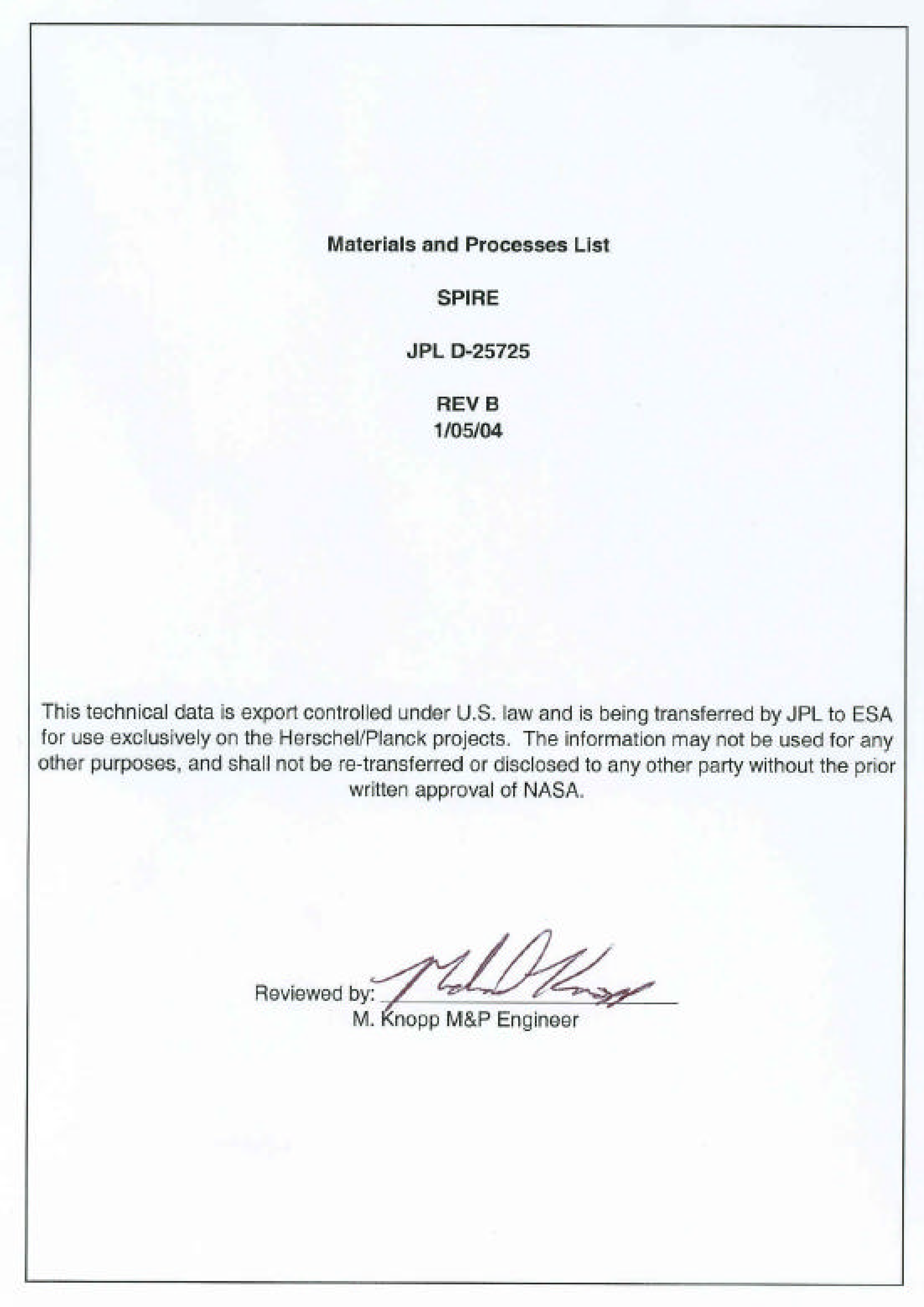
AutoCAD GENERATED

FRAME	CAGE NO	DRAWING NUMBER	REV	SH NO
1 OF 2	23835	10209725	C	1

Released on JUL-15-2004 by Richard G Bannister and signed by James J Bock CHK, Dustin J Crumb DEGN, Martin I Herman PEM, Mark A Weilert COGE, Richard G Bannister

SPIRE MIUL Cover Page

MIUL = Material Identification & Utilization List
Declared Materials List's and Processes List are not included in this HRCR



Materials and Processes List

SPIRE

JPL D-25725

REV B
1/05/04

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Reviewed by: ____________________
M. Knopp M&P Engineer

AIDS:	244558

SPIRE Assembly Array/Backshort Assembly Travelle
Revised by A Turner Dec 17,2004

Height measurements of Backshort to Detector to NTD chip

Device #	SLW 4.1	SLW BS 3.1
Date	16-Feb-05	
Collected by	A.Turner	
AIDS	244558	

Device Thickness Measurements

Zero at	Measure at	Meas (mm)
1	1	0.0000
1	2	-1.0220
1	3	-1.0230
1	4	-1.0225
1	5	0.0000
1	6	-1.0230
1	7	-1.0260
1	8	-1.0255
1	9	-1.0265
1	10	-1.0275
1	11	-1.0250
1	12	-1.0275
1	13	-1.0295
1	14	-1.0335
1	15	-1.0360
1	16	-0.0010
1	17	-1.0295
1	18	-1.0335
1	19	-1.0380
1	20	-0.0020

Targets	mm	tol (mm)
Stack thick	1.0283	0.0465
NTD chip	0.0250	0.0100
BS dist	0.113	0.011

Stack Thickness (mm)	
Average	1.0280
max	1.0380
min	1.0220
p-p	0.0160

Backshort Thickness(mm)	
Average	0.9203
max	0.9200
min	0.9205
p-p	0.0005

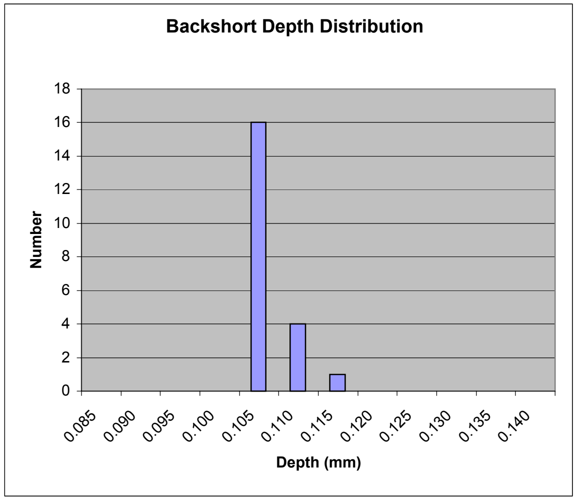
Backshort Distance (mm)	
Average	0.1091
max	0.1160
min	0.1060
p-p	0.0100

NTD Chip Thickness(mm)	
Average	0.0314
max	0.0355
min	0.0260
p-p	0.0095

a= BS height
b= to web
c= NTD height

Pillar Height Measurements

Zero at	Pixel#	a (mm)	b(mm)	c(mm)	NTD chip (mm)	BS dist (mm)
1	DK1	-0.9200	-1.0260	-1.0590	0.0330	0.1060
1	A1	-0.9200	-1.0265	-1.0620	0.0355	0.1065
1	A2	-0.9200	-1.0275	-1.0560	0.0285	0.1075
1	A3	-0.9200	-1.0270	-1.0560	0.0290	0.1070
1	T1		-1.0265	-1.0635	0.0370	
1	B1	-0.9200	-1.0285	-1.0575	0.0290	0.1085
1	B2	-0.9200	-1.0275	-1.0615	0.0340	0.1075
1	B3	-0.9200	-1.0270	-1.0585	0.0315	0.1070
1	B4	-0.9205	-1.0280	-1.0570	0.0290	0.1075
1	T2		-1.0280	-1.0600	0.0320	
1	C1	-0.9205	-1.0280	-1.0600	0.0320	0.1075
1	C2	-0.9205	-1.0285	-1.0600	0.0315	0.1080
1	C3	-0.9200	-1.0285	-1.0545	0.0260	0.1085
1	C4	-0.9200	-1.0290	-1.0605	0.0315	0.1090
1	C5	-0.9200	-1.0310	-1.0655	0.0345	0.1110
1	D1	-0.9205	-1.0290	-1.0590	0.0300	0.1085
1	D2	-0.9205	-1.0290	-1.0590	0.0300	0.1085
1	D3	-0.9205	-1.0295	-1.0600	0.0305	0.1090
1	D4	-0.9205	-1.0330	-1.0665	0.0335	0.1125
1	E1	-0.9205	-1.0305	-1.0620	0.0315	0.1100
1	E2	-0.9205	-1.0320	-1.0665	0.0345	0.1115
1	E3	-0.9205	-1.0335	-1.0655	0.0320	0.1130
1	DK2	-0.9205	-1.0365	-1.0695	0.0330	0.1160



SPIRE Assembly Array/Backshort Assembly Traveller
Revised by A Turner Dec 17,2004

Backshort Distance after Assembly (in mm)

Device	**SLW 4.1**
Date	**02/16/05**
By	**A.Turner**
AIDS	**244558**

	DK1 0.106		A1 0.1065		A2 0.1075		A3 0.107			
T1 🟥		B1 0.1085		B2 0.1075		B3 0.107		B4 0.1075		T2 🟥
	C1 0.1075		C2 0.108		C3 0.1085		C4 0.109		C5 0.111	
		D1 0.1085		D2 0.1085		D3 0.109		D4 0.1125		
			E1 0.11		E2 0.1115		E3 0.113		DK2 0.116	

BS Range (mm)	
Low	0.102
High	0.124

BS Dist to web (mm)	
Average	0.1091
Max	0.1160
Min	0.1060
p-p	0.0100

Stack Thickness(mm)	
Average	1.0280
Max	1.0380
Min	1.0220
p-p	0.0160

BS Thickness (mm)	
Average	0.9203
Max	0.9200
Min	0.9205
p-p	0.0005

Detector Front Short Gap

FH-SLW 10209843-1 SN02 Hex

	xaxis						
yaxis	0.000	-6.250	-12.500	-18.750	-25.000	-31.250	-37.500
0.000	0.000	0.004	0.007	0.009	0.012	0.012	0.011
-4.467	0.001	0.007	-1.805	-1.805	-1.799	0.016	0.016
-8.933	0.003	0.007	-1.808	-1.804	-1.800	0.016	0.020
-13.400	0.003	0.005	-1.809	-1.805	-1.801	0.014	0.020
-17.867	0.002	0.005	-1.809	-1.806	-1.800	0.015	0.018
-22.333	0.001	0.005	-1.809	-1.805	-1.801	0.014	0.014
-26.800	0.002	0.005	0.006	0.009	0.013	0.012	0.012

Slope Corrected

	xaxis						
yaxis	0.000	-6.250	-12.500	-18.750	-25.000	-31.250	-37.500
0.000	0.000	0.002	0.004	0.004	0.005	0.003	0.000
-4.467	0.000	0.005	-1.808	-1.810	-1.806	0.007	0.005
-8.933	0.003	0.004	-1.812	-1.810	-1.807	0.006	0.009
-13.400	0.002	0.003	-1.813	-1.811	-1.808	0.004	0.009
-17.867	0.001	0.003	-1.813	-1.811	-1.807	0.006	0.006
-22.333	0.000	0.002	-1.813	-1.811	-1.808	0.004	0.002
-26.800	0.001	0.002	0.002	0.002	0.005	0.002	0.000

ave =	-1.810
max =	-1.806
min =	-1.813
p-p =	0.007

cp16-SN010-SLW 4.1-SLWBS3.1 clipped in

	xaxis						
yaxis	0.000	-6.250	-12.500	-18.750	-25.000	-31.250	-37.500
0.000	0.000	2.992	2.994	2.994	2.993	2.990	-0.003
4.467	n/a	1.968	1.965	1.965	1.966	1.969	n/a
8.933	n/a	n/a	1.964	1.963	1.963	n/a	n/a
13.400	n/a	n/a	1.962	1.959	1.959	n/a	n/a
17.867	n/a	n/a	1.961	1.956	1.955	n/a	n/a
22.333	n/a	1.963	1.957	1.953	1.950	1.950	n/a
26.800	-0.003	2.551	2.554	2.555	2.555	2.553	-0.009

Slope Corrected

	xaxis						
yaxis	0.000	-6.250	-12.500	-18.750	-25.000	-31.250	-37.500
0	0.000	2.992	2.994	2.995	2.995	2.992	0.000
-4.467	#VALUE!	1.969	1.966	1.967	1.968	1.972	#VALUE!
-8.933	#VALUE!	#VALUE!	1.965	1.965	1.966	#VALUE!	#VALUE!
-13.400	#VALUE!	#VALUE!	1.964	1.962	1.961	#VALUE!	#VALUE!
-17.867	#VALUE!	#VALUE!	1.963	1.959	1.958	#VALUE!	#VALUE!
-22.333	#VALUE!	1.965	1.959	1.956	1.953	1.954	#VALUE!
-26.800	0.000	2.554	2.557	2.559	2.559	2.557	-0.004

ave =	1.963
max =	1.972
min =	1.953
p-p =	0.018

Front short Estimation
GAP

yaxis	0.000	-6.250	-12.500	-18.750	-25.000	-31.250	-37.500
0.000	0.000						0.000
-4.467			0.158	0.157	0.162		
-8.933			0.153	0.156	0.159		
-13.400			0.151	0.151	0.153		
-17.867			0.150	0.148	0.151		
-22.333			0.147	0.145	0.145		
-26.800	0.001						-0.004

ave =	0.152
max =	0.162
min =	0.145
p-p=	0.017

Coverplate SN	**cp-16 SN010**
Feedhorn SN	**SLW SN02**
Detector SN	**SLW 4.1**
Backshort SN	**SLW BS 3.1**
SLW FS	**0.158**
SLW FS tol	**0.054**
SLW BS	**0.113**
SLW BS tol	**0.011**

Alignment Measurement Summary

for

FS SLW BDA

10209800-4 SN015

WARM ALIGNMENT MEASUREMENTS:

Position:

Center of feed horn entrance plane with respect to the alignment pin hole, mounting face and alignment slot as defined in the ICD drawing 10209721 sht. 3 (see Figure 1 below)

(x,y,z) = (24.756, -33.673, 36.852) (all distances in mm)

Nominal x,y position:

(x_{nom},y_{nom}) = (24.687, -33.979)

x-y shift from nominal:

(dx,dy) = (0.069, 0.306)

The z position of the suspended part referenced to the 34.2 mm nominal dimension on ICD pg 2, zone G9:

Measured z dimension:

34.300 mm

Z shift from nominal

0.100 mm

Rotation:

Feed horn rotation in xy plane (top view, as in ICD, sht. 3)

0.081° counterclockwise

Normal vector to feedhorn entrance plane:

(-0.00389, 0.01095, 0.99993)

which is 0.666° from the z direction.

COLD ALIGNMENT MEASUREMENTS:

(BDA cooled from RmT to approximately 7-8 K)

Shifts on Cooling:

XY Shift of center of 300 mK stage on cooling (with respect to flange alignment pin hole):

$(dx, dy) =(-0.13, 0.13)$

300 mK stage rotation in xy plane on cooling (top view):

$|\theta| < 0.04°$ (not repeatable, values scattered below this limit)

The suspended portion of the BDA shifted approximately 0.06 mm down in the z axis on cooling, moving closer to the mounting flange. The rotation about the x-axis on cooling was measured as -0.09° (+y end moving down toward mounting plate), but this did not recover on warming, so the repeatability is in question. We have no information about rotation in the y axis on cooling.

These shifts are not accurate to better than ±40 microns, and the repeatability over multiple cooldowns is not well known.

Net Result:

xy cold position of the feedhorn center relative to alignment pin hole:

$(x, y) = (24.63, -33.54)$

Rotation of feedhorn relative to xy axes (top view) is nominally 0.08° ccw, ± roughly 0.04°.

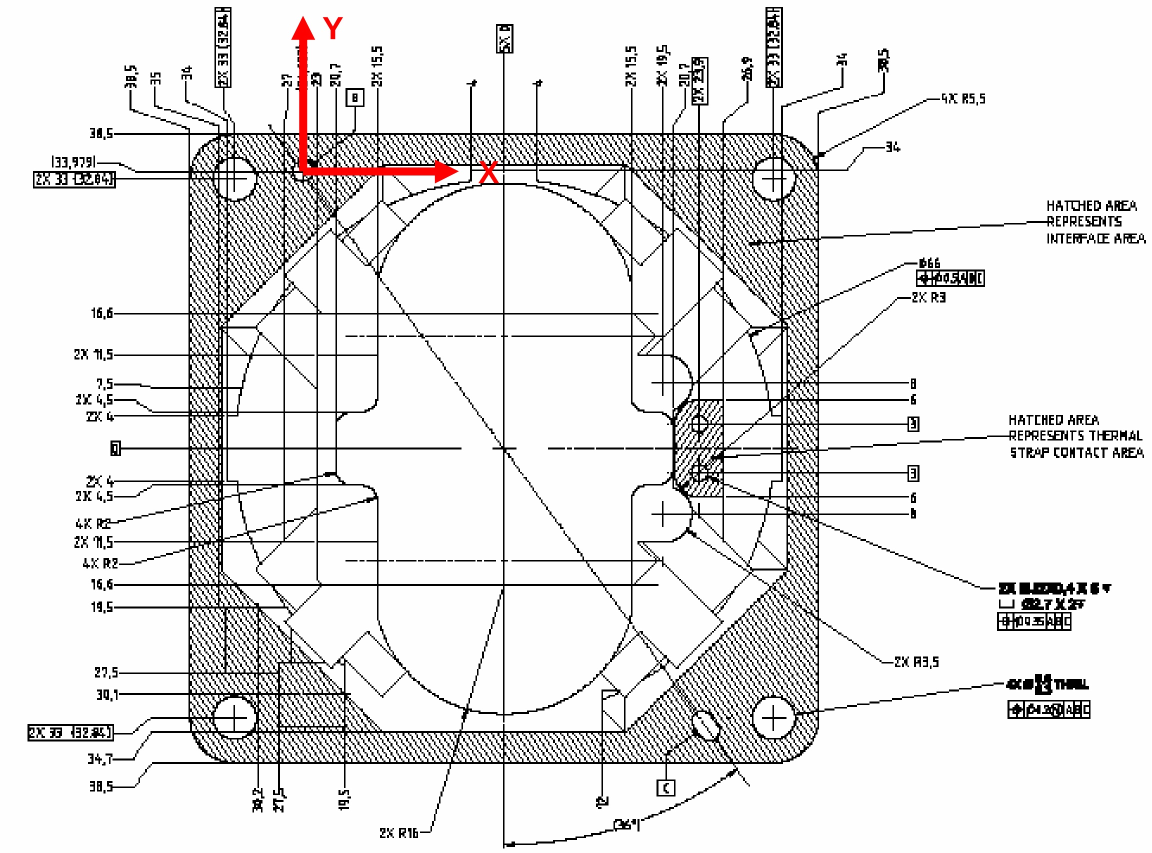


Figure 1 (excerpt from ICD dwg 10209721, with coordinate axes shown)

CMI *Advancing Ultra-Precision Manufacturing*

Custom Microwave Inc.
940 Boston Avenue
Longmont, CO 80501

CERTIFICATE OF COMPLIANCE

JPL	1248788
CUSTOMER	PURCHASE ORDER NUMBER
3609	10209843
INVOICE NUMBER	PART NUMBER(S)
P8647	1 EA.
LOT NUMBER(S)/SERIAL	QUANTITY

Custom Microwave, Inc. certifies that all materials and processes used in the manufacturing of supplied parts conforms in all respects to the above mentioned purchase order, specification and/or drawing requirements and that documents are on file to substantiate this and are available for examination. Custom Microwave, Inc. further certifies that no parts supplied against this purchase order contain mercury or have come in contact with mercury or mercury compounds nor do they contain beryllium or beryllium compounds except beryllium copper.

Authorized Signature Quality Assurance Manager	07/22/03 Date

CMI CAGE CODE: 5Y549

MATERIALS:

COPPER C101 HOUSING: RM#954
BRASS WIRE RM# 1200
SN96 SOLDER: RM#1183

PROCESSES:

COPPER ELECTROFORM CMI COPPER # 3
GOLD PLATE PER MIL-G-45204, TYPE 3, CLASS 1, GRADE A

NCR # 12265 attached

1/18

INSPECTION PORT
検 査 成 績 表

Messrs
納先 TMX DIVISION/MILWAUKEE
Order No.
注文No. AT-279 (TOC-279) *TMXP/ONO. 745977/136776-2

No. *B-5003
Date
日付 00/01/28

Manufacturring No. 製造番号	Specification 規格	Article 品名	Size 寸法	Quantity Ordered 注文数量	Quantity Delivered 納入数量
91V1897	SP73-14-1104E ASTM-F-68-93	C1011BD-H (UNS C10100)	2" -12FT	4, 000. 0 LBS	3, 688. 4 LBS (01)

DIMENSION AND PHYSICAL PROPERTY
寸法と物理的性質

Item 項目	Dimension 寸法			Tension Test 引張試験		Yield Strength .2 %Offset 耐力 ksi※	Hardness Test 硬さ試験 HRF	Grain Size 結晶粒度 (mm)	Electric Conductivity 導電率 at 20°C (%)	Electric Resistivity 電気抵抗 at 20°C Ωmm²/m	Pressure Test 水圧試験 Mpa	
	Out. Dia. 外径 (IN)	巾 ( )	Length 長さ (IN)	Tensile Strength 引張り強さ ksi※	Elongation 伸び (%)							
Spec. Value 規格値 Sample No. 試料No.	2" +0. 0025 -0. 0025		12FT - -	Min. Max.	Min. 16 Max.	Min. 37. 0 Max.	Min. 77. 0 Max.	Min. Max.	Min. 101. 0 Max.	Max.	Min.	
1	PASSED	-	PASSED	-	23	41. 9	81. 0	-	101. 8	-	-	

Quench Test (はく離試験) -
H2 Embrittlement Test (水素ぜい化試験) PASSED
MICROSCOPIC BLISTER MACRODEFECT
REPEATED BENDING Min(10) 12. 0

Bend Test (曲げ試験) -
VISUAL INSPECTION (ｶﾞｲｶﾝ ｹﾝｻ) GOOD

Eddy Current Test (渦流探傷試験) -
Expanding Test (押し拡げ試験) -
Flattening Test (偏平試験) -

CHEMICAL COMPOSITION
化学成分 (%)　(ppm)　REMARK: MATERIAL IS FREE FROM MERCURY

※1ksi=1000Lb/in2

Element 成分	Cu +				Pb	Zn	Bi	Cd	O	P	S	Se	Te	Sb	As	Fe	Mn	Ni	Ag	Sn			
Specified Value 規格値	Min. 99. 99	~			Max. 5	Max. 1	Max. 1	Max. 1	Max. 5	Max 3	Max. 15	Max. 3	Max. 2	Max. 4	Max. 5	Max. 10	Max. 0. 5	Max. 10	Max. 25	Max. 2			
Measured Value 測定値	99. 99				1	0. 3	0. 2	0. 2	2	2	8	2	0. 5	1	1	4	0. 3	1	8	1			

HITACHI CABLE, LTD.
TSUCHIURA WORKS

Manager Quality Assuranca Dept.

FM 954

SOLD TO Custom Microwave Co
DATE 8-14-02 QTY. 24#s
CUSTOMER P.O. 11587
SHIPPER NO. ND 7200
BY
COPPER and BRASS SALES
INC.

of Test Report

Item	Customer PO

ereby certify that this
represents materials
on the above order
rass Sales, Inc.

EIS Phoenix
1524 West 14th Street Suite 106
TEMPE AZ 85281
USA

Packing List # 2643045
Cust. Phone: 3036510707
Page: 2 / 3

Date: 04/22/02 00:46:23
Sales Order #: 16054154
Sales Order Dt: 04/08/02

Sold To: CUSTOM MICROWAVE, INC
940 BOSTON AVE
LONGMONT CO 80501
USA

Ship To: CUSTOM MICROWAVE, INC
940 BOSTON AVE
LONGMONT CO 80501
USA

RM 1183

CUSTOMER ORDER NO. 12446

PCS.

WT.

BILL OF LADING 2643045

PACKING LIST NO 2643045

ORDER DATE 04/08/02

CUST. NO 80913

Sales INSIDE SALESMAN Krist Althoff

ORDERED BY

SHIP VIA FRT PPD & CHG

Phone #:30332

SHIP DATE 04/22/02

SALESMAN 99944

④

PICKED BY

DATE

CATALOG	DESCRIPTION COLOR: PUT UP:	U/M	QUANTITY ORDERED	QUANTITY SHIPPED	QUANTITY BACK ORDERED
SN96SW.031 2306B	SOLDER,SOLID WIRE,SN96.3AG3.7,1 LB	LB	2.00	②	0.00

****

CERTIFICATE OF CONFORMANCE

PRODUCTS SHIPPED ON THIS P.O. NUMBER, IDENTIFIED DIRECTLY ABOVE WERE MANUFACTURED IN CONFORMANCE WITH MANUFACTURER S SPECIFICATIONS

Signature / Title: Certs Analyst

Date of Mfg	Lot/Batch Number	Shelf life	Date of Expir.
03/28/02	210903	Unlimited	N/A
__/__/__			__/__/__
__/__/__			__/__/__

****

CATALOG	DESCRIPTION	U/M	QUANTITY ORDERED	QUANTITY SHIPPED	QUANTITY BACK ORDERED
KES185G 7001B FLAMMABLE LIQUID	185 RMA Rosin Flux, 1-gal	GL	1.00	①	0.00

THIS SALE IS SUBJECT TO ALL CONDITIONS AND PROVISIONS APPEARING ON THE REVERSE HEREOF

EDM Supplies, Inc.
9806 Everest Street
Downey, CA 90242-3199
Phone: 562-803-6563
Fax: 562-803-4281

SHIPPER

Sales Order Number	250913
Shipper Number	2
Ship Date	06/28/02
Page	1

SOLD TO
103884
CUSTOM MICROWAVE
940 BOSTON AVE
LONGMONT CO 80501

BILL TO
103884
CUSTOM MICROWAVE
940 BOSTON AVE
LONGMONT CO 80501

FOB: DOWNEY
Terms: NET 30
Freight: PREPAID AND ADD
Customer's PO: 12557
Resale No:

LI#	Order/Qty	UM	Part/Description	Units/Pkg	Ship Qty	Lot Number
1	10	EA	C22-023 .023 DIA. X 12 PBR Rm 1200		5	0
2	10	EA	C22-024 .024 DIA. X 12 PBR Rm 1201		10	0
5	10	EA	C22-027 Rm 1204 .027 DIA. X 12 PBR *****CERTIFICATIONS***** WE HEREBY CERTIFY THIS MATERIAL TO BE PRECISION BRASS ROD ALLOY 260 SIGNED: Lisa Boudreau ORDERED BY DAN JONGSMA		4	0

Ship Via: UPS GRND PPB
Waybill No:

SHIP TO: CUSTOM MICROWAVE
940 BOSTON AVE
LONGMONT CO 80501

CMI Quality Assurance Inspection Plan

Checked By: TA	Date: 5-8-03	DC Stamp CM DC	MAP # MP12700	Rev. 1			
Proj #	P8647	Description	Feedhorn Block, 10209843, Final Assembly	Part #	10209843	Rev.	X11
Customer	JPL	Total Quantity	1	Serial Numbers		MIL STD -105 LEVEL II SINGLE C=100% M= 1.5 AQL A= 4.0 AQL	

Item #	Characteristic	Seq # No.	Dwg Zone	AQL	Insp Gage Number	Actual/Range	Qty Insp	Qty Acc	Qty Rej	Cert Oper Stamp Date	Insp Stamp Date
5	Record Proj #, S/N's, QTY on QAIP	40		C							
	CMI dwg # 16956										
10	Ø.375±.005	40	F2	C		.375	1	1	0		CMI 6 6-2-03
15	Ø.829+.000/-.005 ⌖ Ø.004 X-Y-Z	40	F4	C		.8272 .00125					
20	1.339±.000/-.008	40	E4	C		1.33475					
25	1.772±.010	40	D3	C		1.7718					
30	4X R.354±.008	40	E2	C		.3540					
35	1.6364	40	C2	C		1.6367					
40	▱ .0002	40	C2	C		.00019					
45	R.020±.004	40	D4	C		.020					
50	.1944	40	C4	C		.19471					
55	// .0002 X	40	C4	C		.00020	↓	↓	↓		↓
	CMI dwg # 16957										
57	~~.1450~~ .1420 (RECORD FOR REF)	40	D2	C		ACCEPT PER LATHE	19	19	0		9 6-2-03
58	~~1.8307~~ 1.8337 (USE .1420) PER PRINT 6-2-03	44	D4	C		ACCEPT PER LATHE	↓	↓	↓		↓

CMI Quality Assurance Inspection Plan

Checked By: Date:	DC Stamp DC	MAP # MP12700	Rev. 1		
Proj #		Description	Feedhorn Block, 10209843, Final Assembly	Part #	10209843
Rev.	X11				
Customer	JPL	Total Quantity		Serial Numbers	

MIL STD -105 LEVEL II SINGLE
C=100% M= 1.5 AQL A= 4.0 AQL

Item #	Characteristic	Seq # No.	Dwg Zone	AQL	Insp Gage Number	Actual/Range	Qty Insp	Qty Acc	Qty Rej	Cert Oper Stamp Date	Insp Stamp Date
	JPL dwg # 10209843										
60	⌖ Ø0,04 X Y Z	75	D3	C		.0292 MAX	1	1	0		CMI 6 8-4-03
61	◎ 0,015 E	75	G12	C		ACCEPT .015 MAX	1	1	0		↓
	CMI dwg # 18136										
62	1.6314	93	B2	C		1.6314	1	1	0		CMI 6 6-19-03
63	.1884	93	B4	C		~~[illegible]~~ 6-19-03 ~~.1886 - .1889~~ .18855-.18835	1	1	0		CMI 6 6-19-03
64	~~⌓Ø.013 X Y Z All around~~ INSPECT PER NOTES 3 & 4 DWG 10209843	~~93~~ 125 7-7-03	D5	C		ACCEPT SEE ATTACHED REPORT.	1	1	0		CMI 6 7-7-03
	JPL dwg # 10209843										
65	inspect assembly for aluminum, stains, and debris	125		C		ACCEPT	1	1	0		↓
70	4X R9	140	D10	C		8.95 - 8.99	1	1	0		CMI 6 7-22-03
75	26,06 MAX (see note 4)	140	D11	C		25.6	↓	↓	↓		↓
80	5,94 MIN (see note 4)	140	D10	C		6.49					
82	38,5	140	C11	C		38.56					
83	6,5	140	C10	C		6.471					
85	// 0,05 A	140	F10	C		.0168					

CMI Quality Assurance Inspection Plan

Checked By:

Date:

DC Stamp: CMI DC

MAP #: MP12700

Rev.: 1

Proj #

Description: Feedhorn Block, 10209843, Final Assembly

Part #: 10209843

Rev.: X11

Customer: JPL

Total Quantity:

Serial Numbers:

MIL STD -105 LEVEL II SINGLE
C=100% M= 1.5 AQL A= 4.0 AQL

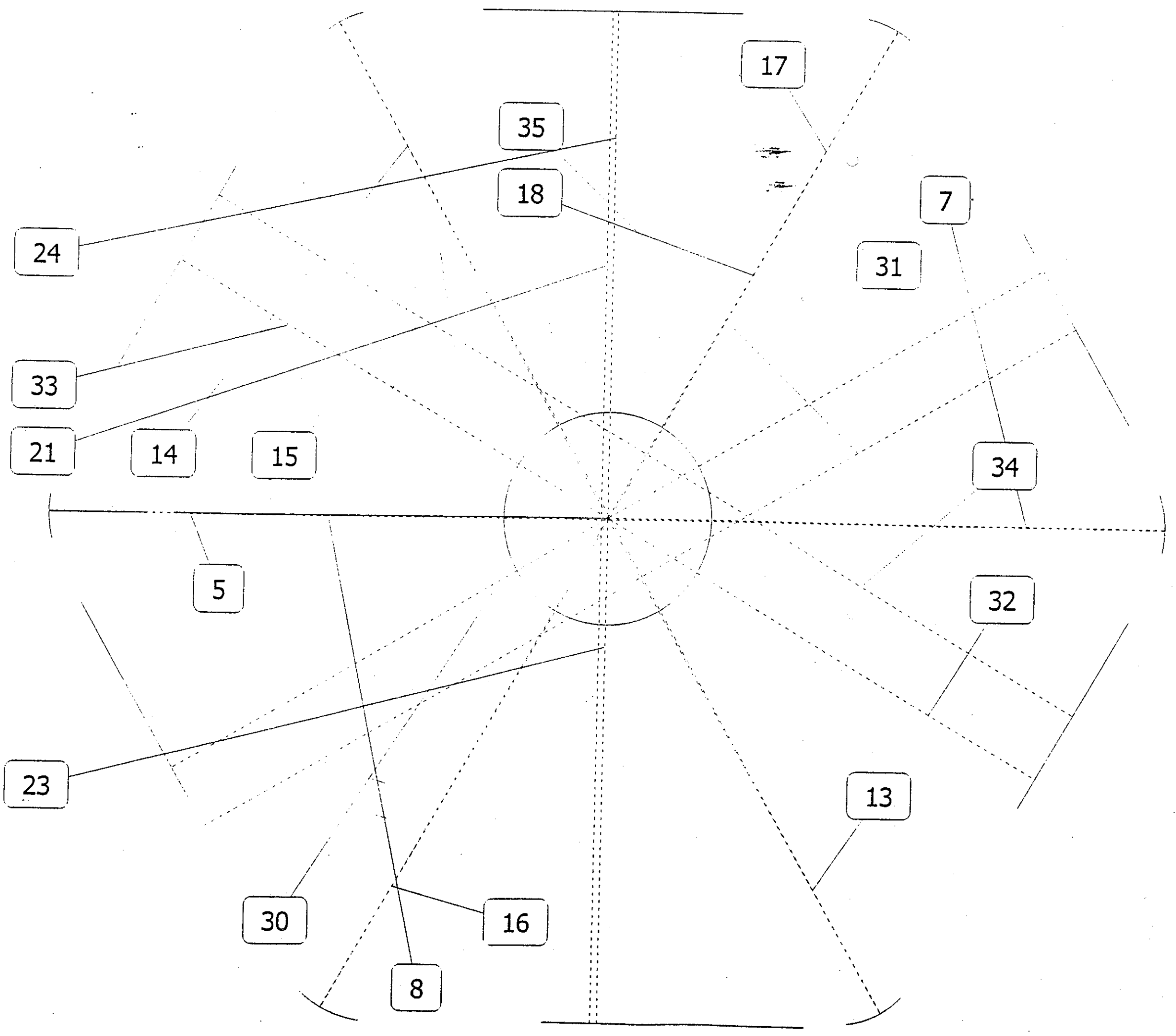
Item #	Characteristic	Seq # No.	Dwg Zone	AQL	Insp Gage Number	Actual/Range	Qty Insp	Qty Acc	Qty Rej	Cert Oper Stamp Date	Insp Stamp Date
90	46,247±0,2 (4 corners)	140	E11	C		7-22-03 ~~46.2247~~ 46.2247	1	1	0		CMI 8 7-22-03
95	// 0,003 A	140	D10	C		.0025	↓	↓	↓		↓
100	2X 17+0/-0,2	140	E8	C		16.96 — 16.95					
105	Ø21 (see note 4)	140	H10	C		20.73					
110	2X R0,5 all around	140	E9	C		.4 - .5					
115	3	140	E7	C		2.983					
120	1,81+0,02/-0 9 boss points, 9 land points	140	E7	C	AVG =	1,8128 PLANE TO PLANE 1.8104 — 1.8131 POINT TO POINT					
125	2X 9 MAX	140	E8	C		8.99 — 8.97					
130	▱ 0,003	140	D7	C		.0026 10 POINTS					
135	19X Ø3,8/3,795 ◎ 0,015 E	140	G10	C		3.823 — 3.8083 .015 MAX NCR 12265 CMI 8	1	1 ~~0~~	0 ~~1~~ 7-30-03		CMI 8 7-22-03
140	19X Ø0,398/0,393 ⌖ Ø0,04 X Y Z	140	D3	C		~~.4020 - .3969~~ 7-22-03 .4019-.3966 .0374 MAX NCR 12265 CMI 8	1	1 ~~0~~	0 ~~1~~ 7-30-03		CMI 8 7-22-03
143	19X 0,2 surface finish	140	E6	C		ACCEPT 0.2	1	1	0		CMI 8 7-22-03
145	4X Ø2,25/2 THRU ⌖ Ø0,05 Ⓜ X Y Z	140	D12	C		2.0338 — 2.1109 .1161 OK WITH BONUS	↓	↓	↓		↓
150	2X Ø3,2/3,12 THRU ⌵ Ø3,85/3,6 X 90° M3,5 X 0,35-6H	140	H12	C		3.1496 3.6068 X 90° ACCEPT					

4/25/2003 F1076 rev.0

CMI Quality Assurance Inspection Plan	Checked By: Date:	DC Stamp CM DC	MAP # MP12700	Rev. 1	
Proj #		Description	Feedhorn Block, 10209843, Final Assembly	Part #	10209843	Rev.	X11
Customer	JPL	Total Quantity		Serial Numbers		MIL STD -105 LEVEL II SINGLE C=100% M= 1.5 AQL A= 4.0 AQL	

Item #	Characteristic	Seq # No.	Dwg Zone	AQL	Insp Gage Number	Actual/Range	Qty Insp	Qty Acc	Qty Rej	Cert Oper Stamp Date	Insp Stamp Date
	⌖ Ø0,35 X Y Z					.0602 MAX	1	1	0		QM1 6 7-[illegible]-03
155	Ø1,61/1,6 THRU	140	C10	C		1.6035					QM1 6 7-[illegible]-03
160	1,6+0,01/-0 ⌖0,1 A B C	140	E1	C		1.6005 - 1.6054 .0338					
165	0,5 ⌖0,1 A B C	140	E2	C		.4911 .0338					
170	2X R	140	E2	C		ACCEPT					
175	Weight parts and record results	140		C		117.5g					
180	Inspect plating per SP1019, section 6.2	140		C		ACCEPT					
185	Final Inspect as per SP1019	140		C		ACCEPT					

Feedhorn outer housing dimensions
(not significant)

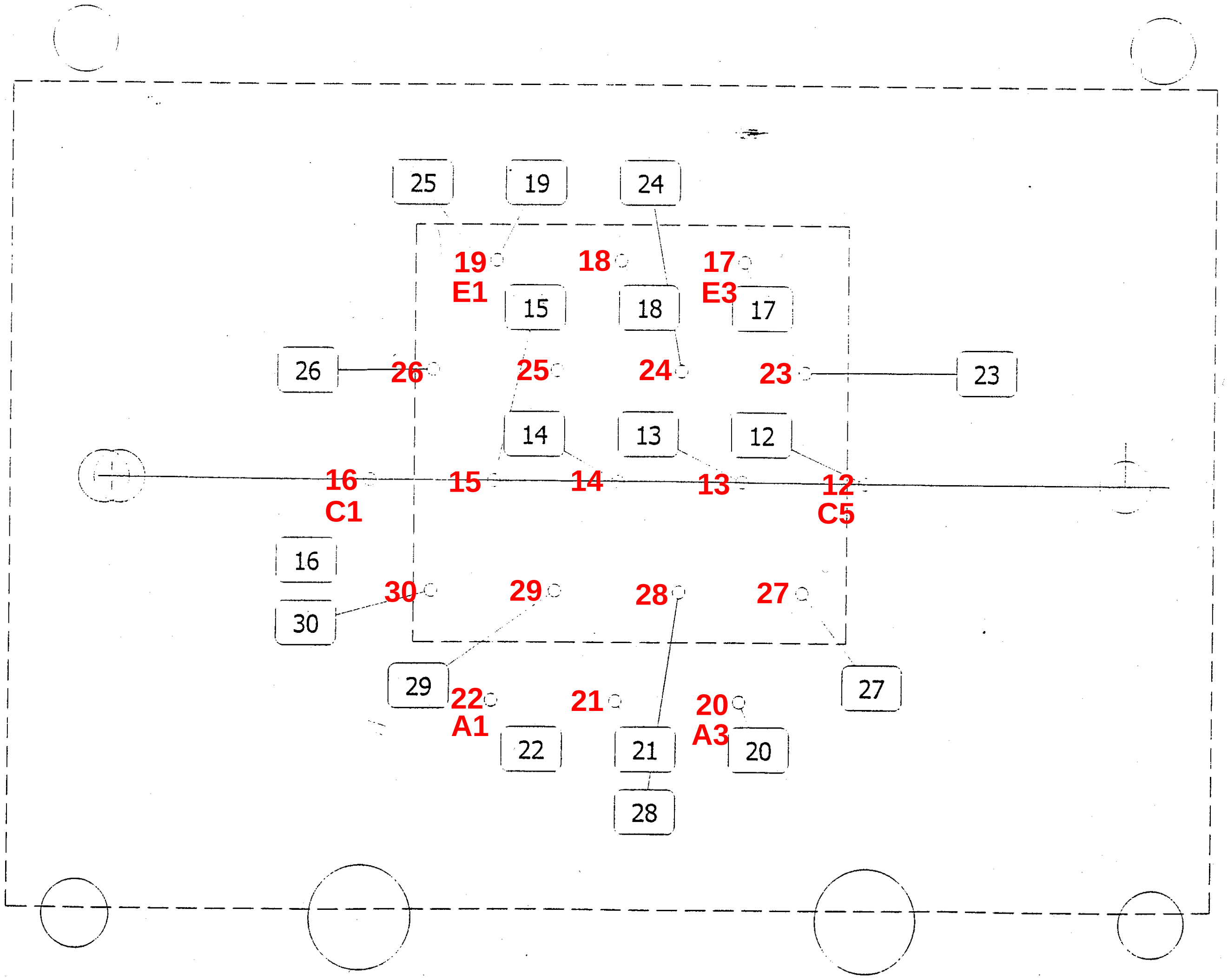


```
Program: Untitled
Units: mm, dec deg                                   Date: Mon Jul 07 2003     Time: 09:05:02

Feature                      Actual     Nominal     Plus (+)    Minus (-)    Dev/Nom     Out/Tol
------------------------------------------------------------------------------------------------
Distance 5                   [MCS]
  Distance XY               10.3292     10.5000     0.0000      2.5000      -0.1708

Distance 7                   [MCS]
  Distance XY               10.3261     10.5000     0.0000      2.5000      -0.1739

Distance 8                   [MCS]
  Distance XY               20.6552     21.0000     0.0000      5.0000      -0.3448

Distance 13                  [MCS]
  Distance XY               10.3695     10.5000     0.0000      2.5000      -0.1305

Distance 14                  [MCS]
  Distance XY               10.3354     10.5000     0.0000      2.5000      -0.1646

Distance 15                  [MCS]
  Distance XYZ              20.7047     21.0000     0.0000      5.0000      -0.2953

Distance 16                  [MCS]
  Distance XY               10.3416     10.5000     0.0000      5.0000      -0.1584

Distance 17                  [MCS]
  Distance XY               10.3536     10.5000     0.0000      2.5000      -0.1464

Distance 18                  [MCS]
  Distance XYZ              20.6951     21.0000     0.0000      5.0000      -0.3049

Distance 23                  [MCS]
  Distance XY                9.2256     10.5000     0.0000      2.5000      -1.2744

Distance 24                  [MCS]
  Distance XY                9.2305     10.5000     0.0000      2.5000      -1.2695

Distance 30                  [MCS]
  Distance XY                9.2130     10.5000     0.0000      2.5000      -1.2870

Distance 31                  [MCS]
  Distance XY                9.2474     10.5000     0.0000      2.5000      -1.2526

Distance 32                  [MCS]
  Distance XY                9.2535     10.5000     0.0000      2.5000      -1.2465

Distance 33                  [MCS]
  Distance XY                9.2128     10.5000     0.0000      2.5000      -1.2872

Distance 34                  [MCS]
  Distance XY               18.4662     21.0000     0.0000      5.0000      -2.5338

Distance 35                  [MCS]
  Distance XY               18.4609     21.0000     0.0000      5.0000      -2.5391
```

10

Feedhorn waveguide diameters:

**red numbers are circle numbers for data on following pages.
Positions are relative to feedhorn alignment pin hole
Corresponding Pixel ID's are given at corners.
Note this is a bottom view of the feedhorn, so the pixel map is
mirrored with respect to the ICD.**



FINAL

```
Program: 10209843 jpl feedhorn 19 small hole with datums.iwpDate: Tue Jul 22 2003     Time: 14:59:07
Units: mm, dec deg

Feature                        Actual      Nominal     Plus (+)    Minus (-)     Dev/Nom      Out/Tol
------------------------------------------------------------------------------------------------------
Circle 3                        [MCS]
  Center X                   276.2954     182.8375                               93.4579
  Center Y                    99.7132     134.7152                              -35.0019
  Diameter                     1.6035       1.6000      0.0100      0.0000         0.0035
  Circularity                  0.0091

Circle 12                [System 11]
  Center X                    -8.2307      -8.2238                               -0.0069
  Center Y                     0.0008       0.0000                                0.0008
  Diameter                     0.3995       0.3930      0.0050      0.0000        0.0065      0.0015
  Circularity                  0.0038
  TP RFS                       0.0138                   0.0400

Circle 13                [System 11]
  Center X                   -12.1354     -12.1351                               -0.0003
  Center Y                     0.0091       0.0000                                0.0091
  Diameter                     0.3986       0.3930      0.0050      0.0000        0.0056      0.0006
  Circularity                  0.0053
  TP RFS                       0.0182                   0.0400

Circle 14                [System 11]
  Center X                   -16.0547     -16.0464                               -0.0083
  Center Y                    -0.0052       0.0000                               -0.0052
  Diameter                     0.3975       0.3930      0.0050      0.0000        0.0045
  Circularity                  0.0046
  TP RFS                       0.0196                   0.0400

Circle 15                [System 11]
  Center X                   -19.9502     -19.9577                                0.0075
  Center Y                     0.0025      -0.0000                                0.0025
  Diameter                     0.3986       0.3930      0.0050      0.0000        0.0056      0.0006
  Circularity                  0.0059
  TP RFS                       0.0158                   0.0400

Circle 16                [System 11]
  Center X                   -23.8525     -23.8690                                0.0165
  Center Y                     0.0011      -0.0000                                0.0011
  Diameter                     0.3997       0.3930      0.0050      0.0000        0.0067      0.0017
  Circularity                  0.0042
  TP RFS                       0.0330                   0.0400

Circle 17                [System 11]
  Center X                   -12.1332     -12.1351                                0.0019
  Center Y                     6.7701       6.7746                               -0.0045
  Diameter                     0.3989       0.3930      0.0050      0.0000        0.0059      0.0009
  Circularity                  0.0040
  TP RFS                       0.0098                   0.0400

Circle 18                [System 11]
  Center X                   -16.0300     -16.0464                                0.0164
  Center Y                     6.7836       6.7746                                0.0090
  Diameter                     0.4019       0.3930      0.0050      0.0000        0.0089      0.0039
  Circularity                  0.0045
  TP RFS                       0.0374                   0.0400

Circle 19                [System 11]
  Center X                   -19.9413     -19.9577                                0.0164
  Center Y                     6.7717       6.7746                               -0.0029
  Diameter                     0.3988       0.3930      0.0050      0.0000        0.0058      0.0008
  Circularity                  0.0071
  TP RFS                       0.0332                   0.0400

Circle 20                [System 11]
  Center X                   -12.1391     -12.1351                               -0.0040
  Center Y                    -6.7674      -6.7746                                0.0072
  Diameter                     0.3976       0.3930      0.0050      0.0000        0.0046
  Circularity                  0.0045
  TP RFS                       0.0164                   0.0400
```

```
Program: 10209843 jpl feedhorn 19 small hole with datums.iwpDate: Tue Jul 22 2003     Time: 14:59:07
Units: mm, dec deg

Feature                      Actual     Nominal    Plus (+)   Minus (-)     Dev/Nom     Out/Tol
-----------------------------------------------------------------------------------------------
Circle 21               [System 11]
  Center X                 -16.0432    -16.0464                                0.0032
  Center Y                  -6.7640     -6.7746                                0.0106
  Diameter                   0.3982      0.3930      0.0050      0.0000      0.0052      0.0002
  Circularity                0.0067
  TP RFS                     0.0221                  0.0400

Circle 22               [System 11]
  Center X                 -19.9482    -19.9577                                0.0095
  Center Y                  -6.7679     -6.7746                                0.0067
  Diameter                   0.3999      0.3930      0.0050      0.0000      0.0069      0.0019
  Circularity                0.0039
  TP RFS                     0.0232                  0.0400

Circle 23               [System 11]
  Center X                 -10.1737    -10.1794                                0.0057
  Center Y                   3.3798      3.3873                               -0.0075
  Diameter                   0.3997      0.3930      0.0050      0.0000      0.0067      0.0017
  Circularity                0.0044
  TP RFS                     0.0187                  0.0400

Circle 24               [System 11]
  Center X                 -14.0818    -14.0907                                0.0089
  Center Y                   3.3813      3.3873                               -0.0060
  Diameter                   0.3966      0.3930      0.0050      0.0000      0.0036
  Circularity                0.0065
  TP RFS                     0.0215                  0.0400

Circle 25               [System 11]
  Center X                 -17.9940    -18.0020                                0.0080
  Center Y                   3.3830      3.3873                               -0.0043
  Diameter                   0.3979      0.3930      0.0050      0.0000      0.0049
  Circularity                0.0055
  TP RFS                     0.0182                  0.0400

Circle 26               [System 11]
  Center X                 -21.9038    -21.9133                                0.0095
  Center Y                   3.3867      3.3873                               -0.0006
  Diameter                   0.3985      0.3930      0.0050      0.0000      0.0055      0.0005
  Circularity                0.0054
  TP RFS                     0.0191                  0.0400

Circle 27               [System 11]
  Center X                 -10.1860    -10.1794                               -0.0066
  Center Y                  -3.3838     -3.3873                                0.0035
  Diameter                   0.4005      0.3930      0.0050      0.0000      0.0075      0.0025
  Circularity                0.0033
  TP RFS                     0.0148                  0.0400

Circle 28               [System 11]
  Center X                 -14.0890    -14.0907                                0.0017
  Center Y                  -3.3896     -3.3873                               -0.0023
  Diameter                   0.4019      0.3930      0.0050      0.0000      0.0089      0.0039
  Circularity                0.0059
  TP RFS                     0.0057                  0.0400

Circle 29               [System 11]
  Center X                 -17.9924    -18.0020                                0.0096
  Center Y                  -3.3746     -3.3873                                0.0127
  Diameter                   0.3997      0.3930      0.0050      0.0000      0.0067      0.0017
  Circularity                0.0059
  TP RFS                     0.0318                  0.0400
```

```
Program: 10209843 jpl feedhorn 19 small hole with datums.iwpDate: Tue Jul 22 2003     Time: 14:59:07
Units: mm, dec deg

Feature                  Actual      Nominal     Plus (+)    Minus (-)    Dev/Nom     Out/Tol
---------------------------------------------------------------------------------------------
Circle 30             [System 11]
  Center X              -21.8996    -21.9133                               0.0137
  Center Y               -3.3853     -3.3873                               0.0020
  Diameter                0.3990      0.3930      0.0050      0.0000       0.0060
  Circularity             0.0053                                                       0.0010
  TP RFS                  0.0278                  0.0400

Circle 31             [System 11]
  Center X              -32.2289    -32.2363                               0.0074
  Center Y                0.0000      0.0000                              -0.0000
  Diameter                1.6054      1.6000      0.0100      0.0000       0.0054

Circle 32             [System 11]
  Center X              -31.7378    -31.7386                               0.0009
  Center Y                0.0056      0.0005                               0.0051
  Diameter                1.6005      1.6000      0.0100      0.0000       0.0005

Point 33              [System 11]
  Location X            -31.9833    -32.0000                               0.0167
  Location Y              0.0028      0.0000                               0.0028
  TP RFS                  0.0338                  0.1000

Circle 34             [System 11]
  Center X                1.0130      1.0000                               0.0130
  Center Y               13.4899     13.5000                              -0.0101
  Diameter                2.0514      2.0000      0.2500      0.0000       0.0514
  TP MMC                  0.0329                  0.0500                  -0.0185

Circle 36             [System 11]
  Center X              -32.9813    -33.0000                               0.0187
  Center Y               13.4758     13.5000                              -0.0242
  Diameter                2.0338      2.0000      0.2500      0.0000       0.0338
  TP MMC                  0.0612                  0.0500                   0.0274

Circle 37             [System 11]
  Center X                1.0082      1.0000                               0.0082
  Center Y              -13.4937    -13.5000                               0.0063
  Diameter                2.0756      2.0000      0.2500      0.0000       0.0756
  TP MMC                  0.0208                  0.0500                  -0.0548

Circle 38             [System 11]
  Center X              -32.9446    -33.0000                               0.0554
  Center Y              -13.4826    -13.5000                               0.0174
  Diameter                2.1109      2.0000      0.2500      0.0000       0.1109
  TP MMC                  0.1161                  0.0500                   0.0053
            7-22-03
Circle 39             [System 11]
  Center X    P/N 616F  -23.9814    -24.0000                               0.0186
  Center Y              -13.5130    -13.5000                              -0.0130
  Diameter      3.1496    ~~3.2042~~  3.1200                               0.0842
  TP RFS                  0.0453                  0.3500

Circle 40             [System 11]
  Center X               -8.0293     -8.0000                              -0.0293
  Center Y              -13.4930    -13.5000                               0.0070
  Diameter                3.1938      3.1200                               0.0738
  TP RFS                  0.0602                  0.3500
```

```
Program: 10209843 jpl feedhorn 19 large hole 1.iwp          Date: Tue Jul 22 2003     Time: 15:15:51
Units: mm, dec deg

Feature                 Actual       Nominal    Plus (+)    Minus (-)     Dev/Nom     Out/Tol
----------------------------------------------------------------------------------------------
Circle 6             [System 5]
  Diameter               3.8211       3.7950     0.0050      0.0000       0.0261      0.0211

Circle 7             [System 5]
  Diameter               3.8090       3.7950     0.0050      0.0000       0.0140      0.0090

Circle 8             [System 5]
  Diameter               3.8230       3.7950     0.0050      0.0000       0.0280      0.0230

Circle 9             [System 5]
  Diameter               3.8125       3.7950     0.0050      0.0000       0.0175      0.0125

Circle 10            [System 5]
  Diameter               3.8111       3.7950     0.0050      0.0000       0.0161      0.0111

Circle 11            [System 5]
  Diameter               3.8113       3.7950     0.0050      0.0000       0.0163      0.0113

Circle 12            [System 5]
  Diameter               3.8189       3.7950     0.0050      0.0000       0.0239      0.0189

Circle 13            [System 5]
  Diameter               3.8140       3.7950     0.0050      0.0000       0.0190      0.0140

Circle 14            [System 5]
  Diameter               3.8090       3.7950     0.0050      0.0000       0.0140      0.0090

Circle 15            [System 5]
  Diameter               3.8142       3.7950     0.0050      0.0000       0.0192      0.0142

Circle 16            [System 5]
  Diameter               3.8176       3.7950     0.0050      0.0000       0.0226      0.0176

Circle 17            [System 5]
  Diameter               3.8154       3.7950     0.0050      0.0000       0.0204      0.0154

Circle 18            [System 5]
  Diameter               3.8148       3.7950     0.0050      0.0000       0.0198      0.0148

Circle 19            [System 5]
  Diameter               3.8104       3.7950     0.0050      0.0000       0.0154      0.0104

Circle 20            [System 5]
  Diameter               3.8130       3.7950     0.0050      0.0000       0.0180      0.0130

Circle 21            [System 5]
  Diameter               3.8106       3.7950     0.0050      0.0000       0.0156      0.0106

Circle 22            [System 5]
  Diameter               3.8150       3.7950     0.0050      0.0000       0.0200      0.0150

Circle 23            [System 5]
  Diameter               3.8083       3.7950     0.0050      0.0000       0.0133      0.0083

Circle 24            [System 5]
  Diameter               3.8211       3.7950     0.0050      0.0000       0.0261      0.0211
```

CMI *Advancing Ultra-Precision Manufacturing*

Custom Microwave Inc.
940 Boston Avenue
Longmont, CO 80501

NON CONFORMANCE REPORT

1. NCR # : 12265

2. Pg. 1 of 1

3. PART # :	REV.	4. PART DESCRIPTION :	5. PROJ. # :	6. CUSTOMER :
10209843		FEEDHORN S/LW BDA	P8647	JPC

7. SERIAL # OR BATCH #	8. VENDOR NAME	9. VEND CERT#	10. VEND P.O #	11. VEND #

8. DETAILS OF NON CONFORMANCE

12. ITEM #	13. DESCRIPTION Dwg Zone, Spec. Para, Ser. no.	14. DISCREPANCY	15. TEAM #	16. QTY	17. DEFECT CODE
1	19X Ø3.8/3.795	3.823 - 3.8083	4	1	05D
2	19X Ø 0.398/0.393	15X .4019 - .3982	4	1	05D

18. ORIGINATOR: (PRINT & SIGN)	DATE:	19. OPERATION DETECTED AT:	20. WORK AREA DETECTED AT:
TROY GEORGE Troy L George	7-22-03	140	INSPECTION

21. ITEM #	22. OPER #	23. DISPOSITION	24. STAMP/ SIGN
1		REQUEST USE AS IS	
2		REQUEST USE AS IS	

25. RTV Qty:	26. SCRAP Qty :	27. REWORK Qty:	28. STANDARD REPAIR Qty:	29. USE AS IS Qty :	30. REPAIR Qty :

31. CLASSIFICATION CRITICAL ☐ MAJOR ☐ MINOR ☐

32. CUSTOMER APPROVAL REQUIRED YES ☒ NO ☐

33. CORRECTIVE ACTION REQUIRED. YES ☐ NO ☒

34. Project Leader :	DATE :	35. Customer Approval:	DATE :	36. Quality Assurance :	DATE
	7/22/03	SEE ATTACHED		Troy L George	7-22-03

37. CAUSE :

38. CAR#:

39. ACTIONEE :

40. ASSIGNED DATE:

41. CORRECTIVE ACTION :

42. EFFECTIVITY DATE/ (Lot#/S/N)

43. DATE COMPLETED :

44. APPROVED BY:

45. CACODE#:

FORM 0001

Clency Lee-Yow

From: Mark Weilert [Mark.A.Weilert@jpl.nasa.gov]
Sent: Wednesday, July 30, 2003 10:06 AM
To: Clency Lee-Yow
Cc: Martin.I.Herman@jpl.nasa.gov; Scott.P.Hughes@jpl.nasa.gov
Subject: Fwd: RE: SLW feedhorn non-conformances

Hi Clency,

Jason and Jamie (by phone) have agreed that the non-conformances are
acceptable as-is.
see below.

So, you are clear to ship.

Mark

```
>Date: Tue, 29 Jul 2003 16:10:34 -0600
>From: Jason Glenn <Jason.Glenn@Colorado.edu>
>Subject: RE: SLW feedhorn non-conformances
>To: 'Mark Weilert' <Mark.A.Weilert@jpl.nasa.gov>, jjb@astro.caltech.edu
>Cc: Jason Glenn <jglenn@origins.colorado.edu>
>Reply-to: Jason.Glenn@Colorado.edu
>Organization: CASA
>X-Mailer: Microsoft Outlook, Build 10.0.2627
>Importance: Normal
>Original-recipient: rfc822;Mark.A.Weilert@jpl.nasa.gov
>
>Hi Mark and Jamie, see below.
>
>Jason Glenn
>Assistant Professor of Astrophysics, University of Colorado CASA
>389-UCB Boulder, CO 80309
>ARL Office: (303) 735-5904   ARL Room 175B
>Main Campus: (303) 492-6073   Room 913 Gamov Tower
>Fax: (303) 492-5941
>Lab: (303) 492-5972    ARL Room 125
>
>
>-----Original Message-----
>From: Mark Weilert [mailto:Mark.A.Weilert@jpl.nasa.gov]
>Sent: Monday, July 28, 2003 12:48 PM
>To: James.J.Bock@jpl.nasa.gov; Jason.Glenn@colorado.edu
>Subject: SLW feedhorn non-conformances
>
>Hi Jamie and Jason,
>
>attached is the non-conformance report from Custom Microwave for the
>SLW
>
>feedhorn that they
>recently finished.  The short version is that there are two problems:
>
>1) The feedhorn openings are all slightly too large,
>3.8083 to 3.823mm instead of the specified 3.795 to 3.800.  (the center
>horn seems is one of the larger ones)
>
>**The impact of this will be that at 350 um, the design wavelength of
>the horns, the beamsizes will decrease by as much as 0.25% FWHM
>compared to a 3.800 um opening.  This is acceptable.  The upper limit
>of 3.800 was chosen because CM felt that a larger radius would lead to
>wall thicknesses that were too thin to machine.
```

>
>2) Most (15 out of 19) of the waveguide ends of the feedhorns are also
>too large, 0.3982-0.4019, instead of the specified 0.393-0.398 (which
>is over-specified, according to Jasons previous email)
>In this case, the center horn is one of the ones that is in spec.
>
>**This impact of this will be to increase the cutoff wavelengths by as
>much as 1% compared to 0.398 openings. This is acceptable also.
>
>I have also included the drawing for reference, and also another CMM
>report which shows the positions of the various large end openings
>(which isn't in
>the original report).
>
>I need to hear whether or not this feedhorn is acceptable as is, so I
>can tell CMI if they can ship.
>
>Thanks
>Mark

Mark Weilert
M/S 79-24
Jet Propulsion Laboratory
4800 Oak Grove Dr.
Pasadena Ca 91109-8099

Mark.A.Weilert@jpl.nasa.gov
office: (818) 354-5060
fax: (818) 393-4878

18/18

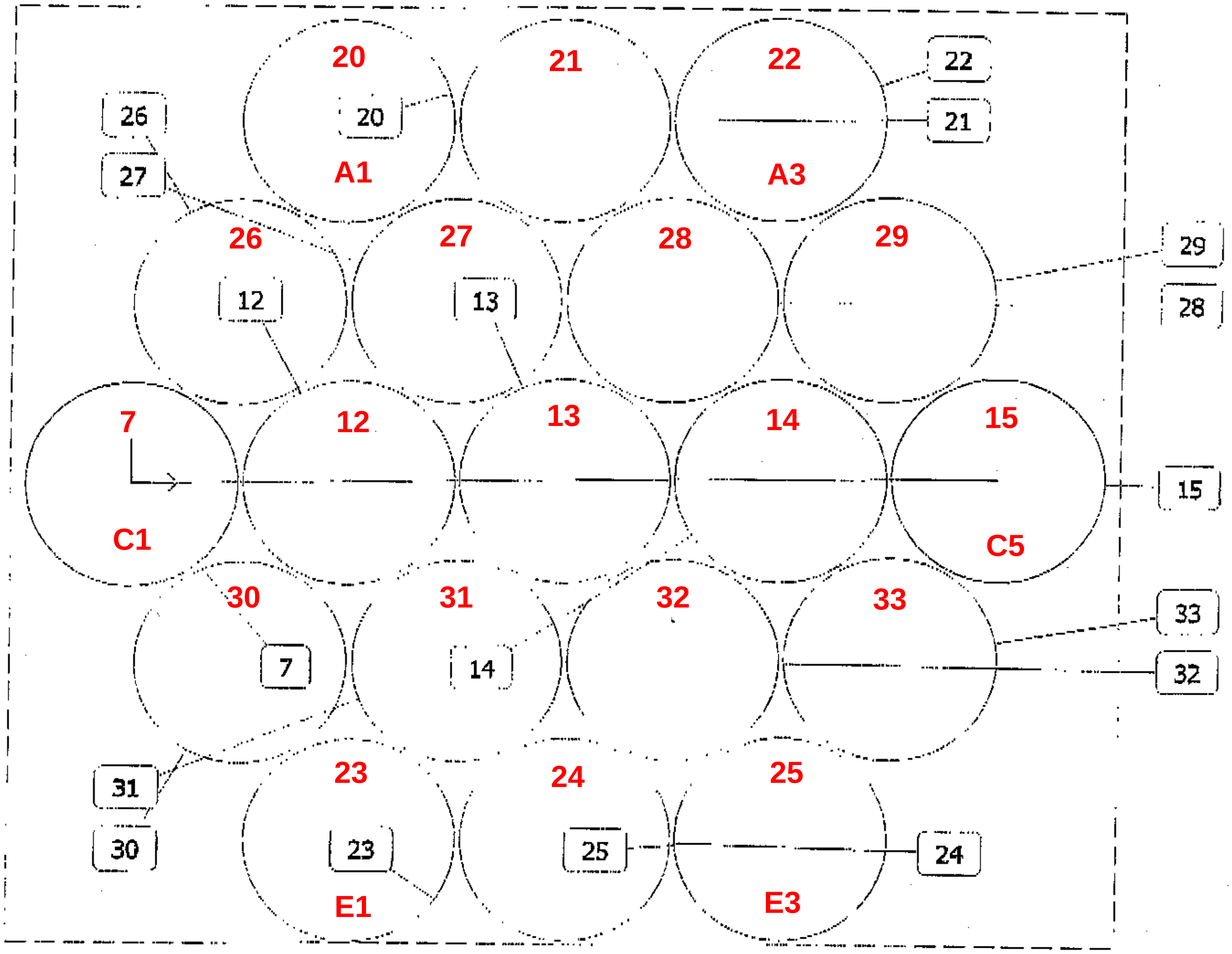
ATTN: Mark

Data for large Dia. End

From DAV Jongsma at Custom microwave

Feedhorn entrance diameters:

red numbers are circle numbers for data on following pages.
Positions are relative to circle 7
Corresponding Pixel ID's are given at corners.



07/23/2003 15:13 3036510706 CUSTOM MICROWAVE INC PAGE 01/03

```
Program: Untitled
Units: mm, dec deg                              Date: Wed Jul 23 2003     Time: 15:58:29

Feature                  Actual     Nominal    Plus (+)   Minus (-)   Dev/Nom    Out/Tol
---------------------------------------------------------------------------------------
Circle 7               [System 6]
  Center X               0.0039     0.0000
  Center Y               0.0019     0.0000                             0.0039
  Diameter               3.8116     3.7950                             0.0019
  TP RFS                 0.0087                0.0050     0.0000       0.0166     0.0116
                                               0.0400

Circle 12              [System 6]
  Center X               3.9128     3.9113
  Center Y              -0.0015    -0.0000                             0.0015
  Diameter               3.8158     3.7950                            -0.0015
  TP RFS                 0.0042                0.0050     0.0000       0.0208     0.0158
                                               0.0400

Circle 13              [System 6]
  Center X               7.8160     7.8226
  Center Y               0.0050     0.0000                            -0.0066
  Diameter               3.8212     3.7950                             0.0050
  TP RFS                 0.0165                0.0050     0.0000       0.0262     0.0212
                                               0.0400

Circle 14              [System 6]
  Center X              11.7229    11.7339
  Center Y              -0.0004     0.0000                            -0.0110
  Diameter               3.8169     3.7950                            -0.0004
  TP RFS                 0.0220                0.0050     0.0000       0.0219     0.0169
                                               0.0400

Circle 15              [System 6]
  Center X              15.6277    15.6452
  Center Y               0.0043     0.0000                            -0.0175
  Diameter               3.8220     3.7950                             0.0043
  TP RFS                 0.0361                0.0050     0.0000       0.0270     0.0220
                                               0.0400

Circle 20              [System 6]
  Center X               3.9048     3.9113
  Center Y               6.7670     6.7746                            -0.0065
  Diameter               3.8146     3.7950                            -0.0076
  TP RFS                 0.0200                0.0050     0.0000       0.0196     0.0146
                                               0.0400

Circle 21              [System 6]
  Center X               7.8144     7.8226
  Center Y               6.7639     6.7746                            -0.0082
  Diameter               3.8163     3.7950                            -0.0107
  TP RFS                 0.0270                0.0050     0.0000       0.0213     0.0163
                                               0.0400

Circle 22              [System 6]
  Center X              11.7170    11.7339
  Center Y               6.7665     6.7746                            -0.0169
  Diameter               3.8195     3.7950                            -0.0081
  TP RFS                 0.0375                0.0050     0.0000       0.0245     0.0195
                                               0.0400

Circle 23              [System 6]
  Center X               3.9220     3.9113
  Center Y              -6.7591    -6.7746                             0.0107
  Diameter               3.8135     3.7950                             0.0155
  TP RFS                 0.0376                0.0050     0.0000       0.0185     0.0135
                                               0.0400

Circle 24              [System 6]
  Center X               7.8269     7.8226
  Center Y              -6.7649    -6.7746                             0.0043
  Diameter               3.8174     3.7950                             0.0097
  TP RFS                 0.0213                0.0050     0.0000       0.0224     0.0174
                                               0.0400

Circle 25              [System 6]
  Center X              11.7242    11.7339
  Center Y              -6.7638    -6.7746                            -0.0097
  Diameter               3.8146     3.7950                             0.0108
  TP RFS                 0.0290                0.0050     0.0000       0.0196     0.0146
                                               0.0400
```

```
Program: Untitled
Units: mm, dec deg                                  Date: Wed Jul 23 2003     Time: 15:58:29

Feature                     Actual     Nominal    Plus (+)    Minus (-)     Dev/Nom     Out/Tol
-----------------------------------------------------------------------------------------------
Circle 26                 [System 6]
  Center X                  1.9576      1.9556                                0.0020
  Center Y                  3.3872      3.3873                               -0.0001
  Diameter                  3.8164      3.7950     0.0050      0.0000         0.0214      0.0164
  TP RFS                    0.0039                 0.0400

Circle 27                 [System 6]
  Center X                  5.8653      5.8669                               -0.0016
  Center Y                  3.3837      3.3873                               -0.0036
  Diameter                  3.8093      3.7950     0.0050      0.0000         0.0143      0.0093
  TP RFS                    0.0079                 0.0400

Circle 28                 [System 6]
  Center X                  9.7651      9.7782                               -0.0131
  Center Y                  3.3830      3.3873                               -0.0043
  Diameter                  3.8094      3.7950     0.0050      0.0000         0.0144      0.0094
  TP RFS                    0.0275                 0.0400

Circle 29                 [System 6]
  Center X                 13.6777     13.6895                               -0.0118
  Center Y                  3.3888      3.3873                                0.0015
  Diameter                  3.8165      3.7950     0.0050      0.0000         0.0215      0.0165
  TP RFS                    0.0237                 0.0400

Circle 30                 [System 6]
  Center X                  1.9580      1.9556                                0.0024
  Center Y                 -3.3788     -3.3873                                0.0085
  Diameter                  3.8132      3.7950     0.0050      0.0000         0.0182      0.0132
  TP RFS                    0.0177                 0.0400

Circle 31                 [System 6]
  Center X                  5.8695      5.8669                                0.0026
  Center Y                 -3.3806     -3.3873                                0.0067
  Diameter                  3.8115      3.7950     0.0050      0.0000         0.0165      0.0115
  TP RFS                    0.0143                 0.0400

Circle 32                 [System 6]
  Center X                  9.7762      9.7782                               -0.0020
  Center Y                 -3.3853     -3.3873                                0.0020
  Diameter                  3.8126      3.7950     0.0050      0.0000         0.0176      0.0126
  TP RFS                    0.0056                 0.0400

Circle 33                 [System 6]
  Center X                 13.6810     13.6895                               -0.0085
  Center Y                 -3.3737     -3.3873                                0.0136
  Diameter                  3.8223      3.7950     0.0050      0.0000         0.0273      0.0223
  TP RFS                    0.0321                 0.0400
```

End Item Data Package (EIDP)

SPIRE - 300mK SLW-FS filter stack

SPIRE Ref.: SPIRE-UCF-
Cardiff Ref.: HSO-CDF-EIDP-089 Issue 1.1
17 December 2004

Prepared by: Peter Hargrave SPIRE Technical Manager

Approved by: Carole Tucker Cardiff Filter Manager

Ian Walker Cardiff SPIRE/HFI Programme Manager

Distribution list

JPL	James Bock	RAL	Eric Sawyer
	Hien Nguyen		Eric Clark
	Martin Herman		Judy Long
	Mark Weilert		Bruce Swinyard
Cardiff	Carole Tucker		
	Peter Ade		
	Matt Griffin		
	Ian Walker		

Change Record

Issue	Section	Date	Changes
1.0		15/12/04	First Issue after DRB approval
1.1		17/12/04	Flight issue post DRB approval

Table of contents

Section	Contents	Req.	Comments
1	Shipping Documents	X	
2	Transportation, Packing, Handling & Integration Procedures	X	
3	Certificate of Conformance / Delivery Review Board MoM Ai-Lists	X	
4	Qualification Status List / Test Matrix	X	
5	Top Level Drawings (inc. Family Tree)	X	
6	Interface Drawings	X	
7	Functional, Block & Mechanical Drawings	X	
8	Electrical Circuit Drawings		
9	As Built Parts List	X	
10	Serialised Components List		
11	List of Waivers	X	
12	Copies of Waivers	X	
13	Operational Manual		
14	Historical Record	X	
15	Logbook / Diary of Events	X	
16	Operating Time / Cycle Record		
17	Connector Mating Record		
18	Age Sensitive Items Record	X	
19	Pressure Vessel History / Test Record		
20	Calibration Data Record	X	
21	Temporary Installation Record	X	
22	Open Work / Deferred Work / Open Tests	X	
23	List of Non-Conformance Reports	X	
24	Copies of Non-Conformance Reports	X	
25	Test Reports	X	
26	Proof Load Certificates		
27	Reference List of EIDP's	X	

	(Lower Level / Associated)		
28	Mass Records / Power Budget	**X**	
29	Cleanliness Statement	**X**	
30	Other Useful Information	**X**	

SECTION 01 - Shipping Documents

Labelling on box:-

Instructions to FedEx – Important!

At LAX, please handover to:-

PackAir Airfreight INC.,
5510 West 104 St.,
Los Angeles CA90045
USA

Power of Attorney - Roger Bachar
Telephone (310) 342 6051

Figure 1 SLW FS filter stack prior to shipping to JPL.

DRB Minutes of meeting

Minutes of SPIRE PFM 300mK FS SLW filter stack DRB
Cardiff, December 16th 2004

Present: Ian Walker (chair), Pete Hargrave, Peter Ade, Carole Tucker, Melanie Whitehead

Contents

DRB scope and objectives

- Review 300mK FS SLW filter stack (FILT-FS-210)

List of relevant documents and status

- HSO-CDF-EIDP-089 (15 December 2004)
- HSO-CDF-ICD-012 (Issue 3.0)
- HSO-CDF-SP-002 (Issue 2.2)
- DML/DPL
    - Overall document to be issued for all SPIRE deliverables
    - DML: HSO-CDF-L1-074 Issue 1.0
    - DMPL: HSO-CDF-L1-075 Issue 1.0
    - DPL: HSO-CDF-L1-076 Issue 1.0

Review of comments received on EIDP

- Comments from Ian Walker & Melanie Whitehead

p6	photos to be added
p7	insert minutes for this DRB
p9	insert checklist for this DRB
p10	change PMW to PSW

p26 last two dates in historical record to be added
p33 location of UWC_Filter_production_PA_V2.0.doc?
p37 location of UWC Filter Fabrication Procedures.doc?
p38 photos to be added

- Above comments accepted and Actions agreed during EIDP run-through (see below).
- Agreed that the Carole would archive dated PDF versions of UWC_Filter_production_PA_V2.0.doc and UWC Filter Fabrication Procedures.doc

EIDP run-through

- Section 1, Shipping Documents – Action: PCH to add photographs, update EIDP number, DRB checklist and Conclusions, and include DRB minutes in final version of EIDP.
- Section 2, Transportation, Packing, Handling & Integration Procedures – PCH amended “PMW BDA (PFM or FS)” to “SLW BDA (FS)”.
- Section 4, Qualification Status List – PCH amended filter reference for ‘Inspection for surface defects’.
- Section 9, As Built Configuration Items Status List – PCH corrected an error relating to a filter number.
- Section 14, Historical Record – Action: PCH to update the last two placeholder dates (in red) and provide appropriate reference to these DRB minutes. PCH to also add reference to post-thermal shock spectral test.
- Section 25, Test Reports – Action: PCH to add note explaining differences between uniformity and calibration data. It was agreed that the performance data meets requirements.
- Section 28, Mass record – Action: PCH to update placeholder mass value (in red) with appropriate value.
- Section 30, Other Useful Information – Action: PCH to add photographs of assembly prior to shipping.

Conclusions and summary of outstanding work

- This unit is deemed acceptable as flight-standard hardware, and may be shipped to JPL for incorporation in the SPIRE PFM FS BDAs.
- The amendments/additions noted above must be made to the EIDP before the unit is shipped.

DRB Check-list

If all listed points are satisfactory then the item may be accepted. If not, the item may be accepted with the caveat that the requirement in question will be met within an agreed time scale.

No.	Record applicable answers and provide explanations in comment column	Yes/No/NA	Comments
1	Are all documents, drawings, etc. complete, approved, and under configuration control?	Yes	
2	Do the released items above reflect all approved changes?	Yes	
3	Is the hardware identical to other hardware delivered. If not provide difference list?	Yes	
4	Does the hardware fulfil its functional requirements, specifications, RFWs, ICDs etc.?	Yes	
5	Does the As-built Configured Items List reflect hardware as delivered?	Yes	
6	Have all required environmental tests and analyses been completed?	Yes	
7	Are all the required test and qualification procedures and reports completed and available to review.	Yes	
8	Have all the Declared Lists, i.e. DML, DMPL, DPL and components (EEE Parts) list been released? (Need not necessarily be included in EIDP, but must be available)	Yes	
9	Have PADS been raised and approved where required?	N/A	
10	Are relevant Test Readiness Review (TRR) minutes and the Post Test Reviews (PTR) complete and available?	N/A	
11	EIDP check: Are all agreed sections of the EIDP complete? Record any anomalies.	Yes	PCH to provide minor amendments to sections as indicated above

		Signature	Date
Ian Walker	Cardiff SPIRE PA manager and DRB chair		
Peter Hargrave	Cardiff SPIRE Technical Manager		
Carole Tucker	Cardiff Filter Manager		

SECTION 02 - Transportation, Packing, Handling & Integration Procedures

This package contains flight hardware.
To be opened only by authorised SPIRE personnel in clean room conditions.
Do not touch filter surface.
Handle only by Aluminium frame.
To be integrated to SPIRE SLW BDA (FS) according to JPL procedure.

Hand over to JPL Cognisant Engineer – Mark Weilert

Mark Weilert
M/S 79-24
Jet Propulsion Laboratory
4800 Oak Grove Dr.
Pasadena Ca 91109-8099

Mark.A.Weilert@jpl.nasa.gov
office: (818) 354-5060
fax: (818) 393-4878

SECTION 03 - Certificate of Conformance

Cardiff University Astronomy Instrumentation Group hereby certifies that the following equipment,

Spacecraft / Project:	**Herschel**
Instrument:	**SPIRE**
Model:	**FS**
Subsystem:	**300mK SLW filter stack**
Serial No:	**FILT-FS-210**

As described in this End Item Data Package: **HSO-CDF-EIDP-089**

Complies with the requirements set out in: **SPIRE-RAL-PRJ-000034 (Instrument requirements document)**

Responsible Authority		***Signature***
Cardiff Filter Management	Prof P.A.R.Ade	
	Dr C.E.Tucker	
Cardiff Product Assurance	Dr I.Walker	
Cardiff SPIRE Management	Dr P.Hargrave	

SECTION 04 - Qualification Status List

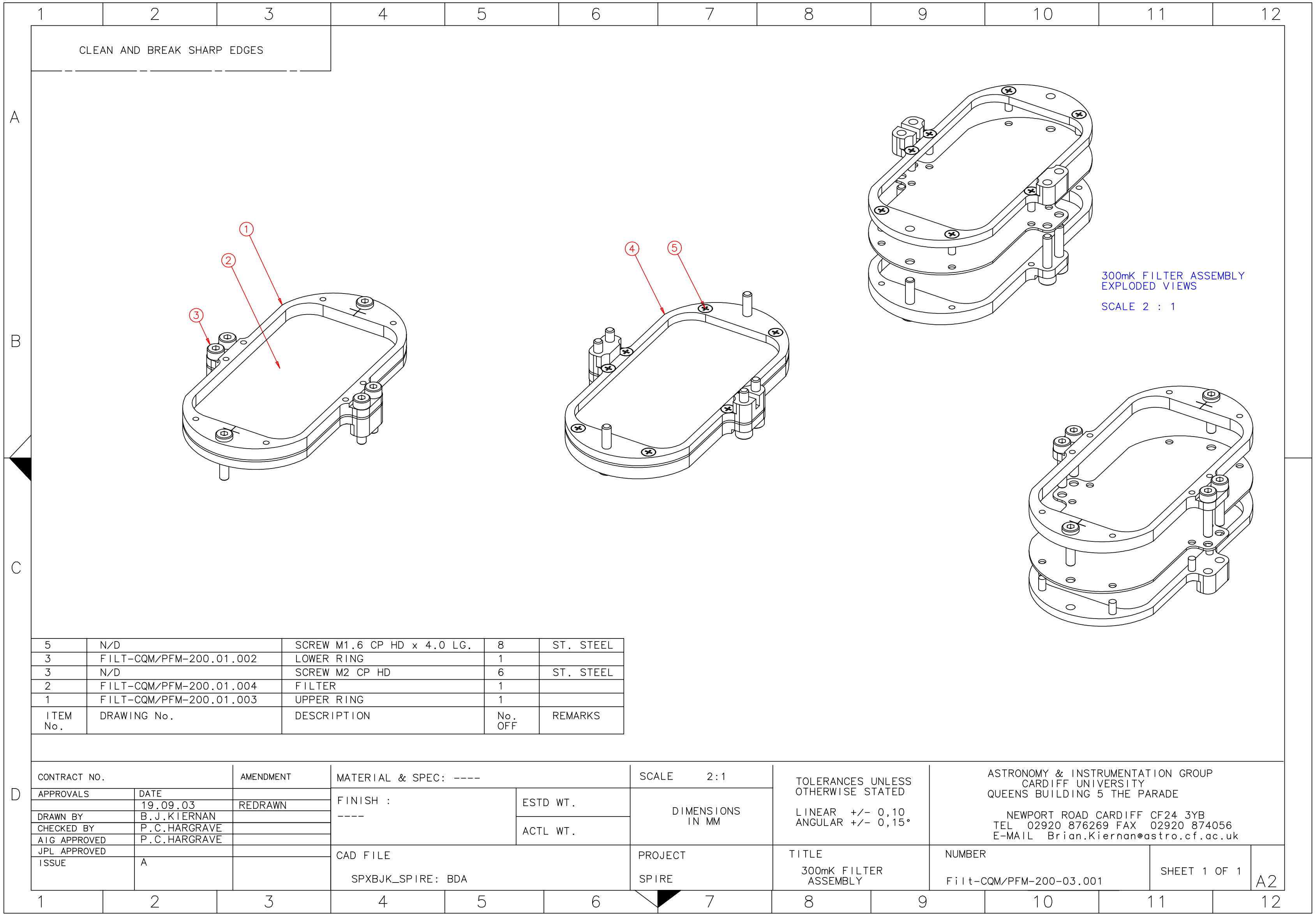
Test	Status	Applicable document / Test reference	Test Institute
	FS-SLW - FILT-FS-210		
Spectral behaviour - In and near-band transmission	Tested at component and assembly level. Compliant with approved waiver (HSO-CDF-RFW-063).	HSO-CDF-SP-002-2.2 See historical record for test references	UWC
Spectral behaviour - out-of-band blocking, at λ<15μm	Open test. Off-cuts of the filter material are securely stored, and may be measured to 15μm using the Bomen spectrometer if required.	HSO-CDF-SP-002-2.2 See historical record for test references	UWC
Dimension and tolerances to specification	Compliant	HSO-CDF-ICD-012-3.0	UWC
Filter flatness	Not applicable for this assembly	HSO-CDF-ICD-012-3.0	UWC
Inspection for surface defects	Passed	UWC Filters database "hundred_acre_wood.mdb" reference B675, B683.	UWC
Mass	Compliant	HSO-CDF-ICD-012-3.0	
Thermal cycling (5 cycles 300K-77K-300K)	Passed	See historical record for test references	UWC
Cold vibration	Not tested at unit level, but qualified in SPIRE CQM cold vibration campaign	MSSL-Technote-SPIRE-26 SPIRE-RAL-REP-002007	MSSL/RAL – Cold vibration RAL – Post vibration inspection
Environmental condition - Vacuum $3x10^{-1}$mBar	Passed	See historical record for test references	UWC
Differential pressure (a pumping-out rate of 10mB/sec)	Passed	See historical record for test references	UWC
Pre-bake out (not exceeding 80˚C)	Passed	UWC PCH SPIRE Filters log-book	UWC
Outgassing	Test not performed. All materials used within ESA / NASA specifications		
Cleanliness checks, by visual inspection.	Passed	UWC Filters database "hundred_acre_wood.mdb" reference B675, B683.	UWC
Degradation due to high energy radiation.	Not tested. Heritage from previous space missions (ISO, Cassini)		

SECTION 05 – Top Level Drawings (Inc. Family Tree)

Although all drawings in this section have numbers of the form FILT-CQM/PFM-XXX-xx-xx, these are also the correct drawings for the flight spare model.

TOP LEVEL DRAWING LIST

Drawing No.	Title
FILT-CQM/PFM-200-03.001	300mK Filter Assembly



ITEM No.	DRAWING No.	DESCRIPTION	No. OFF	REMARKS
5	N/D	SCREW M1.6 CP HD x 4.0 LG.	8	ST. STEEL
3	FILT-CQM/PFM-200.01.002	LOWER RING	1	
3	N/D	SCREW M2 CP HD	6	ST. STEEL
2	FILT-CQM/PFM-200.01.004	FILTER	1	
1	FILT-CQM/PFM-200.01.003	UPPER RING	1	

CONTRACT NO.		AMENDMENT
APPROVALS	DATE	
	19.09.03	REDRAWN
DRAWN BY	B.J.KIERNAN	
CHECKED BY	P.C.HARGRAVE	
AIG APPROVED	P.C.HARGRAVE	
JPL APPROVED		
ISSUE	A	

MATERIAL & SPEC: ----

FINISH :

ESTD WT.

ACTL WT.

SCALE 2:1

DIMENSIONS
IN MM

TOLERANCES UNLESS
OTHERWISE STATED

LINEAR +/- 0,10
ANGULAR +/- 0,15°

ASTRONOMY & INSTRUMENTATION GROUP
CARDIFF UNIVERSITY
QUEENS BUILDING 5 THE PARADE

NEWPORT ROAD CARDIFF CF24 3YB
TEL 02920 876269 FAX 02920 874056
E-MAIL Brian.Kiernan@astro.cf.ac.uk

CAD FILE
SPXBJK_SPIRE: BDA

PROJECT
SPIRE

TITLE
300mK FILTER
ASSEMBLY

NUMBER
Filt-CQM/PFM-200-03.001

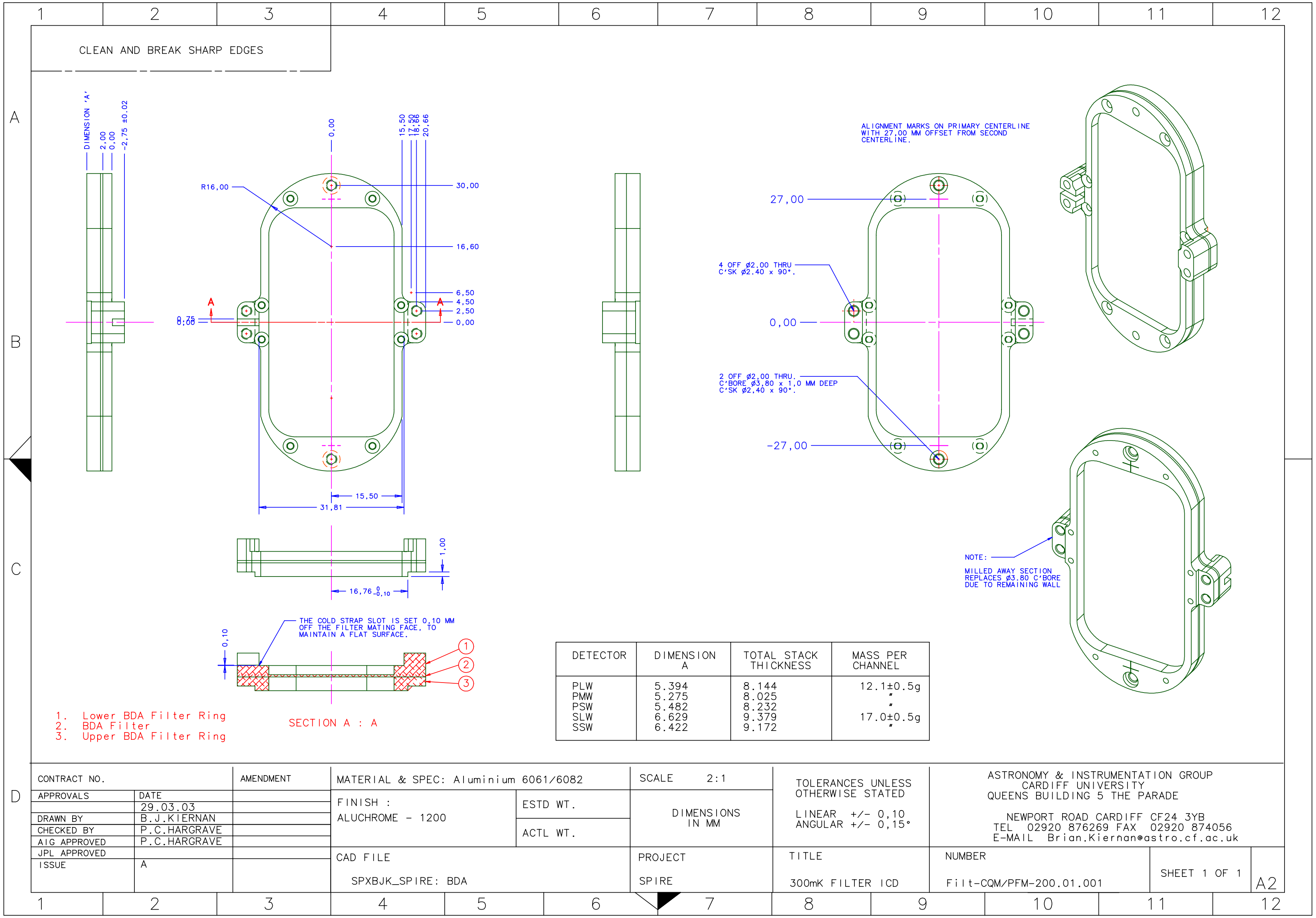
SHEET 1 OF 1

Figure 2 300mK filter stack assembly

SECTION 06 - Interface Drawings

INTERFACE DRAWING LIST

Drawing No.	Title
FILT-CQM/PFM-200	300mK Filter ICD



DETECTOR	DIMENSION A	TOTAL STACK THICKNESS	MASS PER CHANNEL
PLW	5.394	8.144	12.1±0.5g
PMW	5.275	8.025	"
PSW	5.482	8.232	"
SLW	6.629	9.379	17.0±0.5g
SSW	6.422	9.172	"

Figure 3 Interface drawing for 300mK filters

SECTION 07 - Functional, Block & Mechanical Drawings

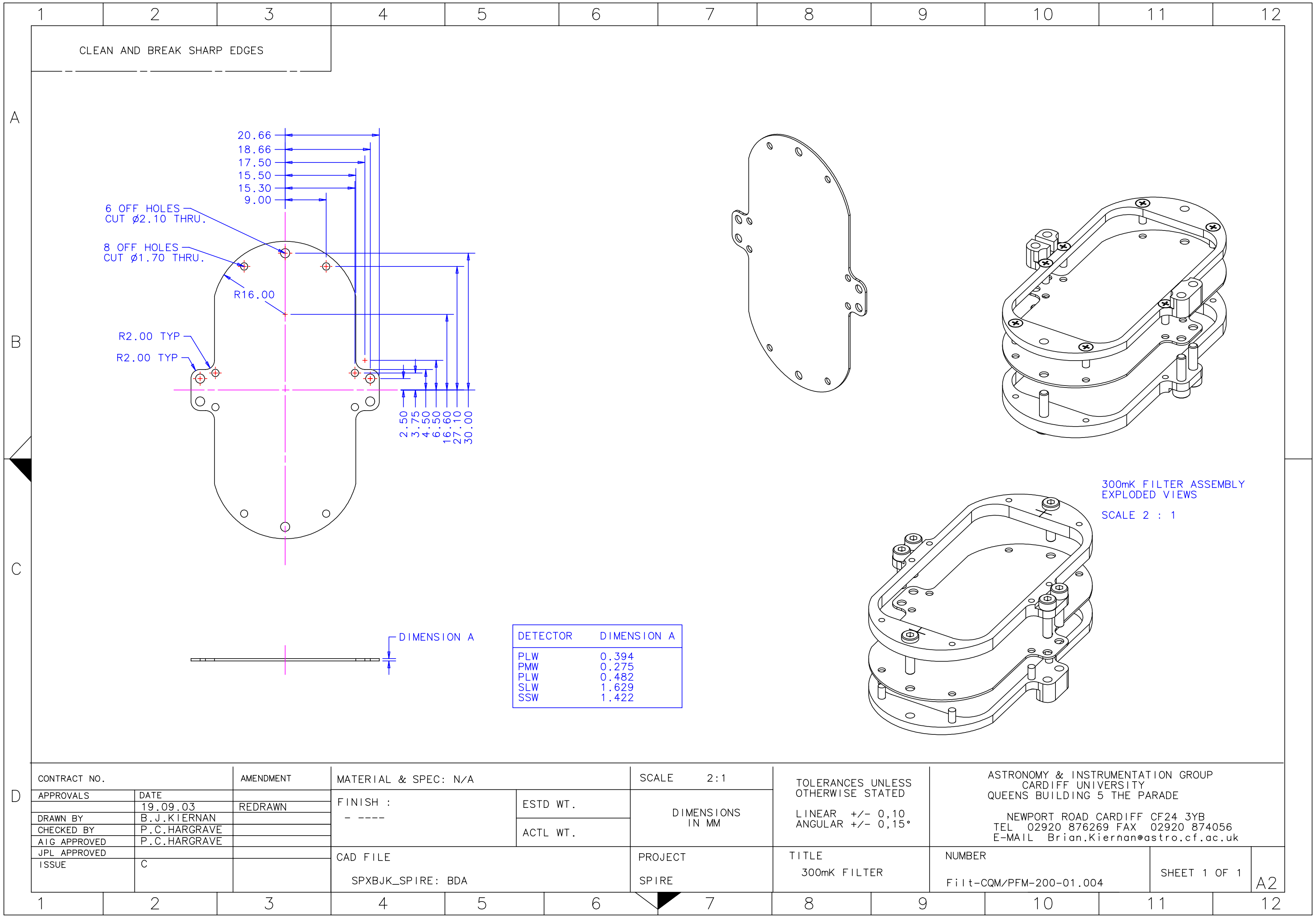
Component drawings are given in this section.

FUNCTIONAL & BLOCK DRAWING LIST

Drawing No.	Title

MECHANICAL COMPONENT DRAWING LIST

Drawing No.	Title
FILT-CQM/PFM-200-01-004	300mK Filter
FILT-CQM/PFM-200-01-003	300mK Filter Upper Ring
FILT-CQM/PFM-200-01-002	300mK Filter Lower Ring
FILT-CQM/PFM-200-02-001	300mK Spectrometer Lens



DETECTOR	DIMENSION A
PLW	0.394
PMW	0.275
PLW	0.482
SLW	1.629
SSW	1.422

CONTRACT NO.
AMENDMENT

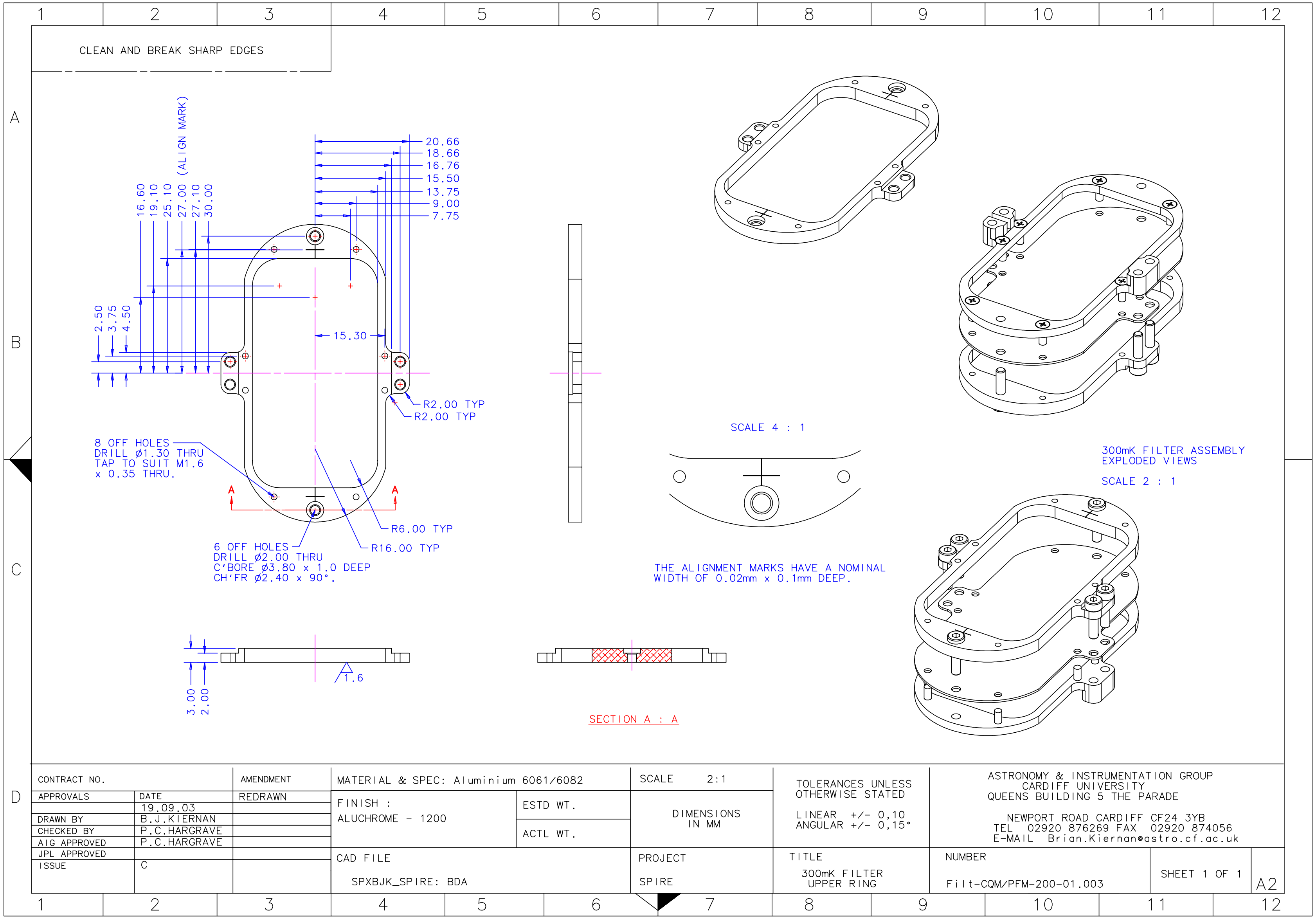
APPROVALS	DATE	
	19.09.03	REDRAWN
DRAWN BY	B.J.KIERNAN	
CHECKED BY	P.C.HARGRAVE	
AIG APPROVED	P.C.HARGRAVE	
JPL APPROVED		
ISSUE	C	

MATERIAL & SPEC: N/A
FINISH :
– ––––
ESTD WT.
ACTL WT.
SCALE 2:1
DIMENSIONS IN MM
TOLERANCES UNLESS OTHERWISE STATED
LINEAR +/– 0,10
ANGULAR +/– 0,15°

ASTRONOMY & INSTRUMENTATION GROUP
CARDIFF UNIVERSITY
QUEENS BUILDING 5 THE PARADE
NEWPORT ROAD CARDIFF CF24 3YB
TEL 02920 876269 FAX 02920 874056
E-MAIL Brian.Kiernan@astro.cf.ac.uk

CAD FILE
SPXBJK_SPIRE: BDA
PROJECT
SPIRE
TITLE
300mK FILTER
NUMBER
Filt-CQM/PFM-200-01.004
SHEET 1 OF 1
A2

Figure 4 300mK Filter



CONTRACT NO.
AMENDMENT
APPROVALS | DATE | REDRAWN
19.09.03
DRAWN BY B.J.KIERNAN
CHECKED BY P.C.HARGRAVE
AIG APPROVED P.C.HARGRAVE
JPL APPROVED
ISSUE C

MATERIAL & SPEC: Aluminium 6061/6082
FINISH :
ALUCHROME - 1200
ESTD WT.
ACTL WT.
CAD FILE
SPXBJK_SPIRE: BDA

SCALE 2:1
DIMENSIONS
IN MM
PROJECT
SPIRE

TOLERANCES UNLESS
OTHERWISE STATED
LINEAR +/- 0,10
ANGULAR +/- 0,15°
TITLE
300mK FILTER
UPPER RING

ASTRONOMY & INSTRUMENTATION GROUP
CARDIFF UNIVERSITY
QUEENS BUILDING 5 THE PARADE
NEWPORT ROAD CARDIFF CF24 3YB
TEL 02920 876269 FAX 02920 874056
E-MAIL Brian.Kiernan@astro.cf.ac.uk

NUMBER
Filt-CQM/PFM-200-01.003
SHEET 1 OF 1
A2

Figure 5 300mK Filter Upper Ring

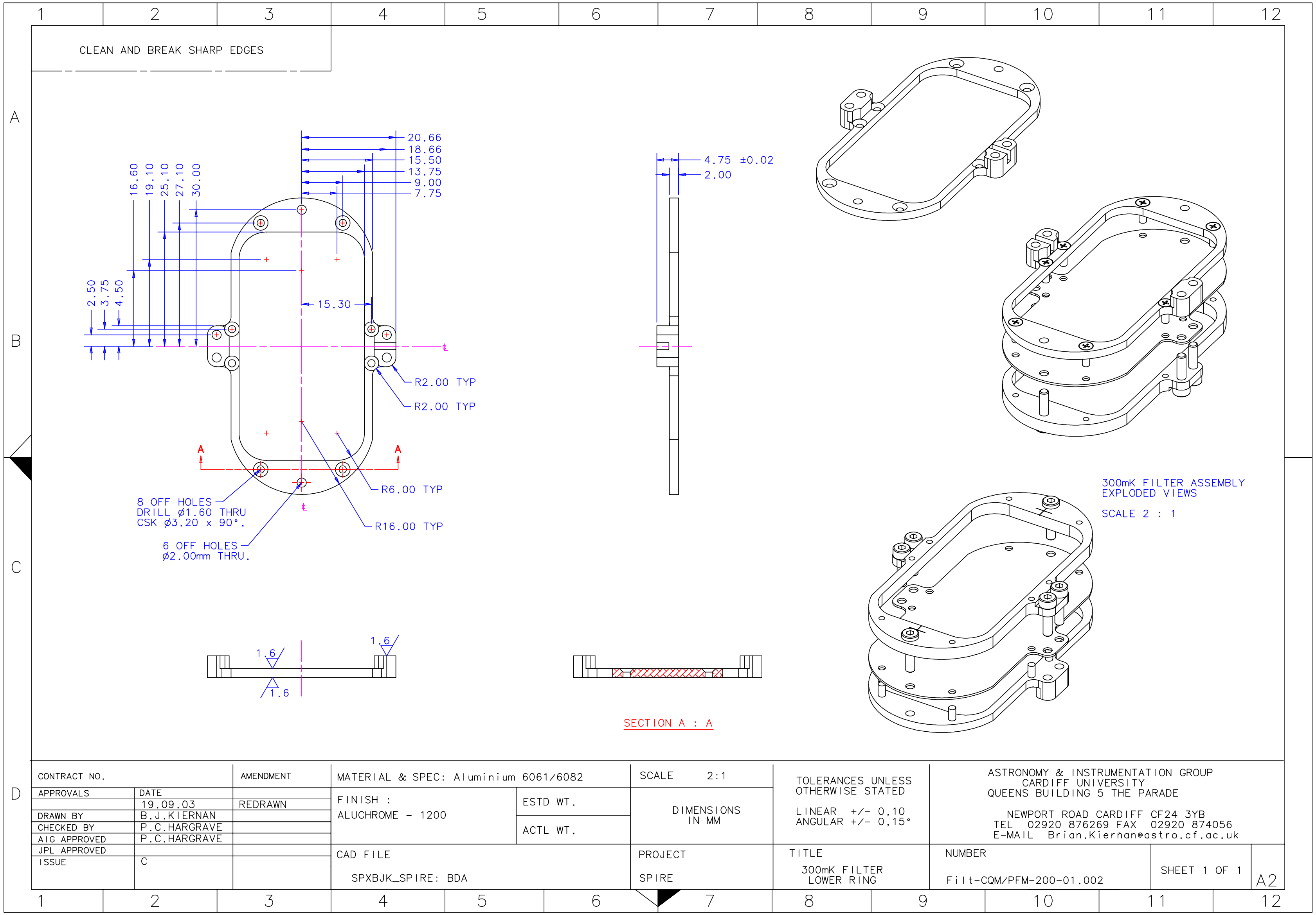
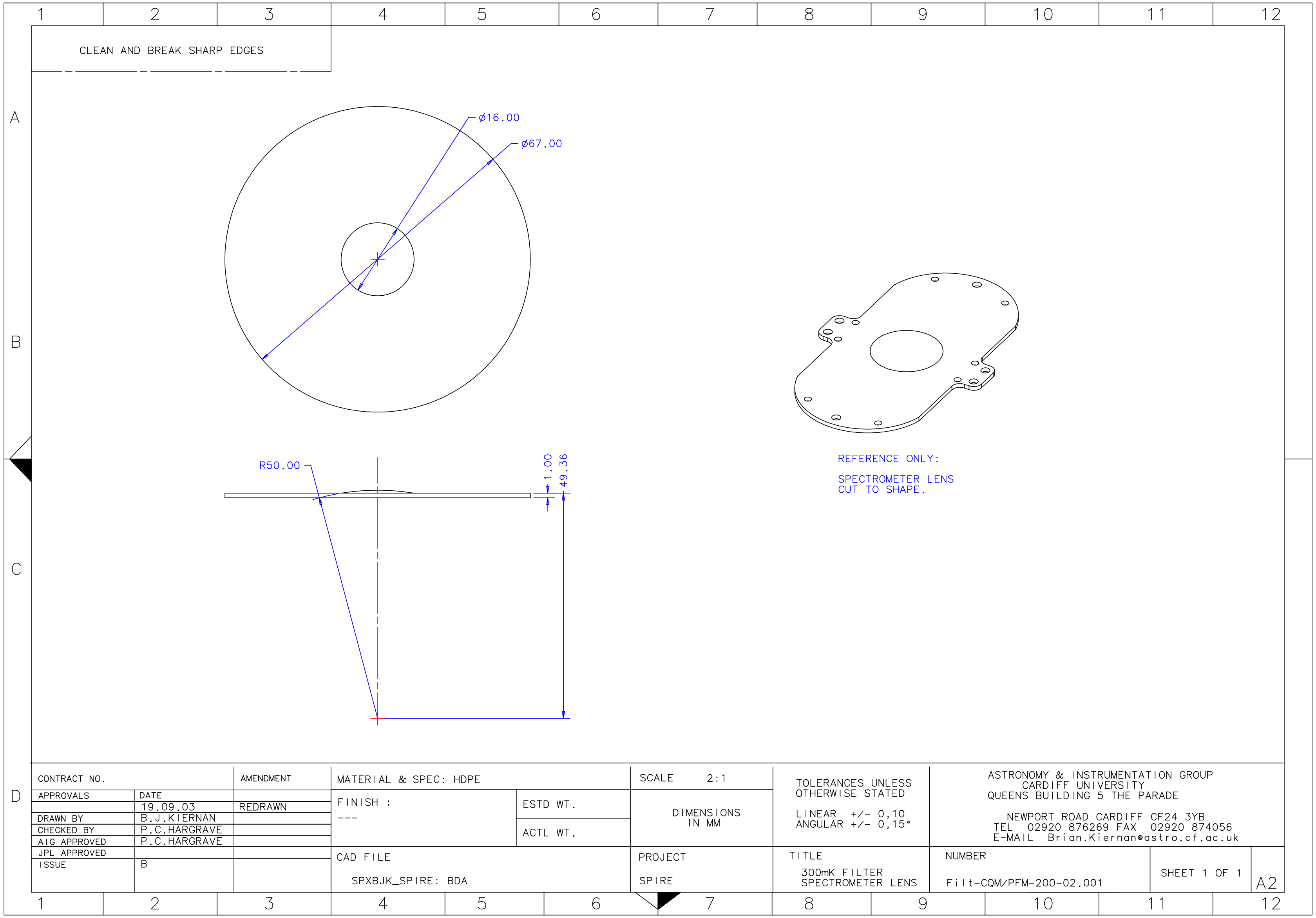


Figure 6 300mK Filter Lower Ring



CONTRACT NO.
AMENDMENT

APPROVALS	DATE	
	19.09.03	REDRAWN
DRAWN BY	B.J.KIERNAN	
CHECKED BY	P.C.HARGRAVE	
AIG APPROVED	P.C.HARGRAVE	
JPL APPROVED		
ISSUE	B	

MATERIAL & SPEC: HDPE

FINISH :

ESTD WT.

ACTL WT.

CAD FILE
SPXBJK_SPIRE: BDA

SCALE 2:1

DIMENSIONS
IN MM

PROJECT
SPIRE

TOLERANCES UNLESS
OTHERWISE STATED

LINEAR +/- 0,10
ANGULAR +/- 0,15°

TITLE
300mK FILTER
SPECTROMETER LENS

ASTRONOMY & INSTRUMENTATION GROUP
CARDIFF UNIVERSITY
QUEENS BUILDING 5 THE PARADE

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E-MAIL Brian.Kiernan@astro.cf.ac.uk

NUMBER
Filt-CQM/PFM-200-02.001

SHEET 1 OF 1

A2

Figure 7 300mK Spectrometer lens

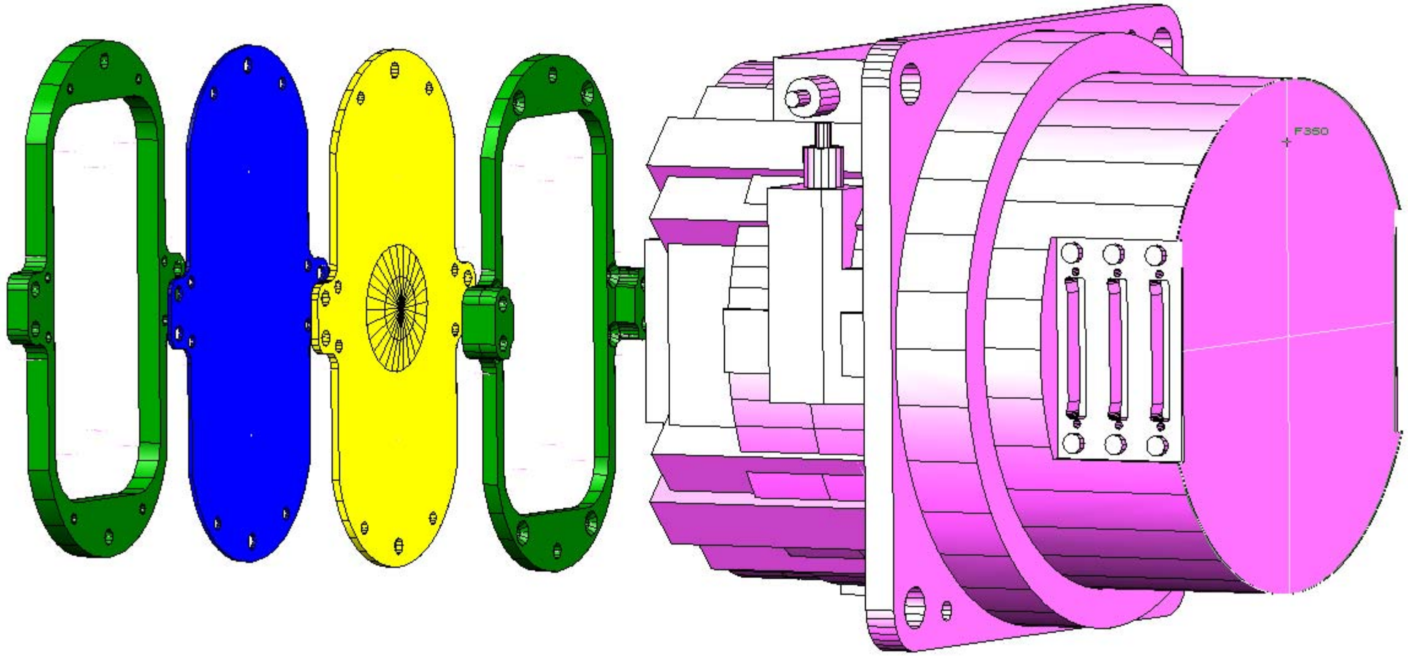


Figure 8 Location of spectrometer lens in 300-mK filter stack. Note that the SLW filter assembly has two filters and one lens in the stack.

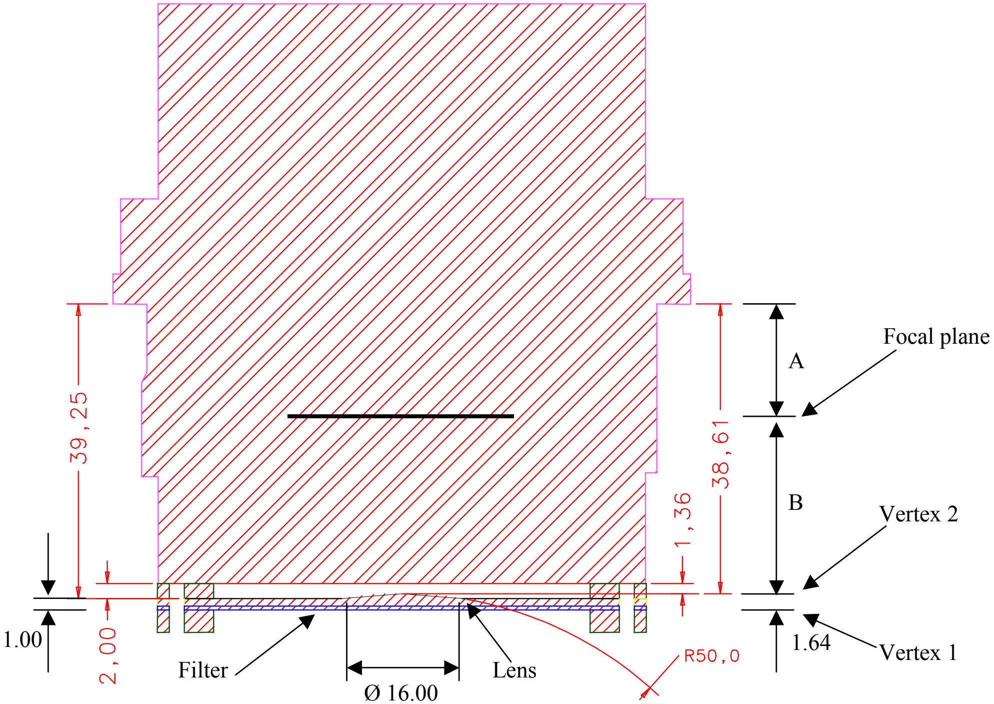


Figure 9 Dimensions of spectrometer lens – filter – detector assembly.

SECTION 09 - As Built Configuration Items Status List

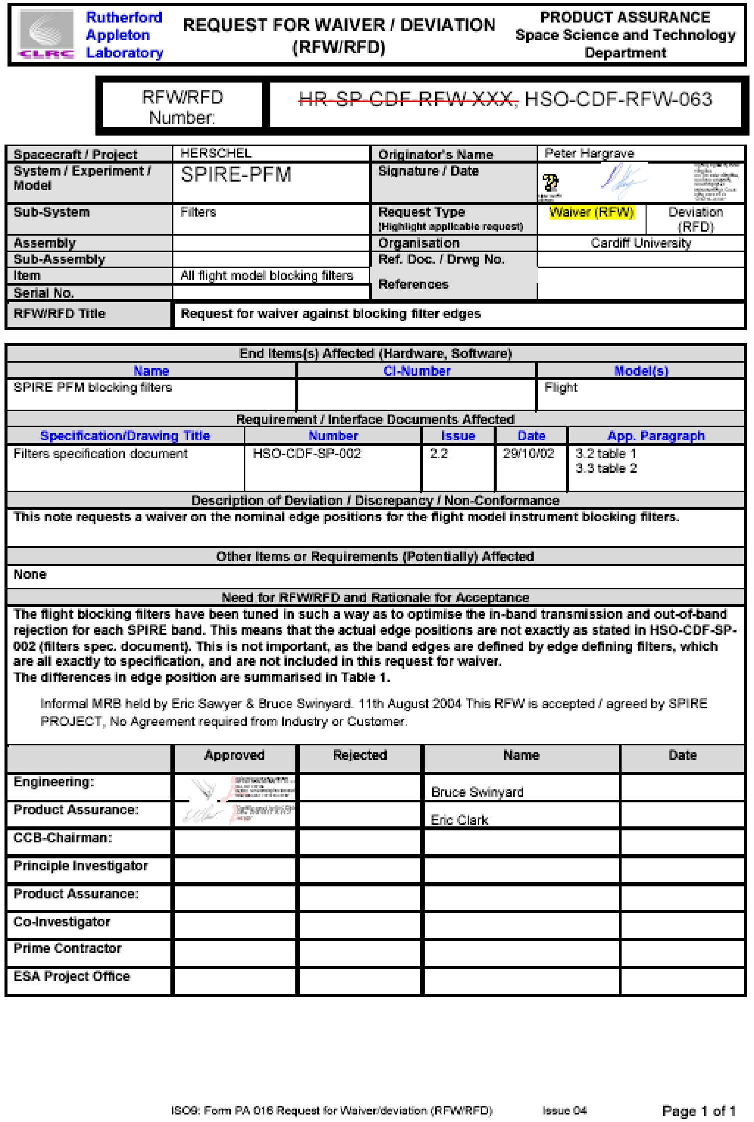
Item	Reference	Location	Notes
Filter drawings and manufacturing files		\\Darkstar\Astroworld\Projects\SPIRE\Cardiff_workpackages\Configured_documents\Filters\Drawings\300MK-filter-CQM-PFM.doc	
Material certificates of conformance		Available at Cardiff for inspection	
FILT-FS-210 Spectroscopic test data SLW-FS assembly		\\Darkstar\Astroworld\Projects\SPIRE\Cardiff_workpackages\Configured_Documents\Issued\Data\FILT-FS-210_FS_SLW_stack.xls	

Part number	Description	Details
FILT-FS-210	***FS SLW FILTER ASSEMBLY***	
FILT-FS-211	SLW FS lower filter ring	Aluminium-6082 – Aluchrom 1200 coated
FILT-FS-212	SLW FS upper filter ring	Aluminium-6082 – Aluchrom 1200 coated
FILT-FS-213	SLW FS lens	Polypropylene lens
FILT-FS-214	SFIL4L – FS – B683#2 filter	34.7 cm-1 LPE blocker
FILT-FS-215	SFIL5L – FS- B675#1 filter	31.9 cm-1 LP edge definer

SECTION 11 - List of Waivers

HSO-CDF-RFW-063	SPIRE PFM Blocking Filters RFW	Closed

SECTION 12 - Copies of Waivers



Rutherford Appleton Laboratory

REQUEST FOR WAIVER / DEVIATION (RFW/RFD)

PRODUCT ASSURANCE
Space Science and Technology Department

RFW/RFD Number:	~~HR-SP-CDF-RFW-XXX,~~ HSO-CDF-RFW-063

Spacecraft / Project	HERSCHEL	**Originator's Name**	Peter Hargrave	
System / Experiment / Model	SPIRE-PFM	**Signature / Date**		
Sub-System	Filters	**Request Type** (Highlight applicable request)	Waiver (RFW)	Deviation (RFD)
Assembly		**Organisation**	Cardiff University	
Sub-Assembly		**Ref. Doc. / Drwg No.**		
Item	All flight model blocking filters	**References**		
Serial No.				
RFW/RFD Title	**Request for waiver against blocking filter edges**			

End Items(s) Affected (Hardware, Software)

Name	CI-Number	Model(s)
SPIRE PFM blocking filters		Flight

Requirement / Interface Documents Affected

Specification/Drawing Title	Number	Issue	Date	App. Paragraph
Filters specification document	HSO-CDF-SP-002	2.2	29/10/02	3.2 table 1 3.3 table 2

Description of Deviation / Discrepancy / Non-Conformance

This note requests a waiver on the nominal edge positions for the flight model instrument blocking filters.

Other Items or Requirements (Potentially) Affected

None

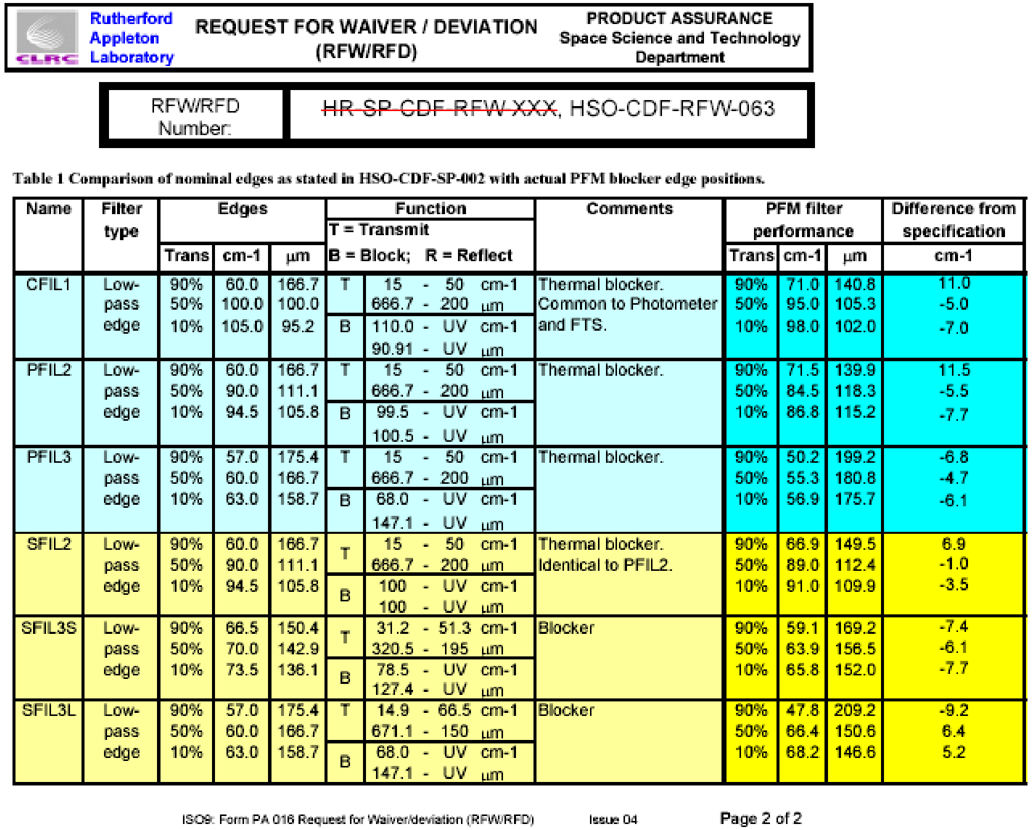
Need for RFW/RFD and Rationale for Acceptance

The flight blocking filters have been tuned in such a way as to optimise the in-band transmission and out-of-band rejection for each SPIRE band. This means that the actual edge positions are not exactly as stated in HSO-CDF-SP-002 (filters spec. document). This is not important, as the band edges are defined by edge defining filters, which are all exactly to specification, and are not included in this request for waiver.
The differences in edge position are summarised in Table 1.

Informal MRB held by Eric Sawyer & Bruce Swinyard. 11th August 2004 This RFW is accepted / agreed by SPIRE PROJECT, No Agreement required from Industry or Customer.

	Approved	Rejected	Name	Date
Engineering:			Bruce Swinyard	
Product Assurance:			Eric Clark	
CCB-Chairman:				
Principle Investigator				
Product Assurance:				
Co-Investigator				
Prime Contractor				
ESA Project Office				

ISO9: Form PA 016 Request for Waiver/deviation (RFW/RFD) Issue 04 Page 1 of 1



Rutherford Appleton Laboratory

REQUEST FOR WAIVER / DEVIATION (RFW/RFD)

PRODUCT ASSURANCE
Space Science and Technology Department

RFW/RFD Number:	~~HR-SP-CDF-RFW-XXX,~~ HSO-CDF-RFW-063

Table 1 Comparison of nominal edges as stated in HSO-CDF-SP-002 with actual PFM blocker edge positions.

Name	Filter type	Edges			Function T = Transmit B = Block; R = Reflect		Comments	PFM filter performance			Difference from specification
		Trans	cm-1	μm				Trans	cm-1	μm	cm-1
CFIL1	Low-pass edge	90% 50% 10%	60.0 100.0 105.0	166.7 100.0 95.2	T B	15 - 50 cm-1 666.7 - 200 μm 110.0 - UV cm-1 90.91 - UV μm	Thermal blocker. Common to Photometer and FTS.	90% 50% 10%	71.0 95.0 98.0	140.8 105.3 102.0	11.0 -5.0 -7.0
PFIL2	Low-pass edge	90% 50% 10%	60.0 90.0 94.5	166.7 111.1 105.8	T B	15 - 50 cm-1 666.7 - 200 μm 99.5 - UV cm-1 100.5 - UV μm	Thermal blocker.	90% 50% 10%	71.5 84.5 86.8	139.9 118.3 115.2	11.5 -5.5 -7.7
PFIL3	Low-pass edge	90% 50% 10%	57.0 60.0 63.0	175.4 166.7 158.7	T B	15 - 50 cm-1 666.7 - 200 μm 68.0 - UV cm-1 147.1 - UV μm	Thermal blocker.	90% 50% 10%	50.2 55.3 56.9	199.2 180.8 175.7	-6.8 -4.7 -6.1
SFIL2	Low-pass edge	90% 50% 10%	60.0 90.0 94.5	166.7 111.1 105.8	T B	15 - 50 cm-1 666.7 - 200 μm 100 - UV cm-1 100 - UV μm	Thermal blocker. Identical to PFIL2.	90% 50% 10%	66.9 89.0 91.0	149.5 112.4 109.9	6.9 -1.0 -3.5
SFIL3S	Low-pass edge	90% 50% 10%	66.5 70.0 73.5	150.4 142.9 136.1	T B	31.2 - 51.3 cm-1 320.5 - 195 μm 78.5 - UV cm-1 127.4 - UV μm	Blocker	90% 50% 10%	59.1 63.9 65.8	169.2 156.5 152.0	-7.4 -6.1 -7.7
SFIL3L	Low-pass edge	90% 50% 10%	57.0 60.0 63.0	175.4 166.7 158.7	T B	14.9 - 66.5 cm-1 671.1 - 150 μm 68.0 - UV cm-1 147.1 - UV μm	Blocker	90% 50% 10%	47.8 66.4 68.2	209.2 150.6 146.6	-9.2 6.4 5.2

ISO9: Form PA 016 Request for Waiver/deviation (RFW/RFD) Issue 04 Page 2 of 2

SECTION 13 - Operations Manual

No operating manual is supplied.

SECTION 14 - Historical Record

The following table contains *brief* historical details of the manufacture, assembly and testing of the FS 300mK SLW filter assembly, including the levels of environmental cleanliness.
A *full* historical record of every stage of manufacture for each individual grid integral to the final mounted filter is traceable at UWC, in both hard copy log-book format and on a Microsoft Access database.

SLW FS filter stack

Date	Action	UWC Test reference
24/5/02	Upper and lower filter clamp rings manufactured – Cardiff MEC. Ref. Q/1731.1	
1/8/03	Filter B675 manufactured in class 1000 clean room	
5/8/03	Filter B675 spectroscopically tested in the range 10-140cm-1	T0146r31
6/8/03	Filter B675 spectroscopically tested in the range 5-40cm-1	T0147r7
13/8/03	Filter B683 manufactured in class 1000 clean room	
14/8/03	Filter B683 spectroscopically tested in the range 10-140cm-1	T0153r19
15/8/03	Filter B683 spectroscopically tested in the range 5-40cm-1	T0155r10
11/8/04	Filter B675 cut to SLW drawing (B675#1)	
11/8/04	B675#1 spectroscopically tested in the range 10-140cm-1	T0405r31
11/8/04	Filter B683 cut to SLW drawing (B683#2)	
11/8/04	B683#2 spectroscopically tested in the range 10-140cm-1	T0405r22
18/8/04	Filters B675#1 and B683#2 bonded together	
19/8/04	Bonded filters B675#1 and B683#2 spectroscopically tested in the range 15-140cm-1 at two locations over area	T0411r19, T0411r22
24/8/04	Bonded filters B675#1 and B683#2 thermally shocked 5 times between 300K and 77K	THERM 0196
31/03/04	2mm polypropylene sheet ordered from North Sea Plastics	
07/04/04	Polypropylene lenses manufactured by MEC – Q/3661	
6/12/04	Filters & polypropylene lens mounted as SPIRE_FS_SLW filter stack	
6/12/04	FS-SLW Assembly spectroscopically tested in the range 10-140cm-1 at two locations over area	T0476r10, T0476r13
7/12/04	FS-SLW Assembly spectroscopically tested in the range 5-40cm-1	T0477r4
8/12/04	FS-SLW baked for 17hrs at 350K	
9/12/04	FS-SLW stack final clean, 24Hr bake-out	
16/12/04	FS SLW 300mK stack DRB meeting	
17/12/04	FS-SLW shipped to JPL	

SECTION 15 - Logbook / Diary of Events

Not provided – available from subsystem provider upon request.
Cardiff log-book, labelled “Cardiff SPIRE filters Log-book”, will be stored in a secure archive.

SECTION 16 - Operating Time / Cycle Record

See historical record.

SECTION 20 - Calibration Data Record

The recommended 300mK filter transmission for the SLW channel to be used for calibration purposes is indicated in this section. This trace is composed of data measured over the ranges 0-40cm^{-1} and 0-140cm^{-1}.
These are the measured transmission spectra prior to final cleaning and packing.
The raw data is stored in the file
\\Darkstar\Astroworld\Projects\SPIRE\Cardiff_workpackages\Configured_Documents\Issued\Data\FILT-FS-210_FS_SLW_stack.xls
(Microsoft Excel workbook). This file is available from Cardiff, and is under configuration control on Livelink (managed by RAL).
Calibration data for all SPIRE flight model filters may be found in the file
\\Darkstar\Astroworld\Projects\SPIRE\Cardiff_workpackages\Configured_documents\Issued\ Data\ PFM-filters-summary.xls

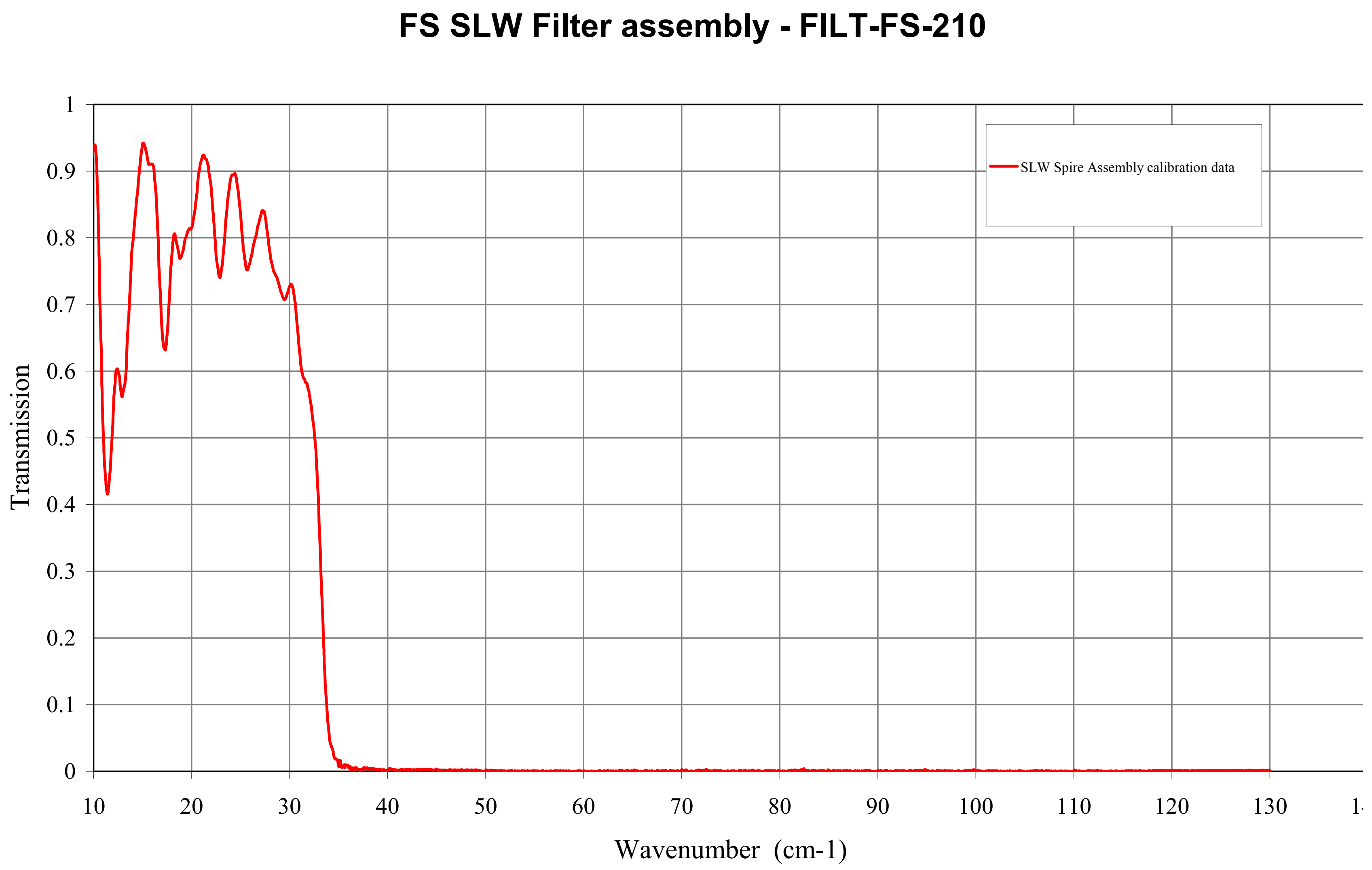


Figure 10 Spectroscopic data for FS-SLW stack

SECTION 21 – Temporary Installation Record

See historical record.

SECTION 22 - Open Work / Deferred Work / Open Tests

Off-cuts of the filter material are securely stored, and may be measured to 15μm using the Bomen spectrometer if required.

SECTION 23 - List of Non-Conformance Reports

None

SECTION 24 - Copies of Non-Conformance Reports

None

SECTION 25 - Test Reports

SPIRE FS SLW test summary - CT

1 Visible inspection

As standard practice, each filter element is checked individually for pattern geometry and defects under an optical microscope, following the procedures laid out in the UWC internal document “UWC_Filter_production_PA_V2.0.doc”.
The assembled filter then undergoes a series of optical, thermal and mechanical tests.

2 Optical measurements

The FIR spectral tests were carried out at UWC, using two Martin-Puplett polarizing Fourier transform interferometers. These instruments allow spectral evaluation from 2 to 650 cm-1, using a series of in-house detectors.
The as-manufactured, unmounted, uncut filters were spectrally tested in- and near-band, following the standard FTS procedures of UWC.
The individual filter components (SFIL4L, SFIL5L) were then bonded together.
The bonded filter stack was then re-measured spectrally, and then machined to the 300mK filter drawing. Measurements were then made in transmission at two extreme locations, as a test for uniformity.
Following thermal cycling tests and mounting with the lens, the SLW filter stack was spectrally re-tested at two locations in one frequency range to verify component integrity.

3 Thermal tests

3.1 Thermal shock

Thermal shocking of the SLW filter stack prior to cutting and mounting was performed using a liquid nitrogen bath. This cycle (300K - 77K - 300K) was performed 5 times. All spectroscopic measurements made thereafter verified no filter de-lamination or degradation.
(If any part of a filter is seen to de-laminate, or show any other signs of weakness, it is rejected and the component remade).

3.2 Thermal cycling

Once machined, the SLW stack underwent a more controlled thermal cycle 3x(300K - 77K - 300K). The component showed no signs of degradation.

4 Mechanical tests

During the evacuating of the Martin-Puplett FTS, the filter stack has been subjected to a differential pressure rate of change of at least 10mB/sec.
It has been taken to a vacuum pressure of 0.5mbar, within the FTS, on at least 8 separate occasions.

The filter stack has been cleaned using an ultrasonic acetone bath, and has been vacuum baked at 350 K for 17 hours with no signs of degradation.

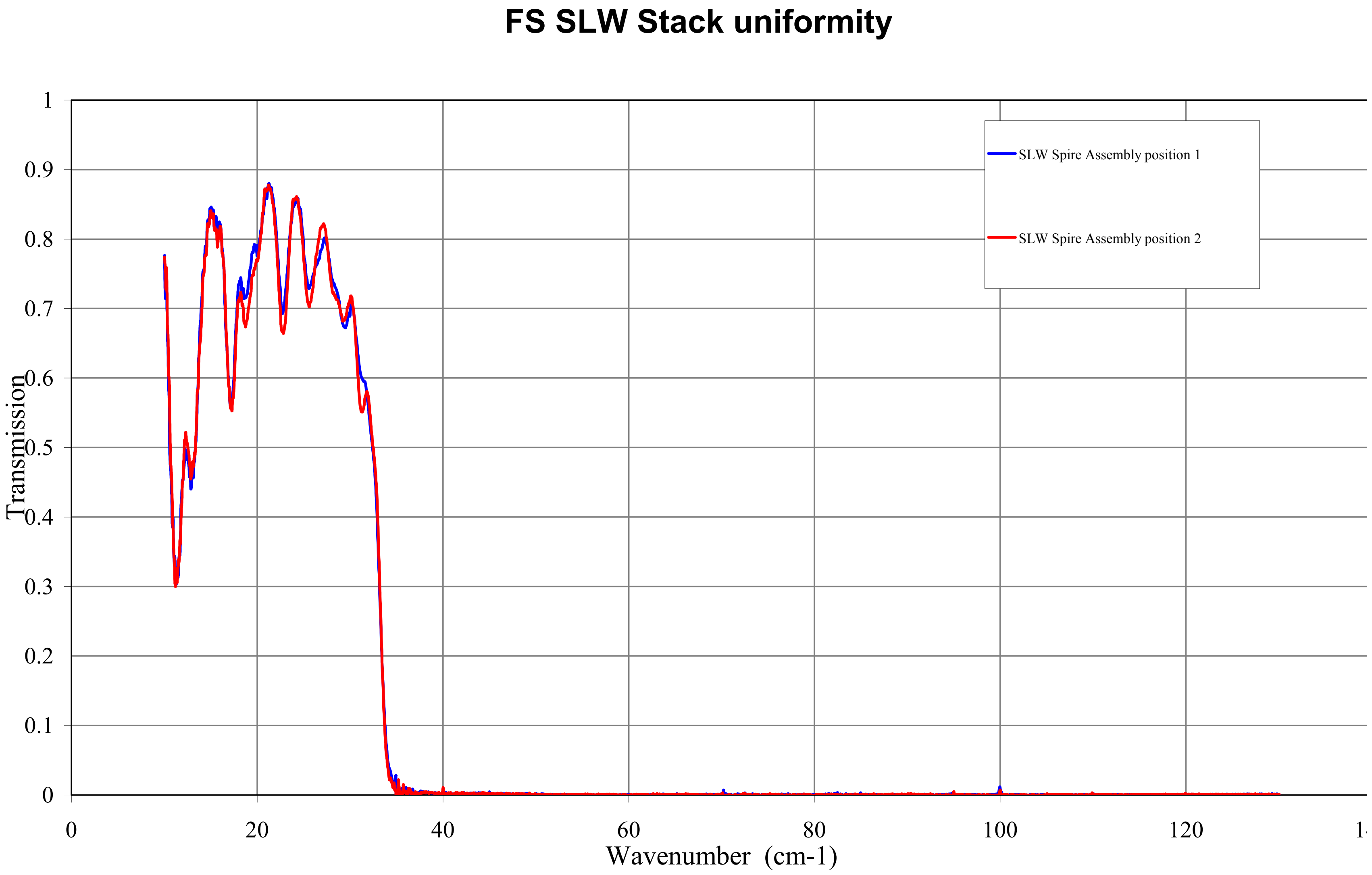


Figure 11 FS SLW stack uniformity – note that these data were measured on a 0-140cm^{-1} spectrometer range, which results in lower signal to noise at lower frequencies. The calibration data shown in section 20 are produced from several higher quality scans over smaller frequency ranges.

SECTION 27 - Reference List of EIDP's

This EIDP will become an annex to the JPL FS SLW BDA.

Associated

Title (Listed in alphabetical order)	**ID** (Serial No.)	**Acronym**	**Document No.**	**Issue**	**Date**
SLW BDA PFM /FS EIDP					

Lower Level

Title (Listed in alphabetical order)	**ID** (Serial No.)	**Acronym**	**Document No.**	**Issue**	**Date**

SECTION 28 - Mass Records

Assembly	Final measured mass
FILT-FS-210 – FS SLW assembly	11.2 ± 0.1 g

SECTION 29 - Cleanliness Statement

Statement

The FS 300mK SLW filter assembly (FILT-FS-210) has been cleaned and assembled within a class 1000 clean room to meet the requirements of the Cardiff PA plan (HSO-CDF-PL-007).

Signed ……………………………………………Peter Hargrave, Technical Manager, Cardiff-SPIRE deliverables

Signed ……………………………………………Carole Tucker, Cardiff Filter Production Manager

Signed ……………………………………………Ian Walker, Programme Manager, Cardiff AIG.

Date ……………..17th December 2004

Extra Information

The manufacture of these filter elements took place within a class 1000 clean-room, following the procedures laid out in the UWC document, “UWC Filter Fabrication Procedures.doc”. Although filter testing took place within a standard laboratory environment, the mounted filters were subsequently cleaned (using acetone and a de-ionised air-gun), in a class 100 laminar flow cabinet, prior to packaging.

SECTION 30 - Other Useful Information

Figure 12 Photographs of the FS SLW assembly prior to shipping

SECTION 31 - DPL/DML

Refer to the Cardiff-SPIRE PFM deliverables lists.

Cardiff-SPIRE-DML	HSO-CDF-LI-074
Cardiff-SPIRE-DMPL	HSO-CDF-LI-075
Cardiff-SPIRE-DPL	HSO-CDF-LI-076

SECTION 32 – List of Appendices/Attachments

Appendix #	Title (Listed in alphabetical order)	Document No.	Issue	Date	Notes