JPL Hardware Requirements Certification Review (HRCR)- Proto-Flight Model (PFM) Spectrometer Long Wavelength (SLW) Bolometer Detector Assembly (BDA)

10209800-4 S/N 008

SPIRE Element

Herschel Space Observatory Project

November 26, 2003

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	
3	Certificate of Conformance / Delivery Review Board MoM		HRCR form is the CofC
4	As Built Configuration Status List		Dwg List, Section 3
5	List of Waivers	16	
6	Copies of Waivers	16	
7	List of Non-Conformance Reports	17, 18	
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	
12	Interface Drawings	14	
13	Functional, Block & Mechanical Drawings		
14	Electrical Circuit Drawings		
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
18	Test Reports		To be supplied later
19	Open Work / Deferred Work / Open Tests	5	
20	Calibration Data		
21	Historical Record		Section 12
22	Manufacturing Logbook(s)	--	To be retained at JPL
23	Operating Time / Cycle Record		Section 12
24	Connector Mating Record		Section 12
25	Age Sensitive Items Record		NA for BDA
26	Pressure Vessels – History/Test Record	26	NA
27	Temporary Installation Record		Section 12
28	Reference List of EIDPs (Lower level)		
29	Other Useful Information		

JPL Hardware Requirements Certification Review – SPIRE Element #D-27547

Assembly/Subsystem	PEM	Phone	Section	Date
SPIRE	Martin Herman	(818) 354-8541	386	26 November, 2003

Drawing/ Part No.	Dwg. Rev.	Nomenclature	Serial No.	Model	Type	Final IR No.	Mass (grams) As Meas. / Req.
10209800-4	X7	Bolometer Detector Assembly	008	PFM	SLW	919940	542 g / 550 g

Check applicable answer and give necessary explanation in remarks column	Yes	No	N/A	Remarks	Data Attachments	Signature Approval & Date
1. Are all drawings and specifications complete, approved, released and frozen?		x		See attached status matrix and note (section 3)	14. Latest Top Assembly Drawings ☒ Attached ☐ None	Cog E [signature] 12/8/03
2. Do the released drawings and specifications reflect all approved changes?	x			See section 3 matrix for which drawings are released.	15. List of open ECRs ☒ Attached ☐ None	PEM [signature] 12/8/03
3. Is hardware identical to other hardware delivered? If no, provide difference list.			x	First hardware of this type delivered	16. Waivers ☐ Attached ☒ None	QA Engineer [signature] 12/15/03
4 Does the hardware meet the requirement of its functional requirements, specifications, waivers and/or ICDs ? If no, provide difference list.		x		All requirements met except as shown in attached verification matrix (section 9) and Issues / NCRs (section 4). See section 10 for detector performance matrix.	17. Open MRBs ☐ Attached ☒ None	Environments/Reliability [signature] 12/10/03
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	Mission Assurance Mgr. [signature] 12/10/03
6. Is complete as-built list information included in the build book?	x			Official Indentured Parts List (IPL) not generated due to drawing status, but traceability information is captured in build books.	19. Open P/FRs on similar H/W ☒ Attached ☐ None	Project [signature] 12/12/03
7. Have all required environmental tests & analyses been completed?	x			Assuming agreement on deviations from test plan: 1 axis cold test vs. 3 axes warm. See Issues / NCRs (section 4).	20. Handling Document ☒ Attached ☐ None	PI [signature] 12/10/03
8. Is all required assembly and/or subsystem level functional testing complete?	x				21. Shortage List ☐ Attached ☒ None	
9. Have all piece parts, processes and materials been approved by JPL?	x				22. Requirements Verification Matrix ☒ Attached ☐ None	
10. Does this hardware meet all contamination control requirements?	x				23. Qualification Status ☒ Attached ☐ None	
11. Are all required shipping containers, shipping procedures, and special handling procedures ready?	x				24. Connector Mate / Demate Log ☒ Attached ☐ None	
12. Is additional work required to bring this hardware to flight readiness?		x			25. Operation Log ☒ Attached ☐ None	
13. Is this hardware acceptable for flight ?	x				26. MICD ☒ Attached ☐ None	

JPL PDMS

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

IR Number
919940

Action
BROWSE

Status "Pending Action for IRDIs"

IR Instructions

REFERS TO:

Part Number	Dash Number	Revision	Latest Rev	Serial Number	Quantity
10209800-4	(with part number)	A	X7	008	1

Nomenclature:	**BOLOMETER DETECTOR ARRAY**		
Prgm/Project:	**HSO-PLANCK**	Inspection Date:	**07-OCT-2003**
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:	**23835**
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	Defect Code	Qty	Zone	S/N	Description	Re-Work	Files
1	2D8	1	N/A	008	parts inspected to x5 dwg.	-	No
2	3C7	1	N/A	008	part needs to be cleaned before shipping	-	No

Item	Disposition	Root Cause Code	Discrep Code	Disp. Appr.	Stamp Date
1	drawing will be released by 12/31/03	-	SA	24-NOV-2003 HUGHES, SCOTT P.	☐ Stamp ☐ Demote
2	final cleaning / inspection to VC-HS will be done immediately prior to shipping	-	SA	24-NOV-2003 HUGHES, SCOTT P.	☐ Stamp ☐ Demote

Inspection Report Notes:

see attached file for kit list

	Initiated by	Signed by COGE	Signed by QAE	Closed by
	HUGHES, SCOTT P.	**WEILERT, MARK A.**	**HUGHES, SCOTT P.**	
Number of Files Attached **1**	Date **24-NOV-2003**	Date **24-NOV-2003**	Date **24-NOV-2003**	Date

Reserved by	Reserved on	Reason

Drawing Release Status Matrix

Many drawings are not yet released due prior to funding contraints,
All unreleased drawings exist in pre-release or redline forms,
which have not yet been incorporated into released versions.
Incorporation of changes and release process is started.

(dark grey) **= unreleased**
(light grey) **= unreleased, but captured in MDL design documents**

Part #	Nomenclature
10209800	Bolometer Detector Assembly
10209860-2	suspension assembly (-2)
10209880-1/A	bottom ring assembly
10209881-1	bottom ring
10209882-2	pin, 11 mm long
10209882-3	pin, 5.5 mm long
10209883-2	stud, 1.6mm (-2)
10209887-2	shaft, pulley (-2)
10209888-1	lock, pulley
10209874-1/C	pulley
10209890-1/A	middle ring assembly
10209887-3	shaft, pulley (-3)
10209882-1	pin, 12.4mm long
10209883-1	stud, 1.6mm (-1)
10209882-4	pin, 5.5 mm long, 1mm dia.
10209858-1	screw, modified
10209891-1	ring A
10209892-1	ring B
10209893-1	vespel spacer
10209894-1	flexure
10209895-1	sleeve
10209896-1	aluminum spacer
10209884-1	prawl
10209870-2	top ring assembly (-2)
10209887-1	shaft, pulley (-1)
10209888-1	lock, pulley
10209874-1/C	pulley
10209871-2/A	top ring (-2)
10209861-1	spacer
10209862-1	capstan 1
10209859-1/B	capstan 3
10209885-1	latch
10209886-1	clamp, capstan
10209898-1	bushing
10209872-1	pulley, no lips
10209845	pulley, spacer
10209840	SLW Detector Assembly
10209841	SLW Bolometer Array
10209822	SLW Backshort Array

Part #	Nomenclature
10209843	SLW Feed Horn
10209815	Center Flexible Printed Cable Assembly
10209814	Center Flexible Printed Cable
10209849	spacer
10209816	Coverplate
10209817	Thermal Strap
10209819	Connector Mount
10209828	Detector Clip
10209837	Threaded Shoulder Pin
10209838	Load Resistor
10209844	Cable Clamp
10209827	Spring Stop
10217668	Spring Stop 2
10217701	Tefon Washer
10209805	light can
FILT-PFM-220	PLW 300mK filter assembly (Cardiff)
10209807	light seal

Issues / NCR's
PFM SLW BDA S/N 008

Configuration / Processing:

- The maximum height of 300 mK stage exceeds ICD drawing 10209721 allowed range by 1.0 mm due to changes in 300 mK filter stack thickness which were not incorporated into the drawing. See attached open ECR: HR-SP-JPL-ECR-003.
- The SLW detector array was not given the DI-water rinse found to be necessary to prevent residual acid contamination and corrosion on the later SSW array. This is not expected to be a problem for the SLW for several reasons. See attached NCR: HR-SP-JPL-NCR-003.

Environmental:

- A single-axis cold shake, 1 minute duration, was performed instead of a 2 minute duration shake. The 2 minute shake plan was finalized after the shake testing on this unit. See attached memo: SPIRE BDA random vibration test program (H. Abakians, 3 Oct. 2003), and prior approved Environmental Test Authorization / Summary (ETAS) form for this unit.
- The current Test Plan specifies a room temperature three-axis shake, 1 minute duration instead of the cold one-axis test performed. Vibration levels were per email from Berend Winter, also in variance from the Test Plan. -- *Same issue as on previous CQM-PLW BDA.*
- No high-level sine-sweep vibration test was performed. See attached email: (M. Herman, 13 May 2003) -- *Same issue as on previous CQM-PLW BDA.*
- 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) -- *Same issue as on previous CQM-PLW BDA.*

Performance:

- The diagnostic "dark" detector pixel is sensitive to stray light incident from the sides of the BDA. This stray light problem does not significantly affect the optical pixels. See attached description.   Note that there is no requirement for the dark pixel, which is included for diagnostic purposes only.

CCLRC Rutherford Appleton Laboratory	**DOCUMENT / ENGINEERING CHANGE REQUEST (ECR)**	**PRODUCT ASSURANCE Space Science and Technology Department**

DCR / ECR Number:	HR-SP-JPL-ECR-003

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		**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-003

Spacecraft / Project	**Herschel**	**Originator's Name**	Martin Herman	
Experiment / Model	SPIRE / CQM	**Signature**		
Sub-System		**Date**	October 6,2003	
Assembly		**Level** (Highlight if applicable)	Major	Minor
Sub-Assembly				
Item	PLW BDA (10209800-1) SLW BDA (10209800-4)	**NRB Reference**		
Serial Number	006 008			

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

NCR Title	**Array Process Change**

NCR Description

We have learned on the S/SW arrays that residual chlorine resulted in latent failures on 2 arrays (not being delivered). This resulted in us instituting a DI (deionized water) rinse to remove Cl. The CQM P/LW and PFM S/LW arrays did not go through the DI rinse. We have looked at non-flight P/LW and S/LW arrays at MDL that have sat at 46% humidity for several months up to a year and see no degradation visually or in device impedance, so we don't believe there is a problem. The arrays inspected and retested are 2 P/LW arrays after 10 months and 1 year, and 4 S/LW arrays after 1.5 months, 6 months, 6 months, and 1 year. Arrays which are not packaged will continue to be monitored periodically. We believe that the failure of the SSW arrays was related to the smaller pixel size, and the associated increased difficulty in removing contaminants from the smaller pixel wells. The DI rinse is being instituted for all other arrays, including those with larger pixel sizes that do not exhibit this problem. We recommend dry storage for these arrays, as we recommend for all arrays due to the associated kevlar issue.

Cause of NCR

Disposition / Corrective Action

Document or Drawing Affected (Title, Number & Issue)

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

NCR Number:	HR-SP-JPL-NCR-003

NCR CLOSED (Signatures Required)	PA Manager (Or Deputy)	Project Manager (Or Deputy)	Date

M. Weilert
79-24

JPL

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

TO: Martin Herman

FROM: Henry Abakians ha

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

ENVIRONMENTAL TEST AUTHORIZATION AND SUMMARY (ETAS)

AUTHORIZATION SECTION

PROJECT: Herschel
LOG NO.: HS015

SUBSYSTEM/ASSEMBLY TITLE: SPIRE SLW BDA SN008
DATE ISSUED: 9/9/2003

REFERENCE DESIGNATION NUMBER:
PART NO. (IF MULTIPLE, ATTACH LIST): 10209800
REV.:
SERIAL NO.: 008

HARDWARE TYPE: [ ] EM QUAL [ ] FLIGHT [X] FLIGHT SPARE [X] 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 ______
[X] RANDOM VIBRATION [X] THERMAL VAC. [ ] THERMAL ATMOSPHERE

TYPE OF TEST:
[ ] QUALIFICATION [ ] FLIGHT ACCEPTANCE
[X] PROTO FLIGHT [ ] RETEST

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

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

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

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

ARE ALL PFRs AGAINST THIS UNIT CLOSED?
[X] YES [ ] NO (IF NO, ATTACH EXCEPTIONS LIST) BRIEF EXPLANATION

HAVE ALL WAIVERS AND ECRs BEEN APPROVED AND ARE THEY INCORPORATED?
[X] 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 144
TEST INITIATION DATE: 09/10/03
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 [X] [ ] [ ]

ACOUSTIC [ ]

PYROSHOCK SHOCK — AXES: X Y Z [ ] [ ] [ ]
SHOCKS/AXIS:

[X] 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

ENVIRONMENTAL TEST AUTHORIZATION AND SUMMARY (ETAS)

OTHER AUTHORIZATION PROVISIONS AND EXPLANATIONS

This is a 1-axis cold vibration test (100 K) done on the SLW BDA. The test will be done with the BDA unit mounted inside a cold vibration facility. The unit is identical to the flight design. 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 TEST AUTHORIZATION AND SUMMARY (ETAS)
ENVIRONMENTAL TEST SUMMARY

HARDWARE	S/N	ETAS	TEST ENVIRONMENT LEVELS & DURATION	DATE TEST PERFORMED	TEST AGENCY	PASS/ FAIL	COMMENTS
SLW BDA (10209800)	8	15	**LATERAL** 1X 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 2 Thermal cycles from 290K to 7K				

Date: Mon, 11 Aug 2003 16:32:18 -0700
From: Martin Herman <Martin.I.Herman@jpl.nasa.gov>
Subject: Waiver (sine vibe)
X-Sender: miherman@pop.jpl.nasa.gov
To: Mark.A.Weilert@jpl.nasa.gov
Cc: Henry.Abakians@jpl.nasa.gov

Date: Tue, 13 May 2003 14:31:52 -0700
To: Matt Griffin <Matt.Griffin@astro.cf.ac.uk>, Eric Sawyer <e.c.sawyer@rl.ac.uk>, Bruce Swinyard <b.m.swinyard@rl.ac.uk>, Doug Griffin <d.k.griffin@rl.ac.uk>, John Delderfield <J.Delderfield@rl.ac.uk>, Peter Hargrave <peter.hargrave@astro.cf.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: Action Items (Second Email)
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, Mark.A.Weilert@jpl.nasa.gov, Terry.D.Scharton@jpl.nasa.gov, Juan.P.Fernandez@jpl.nasa.gov
Bcc:
X-Attachments: :Macintosh HD:458316:BDA_VIB_SPEC.xls:

Dear Matt and SPIRE Team,

We discussed a waiver at today's telecon with regard to sine vibration testing. The following is from Juan:

BDA:
Terry and I reviewed response data from the recent STM SPIRE vibration test to assess the revised BDA test levels proposed by Berend. We agree that the new BDA test input levels and response limit of 15 grms are reasonable based on the available data. Plots of the new and old specifications are attached.

Furthermore, a waiver is needed for the sine test on the grounds that:
1) it poses a risk to personnel and hardware due to a likely failure of the GSE used to cool the unit and which remains attached during testing. The cooling hoses have resonances that are severely excited in the test frequency range of 5 to 100 Hz. The hoses and attach fittings have not been verified to survive the proposed 27 g sine test - an attempt was made this week, but it was abruptly halted out of fear of a failure. Modifications to the GSE equipment and subsequent verification would be costly and carry a schedule impact.
2) the BDA has its first resonance above 200 Hz, so that it would see the sine vibration input as rigid-body excitation - no dynamic amplification as no modes would be excited during the sine sweep from 5 to 100 Hz. The vibration response level to which the BDA will be exposed during random vibration will be at least twice what it would see during sine vibration (15 grms x 4 sigma = 60 g-pk versus 27 g's).

-Juan

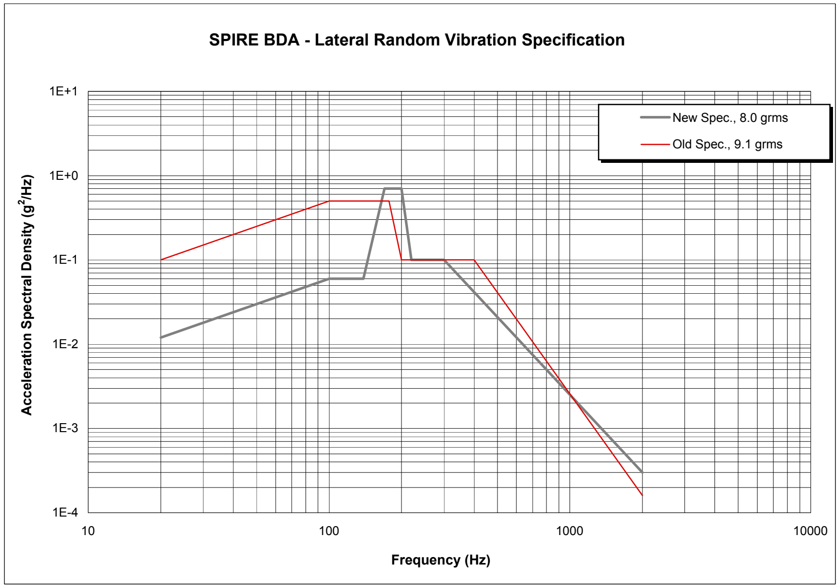
We would like to receive your concurrence to continue testing with this preliminary waiver (elimination of sine testing). We will be glad to submit a formal request at a later time.

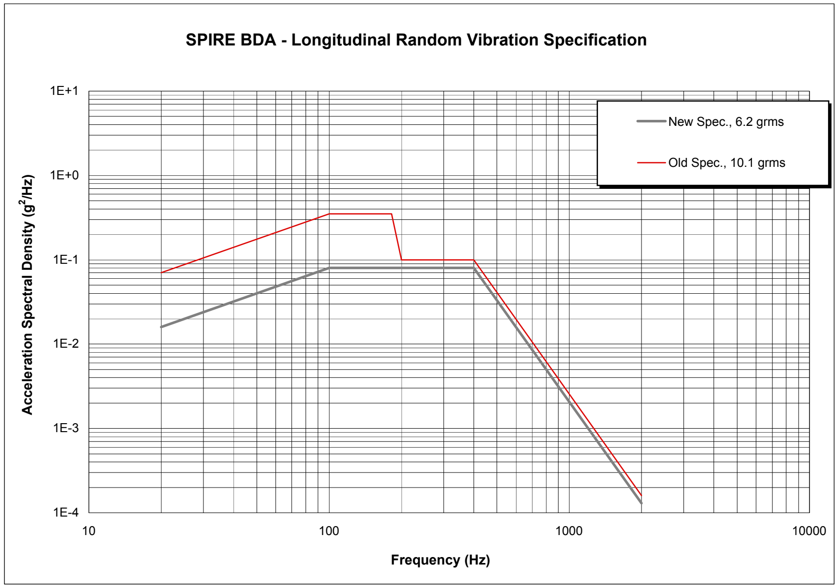
Thanks,
Marty

BDA_VIB_SPEC2.xls

SPIRE BDA - Lateral Random Vibration Specification
SPIRE BDA - Longitudinal Random Vibration Specification

Freq (Hz)	New Spec., 8.	Old Spec., 9.1	New Spec., 6.	Old Spec., 10.1 grms
20	0.012	0.1	0.016	0.07
100	0.06	0.5	0.08	0.35
139	0.06			
170	0.7			
177.5		0.5		
182				0.35
200	0.7	0.1		0.1
220	0.1			
300	0.1			
400		0.1	0.08	0.1
2000	0.0003	0.00016	0.00013	0.00016
grms=	8	9.1	6.2	10.1





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

Dark Pixel Issue

DESCRIPTION OF PROBLEM:

The dark detector pixel, if properly sealed, should exhibit insignificant response if light is shined on the detector/feedhorn assembly. Our optical tests with the SLW BDA reveal that the dark detector, pixel id DP1, in fact absorbs a significant amount of stray light (The second dark pixel, id DP2 is non-functional). The dark channel is designed for diagnostic purposes only and does not have any impact on the BDA performance. Note that testing shows that not more than 5% of the signal from the optical pixels is due to the stray light.

FINDING:

Upon careful review of the BDA assembly, we found the following: the SLW feedhorn assembly consists of a hexagon structure of 19 feedhorns which are attached to a circular mounting flange. This hexagon feedhorn structure extends beyond the bottom flat face of the mounting flange. The extension is needed in order to provide proper optical coupling between the feedhorn and the detector and to protect the optical pixels from stray light. The two dark channels and the two thermistors are outside the perimeter of this hexagon structure and therefore susceptible to stray light which enters from the side of the mounting flange. We believe the optical response by the dark channel is due to this arrangement.

LTR	ZONE	DESCRIPTION		DWN	CHK	STRUCT	MATL	THRM CONT		ENGR	DSGN SUPV	DATA MGT	RELEASE DATE
REVISIONS													
A		INITIAL RELEASE	CODE B	SEE TITLE BLOCK									
X3		ADDED SHIPPING CONTAINER											

(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 PLUS RUNNING TORQUE PER JPL SPEC ES517040.

(5) FOR ALL CONFIGURATIONS EXCEPT -6 AND -7, SECURE ITEM 11, 42, OR 49, CAN TO FLEXURE RING OF ITEM 1 OR 2, USING ITEM 24, SCREW, AND ITEM 21, SPRING WASHER. TORQUE TO 200 N*MM PLUS RUNNING TORQUE 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, SCREW, ITEM 20, NUT, AND ITEM 21, SPRING WASHER. TORQUE TO 260 N*MM PLUS RUNNING TORQUE 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 21, SPRING WASHER AND TORQUE TO 200 N*MM PLUS RUNNING TORQUE PER JPL SPEC ES517040.

(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 PLUS RUNNING TORQUE 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 PLUS RUNNING TORQUE 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
						4	4		50			NA0068A016004	SCREW, MACHINE PAN HEAD	NA0068	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	24			24	24	24	24	24	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 | SPIRE USED ON

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 960939

APPD ____ DATE ____

DWN D. CRUMB 6/14/02

CHK

STRUCT

MATL

THRM CONT

ENGR

DSGN SUPV

JET PROPULSION LABORATORY

CALIFORNIA INSTITUTE OF TECHNOLOGY PASADENA, CA 91109

RELEASED THROUGH EDMG

BOLOMETER DETECTOR ASSEMBLY

SIZE A1 | CAGE NO 23835 | 10209800 | REV X7

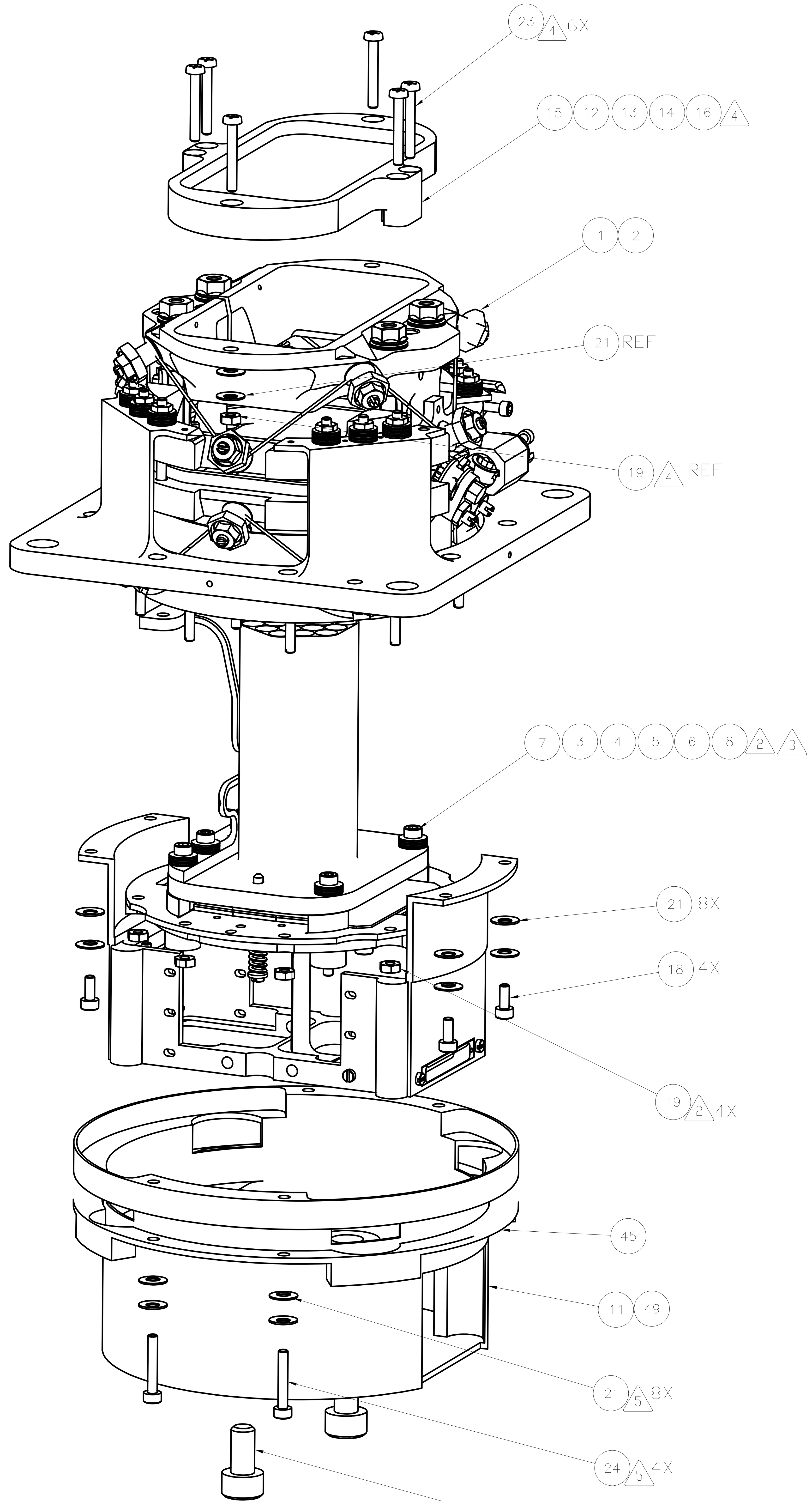
SCALE NONE | UNCLASSIFIED | SHEET 1 OF 4

REV 2/00

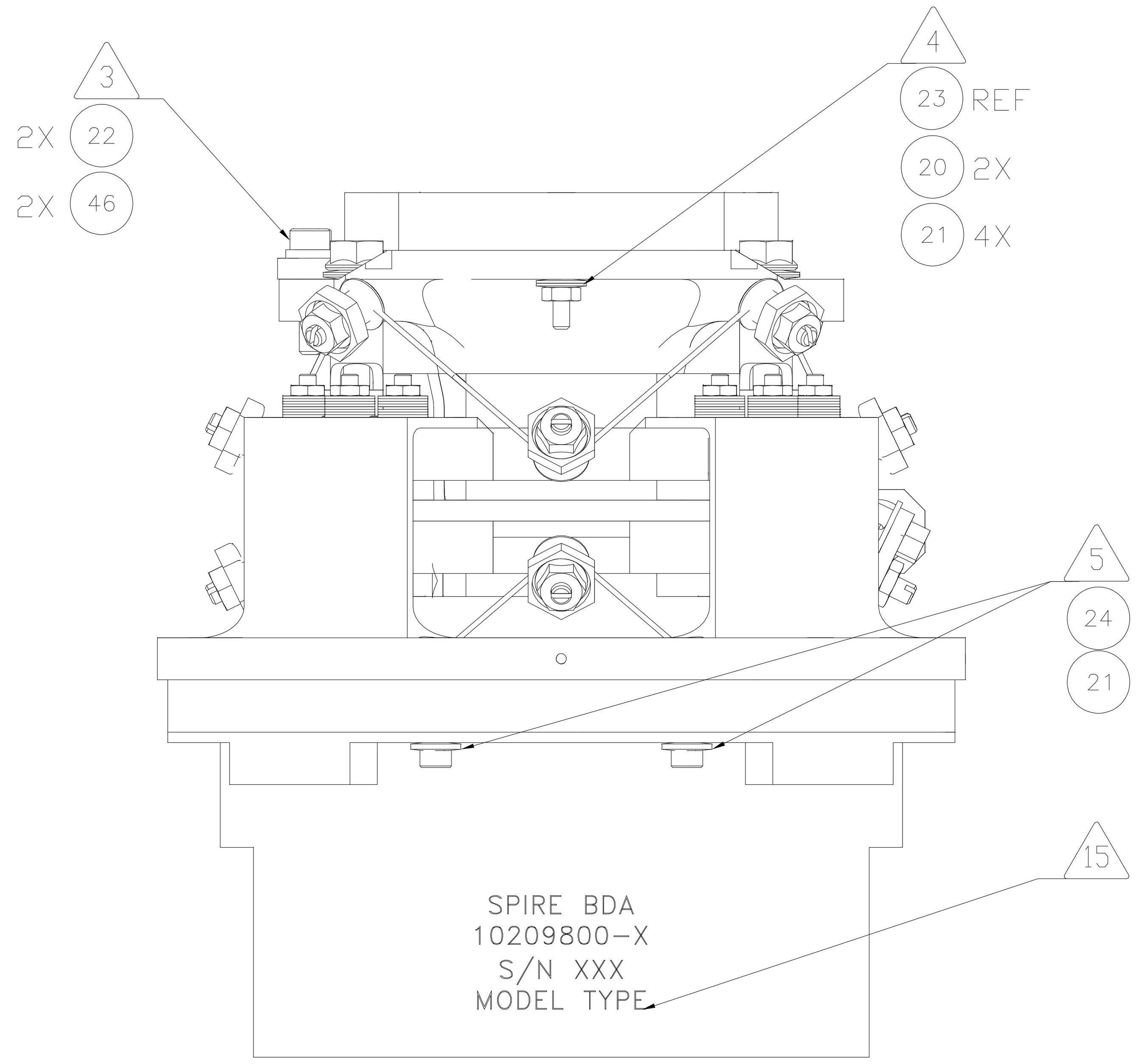
A1 10209800

AutoCAD GENERATED

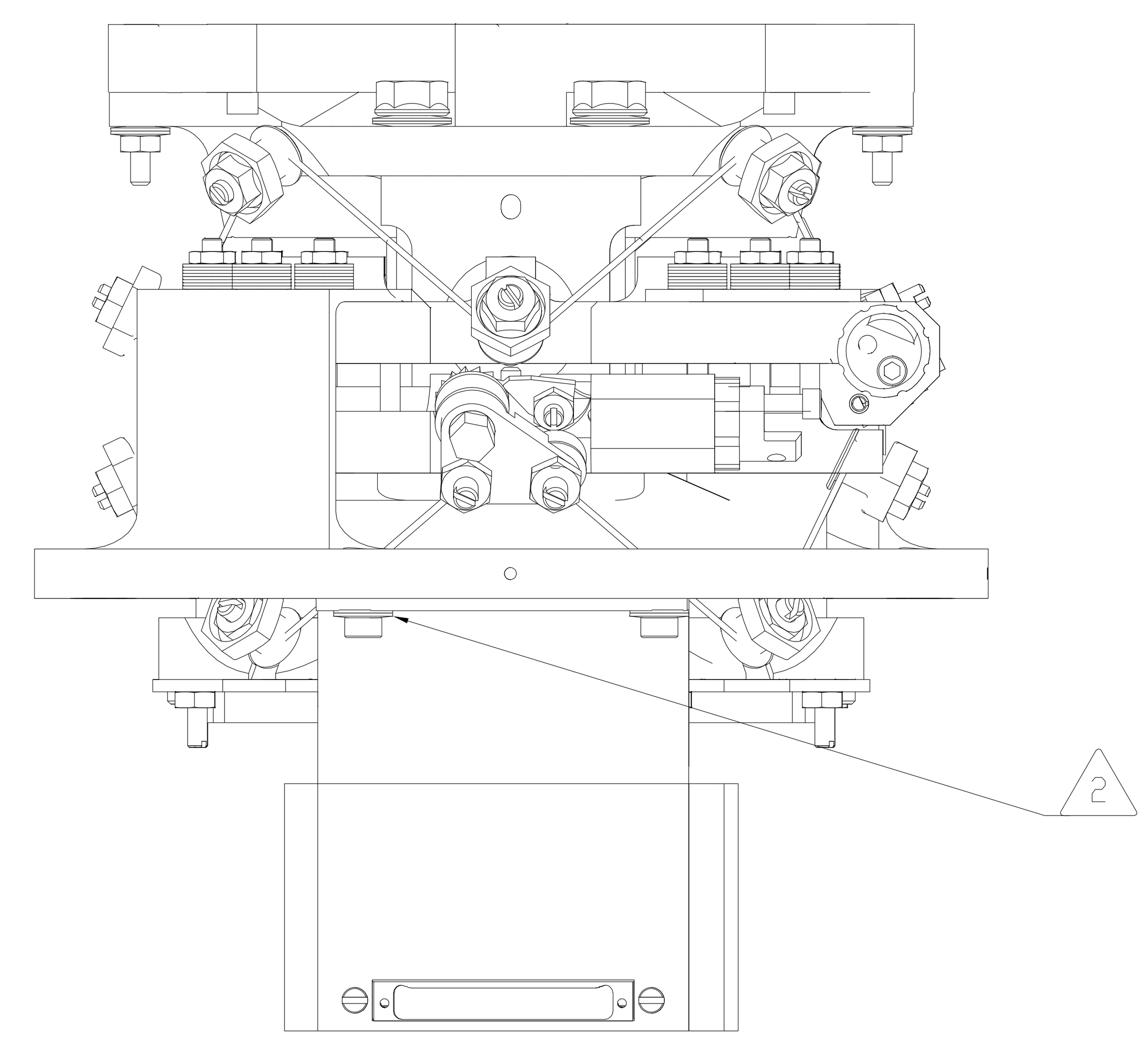
NOT RELEASED



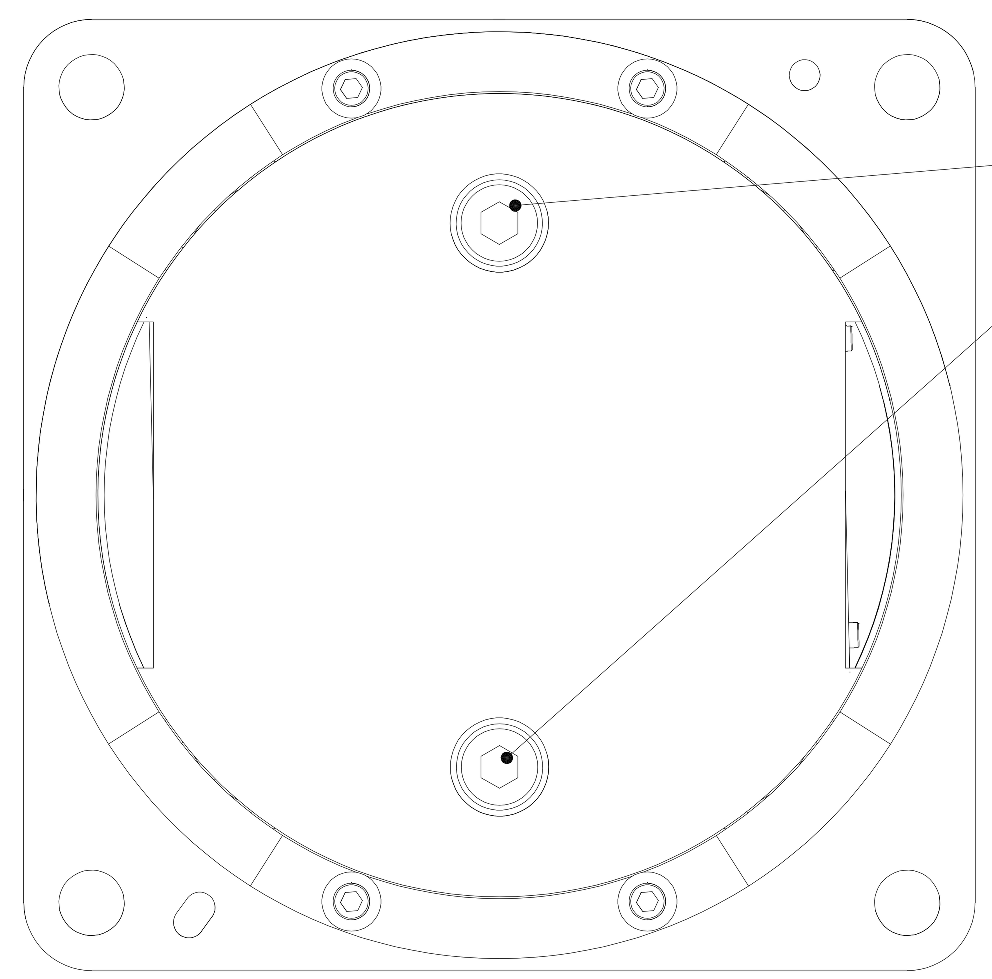
EXPLODED VIEW
REFERENCE ONLY
-4 CONFIGURATION SHOWN
-1, -2, -3, -5 CONFIGURATIONS ARE SIMILAR
-8 CONFIGURATION SIMILAR WITHOUT FILTER



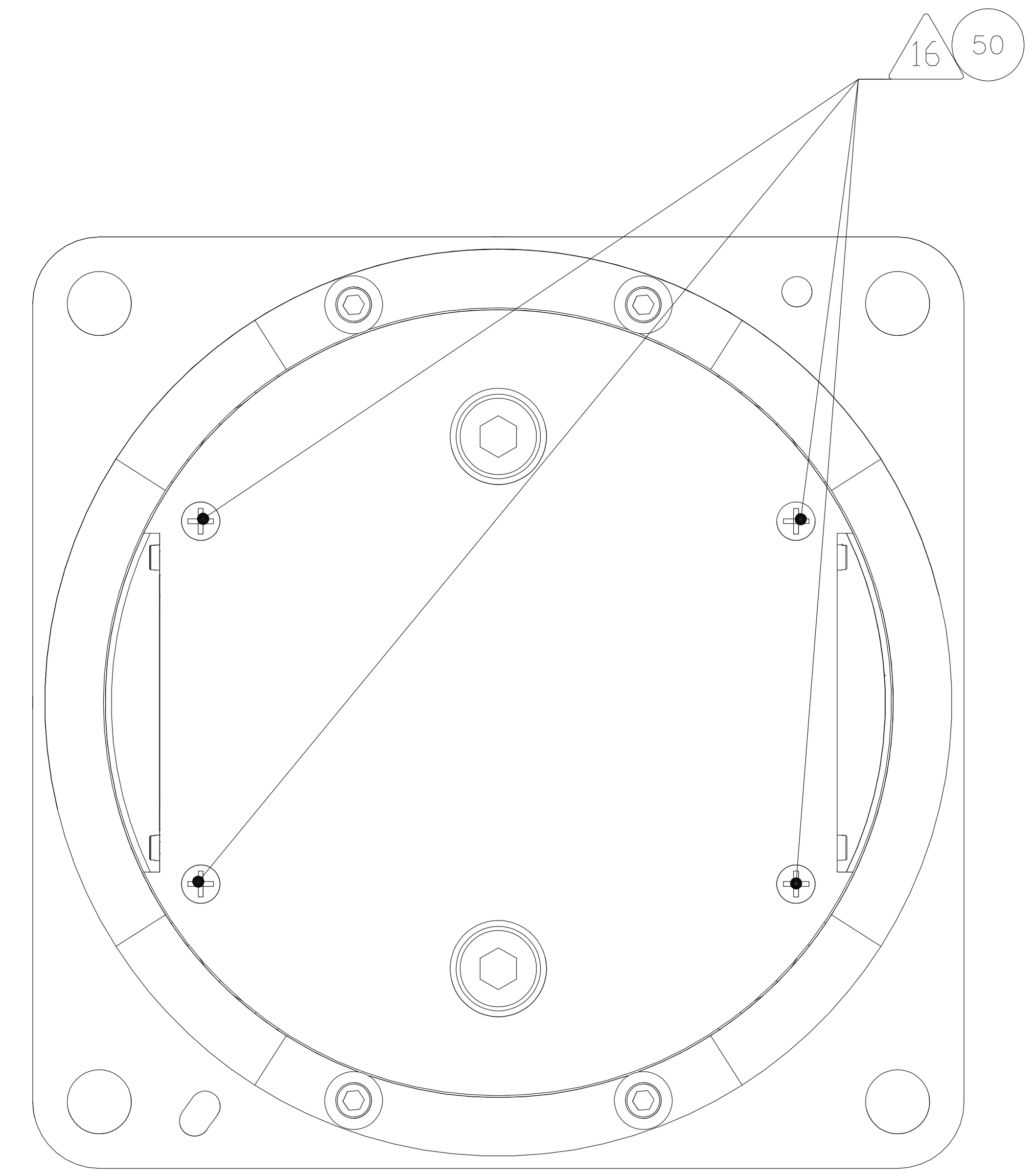
-4 CONFIGURATION SHOWN
-1, -2, -3, -5 CONFIGURATIONS ARE SIMILAR
-8 CONFIGURATION SIMILAR WITHOUT FILTER



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



-2 CONFIGURATION SHOWN
-3 CONFIGURATION IS SIMILAR

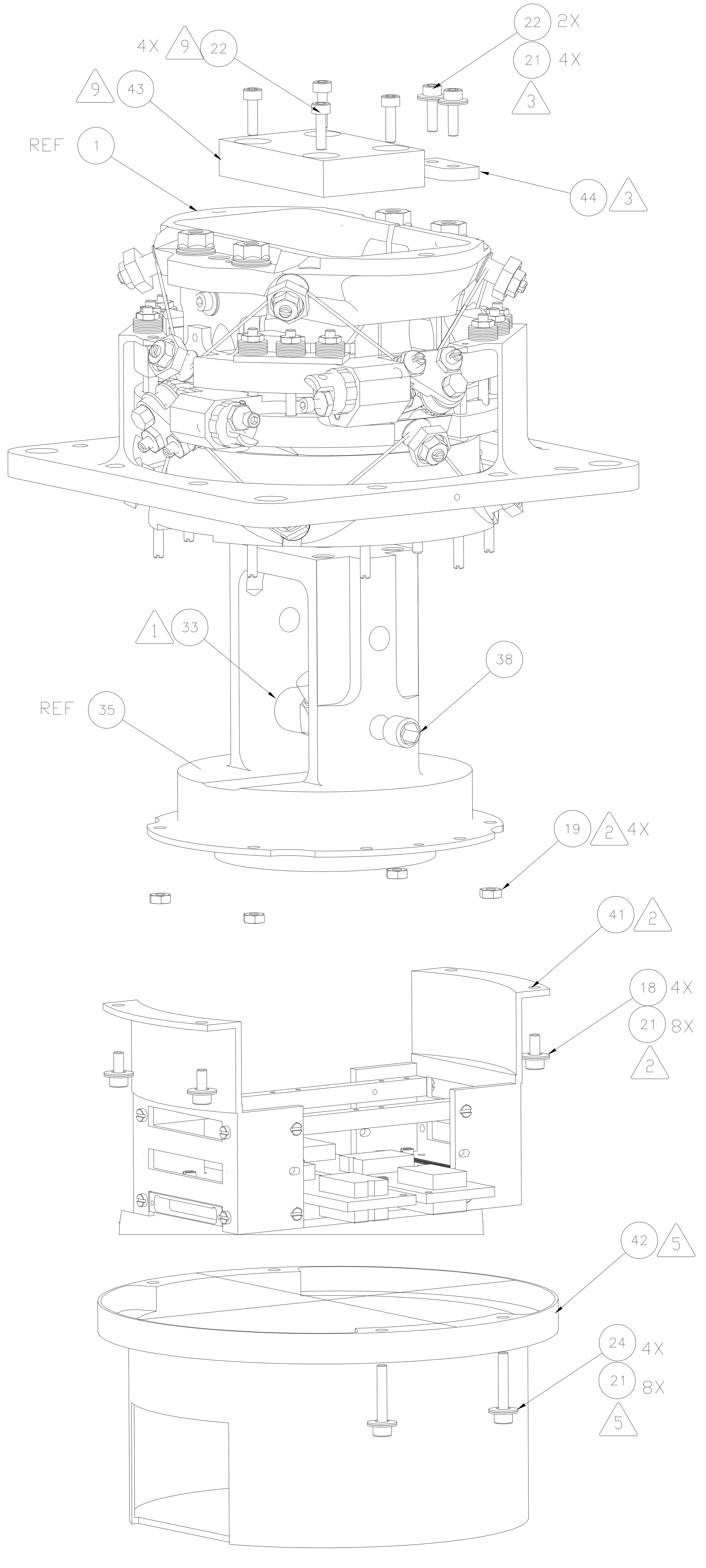
SIZE	CAGE NO		REV
A1	23835	10209800	X7
SCALE NONE		UNCLASSIFIED	SHEET 2 OF 4

REV 2/00

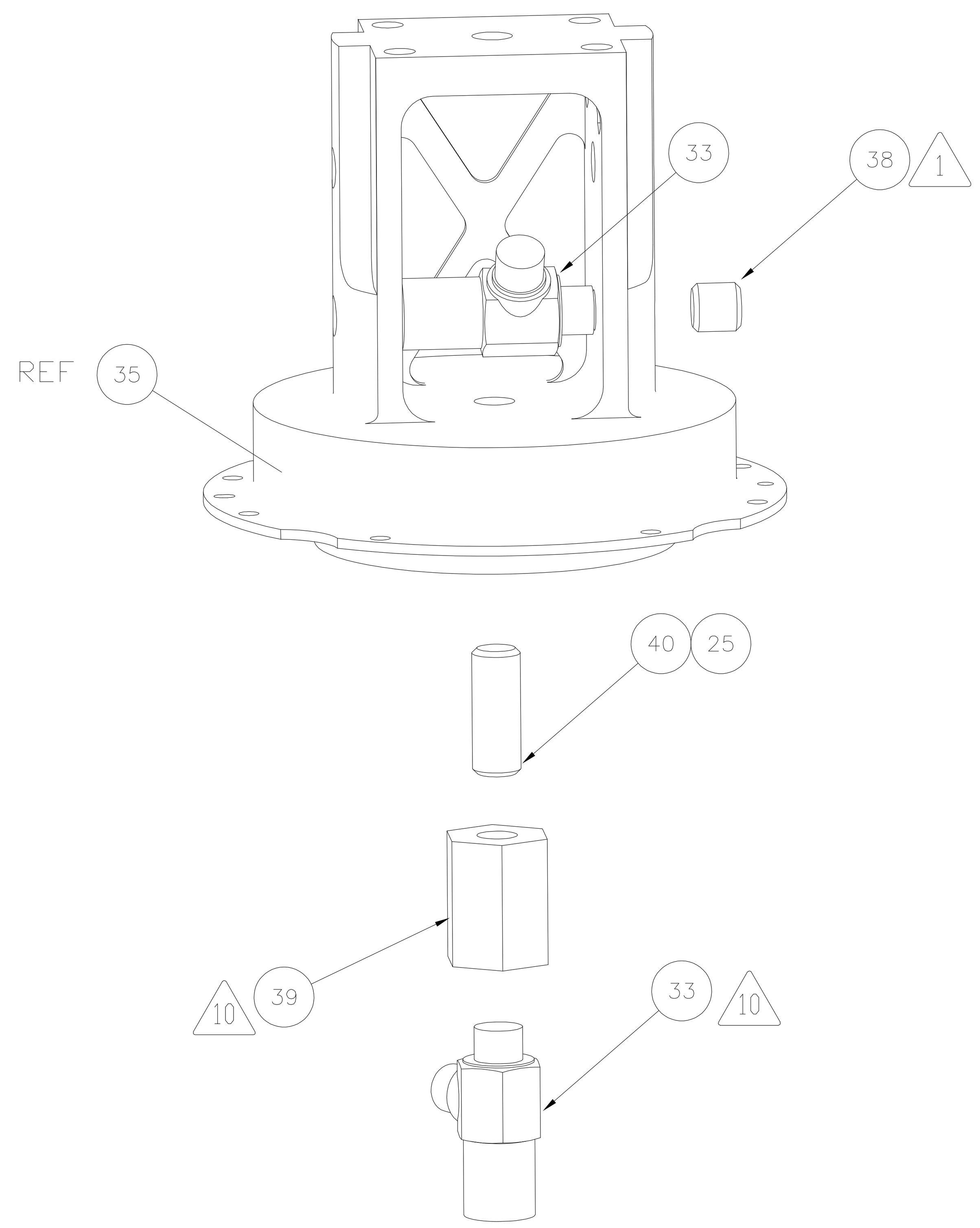
AutoCAD GENERATED

A1 10209800

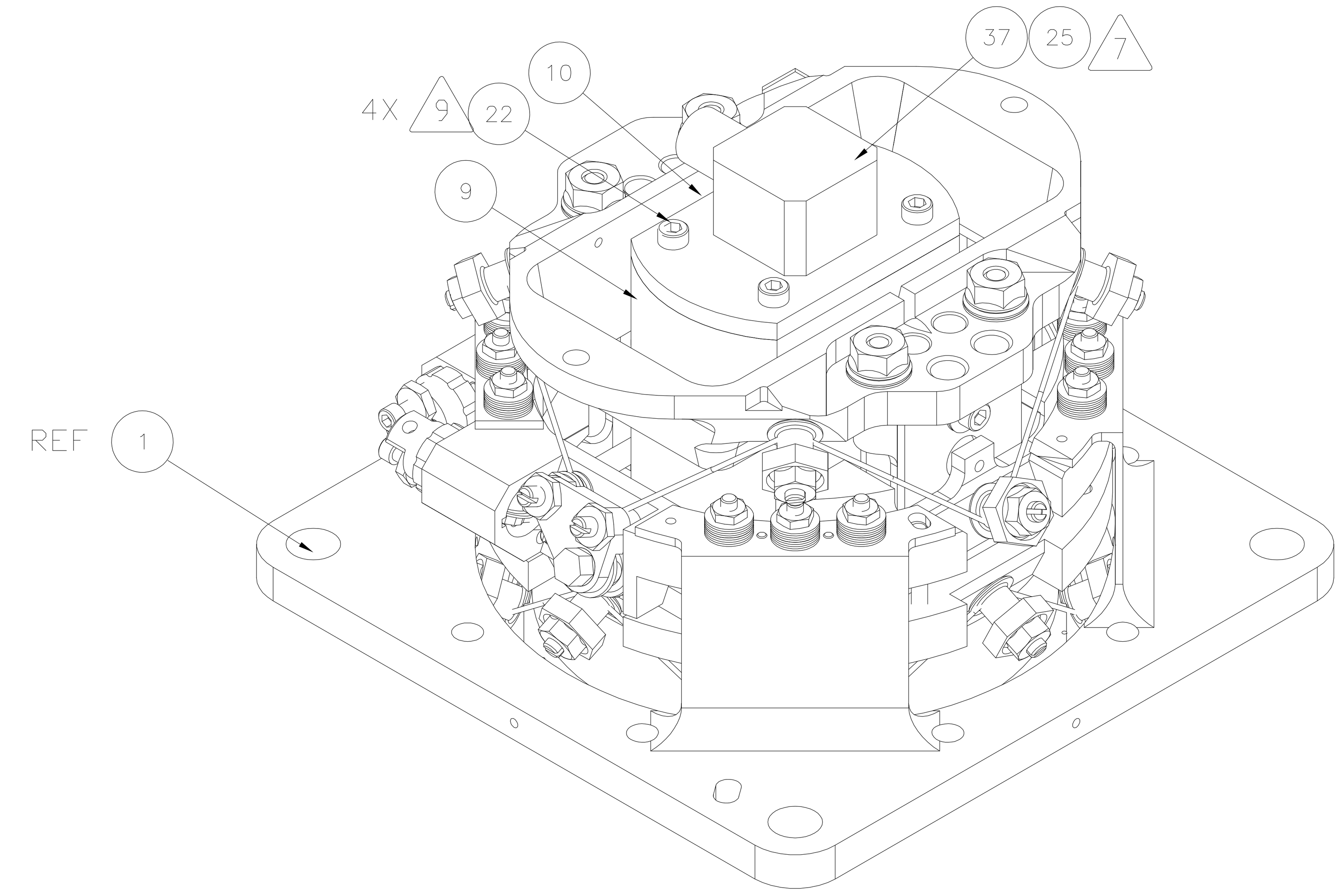
NOT RELEASED



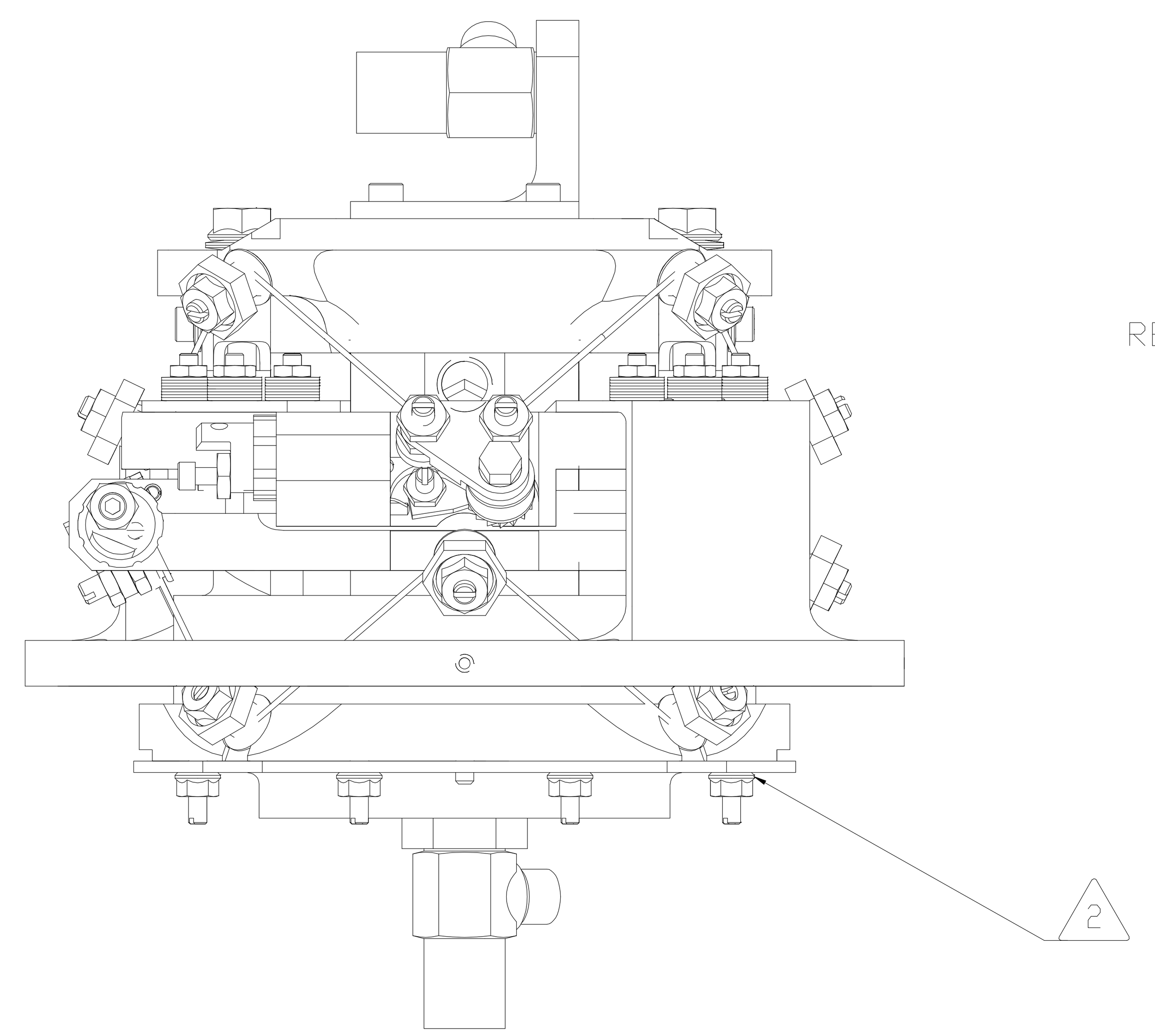
GENERAL VIEW
REFERENCE ONLY
SCALE: NONE
-9 CONFIGURATION,



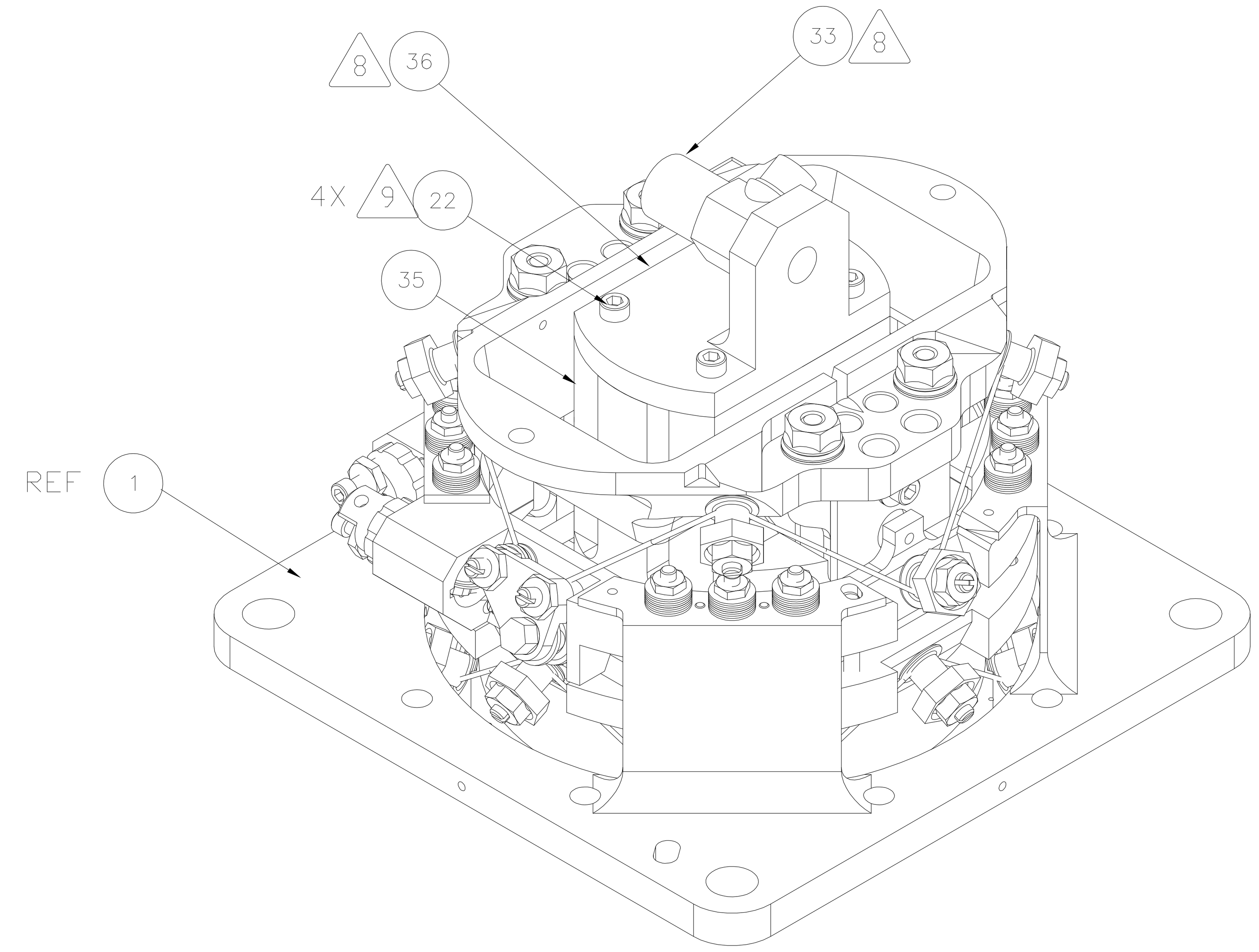
GENERAL VIEW
REFERENCE ONLY
SCALE: NONE
-7 CONFIGURATION,
ONLY ACCELEROMETERS AND
MASS SIMULATOR SHOWN



GENERAL VIEW
REFERENCE ONLY
SCALE: NONE
-6 CONFIGURATION



-7 CONFIGURATION



GENERAL VIEW
REFERENCE ONLY
SCALE: NONE
-7 CONFIGURATION

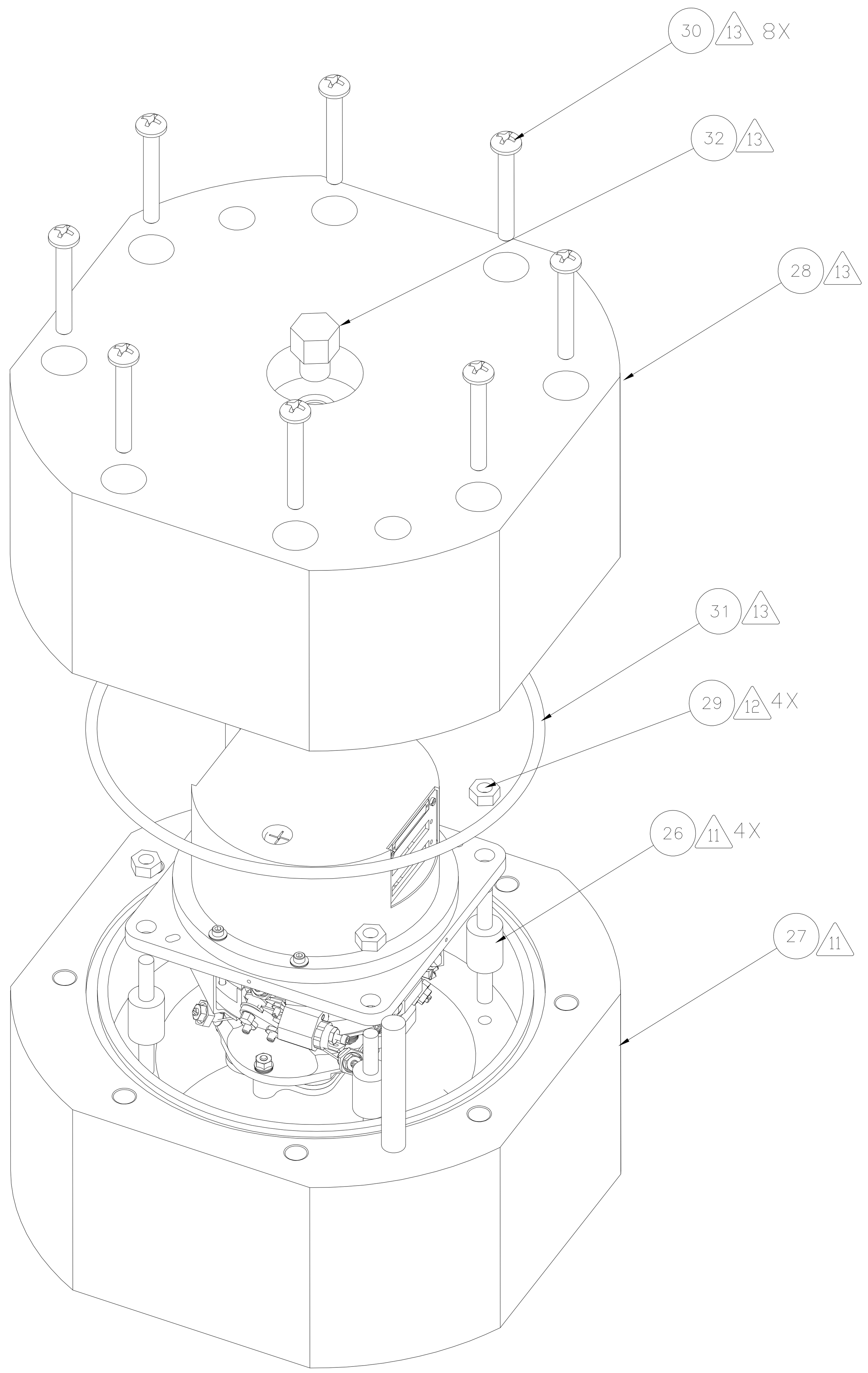
SIZE	CAGE NO		REV
A1	23835	10209800	X7
SCALE NONE	UNCLASSIFIED	SHEET 3 OF 4	

REV 2/00

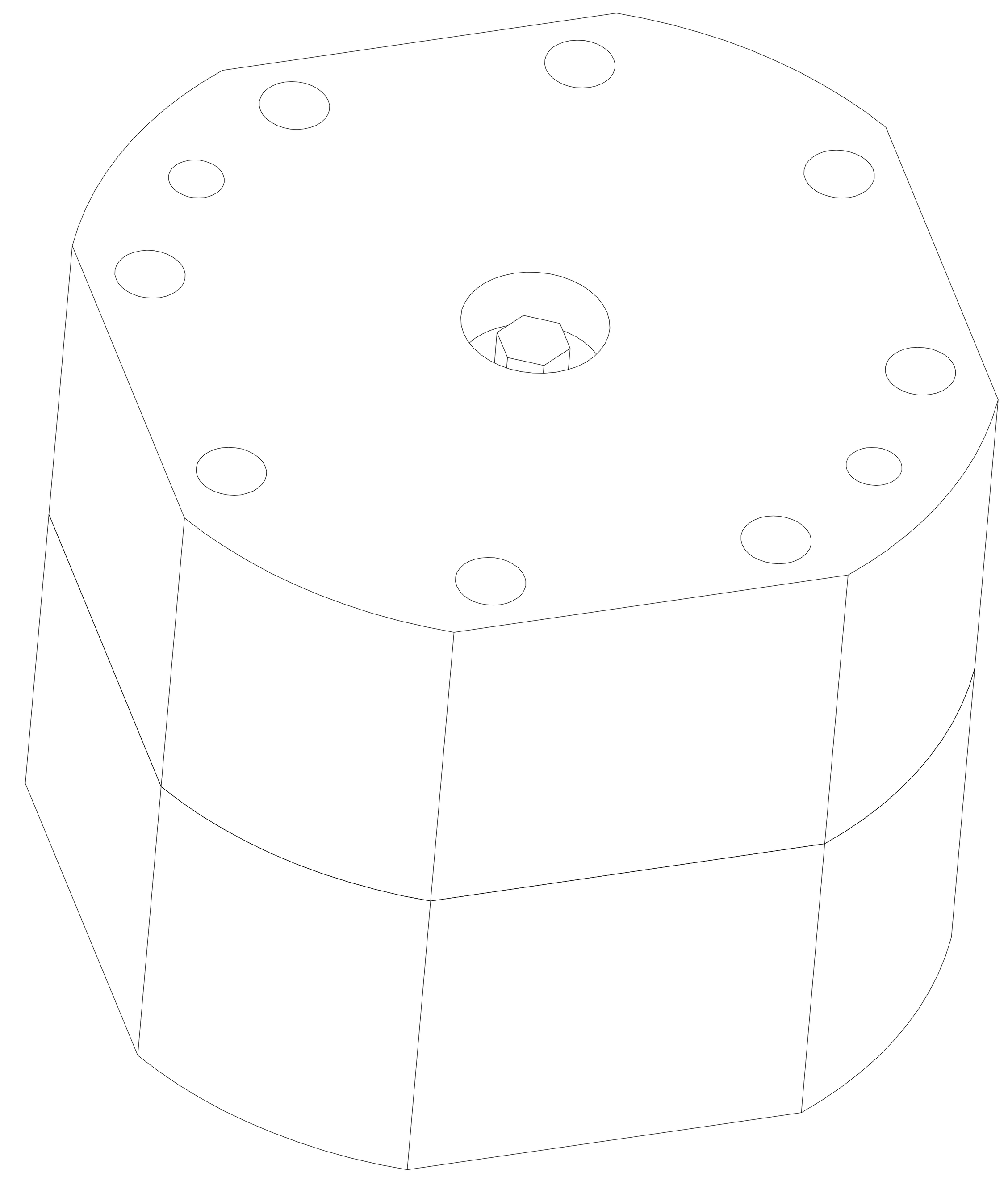
AutoCAD GENERATED

A1 10209800

NOT RELEASED



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



GENERAL VIEW
REFERENCE ONLY
SCALE: NONE
ALL CONFIGURATIONS

SIZE	CAGE NO		REV
A1	23835	10209800	X7
SCALE NONE	UNCLASSIFIED	SHEET 4 OF 4	

REV 2/00

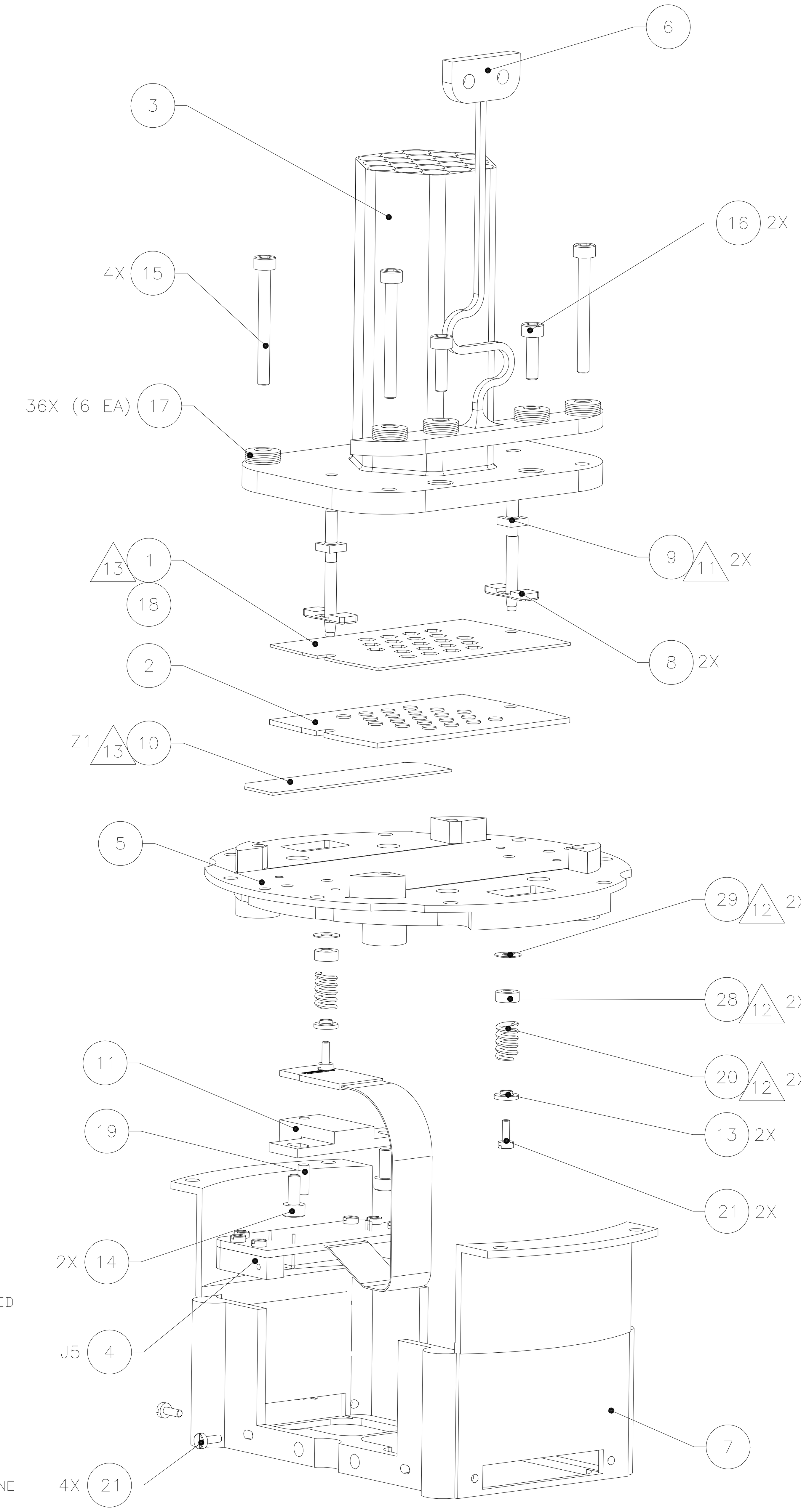
AutoCAD GENERATED

A1 10209800

NOT RELEASED

LTR	ZONE	DESCRIPTION	DWN	CHK	STRUCT	MATL	THRM CONT		ENGR	DSGN SUPV	DATA MGT	RELEASE DATE
A		INITIAL RELEASE (CODE B) — SEE TITLE BLOCK										
X2		ADDED ITEM 29; UPDATED ITEMS 1 AND 2										
X3		CHANGED ITEM CALLOUT IN NOTE 6; REDUCED LENGTH OF ITEM 16 FROM 8 TO 6										

REVISIONS



19. SUGGESTED SOURCE OF SUPPLY:
PIC DESIGN
PRECISION INDUSTRIAL COMPONENTS CORP.
86 BENSON RD.
P.O. BOX 1004
MIDDLEBURY, CT 06762-1004

18. SUGGESTED SOURCE OF SUPPLY:
SPEC
STOCK PRECISION ENGINEERED COMPONENTS
16319 ARTHUR ST
CERRITOS, CA 90703
PHONE: 800 8727732

17. SUGGESTED SOURCE OF SUPPLY:
TRA-CON, INC.
45 WIGGINS AVE.
BEDFORD, MA 01730
PHONE: 800 8722661
FAX: 781 2759249

16. SPOT BOND ALL SCREWS, USING ITEM 26, ADHESIVE, PER D-8208.

15. SECURE ITEM 3, FEED HORN, USING ITEMS 15, SCREWS, AND ITEM 17, SPRING WASHER. THE SLOT IN THE FEED HORN SHOULD ALIGN WITH THE PIN HOLE IN THE DETECTOR. INSTALL WASHERS IN ORIENTATION AS SHOWN. TORQUE SCREWS TO 200 N*MM PLUS RUNNING TORQUE PER JPL SPEC ES517040.

14. SECURE ITEM 6, THERMAL STRAP, TO ITEM 3, FEED HORN, USING ITEMS 16, CAP SCREW, AND ITEM 17, SPRING WASHER. INSTALL WASHERS IN ORIENTATION AS SHOWN. TORQUE SCREW TO 200 N*MM PLUS RUNNING TORQUE PER JPL SPEC ES517040.

13. WIRE BOND ITEM 1, BOLOMETER, TO ITEM 10, LOAD RESISTOR, USING ITEM 18, GOLD WIRE PER ENGINEERING INSTRUCTIONS.

12. SECURE ITEM 1, BOLOMETER, ITEM 2, BACKSHORT, ITEM 28, SPRING STOP 2, AND ITEM 29, WASHER, USING USING ITEM 8, DETECTOR CLIP, ITEM 20, COIL SPRING, ITEM 13, SPRING STOP, AND ITEM 21, SCREW. MACHINE ITEM 28, STOP SPRING 2, TO SPECIFIED DIMENSION. AFTER MACHINING ITEM 28, STOP SPRING 2, CLEAN PER FS505146. TORQUE SCREW TO 25 N*MM PLUS RUNNING TORQUE PER JPL SPEC ES517040.

11. SECURE ITEM 8, DETECTOR CLIP, TO ITEM 9, PIN. IT IS PERMISSIBLE TO USE ITEM 23, STYCAST, IF PARTS DO NOT HOLD TOGETHER.

10. WIREBOND ITEM 10, LOAD RESISTOR, TO ITEM 4, KAPTON CABLE, USING ITEM 18, GOLD WIRE PER ENGINEERING INSTRUCTIONS.

9. SECURE ITEM 7, CONNECTOR BRACKET TO ITEM 4, KAPTON CABLE USING ITEM 21, SCREW. TORQUE TO 25 N*MM PLUS RUNNING TORQUE PER JPL SPEC ES517040. STAKE SCREW HEADS WITH ITEM 26, EPOXY.

8. SECURE ITEM 4, KAPTON CABLE, TO ITEM 5, COVER PLATE, USING ITEMS 11, CABLE CLAMP, AND ITEM 14, SCREW. TORQUE TO 200 N*MM PLUS RUNNING TORQUE PER JPL SPEC ES517040. STAKE SCREW HEADS WITH ITEM 26, EPOXY.

7. APPLY ITEM 25, KAPTON TAPE, TO ITEM 5, COVER PLATE ON INDICATED SURFACE.

6. BOND ITEM 10, LOAD RESISTOR, TO ITEM 5, COVER PLATE, USING A MIXTURE OF ITEM 23, STYCAST AND ITEM 24, GLASS BEADS OF 20:1 EPOXY TO GLASS BEADS BY WEIGHT.

5. WIREBOND STICH BONDS ON ITEM 10, LOAD RESISTOR, USING ITEM 18, GOLD WIRE.

4. BOND ITEM 1, BOLOMETER, TO ITEM 2, BACKSHORT, USING ITEM 27, EPOXY. APPLY EPOXY PER ENGINEERING INSTRUCTIONS.

3. BOND ITEM 19, DOWEL PIN, AND ITEM 4, KAPTON CABLE, TO ITEM 11, CABLE CLAMP, USING ITEM 26, EPOXY. ITEM 19 SHOULD BE AT HEIGHT SHOWN.

2. MEASURE AND RECORD DIMENSION A AND B.

1. BDA - DEFINED AS "BOLOMETER DETECTOR ARRAY".

NOTES: UNLESS OTHERWISE SPECIFIED.

QTY REQD -2	QTY REQD -1	ITEM NO	REF DES	CAGE NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	MATERIAL OR NOTE	ZONE
	2	29			10217701-2	TEFLON, WASHER, STOP, SPRING			
	2	28			10217668-1	STOP SPRING 2			
	AR	27			BB-2102	EPOXY, TRA-BOND BIPAX			
	AR	26			EC 2216 A/B	EPOXY	BS502533		
	AR	25			2342-1R	KAPTON TAPE	FLUORGLASS		
	AR	24			602590	GLASS BEADS, ø.0015"		17	
	AR	23			2850FT/24LV	STYCAST	BS513151		
	AR	22			MILLER-STEPH 907	NON-CONDUCTIVE EPOXY	BS518436		
	6	21			335-0001-01 OR 1589332-1	SCREW, PAN HEAD, 1MM X 0.25 X 3MM		NANONICS OR TYCO	
	2	20			C0120-022-025	SPRINGS		18	
	1	19		3G942	MDP2-2	PIN, 1.5 MM X 4 MM		19	
	AR	18				GOLD WIRE	BS518425		
	36	17			B0187-010-S	BELLEVILLE SPRING WASHER			
	2	16			NA0069-016006	SCREW, CAP, SOCKET HEAD, FULL THREAD, METRIC, 1,6MM	NA0069		
	4	15			NA0069-016016	SCREW, CAP, SOCKET HEAD, FULL THREAD, METRIC, 1,6MM	NA0069	A286	
	2	14			NA0069-016004	SCREW, CAP, SOCKET HEAD, FULL THREAD, METRIC, 1,6MM	NA0069		
	2	13			10209827-1	SPRING STOP			
		12							
	1	11			10209844-1	CLAMP, CABLE			
	1	10	Z1		10209838-1	LOAD RESISTOR			
	2	9			10209837-1	PIN, SHOULDER, THREADED			
	2	8			10209828-1	CLIP, DETECTOR		BERYLIUM COPPER	
	1	7			10209819-1	BRACKET, CONNECTOR			
	1	6			10209817-1	THERMAL STRAP		COPPER	
	1	5			10209816-1	COVER PLATE, P/LW, S/LW		INVAR 36	
	1	4	J5		10209814-1	CABLE, KAPTON, CENTER			
	1	3			10209843-1	FEEDHORN ARRAY, S/LW		COPPER	
	1	2			10209842-1	BACKSHORT ARRAY, S/LW			
	1	1			10209841-1	BOLOMETER ARRAY, S/LW			

PARTS LIST

MATERIAL

METRIC

THIRD ANGLE PROJECTION

NEXT ASSEMBLY	USED ON
SPIRE	10209800

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)

DO NOT SCALE DRAWING
INTERPRET DWG PER ASME Y14.100M

CONTRACT NO 1244858

APPD ______ DATE ______
DWN D. CRUMB 7/24/00
CHK
STRUCT
MATL
THRM CONT
ENGR
DSGN SUPV

JET PROPULSION LABORATORY

CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CA 91109

RELEASED THROUGH EDMG

DETECTOR ASSEMBLY SPECTROMETER LONG WAVE - BDA

SIZE A1 | CAGE NO 23835 | 10209840 | REV X3

SCALE NONE | UNCLASSIFIED | SHEET 1 OF 2

REV 2/00

A1 10209840

AutoCAD GENERATED

NOT RELEASED

COVER PLATE/RESISTOR DETAIL
(CABLE, DETECTOR, BACKSHORT ARRAY, & RESISTOR NOT SHOWN IN LEFT AND TOP VIEWS FOR CLARITY)
4X DIM A
Z1
GENERAL VIEW
FOR REFERENCE ONLY
SCALE: NONE
DIM C
DIM B
5,64±0,01 NS/FS
BOLOMETER/BACKSHORT ARRAY DETAIL
(BOLOMETER ARRAY NOT SHOWN IN TOP VIEW FOR CLARITY)
FEEDHORN DETAIL
EXPLODED DETAIL A
WASHER ORIENTATION DETAIL
6 PLACES
SCALE: NONE
0,113±0,011
DETAIL B
19 PLACES
SCALE: NONE
0,158±0,045
DETAIL C
SCALE: NONE
0,56
CABLE CLAMP/PIN DETAIL
SCALE: 5:1
A1 10209840
AutoCAD GENERATED
SIZE A1
CAGE NO 23835
10209840
REV X3
SCALE 2:1 & NOTED
UNCLASSIFIED
SHEET 2 OF 2
REV 2/00
NOT RELEASED

Open ECR List
PFM SLW BDA 10209800-4 S/N 008

1. HR-SP-JPL-ECR-003 -- Spectrometer BDA Envelope Height

CCLRC Rutherford Appleton Laboratory	**DOCUMENT / ENGINEERING CHANGE REQUEST (ECR)**	**PRODUCT ASSURANCE** **Space Science and Technology Department**

DCR / ECR Number:	HR-SP-JPL-ECR-003

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

PROBLEM FAILURE REPORT (PFR)

PFR# Z81506

Title: PLW-CQM 10MEGAOHM CONNECTION FROM GROUND TO V+ AND V-

Project: HSOP **Status:** OPEN	**Last Processed:** 08/13/2003	**Problem/Failure Date:** 08/13/2003	**Day & Time of Incident (GMT / UTC):** **Day:** 225 **Hr:** **Min:**	
Log #	**Report Type:** FP	**SC or InstrumentID:**	**O** - Grnd / Test **O** - Eng. Model **X** - Flight	**X** - Hardware **O** - Software
Originator: TURNER, ANTHONY D		**Report Date:** 08/13/2003	**Cognizant Engineer:**	

SUBSYSTEM

Tier	Reference Designation	Nomenclature	Serial Number	Oper. Time	Operating Units
0	SPIR - SPECTOMETRIC AND PHOTOMETRIC INFRARED RECEIVER (SPIRE)				
1	10209800-1	PLW-CQM	006		
2					
3					

Problem Area: ELECPACK ~ Electronic Packaging [HSOP-ELEPC]

DESCRIPTION

Description of Problem/Failure:
A POWER LINE ASSEMBLY TEST SHOWED A 10 MEGAOHM RESISTANCE FROM THE V+ TO GND LINES AND A 10.92 MEGAOHM RESISTANCE FROM THE V- TO GND LINES. BOTH LINES SHOULE HAVE SHOWN A >30MEGAOHM RESISTANCE TO GROUND.

Reporting Location: JPL 103 [B103]

Problem/Failure Noted During: Assembly Test [A5]

Specific Environment: Assembly & Rework [04]

Procedure:	**Revision:**	**Paragraph:**

VERIFICATION

Verification and Analysis:
PLEASE REFER TO IR 918970. LINE A CORRESPONDING TO TEST POINT 2 ON DETECTOR R1 SHOWED A SHORT TO GND PASSED THE LOAD RESISTORS. THIS SHORT MAKES A PATH FROM V+ TO GND=10MOHM AND V- TO GND=10.92MOHM. THIS SHORT SHOULD NOT EFFECT THE PERFORMANCE OF THE DEVICE SINCE THERE IS A 1 MOHM CONNECTION FROM V+ TO GND AND V- TO GND BUILT INTO THE READOUT CIRCUITRY ON THE JFET MODULE.

Cause of Problem/Failure: Workmanship: Fabrication or Assembly [W1]

Person Completing This Section: A. TURNER **Date:** 08/13/2003

PART DATA

Piece Part Name	Part #	Serial #	FA Log #	Circuit Desig.	Mfr. Code	Defect
PLW-CQM	10209800-1	006				

CORRECTIVE ACTION

Corrective Action Taken:
NO CORRECTIVE ACTION NEEDED AT THIS TIME. SHORT CAN BE ELIMINATED BY REMOVAL OF 2 WIREBONDS THAT WILL REMOVE SIGNAL R1 FROM THE CIRCUIT IF IT IS DEEMED NECESSARY.

Disposition of Subsystem or Assembly:	**Effectivity:** This Unit

CODES & RATINGS

Lessons Learned Candidate: N	**Alert Concern:** N	**Mission Critical Failure:** N	**STS Criticality:**
Personnel Safety: N	**Hardware Safety:** N	**Safety Status:** SS has not reviewed yet. -	
See PFR #	**See ISA #**	**Failure Effect Rating:**	
ECR #	**Waiver #**	**Failure Cause/ Corrective Action Rating:**	
See Other: IR918970			

SIGNATURES

Cognizant Engineer		
Project Element Manager		
Mission Assurance Manager		
Project Manager		

ISSUES

ATTACHMENTS

NO ATTACHED DOCUMENTS ON FILE.

CHANGE LOG

Changes

** CHANGELOG: Z81506 *************************************
Changes made on 08/13/2003 at 14:51:19 by ATURNER
ROOT.SYSID was: "", now is: "PFR"
ROOT.PROJECT was: "", now is: "HSOP"
ROOT.PFR_NO was: "", now is: "Z81506"
ROOT.IS_PFR was: "NO", now is: "YES"
ROOT.ACTIVE was: "NO", now is: "YES"
ROOT.PFR_DATE was: "", now is: "08/13/2003"
ROOT.ORIGINATN was: "", now is: "08/13/2003"
ROOT.VERIFY_DTE was: "", now is: "08/13/2003"
ROOT.NEED_MF_UP was: "NO", now is: "YES"
ROOT.SAFETY was: "", now is: "N"
ROOT.SEF was: "", now is: "N"
ROOT.ALERT was: "", now is: "N"
ROOT.MCF was: "", now is: "N"
ROOT.VENDOR was: "", now is: "VEN"
ROOT.REPORT_LOC was: "", now is: "B103"
ROOT.ORIGINATOR was: "", now is: "TURNER, ANTHONY D"
ROOT.VERIFYOR was: "", now is: "A. TURNER"
ROOT.SUB_SYS was: "", now is: "SPIR"
ROOT.PROB_AREA was: "", now is: "HSOP-ELEPC"
ROOT.PHASE was: "", now is: "FP"
ROOT.TEST was: "", now is: "A5"
ROOT.ENVIRON was: "", now is: "04"
ROOT.CAUSE was: "", now is: "W1"
ROOT.EFFECTVTY was: "", now is: "This Unit"
ROOT.SEE_OTHER was: "", now is: "IR918970"
ROOT.AT_YEAR was: "", now is: "2003"
ROOT.AT_DAY was: "", now is: "225"
ROOT.TITLE was: "", now is: "PLW-CQM 10MEGAOHM CONNECTION FROM GROUND TO V+ AND V-"
ROOT.DESCRIPTN was: "", now is: "A POWER LINE ASSEMBLY TEST SHOWED A 10 MEGAOHM RESISTANCE FROM THE V+ TO GND LINES AND A 10.92 MEGAOHM RESISTANCE FROM THE V- TO GND LINES. BOTH LINES SHOULE HAVE SHOWN A >30MEGAOHM RESISTANCE TO GROUND."
ROOT.ANALYSIS was: "", now is: "PLEASE REFER TO IR 918970. LINE A CORRESPONDING TO TEST POINT 2 ON DETECTOR R1 SHOWED A SHORT TO GND PASSED THE LOAD RESISTORS. THIS SHORT MAKES A PATH FROM V+ TO GND=10MOHM AND V- TO GND=10.92MOHM. THIS SHORT SHOULD NOT EFFECT THE PERFORMANCE OF THE DEVICE SINCE THERE IS A 1 MOHM CONNECTION FROM V+ TO GND AND V- TO GND BUILT INTO THE READOUT CIRCUITRY ON THE JFET MODULE."
ROOT.CORR_ACTN was: "", now is: "NO CORRECTIVE ACTION NEEDED AT THIS TIME. SHORT CAN BE ELIMINATED BY REMOVAL OF 2 WIREBONDS THAT WILL REMOVE SIGNAL R1 FROM THE CIRCUIT IF IT IS DEEMED NECESSARY."
ROOT.Y2K was: "", now is: "N"
PFR_UNIQ.PFR_NO was: "", now is: "Z81506"
PFR_UNIQ.HRDWR_SFTY was: "", now is: "N"
PFR_UNIQ.FLT_H_W was: "NO", now is: "YES"
PFR_UNIQ.FLT was: "NO", now is: "YES"
HOBO.SYSID was: "", now is: "PFR"
HOBO.PROJECT was: "", now is: "HSOP"
HOBO.PFR_NO was: "", now is: "Z81506"
HOBO.BADG_ASSN2 was: "", now is: "103168"

--end of change log--

SPIRE
Bolometer Detector Assembly
Handling Document

Prepared by
Mark Weilert

20 August, 2003
revised 20 Nov. 03

WARNINGS

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

BDA is ESD Sensitive, handle with grounding straps, ESD-safe gloves and ESD smocks at an ESD-safe workstation. Note that no connector savers or other connector protection are shipped with the BDA, per the business agreement.

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, higher humidity is acceptable to maintain ESD safety, 35-50% RH typical.)

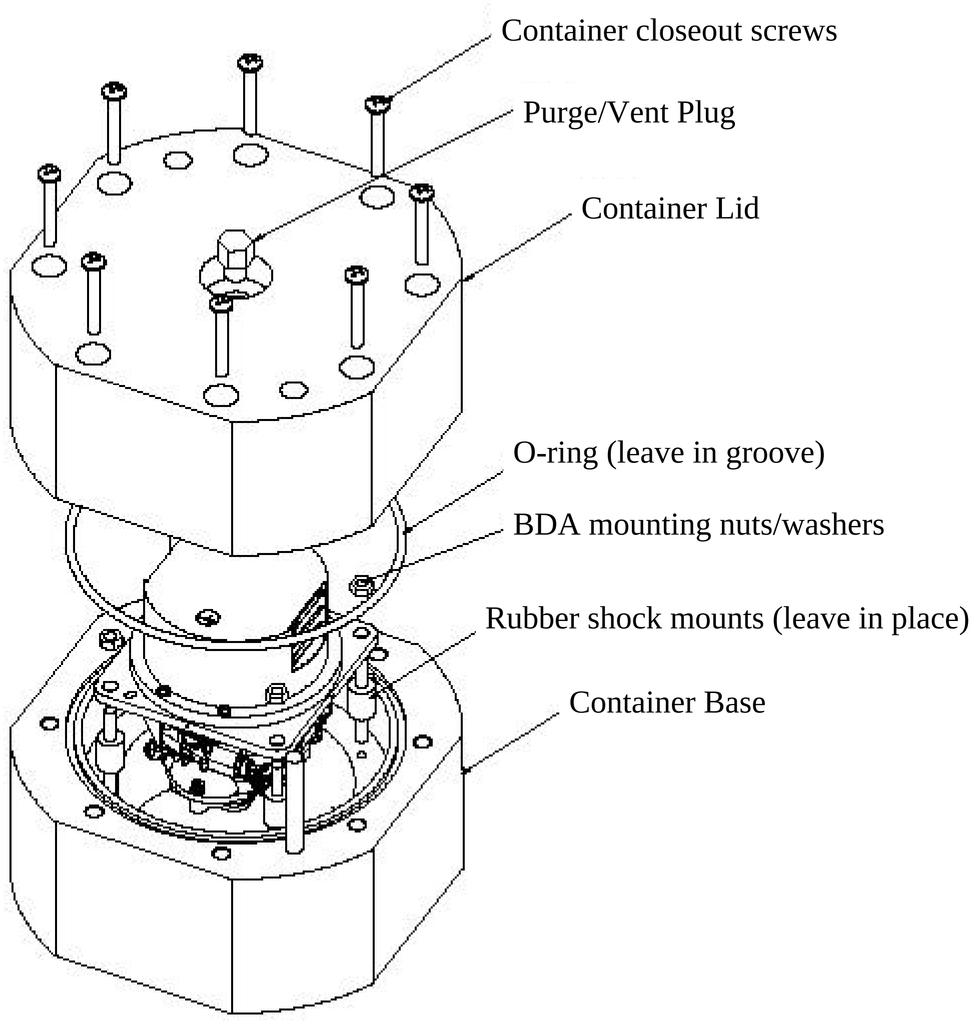
BDA is Temperature Sensitive: The Kevlar tension and creep increases at high temperatures, **DO NOT BAKE OUT AT ABOVE 80°C.**

Unpacking Procedure:

The BDA is shipped in a multi-layer container. A custom shipping container (red) inside a case inside 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.

SPIRE

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

Prepared by: Anthony Turner

Document No:

Issue: Draft **Date: 11/20/03**

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

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

Distribution

Change Record

Issue	Date

Table of Contents

Glossary

1. Introduction:

This document provides the Electronic Handling Procedure for the Proto-Flight Model-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-PFM 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.

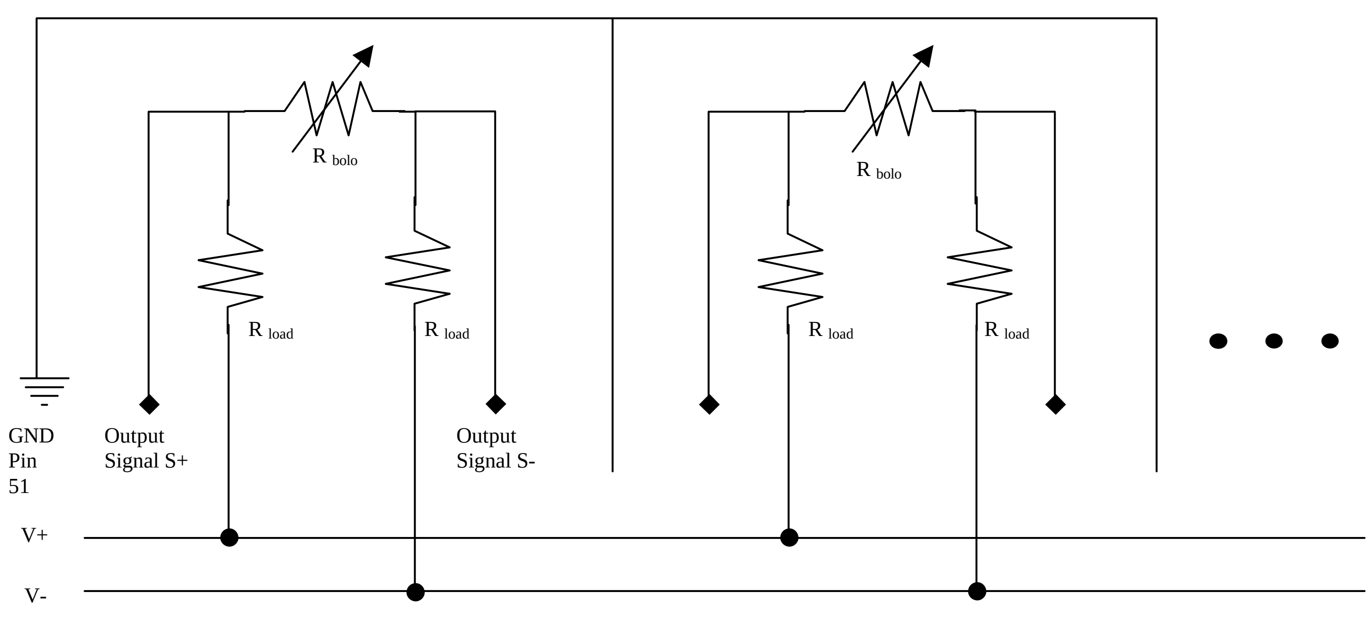


Figure 1: Interface circuit of the Bolometer Detector Array

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 Multimeter 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-PFM Room Temperature DC Detector Measurements J05 connector

Connector Label	Signal	Nanonics Pin From	Nanonics Pin To	Detector Label	Resistance (kohms)	Failure Mode
Z1/J05	1	1	26	R1	5.32M	
	2	2	27	T1	1.165	
	3	3	28	C1	1.434	
	4	4	29	DK1	1.599	
	5	5	30	B1	1.489	
	6	6	31	D1	1.351	
	7	7	32	E1	1.271	
	8	8	33	A1	1.497	
	9	9	34	C2	1.34	
	10	10	35	D2	1.336	
	11	11	36	B2	1.395	
	12	12	37	E2	1.25	
	13	13	38	A2	1.477	
	14	14	39	C3	1.406	
	15	15	40	D3	1.282	
	16	16	41	B3	1.462	
	17	17	42	E3	1.269	
	18	18	43	C4	1.416	
	19	19	44	DK2	1.284	short
	20	20	45	D4	1.584	
	21	21	46	C5	1.484	
	22	22	47	B4	1.595	
	23	23	48	A3	1.692	
	24	24	49	T2	1.127	
	V+ to V-	25	50		1.021M	
	V- to gnd	50	51		>30M	
	V+ to gnd	25	51		>30M	
	Chassis to gnd				62.2ohms	

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 multimeter 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 ~ 1.5kΩ) should read approximately 5-8MΩ. Channels with open bolometer channels will give values 10MΩ or higher. The Data sets for the S/LW-PFM for the final test through the entire circuit are shown in Table 3.

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

Connector Label	Signal	Detector Label	Resistance V+ to S+ (Mohms)	Resistance V- to S- (Mohms)
Z1/J05	1	R1	7.36	7.35
	2	T1	6.16	6.16
	3	C1	6.12	6.09
	4	DK1	6.13	6.12
	5	B1	6.2	6.2
	6	D1	6.2	6.2
	7	E1	6.23	6.2
	8	A1	6.24	6.23
	9	C2	6.24	6.24
	10	D2	6.26	6.26
	11	B2	6.27	6.28
	12	E2	6.28	6.28
	13	A2	6.28	6.28
	14	C3	6.3	6.31
	15	D3	6.31	6.32
	16	B3	6.32	6.32
	17	E3	6.34	6.35
	18	C4	6.36	6.36
	19	DK2	6.36	6.37
	20	D4	6.4	6.4
	21	C5	6.41	6.4
	22	B4	6.44	6.44
	23	A3	6.4	6.4
	24	T2	6.48	6.48

EIDP Coverpage For PFM SLW BDA

Unit Identfication							
Name	PFM SLW BDA						
Part #	10209800-4						
S/N	#008						

Environmemtal Testing	Axes Tested	Temperature	Duration or Number of Cycles	Pass/Fail	Requirement	Source	Waiver #
Random Vibration Test	X	100 K	1 min per axis	P	X, Y, Z at 90 K 1 min per axis	SSSD Sec # 3.4	
High Level Sine Vibe Test	None	NA	NA	NA	X, Y, Z at 90 K	SSSD Sec # 3.4	
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	D-20549	

Other Testing	Frequency [Hz]						
	Pre-full level	Post-full level			Minimum Performance	Source	Waiver #
Lowest Resonant Frequency	273 Hz	270			> 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	20 µm	18 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	48 µm	9 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	22 µm	7 µm		Y	125 µm in X/Y and 500 µm in Z	SSSD Sec # 3.1.1	NA
Cumulative Maximum motion	55 µm	34 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

JPL

Sine Spectrum

Test Date/Time: 10-Sep-2003 15:59:24

Test Title: SPIRE; W/O 101369

Specimen Name: Bolometer Detector Assembly (BDA)

Test File Number: Run 4

Part Number/ID: S/N 008

Channel #: 8 Node Number: 0008

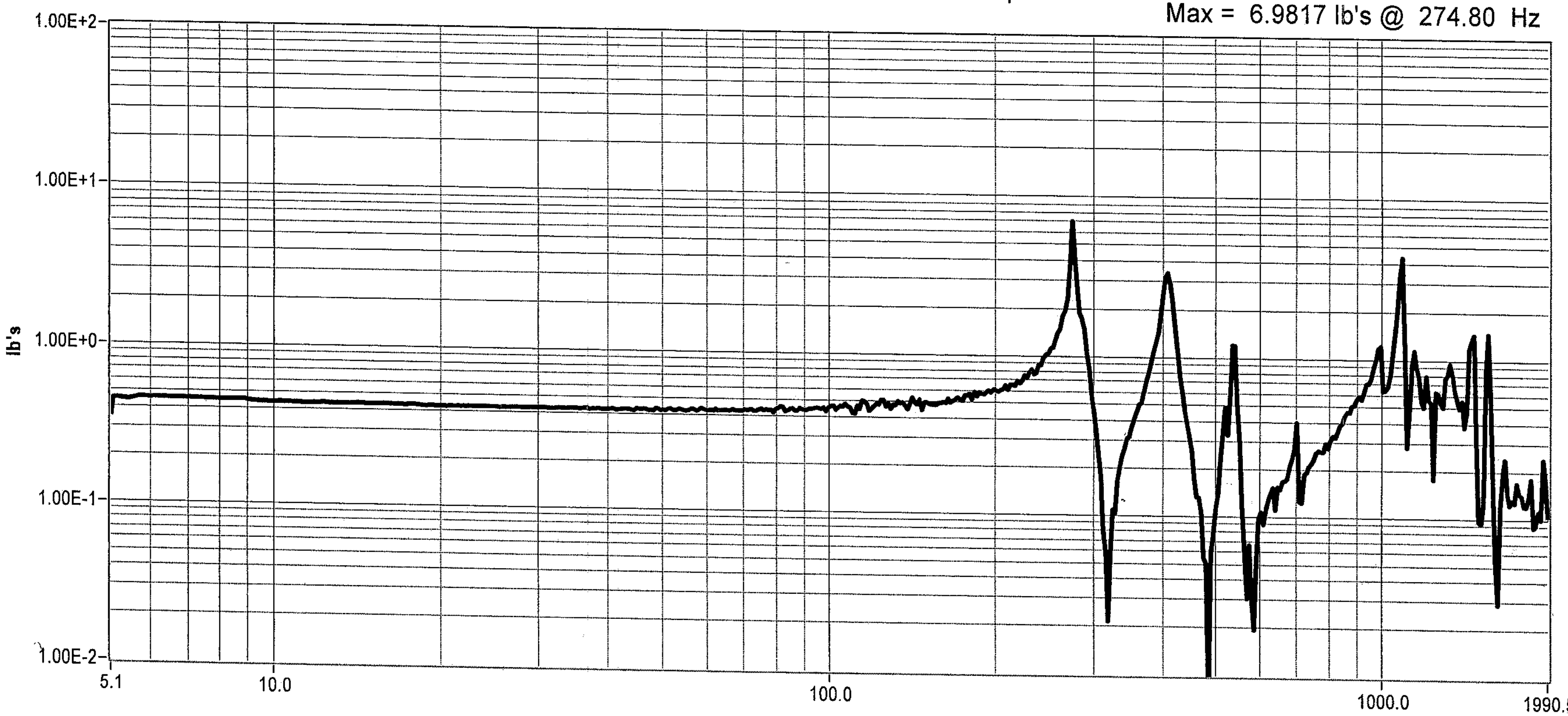
Channel Description: na

Test Description

Sine Survey, X-axis, cold Before Shake

Log Analysis Sweep dF= 0.01 x Frequency, Proportional Bandwidth dF= 20.00% of Freq

Max = 6.9817 lb's @ 274.80 Hz



Analysis Date/Time: 10-Sep-2003 16:56:53

Frequency HZ

Sum Force; X

JPL

Sine Spectrum

Test Date/Time: 10-Sep-2003 15:59:24

Test Title: SPIRE; W/O 101369

Specimen Name: Bolometer Detector Assembly (BDA)

Test File Number: Run 4

Part Number/ID: S/N 008

Channel #: 9 Node Number: 0009

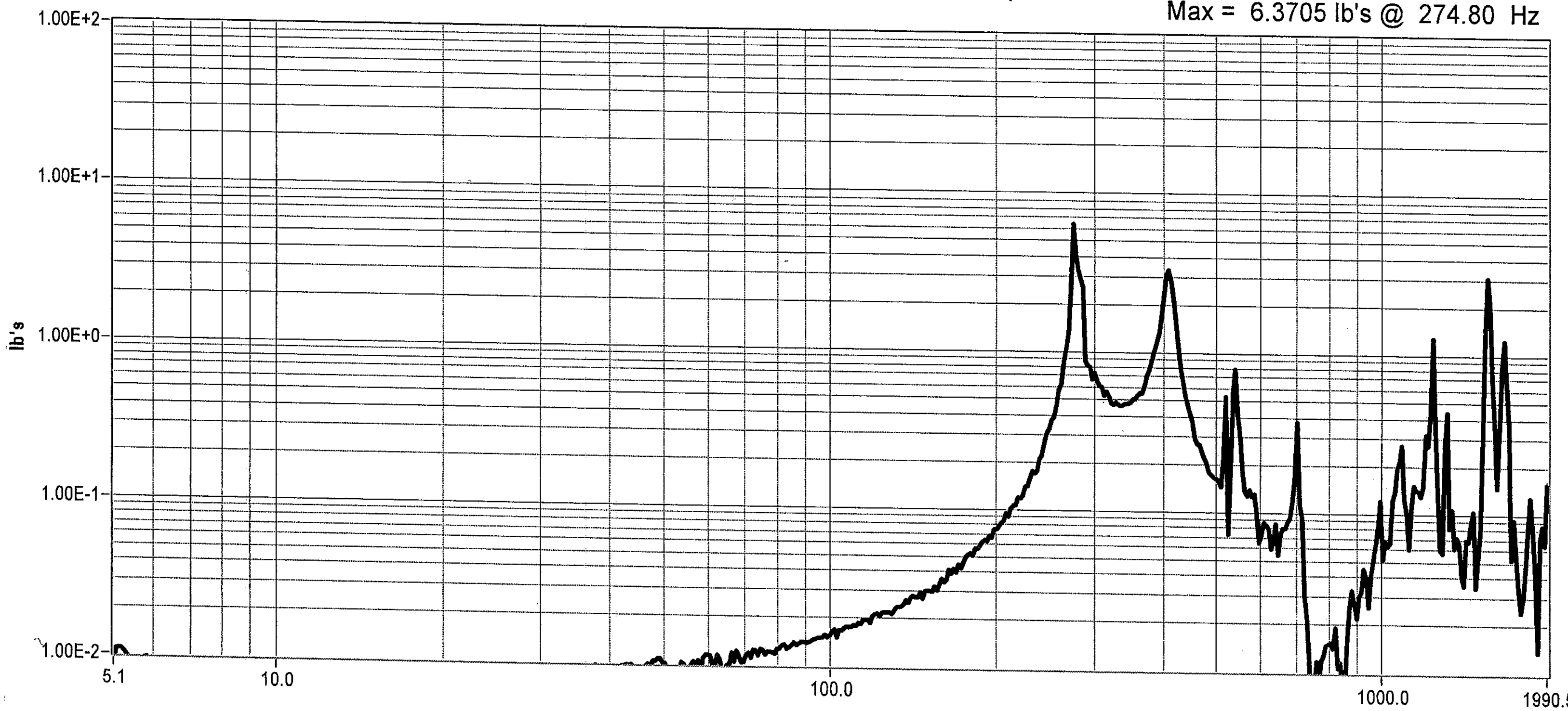
Channel Description: na

Test Description

Sine Survey, X-axis, cold Before Shake

Log Analysis Sweep dF= 0.01 x Frequency, Proportional Bandwidth dF= 20.00% of Freq

Max = 6.3705 lb's @ 274.80 Hz



Analysis Date/Time: 10-Sep-2003 16:56:58

Frequency HZ

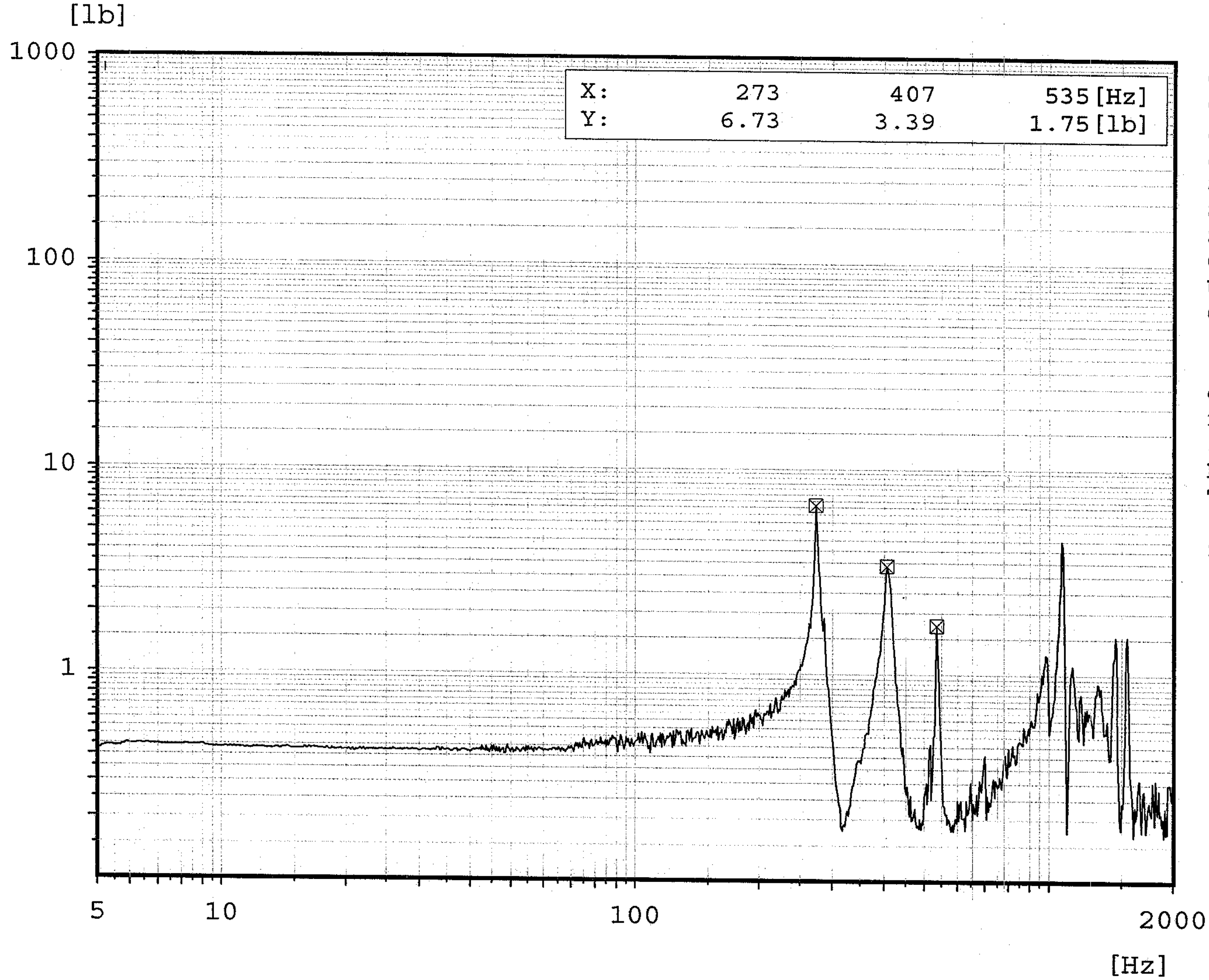
Sum Force; Y

Sine Before Shake, Cold

101369, Run # 4, X axis

Force Sum X

JPL



Chan.no: 5
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

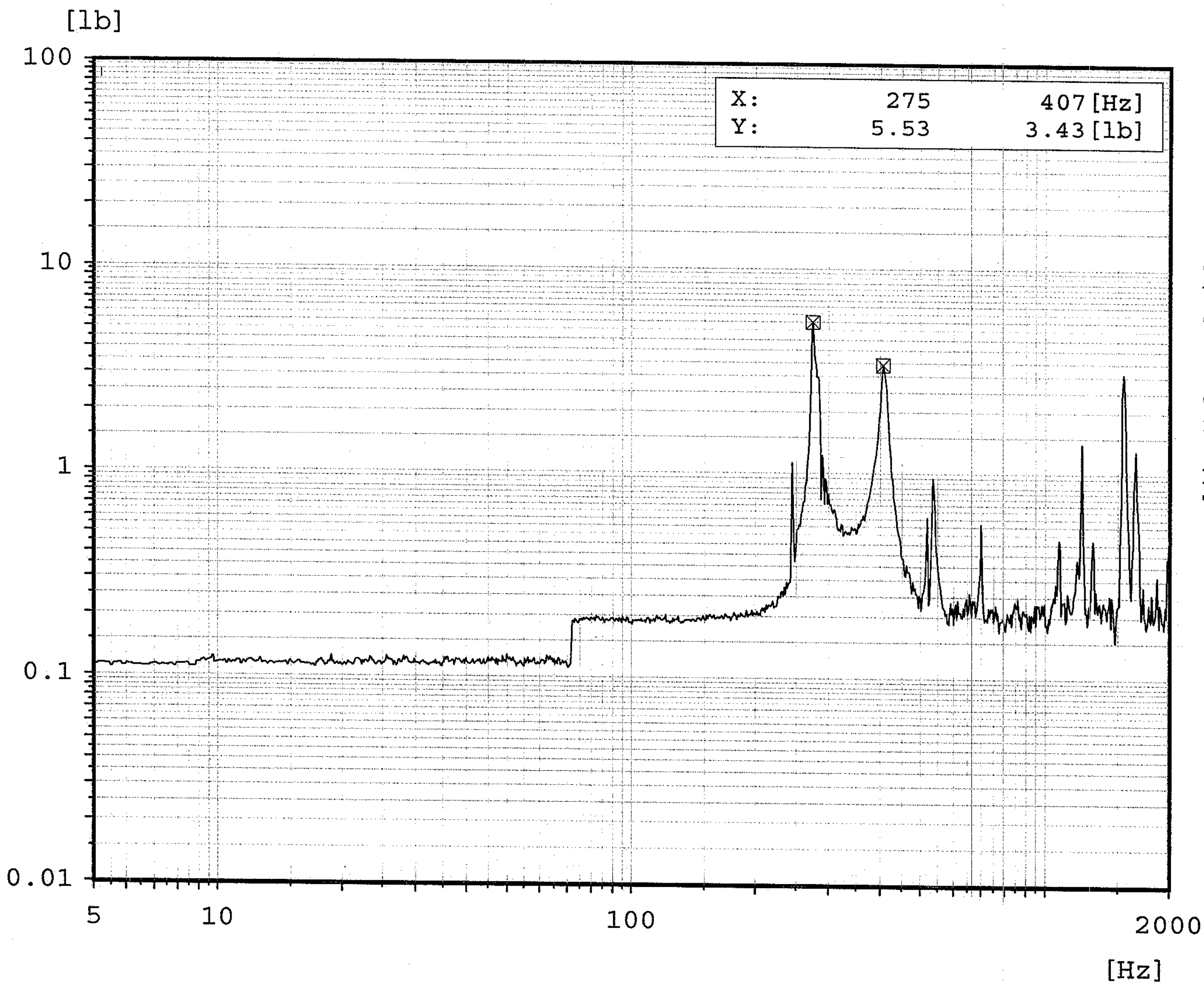
Date: 09-10-03
Time: 12:57:03

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

C:\VcpNT\Daten\m+p\SPIRE\101369\101369 run 4 xax.rsn

Sine Before Shake, Cold
101369, Run # 4, X axis

Force Sum Y



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: 09-10-03
Time: 12:57:03

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

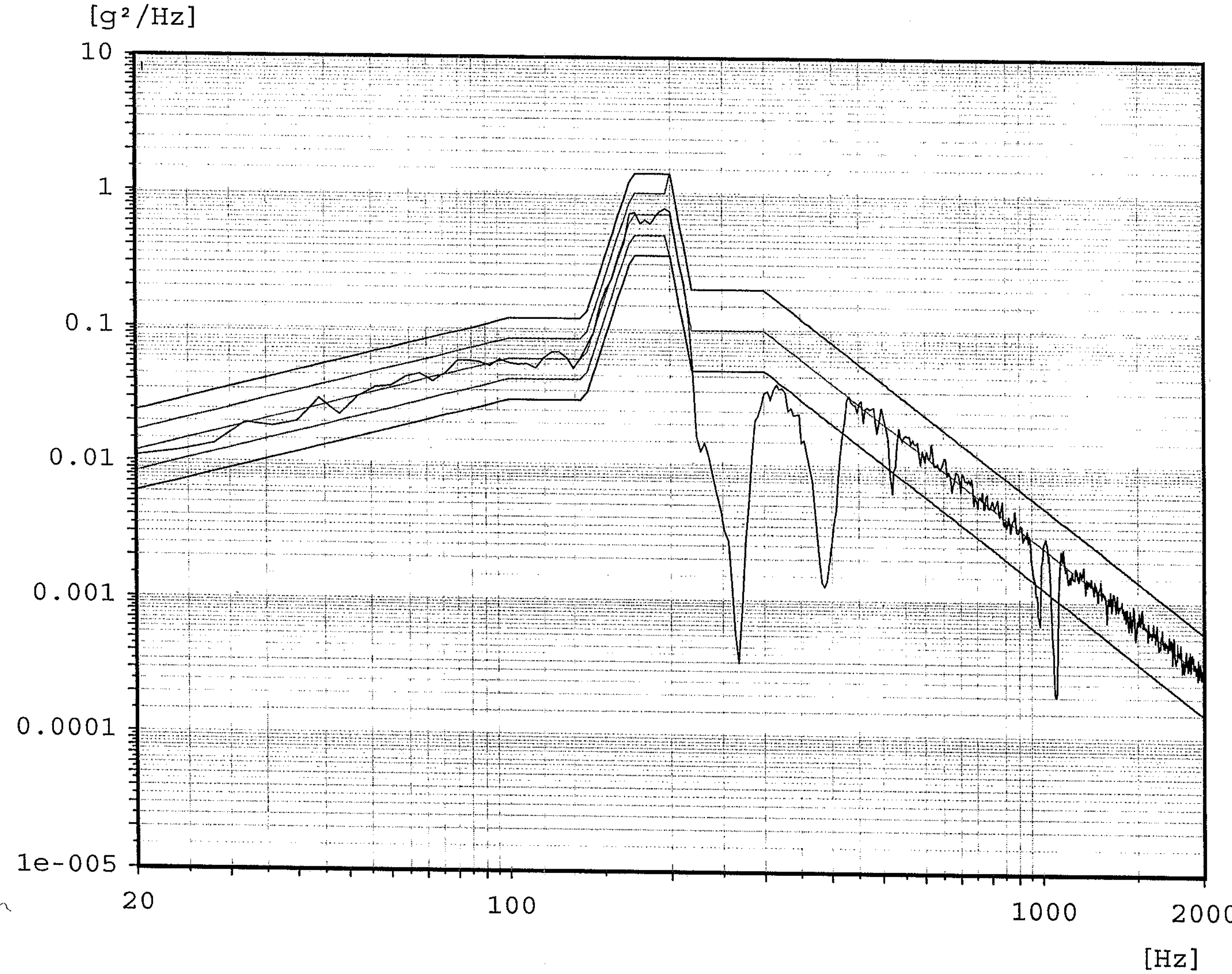
C:\VcpNT\Daten\m+p\SPIRE\101369\101369 run 4 xax.rsn

Random 0dB, Cold

101369, Run # 6, X axis

Control channel

JPL



Chan.type:	X
DOF:	180
Level:	0.0 dB
Resolution:	4 Hz
Contr.strat.:	Maximum
Unit:	g²/Hz
RMS (act.):	7.126 g
RMS (req.):	7.945 g
Contr.strat.:	Closed loop

-- Time on act. level --

elapsed:	000:01:00
remaining:	000:00:00

-- Time total --

elapsed:	000:02:39
remaining:	000:00:00

Date:	09-10-03
Time:	13:29:53

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

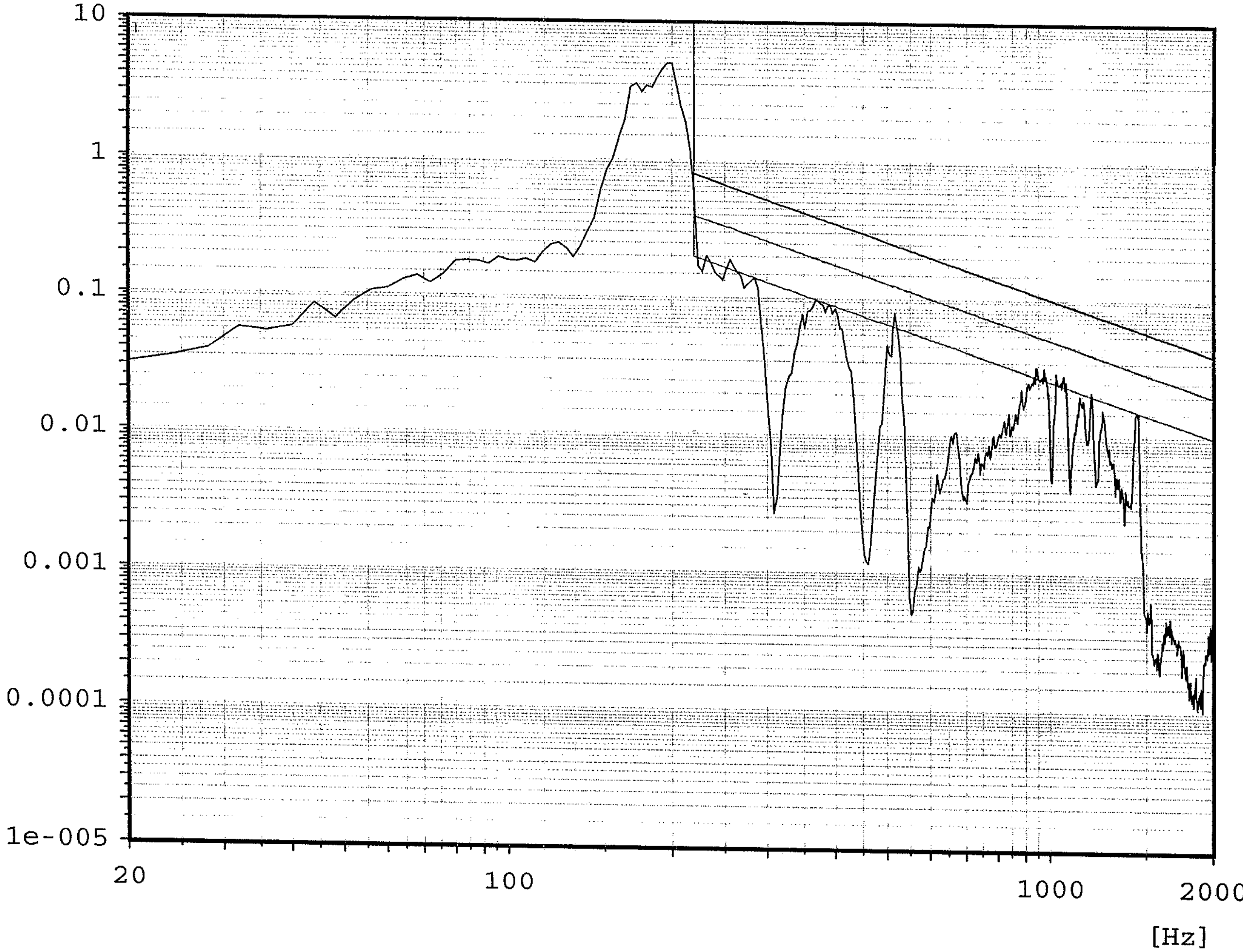
C:\VcpNT\Daten\m+p\SPIRE\101369\101369 run 6 xax.rrn

Random 0dB, Cold

101369, Run # 6, X axis

Force Sum X

JPL



Chan.no:	5
Chan.type:	W
DOF:	90
Level:	0.0 dB
Resolution:	4 Hz
Contr.strat.:	Maximum
Unit:	lb²/Hz
RMS (act.):	15.91 lb
Contr.strat.:	Closed loop

-- Time on act. level --

elapsed:	000:01:00
remaining:	000:00:00

-- Time total --

elapsed:	000:02:39
remaining:	000:00:00

Date:	09-10-03
Time:	13:29:53

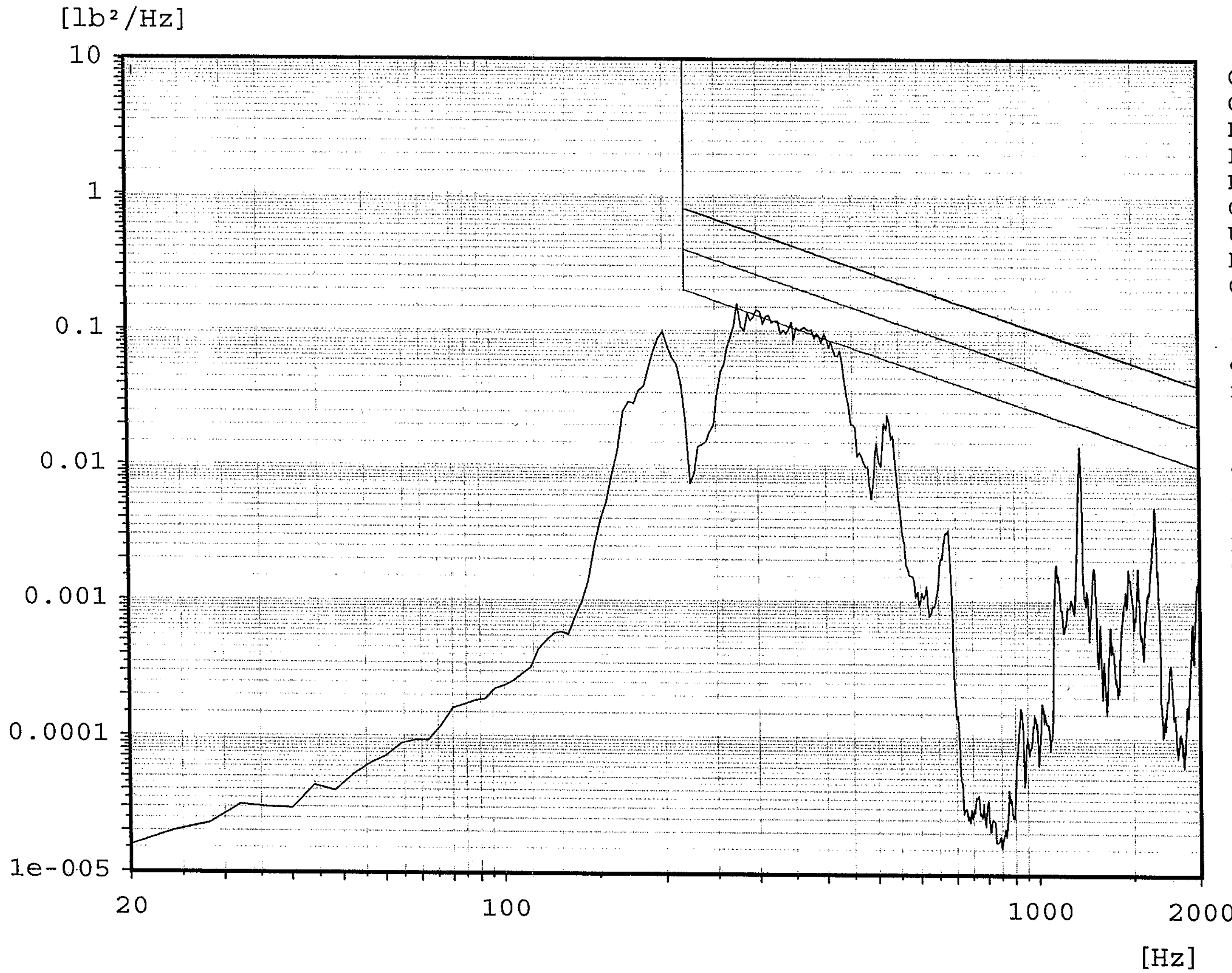
964#1/ Amp#2/ M+P#1

C:\VcpNT\Daten\m+p\SPIRE\101369\101369 run 6 xax.rrn

Random 0dB, Cold

101369, Run # 6, X axis

Force Sum Y



Chan.no: 6
Chan.type: W
DOF: 90
Level: 0.0 dB
Resolution: 4 Hz
Contr.strat.: Maximum
Unit: lb²/Hz
RMS (act.): 4.976 lb
Contr.strat.: Closed loop

-- Time on act. level --
elapsed: 000:01:00
remaining: 000:00:00

-- Time total --
elapsed: 000:02:39
remaining: 000:00:00

Date: 09-10-03
Time: 13:29:53

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

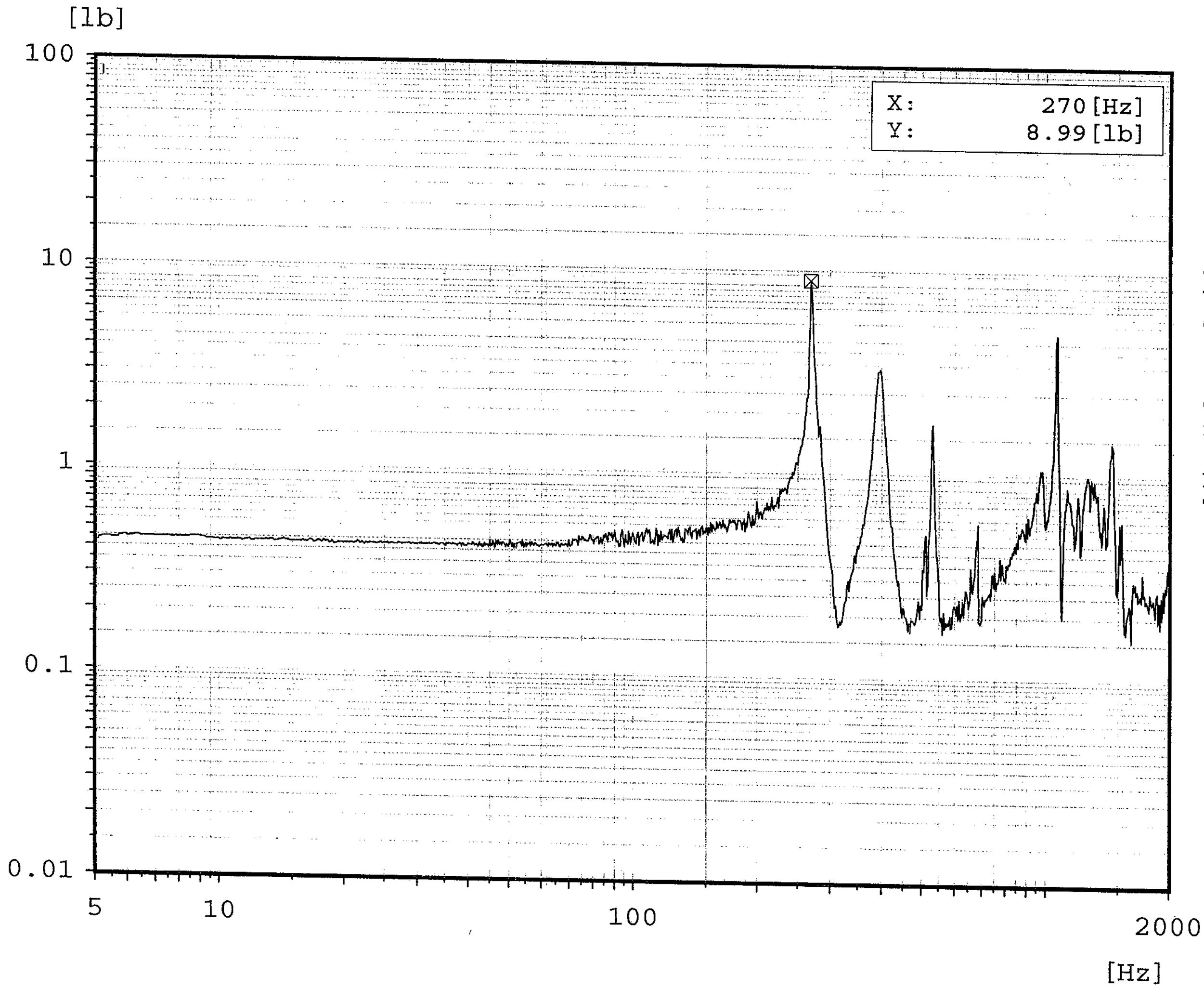
C:\VcpNT\Daten\m+p\SPIRE\101369\101369 run 6 xax.rrn

Sine After Shake, Cold

101369, Run # 8, X axis

Force Sum X

JPL



Chan.no: 5
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: 09-10-03
Time: 13:44:37

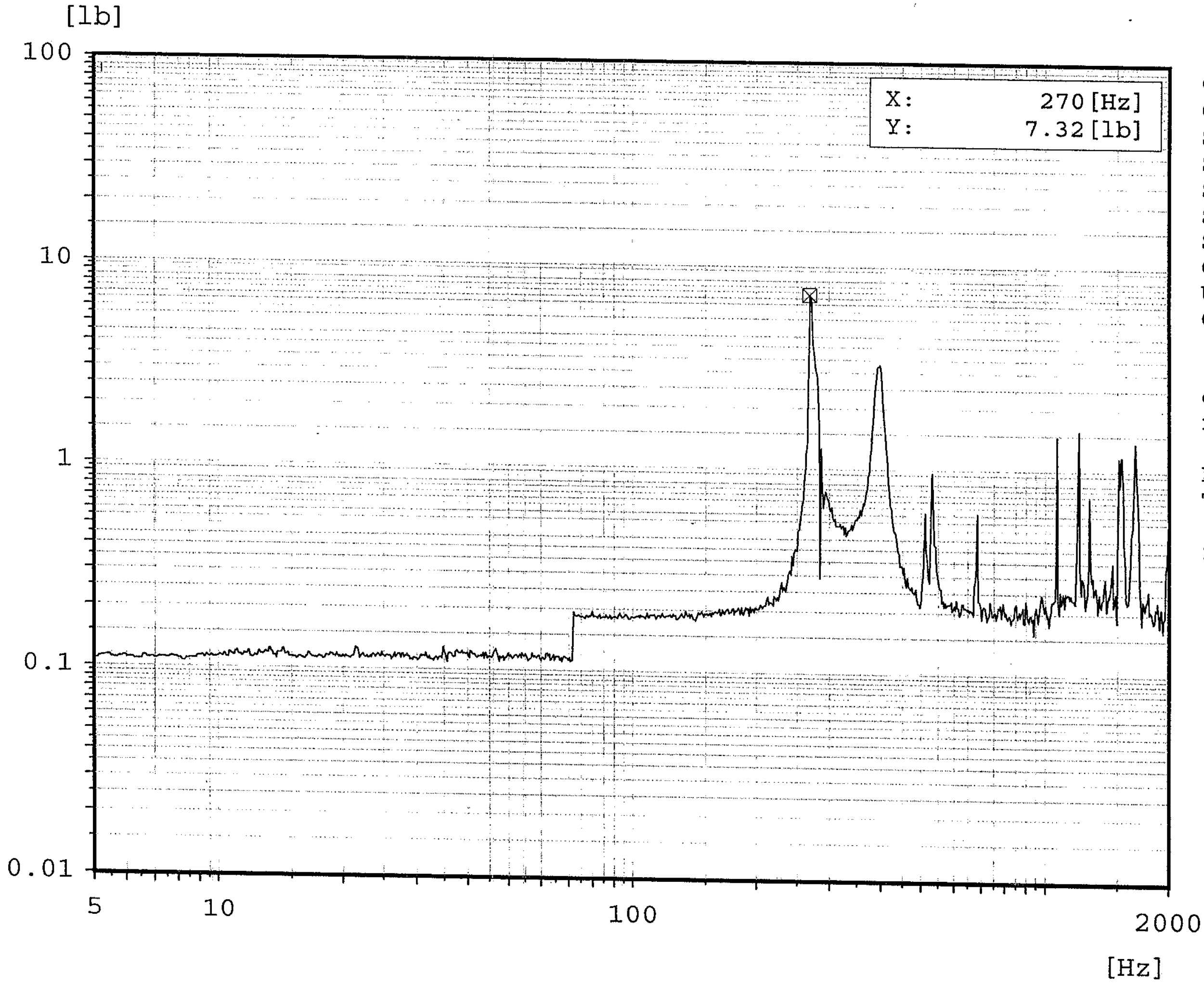
964#1/Amp #2/ M+P #1

C:\VcpNT\Daten\m+p\SPIRE\101369\101369 run 8 xax.rsn

Sine After Shake, Cold

101369, Run # 8, X axis

Force Sum Y



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: 09-10-03
Time: 13:44:37

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

C:\VcpNT\Daten\m+p\SPIRE\101369\101369 run 8 xax.rsn

PRELIMINARY

12/12/2003

PERFORMANCE VERIFICATION MATRIX - PFM SLW BDA - S/N 10209800-1-008

BDA Performance

Item	D. Value	Min Perf	Measured Median	Unit	Reference	Note
Number of bad optical pixels	= 2	= 5	0		BDA-PER-01	
(NEPphoton/NEPtotal)^2 (derived)	> 0.6	> 0.5	0.53		BDA-PER-02	at 40 mV bias
(NEPphoton/NEPtotal)^2 (measured)	> 0.6	> 0.5	0.27		BDA-PER-02	at 40 mV bias
Optical efficiency*	> 0.7	> 0.65	0.75		BDA-PER-05	
Detector time constant	< 4.2	< 14	5.1	ms	BDA-PER-07	at 25 mV bias
Vmax***	< 17		12.8	mV	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	< 30	mHz	BDA-PER-10	at 25 mV bias
Average conducted heat load from 1.7 K	< 1.6	< 3.0	< 2.9	uW	BDA-TEC-06	

BDA Design Values (at 300 mK)

Item	Target	Measured Median	Unit	Reference	Note
R0	180.0	90.2	Ohms	BDA-SSSD	
Delta	41.8	41.3	K	BDA-SSSD	
R300	24.0	11.2	MOhms	BDA-SSSD	
G300	170.0	160.6	pW/K	BDA-SSSD	
Beta	1.50	1.26		BDA-SSSD	
C300	1.00	0.88	pJ/K	BDA-SSSD	
Rlr	10.0	12.1	MOhms	BDA-SSSD	room temp
Dark Sdc	4.1	3.2	e8 V/W	derived	at 25 mV bias
Dark NEP (1 Hz), incl 10 nV/rtHz amp. noise	5.6	5.7	e-17 W/rtHz	derived	at 25 mV bias
Dark NEP (0.1 Hz), incl 10 nV/rtHz amp. noise	5.6	6.7	e-17 W/rtHz	derived	at 25 mV bias
Vmax	0.0114	0.0103	Vrms	BDA-SSSD	
BDA temperature rise from 1.7 K	< 10	< 11.6	mK	BDA-HCO-1	
BDA thermal time constant	> 100	200	s	BDA-HCO-2	

*assumes νlower = 1.02 νcutoff

**not tested

***Thermistor values are not included

thermistors saturate at **31 & 69 mV** bias at **0.3 K**

PRELIMINARY

Pixel Performance												
Item	**DV**	**MP**										
BDA connector			J05	J05	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	9,34	10,35
Channel ID			**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Detector ID			R1	T1	C1	DK1	B1	D1	E1	A1	C2	D2
BDA Pixel Operability			Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BoDAC channel Operability	N/A	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Noisy BoDAC channel	N/A	N/A	No	No	No	No	No	No	No	No	No	No
(NEPphoton/NEPtotal)^2 (derived)	> 0.60	> 0.50	N/M	N/M	0.50	0.50	0.55	0.52	0.52	0.51	0.54	0.60
(NEPphoton/NEPtotal)^2 (measured)	> 0.60	> 0.50	N/M	N/M	0.30	N/A	0.28	0.25	0.26	0.28	0.30	0.34
Optical efficiency*	> 0.7	> 0.65	N/M	N/M	0.73	N/A	0.74	0.74	0.74	0.72	0.77	0.72
Detector time constant	< 4.2	< 14	N/M	N/M	7.50	6.16	5.16	4.66	6.03	8.25	3.96	6.48
Calibration uniformity**	> 0.99	> 0.99	N/A	N/A	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	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	N/A	N/A
1/f knee frequency	< 30	< 100	< 30	< 30	< 30	33	< 30	< 30	< 30	< 30	< 30	< 30
Pixel Design Values												
Item	**Target**											
R0	180.0		N/M	222.7	78.2	233.45	96.23	82.7	97.83	81.08	76.79	145.75
Delta	41.8		N/M	41.59	40.9	33.9	41.43	41.08	39.98	40.9	42.39	41.63
G300	170		N/M	664.13	162.53	158.92	161.82	163.49	167.25	156.09	164.96	160.58
Beta	1.5		N/M	1.56	1.27	1.24	1.26	1.23	1.24	1.27	1.25	1.27
C300	1.00		N/M	0.57	0.87	1.01	1.88	1.10	0.47	0.56	0.69	0.69
Gamma	1 (fixed)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
R300	24.1		N/M	28.9	9.2	9.7	12.2	10.0	10.1	9.5	11.2	19.0
Rlr+	10.0		11.8	11.8	11.8	11.9	12.0	11.9	12.0	12.0	12.0	12.0
Rlr-	10.0		11.7	11.8	11.6	11.7	11.8	11.9	12.0	11.9	12.0	12.1
Dark Sdc	4.08		N/M	1.8	2.9	2.8	3.2	3.0	2.9	3.0	3.1	3.8
Dark NEP (1 Hz), incl 10 nV/rtHz amp. noise	5.6		N/M	N/M	6.3	8.1	5.7	5.6	6.0	6.1	5.2	4.3
Dark NEP (0.1 Hz), incl 10 nV/rtHz amp. noise	5.6		N/M	N/M	7.2	8.3	5.7	7.3	8.5	6.0	7.0	5.4
Vmax	11.4		N/M	N/M	6.0	6.3	6.9	6.3	6.5	6.0	6.6	5.7
*assumes vlower = 1.02 vcutoff												
**not tested												

PRELIMINARY

Pixel Performance												
Item												
BDA connector	J05	J05	J05	J05	J05	J05	J05	J05	J05	J05	J05	J05
BDA pins	11,36	12,37	13,38	14,39	15,40	16,41	17,42	18,43	19,44	20,45	21,46	22,47
Channel ID	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
Detector ID	B2	E2	A2	C3	D3	B3	E3	C4	DK2	D4	C5	B4
BDA Pixel Operability	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
BoDAC channel Operability	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Noisy BoDAC channel	No	No	No	No	No	No	No	No	No	No	No	No
(NEPphoton/NEPtotal)^2 (derived)	0.54	0.59	0.54	0.58	0.53	0.58	0.53	0.53	N/M	0.54	0.53	0.52
(NEPphoton/NEPtotal)^2 (measured)	0.27	0.27	0.25	0.29	0.14	0.27	0.07	0.29	N/M	0.27	0.12	0.27
Optical efficiency*	0.74	0.75	0.77	0.73	0.75	0.74	0.76	0.76	N/A	0.76	0.76	0.78
Detector time constant	4.95	4.48	4.52	8.21	4.73	4.92	5.74	4.83	N/M	3.84	5.69	4.59
Calibration uniformity**	N/A	N/A	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	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	N/A	N/A
1/f knee frequency	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 30
Pixel Design Values												
Item												
R0	78.57	133.89	91.55	136.53	74.69	114.84	86.45	83.24	N/M	212.81	88.81	83.99
Delta	42.29	41.42	41.23	40.78	42.28	41.84	41.23	41.73	N/M	40.98	41.73	41.55
G300	154.24	161.74	158.59	155.96	161.96	155.21	171.06	157.74	N/M	160.13	164.96	156.35
Beta	1.26	1.26	1.26	1.26	1.24	1.27	1.25	1.25	N/M	1.27	1.27	1.26
C300	0.69	1.61	1.61	1.14	0.82	1.25	0.90	0.81	N/M	0.93	1.36	N/M
Gamma	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	N/M	1.0	1.0	1.0
R300	11.3	17.0	11.3	15.8	10.7	15.5	10.7	11.0	N/M	25.3	11.8	10.8
Rlr+	12.0	12.0	12.1	12.2	12.2	12.1	12.1	12.2	12.3	12.3	12.3	12.3
Rlr-	12.0	12.1	12.1	12.1	12.2	12.3	12.3	12.2	12.2	12.3	12.3	12.4
Dark Sdc	3.2	3.7	3.5	3.6	3.1	3.6	3.0	3.2	N/M	4.2	3.2	3.2
Dark NEP (1 Hz), incl 10 nV/rtHz amp. noise	5.7	4.9	5.4	5.0	7.5	4.9	10.2	5.4	N/M	5.6	14.9	5.5
Dark NEP (0.1 Hz), incl 10 nV/rtHz amp. noise	7.5	6.8	6.6	6.0	8.2	5.8	7.1	6.5	N/M	6.0	14.9	5.0
Vmax	5.7	8.2	6.6	7.8	6.4	7.6	6.7	6.5	N/M	10.0	6.9	6.4
*assumes vlower = 1.02 vcutoff												
**not tested												

Pixel Performance					
Item			**Unit**	**Reference**	**Note**
BDA connector	J05	J05			
BDA pins	23,48	24,49			
Channel ID	**23**	**24**			
Detector ID	A3	T2			
BDA Pixel Operability	Yes	Yes			
BoDAC channel Operability	Yes	Yes			
Noisy BoDAC channel	No	No			
(NEPphoton/NEPtotal)^2 (derived)	N/M	N/M		BDA-PER-02	at 40 mV bias
(NEPphoton/NEPtotal)^2 (measured)	0.25	N/M		BDA-PER-02	at 40 mV bias
Optical efficiency*	0.80	0.80		BDA-PER-05	
Detector time constant	6.40	N/M	ms	BDA-PER-07	at 25 mV bias
Calibration uniformity**	N/A	N/A		BDA-PER-08	
Cross-talk (n-n)**	N/A	N/A		BDA-PER-09	
Cross-talk (non n-n)**	N/A	N/A		BDA-PER-09	
1/f knee frequency	< 30	< 30	mHz	BDA-PER-10	at 25 mV bias
Pixel Design Values					
Item			**Unit**	**Reference**	**Note**
R0	110.72	73.19	Ohms	BDA-SSSD	
Delta	39.2	40.51	K	BDA-SSSD	
G300	156.28	N/M	pW/K	BDA-SSSD	
Beta	1.25	N/M		BDA-SSSD	
C300	0.55	0.88	pJ/K	BDA-SSSD	
Gamma	1.0	1.0			
R300	10.2	N/M	MOhms	BDA-SSSD	
Rlr+	12.4	12.5	MOhms	BDA-SSSD	room temp
Rlr-	12.3	12.5	MOhms	BDA-SSSD	room temp
Dark Sdc	3.0	N/M	e8 V/W	derived	at 25 mV bias
Dark NEP (1 Hz), incl 10 nV/rtHz amp. noise	5.9	N/M	e-17 W/rtHz	derived	at 25 mV bias
Dark NEP (0.1 Hz), incl 10 nV/rtHz amp. noise	6.6	N/M	e-17 W/rtHz	derived	at 25 mV bias
Vmax	6.3	N/M	mVrms	BDA-DRCU-22	
*assumes vlower = 1.02 vcutoff					
**not tested					

PRELIMINARY

12/12/2003

Symbol	Units	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
T0	K	0.3025	Base Temperature										
Vn	nV/rtHz	10	Amplifier Voltage Noise										
Q	pW	0.5	Absorbed Power Onto Bolometer										
NEP_{photon}	1e-17 W/rtHz	1.85	Noise in Absorbed Optical Power										
Vbias	mV	25	Bias Across Bolometer & Load Resistors										
Detector ID		**Target**	**R1**	**T1**	**C1**	**DK1**	**B1**	**D1**	**E1**	**A1**	**C2**	**D2**	**B2**
Pthermal	pW	7.692	N/M	0.000	4.582	4.711	5.065	4.659	4.674	4.506	4.843	5.862	4.786
Pelec+Q	pW	7.692	N/M	7.081	4.582	4.711	5.065	4.659	4.674	4.506	4.842	5.862	4.786
Tbolo	K	0.34303	N/M	0.30250	0.32892	0.33025	0.33169	0.32924	0.32874	0.32952	0.32998	0.33621	0.33145
T/T0		1.134	N/M	1.000	1.087	1.092	1.096	1.088	1.087	1.089	1.091	1.111	1.096
Rbolo	Ω	1.12E+07	6.67E+06	2.75E+07	5.45E+06	5.87E+06	6.87E+06	5.87E+06	6.02E+06	5.59E+06	6.42E+06	9.91E+06	6.32E+06
Vbolo	mV	8.98	5.52	13.46	4.71	4.97	5.60	4.94	5.01	4.73	5.28	7.29	5.21
Ibolo	nA	0.80	0.83	0.49	0.87	0.85	0.82	0.84	0.83	0.85	0.82	0.74	0.82
A		-5.52	N/M	-5.86	-5.58	-5.07	-5.59	-5.59	-5.51	-5.57	-5.67	-5.56	-5.65
C	pJ/K	1.14	N/M	0.57	0.95	1.11	2.08	1.20	0.51	0.61	0.76	0.77	0.76
G	pW/K	205.3	N/M	672.8	182.7	179.0	183.6	183.3	187.3	175.9	185.8	185.6	174.9
Z/R		0.279	1.000	0.681	0.451	0.470	0.410	0.444	0.456	0.444	0.427	0.353	0.411
τ	ms	4.806	4.000	0.867	4.225	5.102	9.193	5.318	2.223	2.797	3.316	3.474	3.505
Sdc	V/W	3.89E+08	0.00E+00	1.82E+08	2.87E+08	2.80E+08	3.24E+08	2.98E+08	2.93E+08	2.98E+08	3.13E+08	3.84E+08	3.23E+08
$NEP_{johnson}$	1e-17 W/rtHz	2.070	N/M	5.529	2.273	2.428	2.183	2.259	2.329	2.217	2.216	2.087	2.120
NEP_{phonon}	1e-17 W/rtHz	3.303	N/M	N/M	3.096	3.070	3.112	3.104	3.136	3.039	3.126	3.140	3.036
NEP_{load}	1e-17 W/rtHz	0.635	N/M	4.841	0.653	0.740	0.651	0.661	0.701	0.631	0.657	0.663	0.605
NEP_{amp}	1e-17 W/rtHz	2.570	N/M	5.506	3.482	3.568	3.088	3.360	3.410	3.361	3.200	2.604	3.097
NEP_{det}	1e-17 W/rtHz	5.787	N/M	N/M	6.709	6.912	6.256	6.580	6.702	6.515	6.398	5.745	6.174
DQE		0.093	N/M	N/M	0.071	0.067	0.080	0.073	0.071	0.075	0.077	0.094	0.082
Vn(det)	nV/rtHz	22.5	13.38	N/M	19.3	19.4	20.3	19.6	19.7	19.4	20.0	22.1	19.9
Vn(total)	nV/rtHz	23.6	13.4	N/M	20.0	20.1	21.1	20.3	20.4	20.2	20.8	23.2	20.8
Vn(calculated)		20.8											
Vn(measured)		26.28	14.03	31.13	23.63	30.12	25.67	26.11	26.46	24.94	23.98	25.53	25.71
Vn(measured) - gain = 57300			0.001137163	0.001783931	0.001354	0.0017259	0.0014706	0.001496	0.001516	0.0014293	0.0013743	0.001463	0.0014734
Sdc(measure	V/W		N/M	N/M	2.86E+08	2.39E+08	3.24E+08	2.98E+08	2.92E+08	2.97E+08	3.14E+08	3.83E+08	3.23E+08

PRELIMINARY

12/12/2003

Symbol	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	
T0													
Vn													
Q													
NEP_{photon}													
Vbias													
Detector ID	**E2**	**A2**	**C3**	**D3**	**B3**	**E3**	**C4**	**DK2**	**D4**	**C5**	**B4**	**A3**	**T2**
Pthermal	5.643	4.788	5.440	4.650	5.345	4.702	4.698	6.224	4.821	4.584	4.485	N/M	N/M
Pelec+Q	5.643	4.787	5.440	4.650	5.345	4.702	4.698	6.224	4.821	4.584	4.484	N/M	N/M
Tbolo	0.33483	0.33070	0.33482	0.32942	0.33442	0.32832	0.33036	0.33825	0.32984	0.32993	0.32939	N/M	0.30250
T/T0	1.107	1.093	1.107	1.089	1.106	1.085	1.092	1.118	1.090	1.091	1.089	N/M	1.000
Rbolo	9.06E+06	6.47E+06	8.48E+06	6.21E+06	8.28E+06	6.36E+06	6.33E+06	1.28E+07	6.81E+06	6.28E+06	6.05E+06	N/M	N/M
Vbolo	6.83	5.27	6.47	5.08	6.33	5.17	5.15	8.57	5.43	5.06	4.91	N/M	N/M
Ibolo	0.75	0.81	0.76	0.82	0.77	0.81	0.81	0.67	0.80	0.81	0.81	N/M	N/M
A	-5.56	-5.58	-5.52	-5.66	-5.59	-5.60	-5.62	-5.50	-5.62	-5.61	-5.45	N/M	N/M
C	1.80	1.77	1.27	0.90	1.39	0.98	0.89	1.04	1.50	N/M	0.60	N/M	0.89
G	185.7	179.3	179.1	181.9	178.2	191.5	177.9	186.5	186.1	176.3	175.6	N/M	N/M
Z/R	0.370	0.425	0.375	0.436	0.375	0.455	0.427	0.334	0.433	0.435	0.454	N/M	N/M
τ	8.003	8.024	5.801	4.015	6.362	4.194	4.056	4.833	6.565	N/M	2.800	N/M	N/M
Sdc	3.67E+08	3.17E+08	3.62E+08	3.10E+08	3.62E+08	3.00E+08	3.17E+08	4.25E+08	3.18E+08	3.16E+08	3.03E+08	N/M	N/M
$NEP_{johnson}$	2.120	2.192	2.102	2.214	2.080	2.330	2.180	2.070	2.240	2.189	2.266	N/M	N/M
NEP_{phonon}	3.138	3.072	3.082	3.092	3.072	3.169	3.060	3.153	3.127	3.044	3.038	N/M	N/M
NEP_{load}	0.667	0.646	0.644	0.651	0.628	0.714	0.637	0.708	0.682	0.640	0.670	N/M	N/M
NEP_{amp}	2.724	3.152	2.763	3.223	2.759	3.337	3.159	2.355	3.144	3.168	3.301	N/M	N/M
NEP_{det}	5.880	6.305	5.868	6.402	5.839	6.647	6.296	5.532	6.365	6.304	6.495	N/M	N/M
DQE	0.090	0.079	0.090	0.077	0.091	0.072	0.079	0.101	0.078	0.079	0.075	N/M	N/M
Vn(det)	21.6	20.0	21.2	19.9	21.2	19.9	19.9	23.5	20.2	19.9	19.7	N/M	N/M
Vn(total)	22.6	20.8	22.3	20.7	22.2	20.7	20.8	24.8	21.1	20.7	20.5	N/M	N/M
Vn(calculatec													
Vn(measurec	29.37	27.83	29.34	37.53	30.08	30.58	24.35	9.72	35.37	109.69	25.11	26.05	28.74
Vn(measurec	0.0016828	0.0015944	0.0016811	0.0021507	0.0017235	0.0017522	0.001395	0.0005571	0.0020268	0.0062851	0.0014388	0.0014929	0.0016468
Sdc(measure	3.64E+08	3.16E+08	3.62E+08	3.12E+08	3.64E+08	2.98E+08	3.19E+08	4.21E+08	3.17E+08	3.15E+08	3.02E+08	N/M	N/M

PRELIMINARY

Symbol	Equation (or Comments)	
T0		
Vn		
Q		
NEP_{photon}		
Vbias		
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	$P_e + Q = [V_{bias}/(2R_L + R_B)]^2 R_B + Q$
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.	$NEP_{load} = [4kTo/2R_L]^{1/2} \lvert 2(Z/R)R_BIbolo/[(Z/R) - 1]\rvert$
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(calculated		
Vn(measured		
Vn(measured		
Sdc(measure		

PRELIMINARY

12/12/2003

Symbol	Units	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value
T0	K	0.296	Base Temperature											
Vn	nV/rtHz	10	Amplifier Voltage Noise											
Q	pW	10.6	Absorbed Power Onto Bolometer											
NEP_{photon}	1e-17 W/rtHz	10.50	Noise in Absorbed Optical Power											
Vbias	mV	40	Bias Across Bolometer & Load Resistors											
			Detector ID											
		Target	**R1**	**T1**	**C1**	**DK1**	**B1**	**D1**	**E1**	**A1**	**C2**	**D2**	**B2**	**E2**
Pthermal	pW	23.010	N/M	0.000	16.409	16.877	17.297	16.562	16.695	16.219	16.890	19.001	16.651	18.527
Pelec+Q	pW	23.010	N/M	27.215	16.409	16.877	17.297	16.562	16.695	16.219	16.890	19.001	16.650	18.527
Tbolo	K	0.40327	0.29600	0.29600	0.38231	0.38645	0.38675	0.38295	0.38175	0.38447	0.38356	0.39482	0.38752	0.39226
T/T0		1.362	1.000	1.000	1.292	1.306	1.307	1.294	1.290	1.299	1.296	1.334	1.309	1.325
Rbolo	Ω	4.75E+06	N/M	3.13E+07	2.43E+06	2.73E+06	3.01E+06	2.60E+06	2.72E+06	2.44E+06	2.82E+06	4.20E+06	2.70E+06	3.89E+06
Vbolo	mV	7.68	N/M	22.81	3.76	4.14	4.49	3.94	4.07	3.71	4.22	5.94	4.05	5.55
Ibolo	nA	1.62	N/M	0.73	1.55	1.52	1.49	1.51	1.50	1.52	1.49	1.41	1.50	1.43
A		-5.09	N/M	-5.93	-5.17	-4.68	-5.18	-5.18	-5.12	-5.16	-5.26	-5.13	-5.22	-5.14
C	pJ/K	1.34	N/M	0.56	1.11	1.30	2.42	1.40	0.59	0.71	0.88	0.91	0.89	2.11
G	pW/K	270.3	N/M	650.4	221.1	217.5	222.9	220.7	225.5	213.9	224.3	227.6	212.9	226.7
Z/R		0.266	N/M	0.323	0.476	0.482	0.426	0.465	0.468	0.479	0.445	0.351	0.446	0.372
τ	ms	4.000	N/M	0.932	3.891	4.682	8.290	4.896	2.037	2.584	3.018	2.983	3.206	6.976
Sdc	V/K	2.14E+08	N/M	3.25E+08	1.62E+08	1.62E+08	1.82E+08	1.68E+08	1.69E+08	1.64E+08	1.77E+08	2.16E+08	1.76E+08	2.07E+08
$NEP_{johnson}$	1e-17 W/rtHz	2.868	N/M	3.221	3.116	3.309	2.973	3.074	3.128	3.099	3.002	2.819	2.971	2.861
NEP_{phonon}	1e-17 W/rtHz	3.980	N/M	N/M	3.546	3.538	3.580	3.551	3.583	3.496	3.579	3.651	3.502	3.634
NEP_{load}	1e-17 W/rtHz	0.504	N/M	1.812	0.569	0.640	0.553	0.567	0.592	0.563	0.557	0.530	0.537	0.541
NEP_{amp}	1e-17 W/rtHz	4.684	N/M	3.075	6.191	6.181	5.483	5.943	5.926	6.103	5.656	4.629	5.672	4.820
NEP_{det}	1e-17 W/rtHz	6.801	N/M	N/M	10.455	10.567	9.552	10.139	10.165	10.323	9.770	8.522	9.738	8.753
DQE		0.704	N/M	N/M	0.502	0.497	0.547	0.517	0.516	0.509	0.536	0.603	0.538	0.590
Vn(det)	nV/rtHz	14.5	13.4	N/M	16.9	17.1	17.4	17.1	17.2	16.9	17.3	18.4	17.2	18.2
Vn(total)	nV/rtHz	26.7	13.4	N/M	23.9	24.1	25.9	24.6	24.7	24.1	25.4	29.2	25.2	28.4
			14.4	21.7	16.7	13.0	19.1	19.0	18.9	17.6	18.6	26.9	19.7	22.3
Measured														
Q_incident	1.16E-11													
NEP_photon	9.69E-17													
Q_absorbed			N/M	N/M	8.4263E-12	N/A	8.59423E-12	8.56177E-12	8.60338E-12	8.41389E-12	8.90366E-12	8.34449E-12	8.60083E-12	8.723E-12
NEP_photon			N/M	N/M	8.2511E-17	N/A	8.3329E-17	8.31716E-17	8.33734E-17	8.24502E-17	8.48159E-17	8.21094E-17	8.3361E-17	8.3951E-17
Vn(total, gain = 57300)			0.0012333	0.00208137	0.0013961	N/A	0.001645615	0.00159327	0.001588958	0.001467292	0.001561383	0.001751086	0.001630229	0.001908874
Vn(total)		2.8585E-08	1.52195E-08	3.6324E-08	2.4365E-08	N/A	2.87193E-08	2.78058E-08	2.77305E-08	2.56072E-08	2.72493E-08	3.056E-08	2.84508E-08	3.33137E-08
Sdc			N/M	N/M	1.62E+08	N/A	1.81E+08	1.68E+08	1.69E+08	1.64E+08	1.75E+08	2.18E+08	1.78E+08	2.05E+08
NEP(total)					1.5011E-16	N/A	1.58817E-16	1.65579E-16	1.64367E-16	1.55905E-16	1.55514E-16	1.39877E-16	1.6027E-16	1.62547E-16
DQE		0.27	N/M	N/M	0.30	N/A	0.28	0.25	0.26	0.28	0.30	0.34	0.27	0.27

PRELIMINARY

Symbol	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	Value	
T0												
Vn												
Q												
NEP_{photon}												
Vbias												
	A2	**C3**	**D3**	**B3**	**E3**	**C4**	**DK2**	**D4**	**C5**	**B4**	**A3**	**T2**
Pthermal	16.767	18.046	16.521	17.809	16.779	16.575	20.093	16.927	16.381	16.284	N/M	N/M
Pelec+Q	16.767	18.046	16.521	17.809	16.779	16.575	20.093	16.927	16.382	16.284	N/M	N/M
Tbolo	0.38590	0.39308	0.38337	0.39228	0.38038	0.38553	0.39982	0.38353	0.38521	0.38488	N/M	0.30000
T/T0	1.304	1.328	1.295	1.325	1.285	1.302	1.351	1.296	1.301	1.300	N/M	1.000
Rbolo	2.82E+06	3.62E+06	2.72E+06	3.51E+06	2.87E+06	2.75E+06	5.31E+06	3.01E+06	2.72E+06	2.67E+06	N/M	N/M
Vbolo	4.17	5.19	4.01	5.03	4.21	4.05	7.10	4.36	3.97	3.90	N/M	N/M
Ibolo	1.48	1.43	1.48	1.43	1.47	1.48	1.34	1.45	1.46	1.46	N/M	N/M
A	-5.17	-5.09	-5.25	-5.16	-5.21	-5.20	-5.06	-5.22	-5.19	-5.05	N/M	N/M
C	2.07	1.49	1.05	1.63	1.13	1.04	1.23	1.74	N/M	0.71	N/M	0.88
G	217.8	219.2	219.5	218.2	230.2	215.8	230.6	225.3	214.2	213.4	N/M	N/M
Z/R	0.450	0.389	0.460	0.394	0.463	0.456	0.315	0.447	0.466	0.482	N/M	N/M
τ	7.314	5.117	3.685	5.629	3.822	3.716	4.001	5.942	N/M	2.581	N/M	4.000
Sdc	1.77E+08	2.01E+08	1.74E+08	2.00E+08	1.74E+08	1.75E+08	2.40E+08	1.81E+08	1.74E+08	1.69E+08	N/M	N/M
$NEP_{johnson}$	3.022	2.889	3.030	2.873	3.100	3.019	2.778	3.031	3.048	3.147	N/M	N/M
NEP_{phonon}	3.535	3.577	3.541	3.564	3.612	3.519	3.697	3.584	3.503	3.496	N/M	5.000
NEP_{load}	0.561	0.542	0.560	0.535	0.594	0.556	0.532	0.576	0.564	0.590	N/M	N/M
NEP_{amp}	5.657	4.966	5.753	4.996	5.756	5.703	4.169	5.534	5.745	5.926	N/M	N/M
NEP_{det}	9.768	8.910	9.886	8.928	9.961	9.812	8.027	9.651	9.874	10.147	N/M	N/M
DQE	0.536	0.581	0.530	0.580	0.526	0.534	0.631	0.542	0.531	0.517	N/M	N/M
Vn(det)	17.3	17.9	17.2	17.9	17.3	17.2	19.3	17.4	17.2	17.1	N/M	N/M
Vn(total)	25.3	27.7	25.1	27.6	25.1	25.2	31.7	25.8	25.1	24.6	N/M	N/M
	19.7	21.0	26.5	21.2	20.0	29.2	7.0	24.4	25.7	18.4	18.6	17.3
Measured												
Q_incident												
NEP_photon												
Q_absorbed	8.94233E-12	8.52818E-12	8.66353E-12	8.60666E-12	8.8394E-12	8.88248E-12	N/A	8.802E-12	8.877E-12	9.107E-12	9.275E-12	N/A
NEP_photon	8.49999E-17	8.30082E-17	8.36643E-17	8.33893E-17	8.45093E-17	8.47149E-17	N/A	8.433E-17	8.469E-17	8.578E-17	8.657E-17	N/A
Vn(total, gain	0.001672062	0.001806447	0.002212419	0.001843819	0.003067526	0.001578476	N/A	0.0021829	0.0024331	0.0015758	0.0015971	0.0015366
Vn(total)	2.91808E-08	3.15261E-08	3.86112E-08	3.21783E-08	5.35345E-08	2.75476E-08	N/A	3.81E-08	4.246E-08	2.75E-08	2.787E-08	2.682E-08
Sdc	1.72E+08	2.03E+08	1.74E+08	2.00E+08	1.68E+08	1.74E+08	N/M	2.34E+08	1.75E+08	1.67E+08	1.61E+08	N/M
NEP(total)	1.69769E-16	1.54939E-16	2.22E-16	1.60983E-16	3.18569E-16	1.58073E-16	N/M	1.63E-16	2.424E-16	1.645E-16	1.735E-16	N/M
DQE	0.25	0.29	0.14	0.27	0.07	0.29	N/M	0.27	0.12	0.27	0.25	N/M

Symbol	Equation (or Comments)	
T0		
Vn		
Q		
NEP_{photon}		
Vbias		
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	$P_e + Q = [V_{bias}/(2R_L + R_B)]^2 R_B + Q$
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.	$NEP_{load} = [4kTo/2R_L]^{1/2} \lvert 2(Z/R)R_BIbolo/[(Z/R) - 1]\rvert$
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	$Vn(total) = [NEP_{det}^2 + NEP_{photon}^2]^{1/2}Sdc$
Measured		
Q_incident		
NEP_photon		
Q_absorbed		
NEP_photon		
Vn(total, gain		
Vn(total)		
Sdc		
NEP(total)		
DQE		

PRELIMINARY

12/12/2003

Pixel No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Pixel No.	R1	T1	C1	DK1	B1	D1	E1	A1	C2	D2	B2	E2	A2	C3	D3
Tau	0.004026	0.003893	0.007499	0.006161	0.005155	0.004659	0.006029	0.00825	0.003963	0.006481	0.004948	0.004475	0.004524	0.008208	0.004728
Pixel No.	R1	T1	C1	DK1	B1	D1	E1	A1	C2	D2	B2	E2	A2	C3	D3
Ro		222.7	78.2	233.45	96.23	82.7	97.83	81.08	76.79	145.75	78.57	133.89	91.55	136.53	74.69
Delta	0	41.59	40.9	33.9	41.43	41.08	39.98	40.9	42.39	41.63	42.29	41.42	41.23	40.78	42.28
Go	40	517.41	132.74	130.45	132.45	134.32	137.11	127.38	135.06	131.26	126.15	132.45	129.76	127.65	132.75
Beta	1.5	1.59	1.28	1.25	1.27	1.24	1.26	1.29	1.27	1.28	1.27	1.27	1.27	1.27	1.26
DAS Ch. No.			99	100	101	102	103	104	105	106	107	108	109	110	111
Eta #1			0.600965	1.58121	0.612795	0.605986	0.615433	0.605205	0.641834	0.596077	0.618569	0.627557	0.639876	0.61264	0.622954
Eta #2			0.65128	1.45393	0.665711	0.666499	0.666484	0.645527	0.693678	0.64434	0.665848	0.676044	0.695541	0.660478	0.672412
Eta #3			0.683214	1.44437	0.700314	0.697956	0.699265	0.68153	0.723195	0.673926	0.696106	0.708465	0.733274	0.688649	0.701345
DAS Ch. No.	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
Plateau	0.00102	0.00222	0.0016	0.00176	0.00172	0.00184	0.00176	0.00162	0.00161	2.02E-03	1.75E-03	0.00217	1.85E-03	0.0018	0.00596
1/f Knee #1			0.018	0.037	0.018	0.018	0.027	0.018							
1/f Knee #2			0.014	0.028	0.005	0.008	0.024	0.012							
Rlr+	11.8	11.84	11.8	11.92	12	11.91	11.99	12.02	12.02	12	12	12	12.12	12.16	12.16
Rlr-	11.72	11.76	11.63	11.72	11.8	11.92	12.02	11.92	11.96	12.08	12.04	12.12	12.12	12.11	12.22
DAS Ch. No.		98	99	100	101	102	103	104	105			108		110	111
Vbias		0.016656	0.016656	0.016656	0.016656	0.016656	0.016656	0.016656	0.016656			0.016656		0.016656	0.016656
Sdc		530173000	542714000	480897000	519256000	531622000	545332000	497128000	512695000		3.90E+08	461334000	3.90E+08	448642000	536264000
DAS Ch. No.	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
Vmax	N/M	N/M	0.0060437	0.006339	0.0069327	0.0063014	0.0064785	0.0060395	0.0066256	0.008636	0.006454	0.0081814	0.006611	0.0077946	0.0064294
DAS Ch.	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
Noise (0.1 Hz)	0.00116	0.00175	0.00167	0.00188	0.00149	0.00177	0.00203	0.00145	0.00176	1.67E-03	1.97E-03	0.00202	1.87E-03	0.00176	0.00205
Noise (1.0 Hz)	0.00126	0.00167	0.00147	0.00185	0.0015	0.00136	0.00142	0.00147	0.00131	1.33E-03	1.50E-03	0.00146	1.52E-03	0.00147	0.00188
DAS Ch. No.		98	99	100	101	102	103	104	105			108		110	111
		34	35	36	37	38	39	40	41			44		46	47
R300		1.25E+07	1.35E+07	1.03E+07	1.13E+07	1.03E+07	1.31E+07	1.11E+07	1.18E+07			1.01E+07		1.00E+07	1.39E+07
DAS Ch. No.															
C300															
DAS Ch. No.															
Gamma	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NEV_optical	14.4	21.7	16.7	13.0	19.1	19.0	18.9	17.6	18.6	26.9	19.7	22.3	19.7	21.0	26.5
Avg. 1/f Knee	0	0	0.016	0.0325	0.0115	0.013	0.0255	0.015	0	0	0	0	0	0	0
Avg. Eta	#DIV/0!	#DIV/0!	0.645153	1.49317	0.6596067	0.6568137	0.660394	0.6440873	0.6862357	0.638114	0.660174	0.6706887	0.689564	0.6539223	0.6655703

PRELIMINARY

Pixel No.	16	17	18	19	20	21	22	23	24
Pixel No.	B3	E3	C4	DK2	D4	C5	B4	A3	T2
Tau	0.004915	0.005741	0.004834	0.001125	0.003841	0.005686	0.004587	0.006395	0.000581
Pixel No.	B3	E3	C4	DK2	D4	C5	B4	A3	T2
Ro	114.84	86.45	83.24	0	212.81	88.81	83.99	110.72	73.19
Delta	41.84	41.23	41.73	0	40.98	41.73	41.55	39.2	40.51
Go	126.88	140	129.15	-24.21	130.97	134.67	127.78	128.03	
Beta	1.28	1.27	1.27	334.88	1.28	1.28	1.28	1.26	-0.9
DAS Ch. No.	112	113	114		116	117	118	119	121
Eta #1	0.620508	0.634216	0.641689		0.636454	0.639167	0.656161	0.668955	0.668955
Eta #2	0.665597	0.685903	0.689573		0.680292	0.68822	0.708629	0.723014	0.723014
Eta #3	0.695923	0.721999	0.721977		0.715747	0.724461	0.746346	0.762604	0.762604
DAS Ch. No.	112	113	114	115	116	117	118	119	120
Plateau	0.00184	0.00169	0.00165	0.000543	0.00296	0.00371	0.00153	0.00156	0.0016
1/f Knee #1		0.018						0.018	0.027
1/f Knee #2		0.007						0.007	0.021
Rlr+	12.12	12.12	12.16	12.27	12.32	12.28	12.32	12.44	12.48
Rlr-	12.28	12.28	12.21	12.24	12.28	12.3	12.4	12.32	12.46
DAS Ch. No.	112	113	114	115	116	117		119	120
Vbias	0.016656	0.016656	0.016656	0.016656	0.016656	0.016656		0.016656	0.016656
Sdc	528279000	457674000	632628000	584548000	530247000	419464000	3.90E+08	4.83E+08	4.51E+08
DAS Ch. No.	112	113	114	115	116	117	118	119	120
Vmax	0.0076169	0.0066575	0.0064847	N/M	0.0100378	6.86E-03	0.006415	0.006348	N/M
DAS Ch.	112	113	114	115	116	117	118	119	120
Noise (0.1 Hz)	0.00169	0.00172	0.00166	0.000576	0.00208	0.00384	1.28E-03	0.00163	0.00165
Noise (1.0 Hz)	0.00145	0.00248	0.00139	0.000611	0.00194	0.00384	1.40E-03	0.00145	0.00133
DAS Ch. No.	112	113	114	115	116	117		119	120
	48	49	50	51	52	53		55	56
R300	1.45E+07	9.55E+06	2.55E+07	1.99E+07	1.52E+07	8.47E+06		1.09E+07	1.04E+07
DAS Ch. No.									
C300									
DAS Ch. No.									
Gamma	1	1	1	1	1	1	1	1	1
NEV_optical	21.2	20.0	29.2	7.0	24.4	25.7	18.4	18.6	17.3
Avg. 1/f Knee	0	0.0125	0	0	0	0	0	0.0125	0.024
Avg. Eta	0.660676	0.680706	0.684413	#DIV/0!	0.6774977	0.6839493	0.703712	0.718191	0.718191

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	NA
High Level Sine Vibe Test	None	NA	NA	NA	X, Y, Z at 90 K	SSSD Sec # 3.4	
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	Complete	RmT- 6K	27	P	Min15 (max 20), from RmT-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	9 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)	10 µm	11 µm		Y	125 µm in X/Y and 500 µm in Z	SSSD Sec # 3.1.1	NA
Maximum motion due to 27 thermal cycles	40 µm	24 µm		Y	125 µm in X/Y and 500 µm in Z	SSSD Sec # 3.1.1	NA
Cumulative Maximum motion	63 µm	34 µm		Y	125 µm in X/Y and 500 µm in Z	SSSD Sec # 3.1.1	NA

Cold Continuity Measurements:

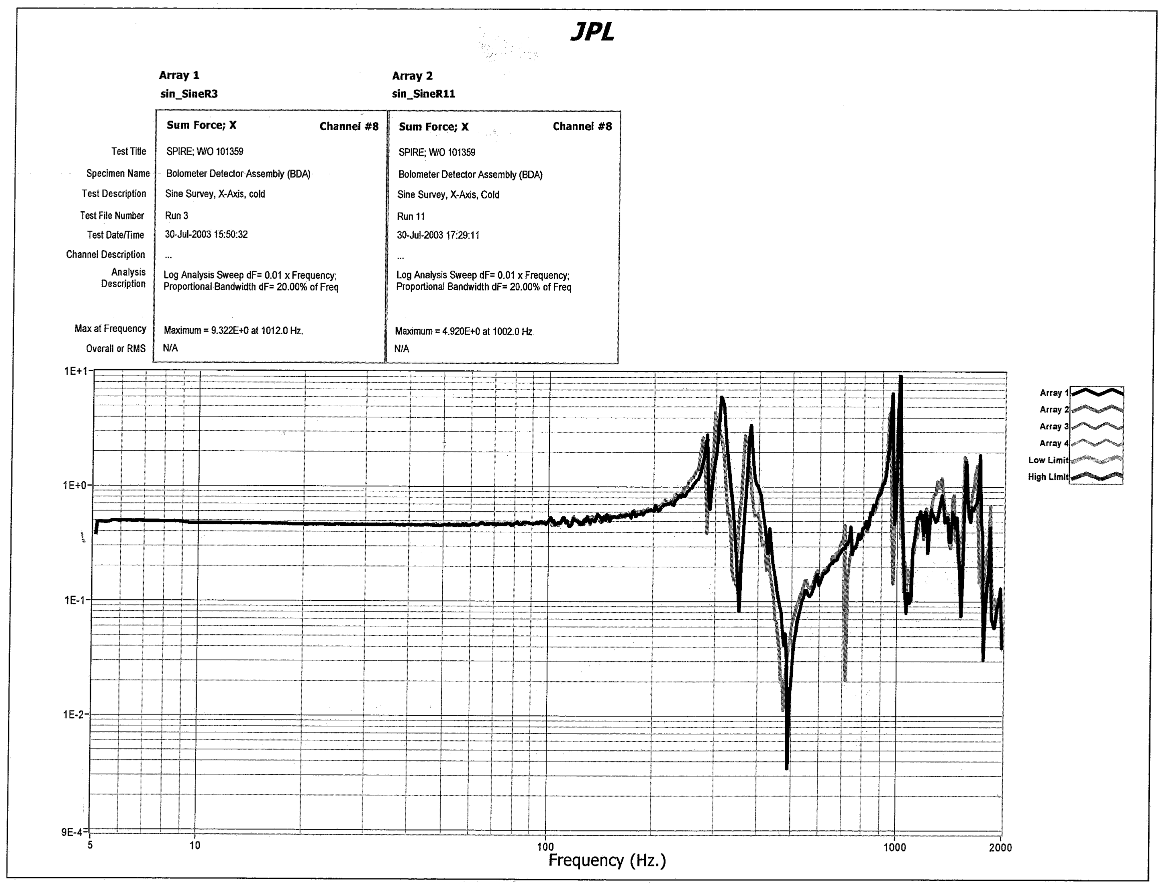
				Pass/Fail	Requirement	Source	Waiver #
Cold Continuity Test (1st Thermal Cycle)	Complete			N/A	None	NA	NA
Cold Continuity Test (2nd Thermal Cycle)	Complete			N/A	None	NA	NA
Cond Continuity Test (27th Thermal Cycle)	Complete			N/A	None	NA	NA

QM BDA Random Vibration Test

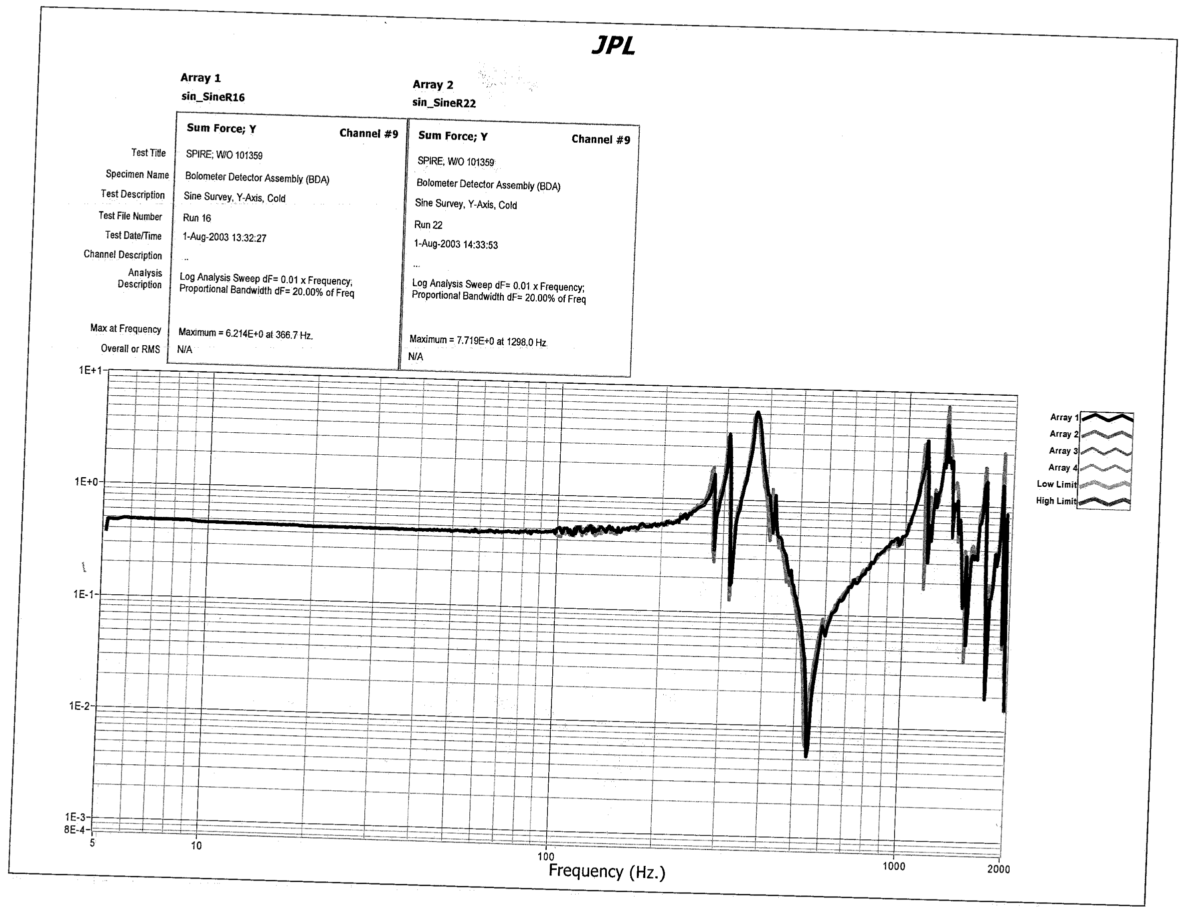
P/N 10209800-8

S/N 007

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



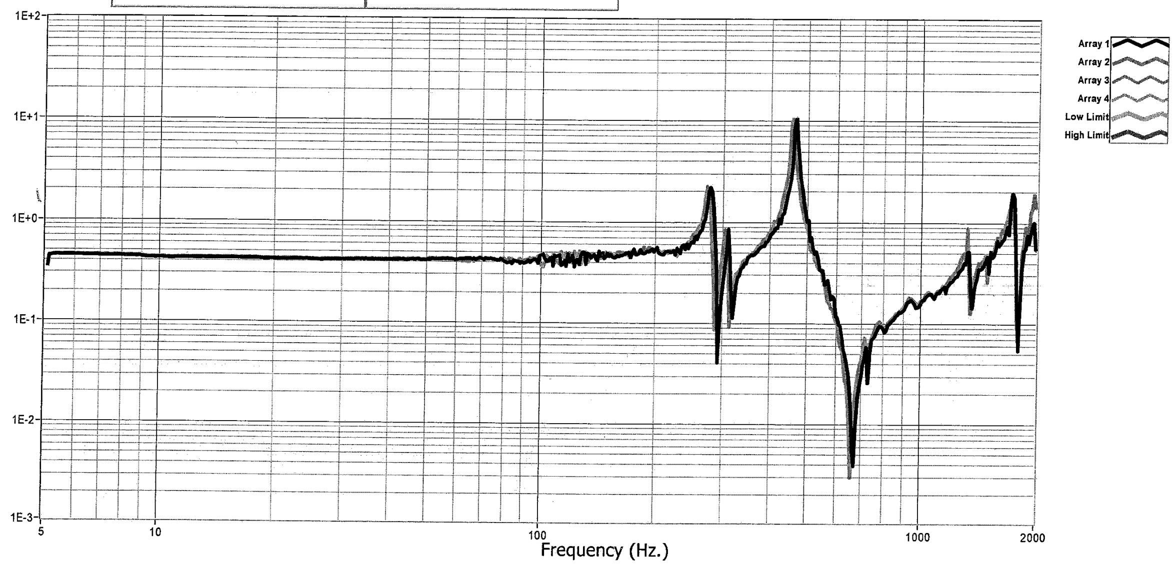
Y-axis Shake, Cold, Sine Surveys (Before and After 0 dB Random Vibe)



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 PFM SLW BDA 10209800-4 S/N 008

Date	Time	AIDS	Power	Mate	Demate	Transport	Notes
5-9-03		239407		JOS	JOS		Kapton cable test (mate, test, demate)
5-15-03		239407		JOS	JOS		Load resistor test "
6-30-03		239407		JOS	JOS		Bolometer test
7-3-03		239407		JOS	JOS		Detector test, after feedhorn install.
9-2-03	3 pm	240503		JOS			} final pre-install test on 300mK assembly
9-2-03	3:24 pm	240503			JOS		(after Thermal strap swap)
							assembly complete
9-5-03	9am	240509				103 → 306-217	for vacuum bake.
9-5 → 9-8-03		240509					vacuum bakeout (includes pump, bake, warmup)
9-8-03	2pm	240509				306-217 → 170	for metrology
9-8-03	~ 3pm	240509				170 Bld → 103	
9-9-03	8:30am	240509		JOS			} post-bakeout electrical test, bolometers and L.R.
9-9-03	10:35	240509			JOS		
9-9-03	~11:am	240509				Bld 103 → 183-215	to env. testing.

Hardware ID BPA SLW S/N 8

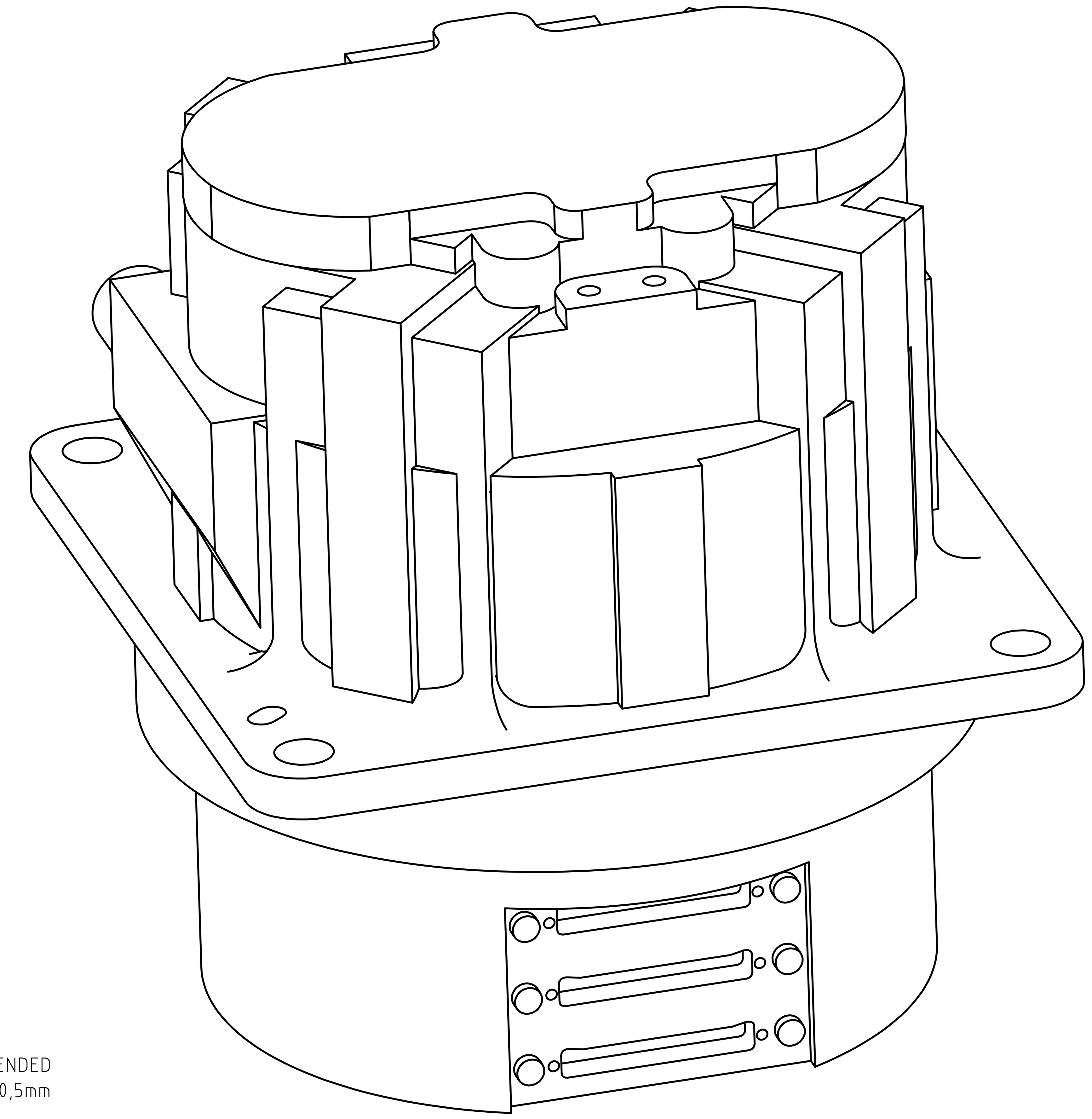
Date	Time	AIDS	Power	Mate	Demate	Transport	Notes
9/9	10 A	240540				X	103 to 183 (spire lab)
9/10	8A	"					
						X	183 to 144 (shake)
9/11	10A	"					
						X	144 to 183
9/11	1 P	"				X	183 to 170 (metrology)
9/11	3 P	"				X	170 to 183
9/16	10 A	240556		X			mate connector in CAF
9/19	11 A	"			X		demate connector from CAF
9/19	11:30 A	"				X	183 to 170
9/19	1:00P					X	170 to 183
9/19	2P	240611		X			mate connector in CAF
9/24		"			X		demate connector from CAF
9/24	9 A	"				X	183 to 170
9/24	11:30A	"					170 to 103
9/11	11 AM	240540					1 T.C. to ~90K
9/17	10 A	240556					1 pump down, 1 T.C. to 5K
9/22	3 PM	240611					1 pump down, 1 T.C. to 5K

Hardware ID SLW BDA SN 008

Date	Time	AIDS	Power	Mate	Demate	Transport	Notes
9/30/03		240628		JOS			Installation in BoDAC test dewar
10/1/03		"					pumpdown
10/2/03		"					cool → 77k → 4k
							Bodac Testing
10/22/03		240957					warmup (Finished this date) /vent
10/23/03		240956					(Installed baffle in Bodac)
10/23/03		"					Pumpdown
10/24/03		"					cooldown
							Bodac Tests
11/1/03		241083					warmup
11/13/03		"					vent
11/14/03		"			JOS		removed from Bodac.
11/14/03						X	to drybox in 103-109D cleanRoom.

REVISIONS

LTR	ZONE	DESCRIPTION	CODE	DWN	CHK	STRUCT	MATL	THRM CONT			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											



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 960939

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
	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, MECHANICAL ID, SPIRE

SIZE A1 | CAGE NO 23835 | 10209721 | REV B

SCALE NONE | UNCLASSIFIED | SHEET 1 OF 7

REV 2/00

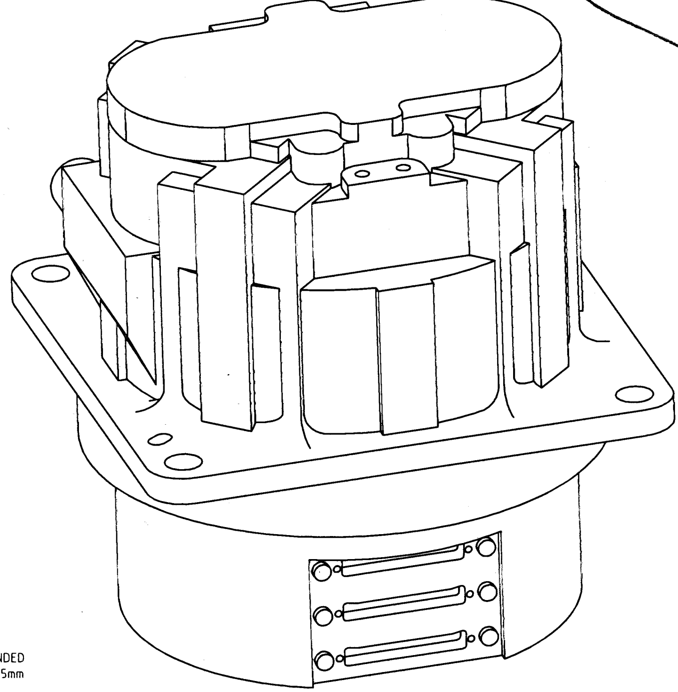
A1 10209721

AutoCAD GENERATED

REVISIONS														
LTR	ZONE	DESCRIPTION	CODE	DWN	CHK	STRUCT	MATL	THRM CONT			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											

I CONFIRM THAT THE CHANGES DETAILED IN THIS ISSUE (B) OF THE JPL BDA INTERFACE DRAWING ARE ACCEPTABLE TO MSSL.

[signature] 21st FEB 2003



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 051M6SN.

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 960939

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
	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, MECHANICAL ID, SPIRE

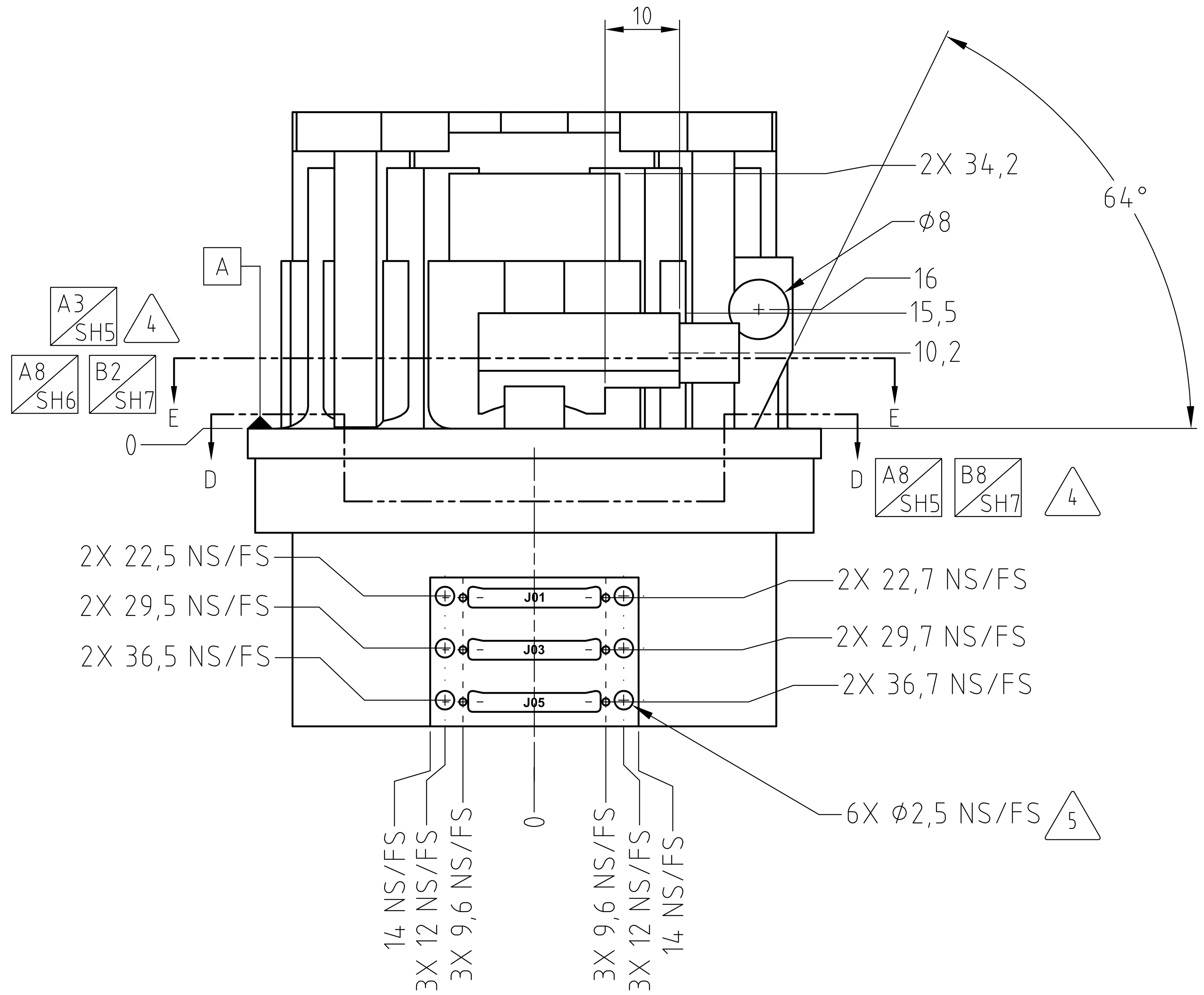
SIZE	CAGE NO		REV
A1	23835	10209721	B

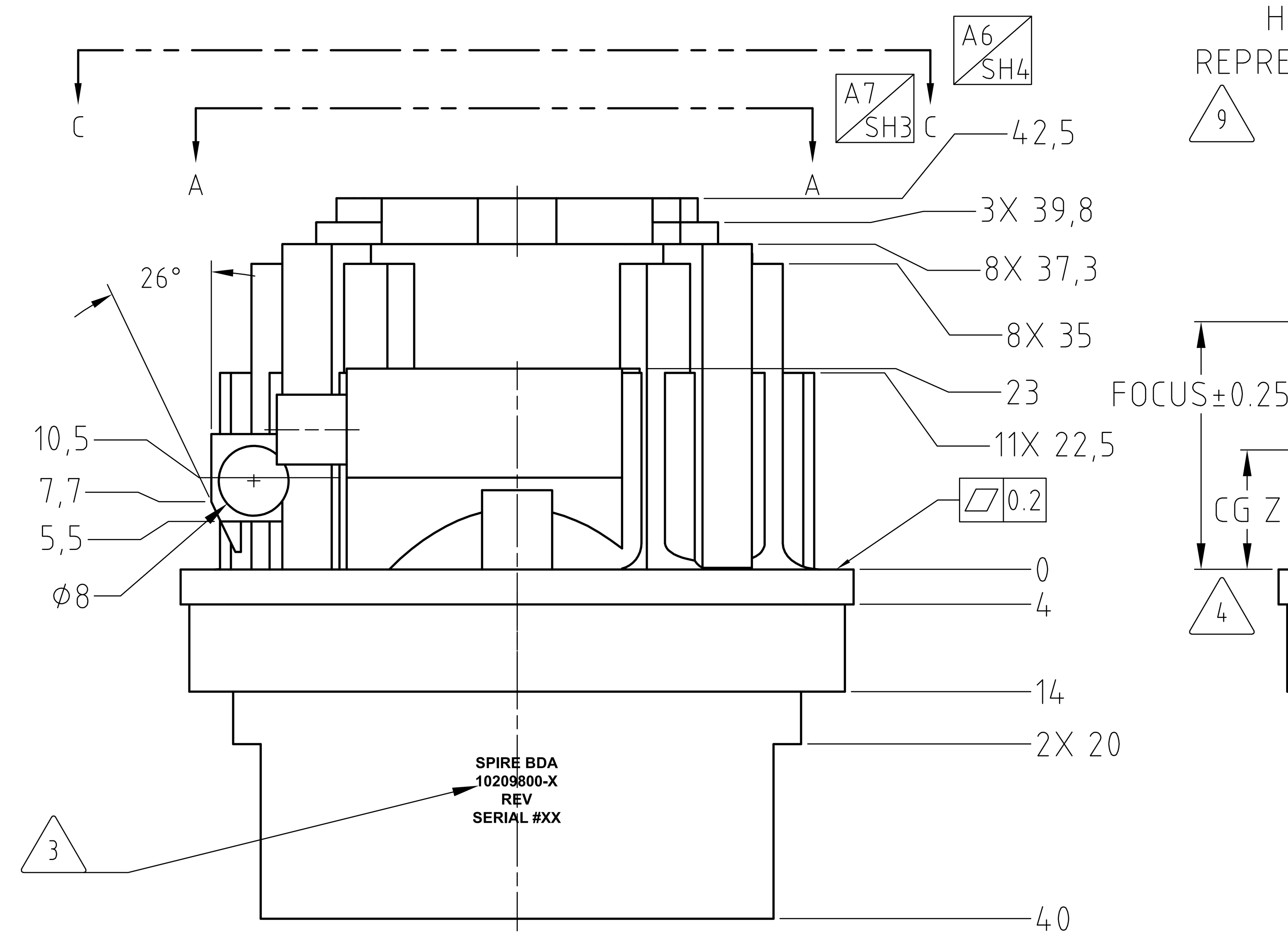
SCALE NONE | UNCLASSIFIED | SHEET 1 OF 7

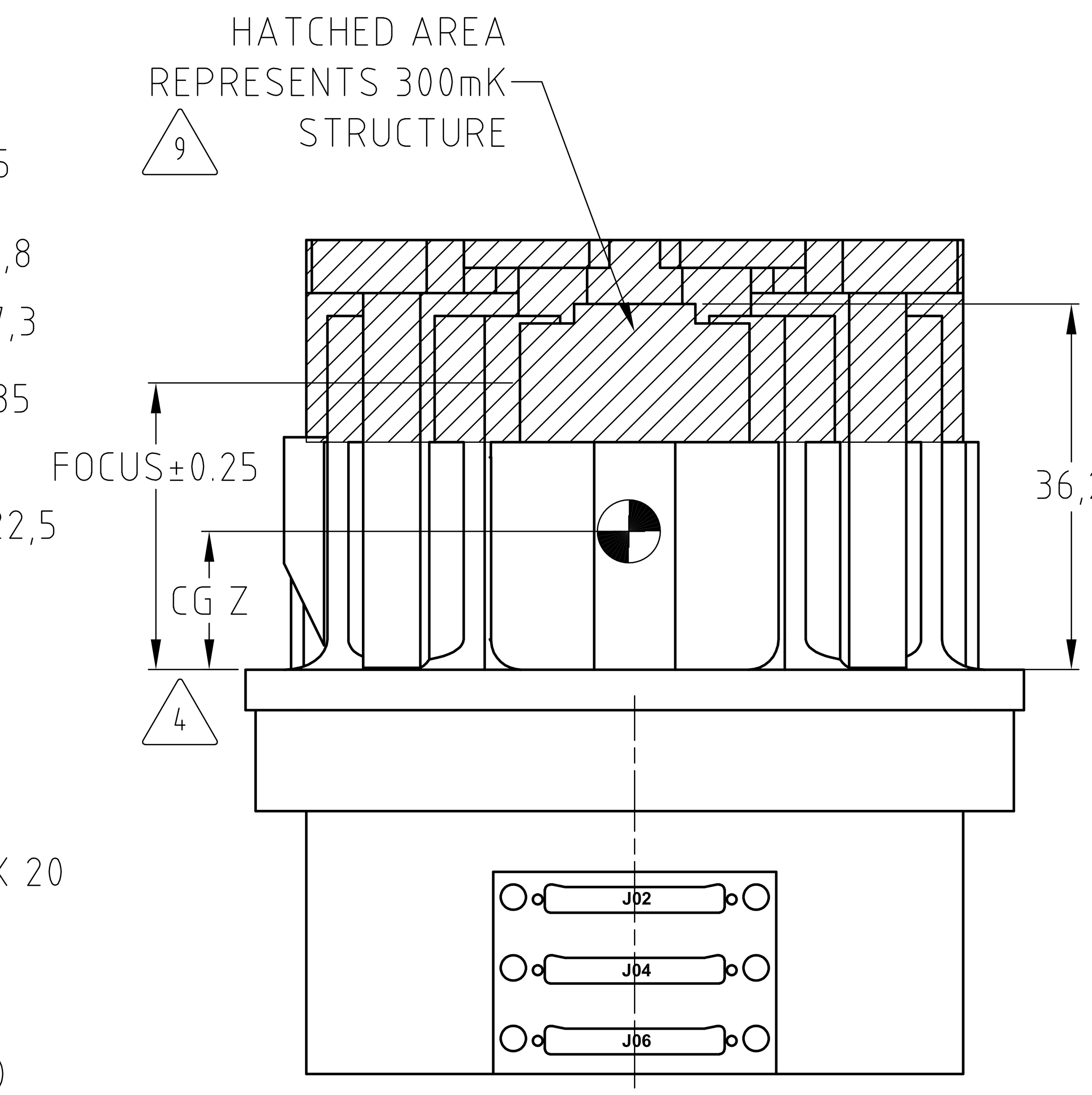
REV 2/00

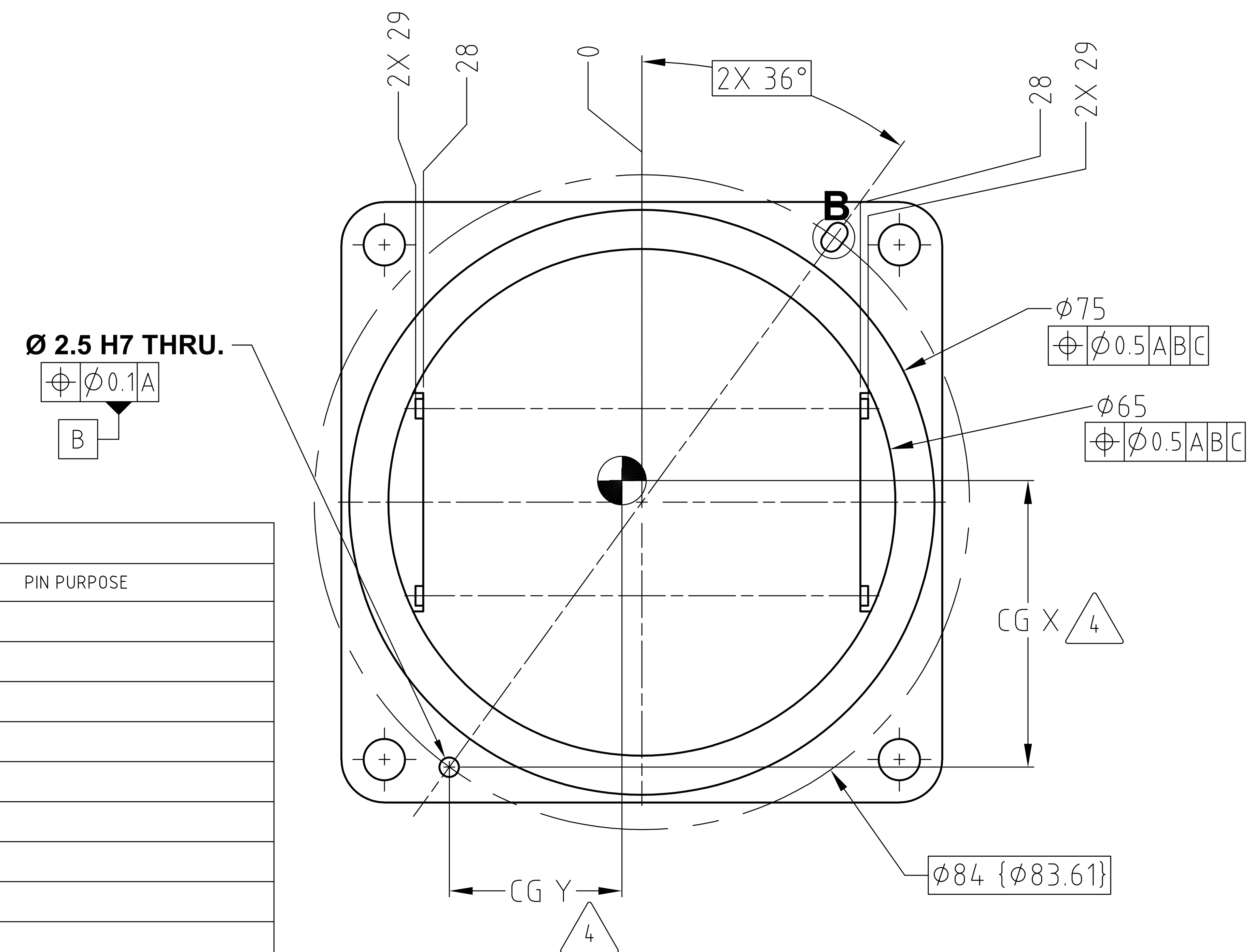
A1 10209721

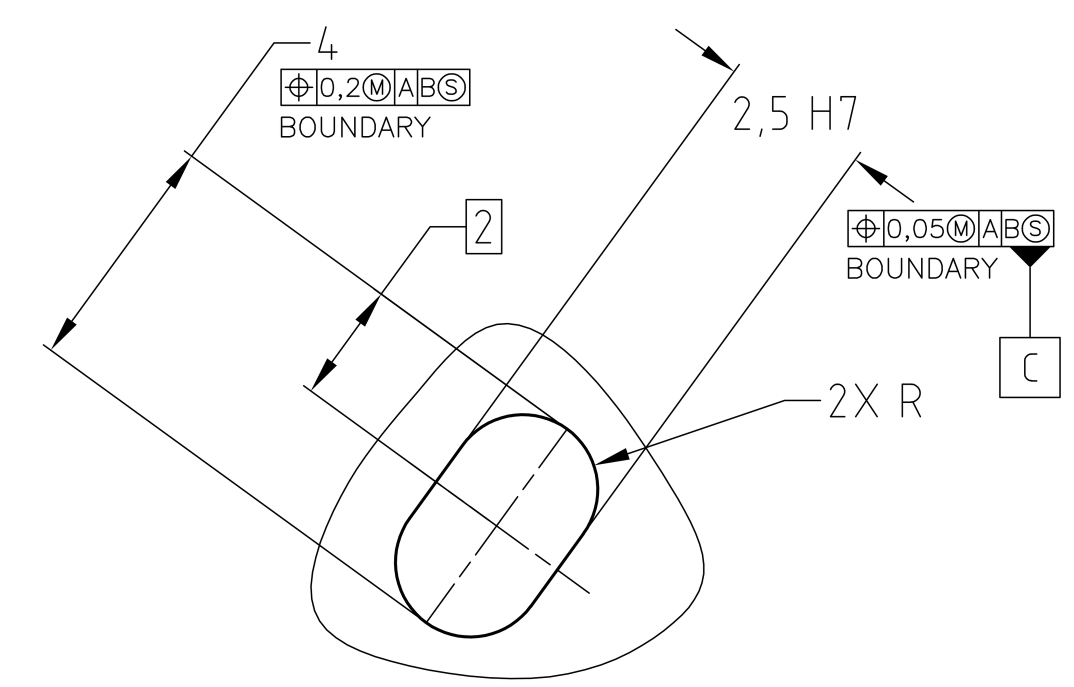
AutoCAD GENERATED









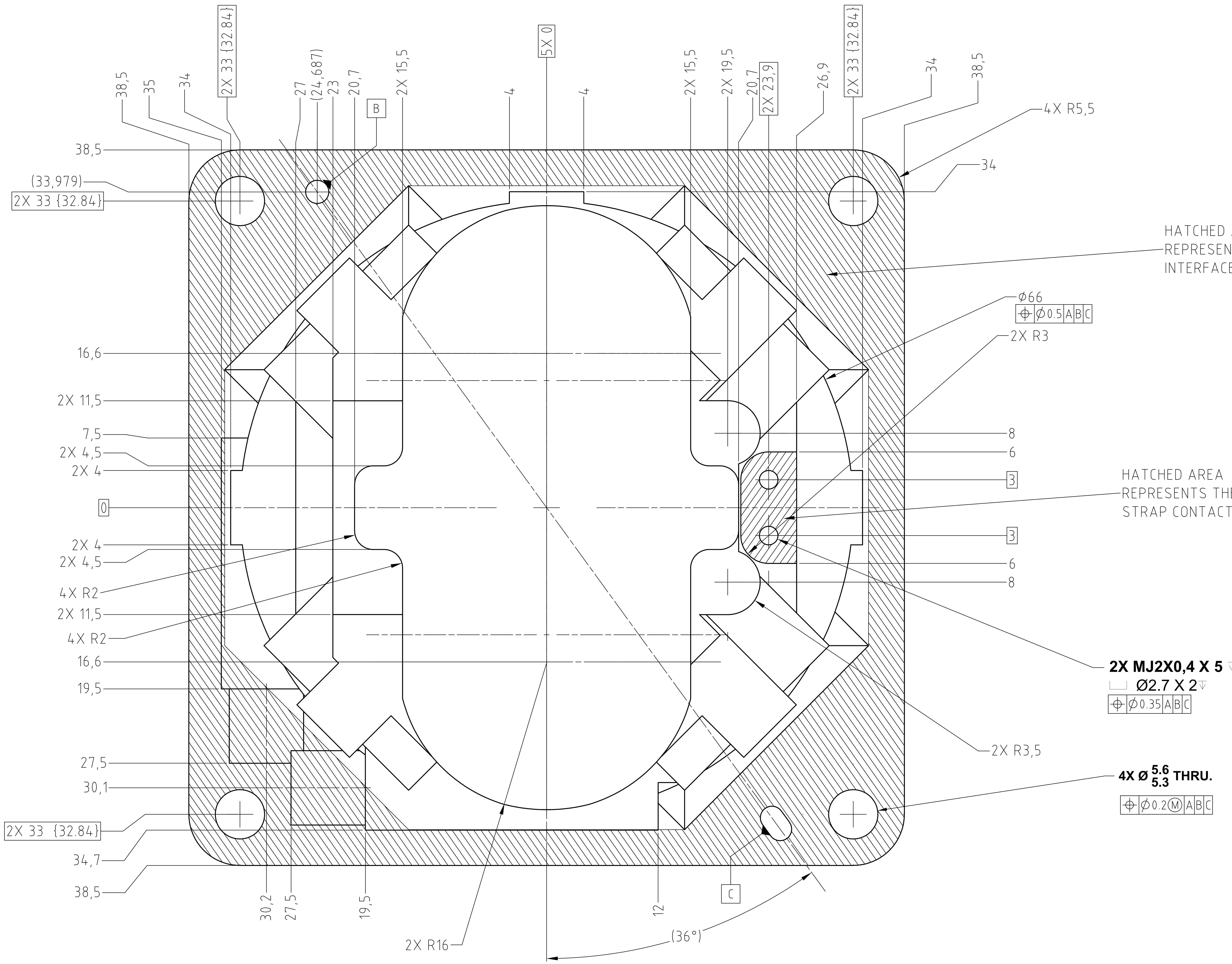


VIEW B
SCALE: 10:1

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

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

10209721 A1



VIEW A-A

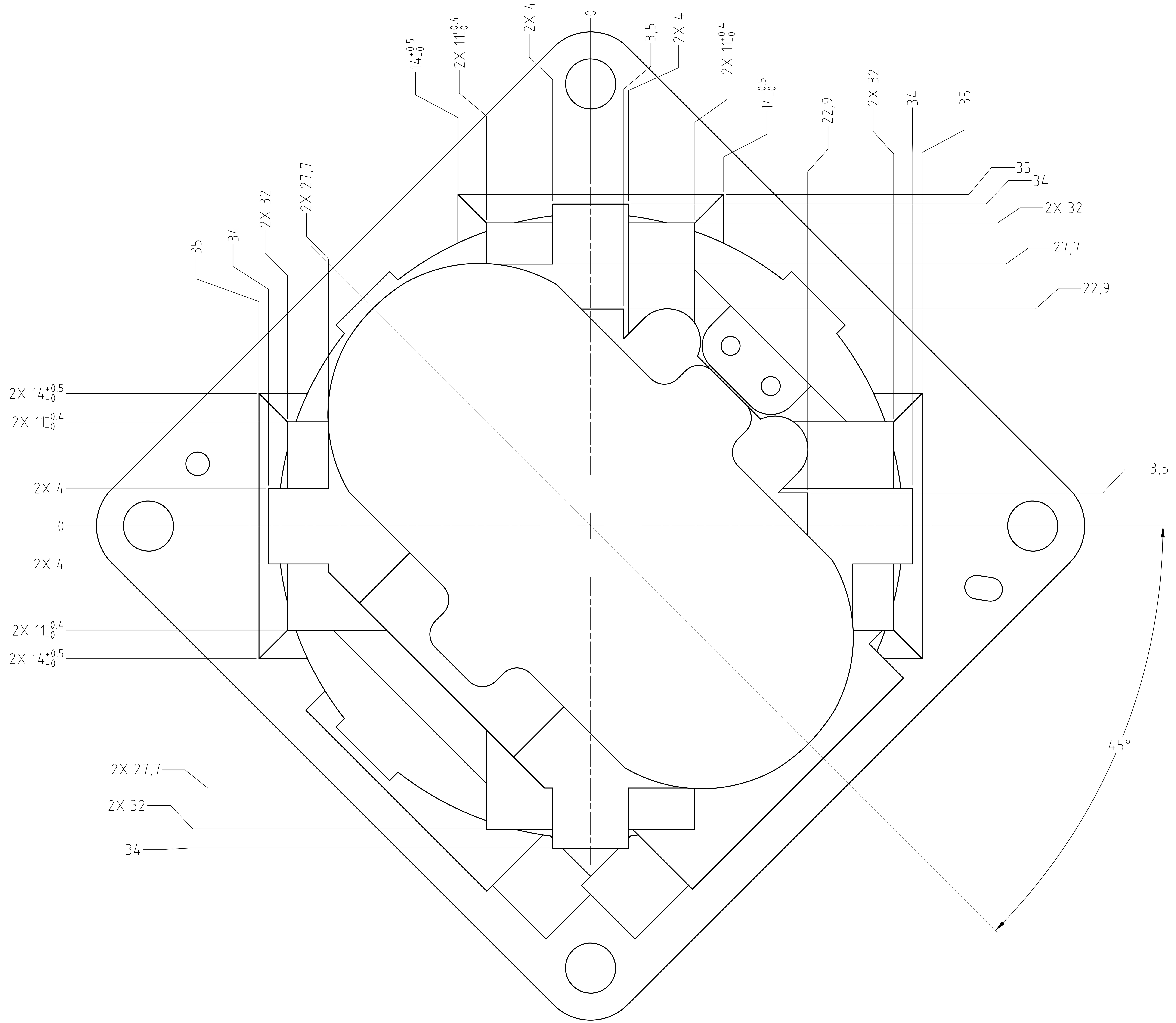
H4/SH2

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

REV 2/00

AutoCAD GENERATED

A1 10209721



VIEW C-C ROTATED 45° CCW H4/SH2

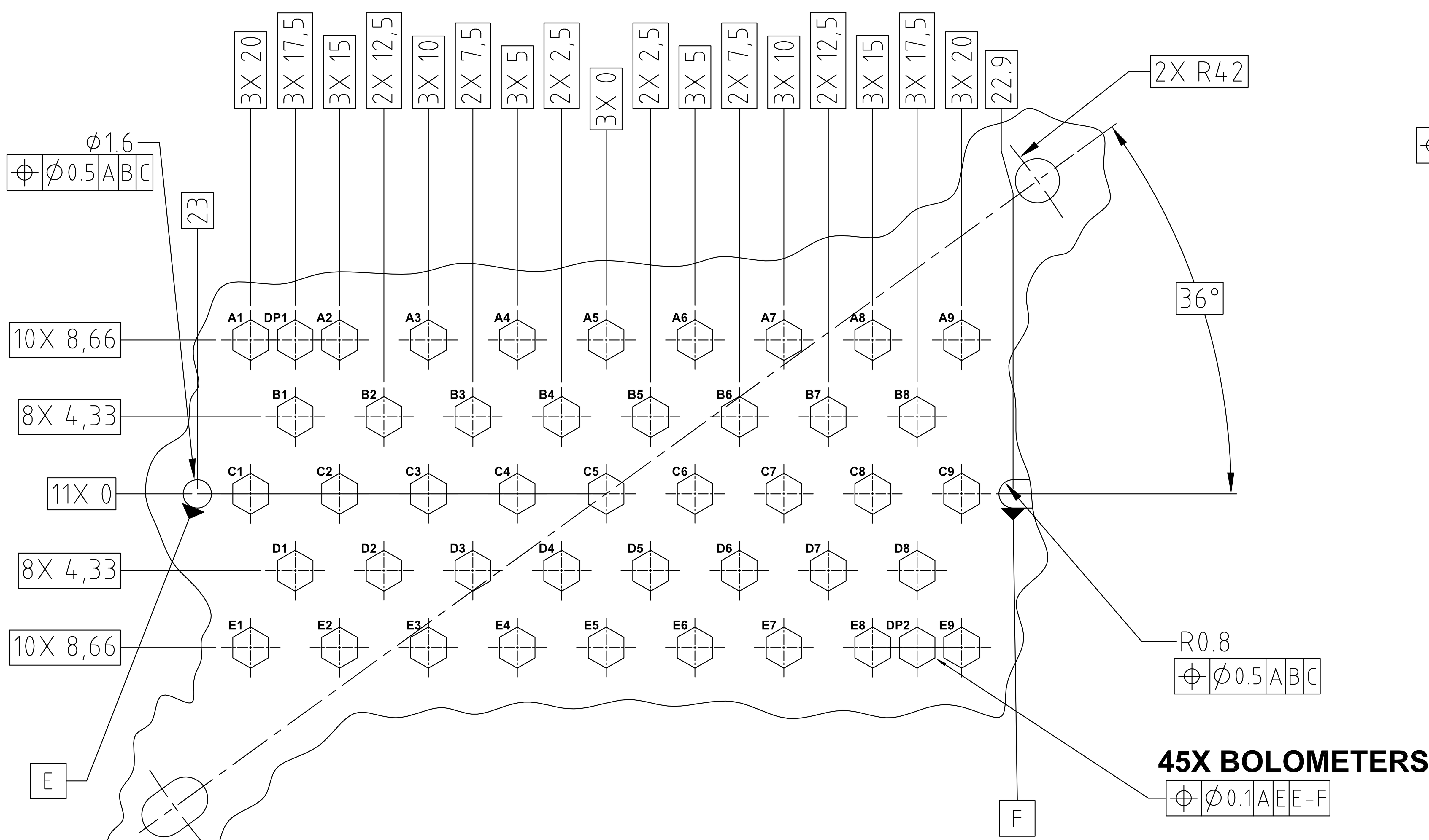
SIZE	CAGE NO		REV
A1	23835	10209721	B
SCALE 2:1	UNCLASSIFIED	SHEET 4 OF 7	REV 2/00

AutoCAD GENERATED

A1 10209721

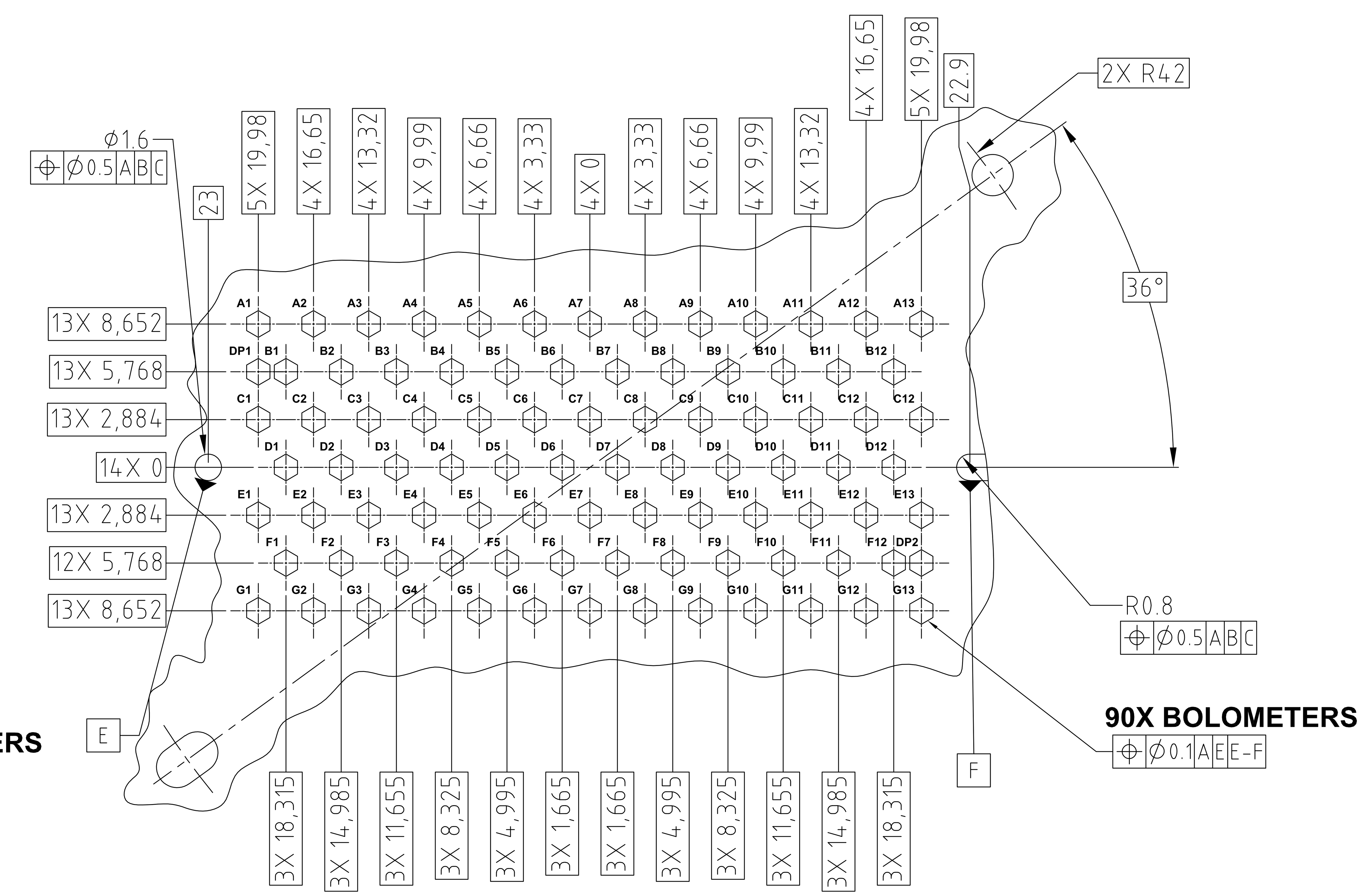
SUBSYSTEM INTERFACE DATA			
UNIT: P/LW			
NUMBER: 10209800−1			
FOCUS: 32.8			
CONNECTOR POSITIONS USED: J05, J06			
MECHANICAL CHARACTERISTICS			
MASS: 632 g			
C.O.G. LOCATION W.R.T. LOCATION HOLE:	X 34.4	Y 24.3	Z 6
MOMENT OF INERTIA:	I_x 772 Kg*mm^2	I_y 1,145 Kg*mm^2	I_z 1,423 Kg*mm^2
MECHANICAL INTERFACE 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: 33.2			
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
PHOTOMETER LONG WAVE
SCALE: 5:1

F9 / SH2



SECTION E−E
PHOTOMETER MEDIUM WAVE
SCALE: 5:1

G12 / SH2

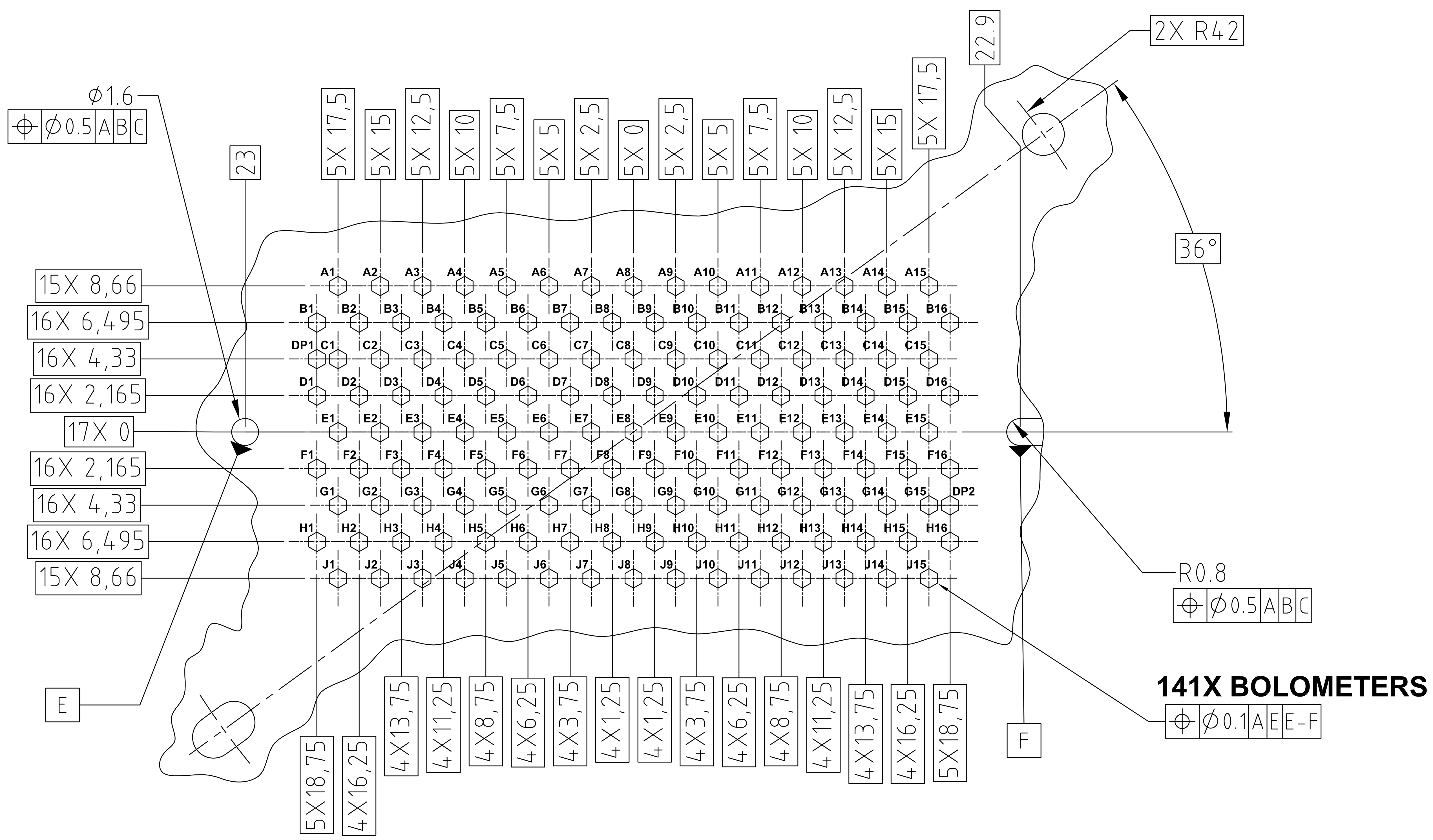
SIZE	CAGE NO		REV
A1	23835	10209721	B
SCALE NOTED	UNCLASSIFIED	SHEET 5 OF 7	

REV 2/00

A1 10209721

AutoCAD GENERATED

SUBSYSTEM INTERFACE DATA			
UNIT: P/SW			
NUMBER: 10209800-3			
FOCUS: 25			
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	B
SCALE NOTED	UNCLASSIFIED	SHEET 6 OF 7	

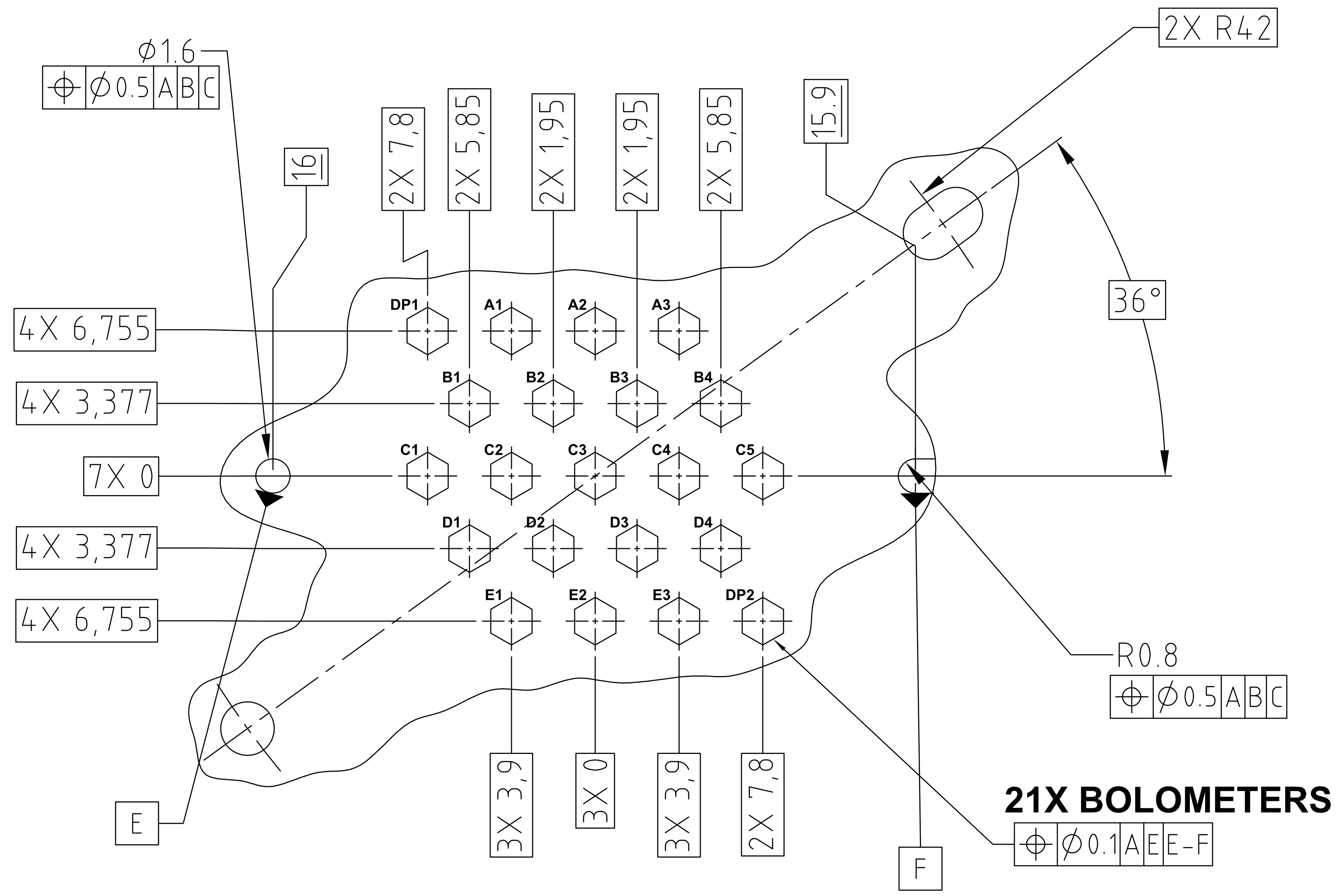
REV 2/00

AutoCAD GENERATED

A1 10209721

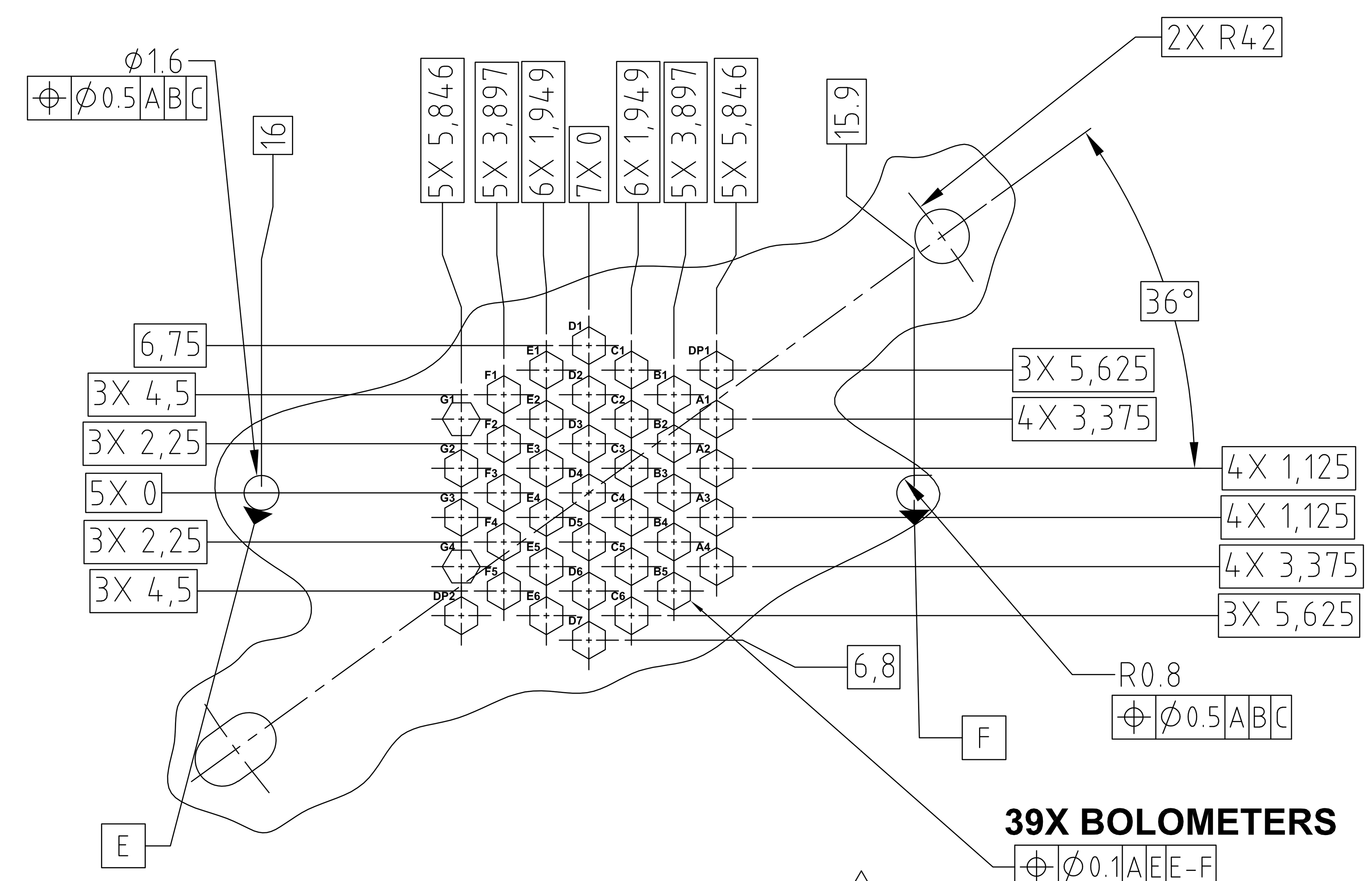
SUBSYSTEM INTERFACE DATA			
UNIT: S/LW			
NUMBER: 10209800–4			
FOCUS: 36.9			
CONNECTOR POSITIONS USED: J05			
MECHANICAL CHARACTERISTICS			
MASS: 550 g			
C.O.G. LOCATION W.R.T. LOCATION HOLE:	X 34.5	Y 24.1	Z 4.4
MOMENT OF INERTIA:	I_x 665 Kg*mm^2	I_y 990 Kg*mm^2	I_z 1,239 Kg*mm^2
MECHANICAL INTERFACE 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

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

REV 2/00

A1 10209721

AutoCAD GENERATED

AIDS:	239773

SPIRE Assembly Array/Backshort Assembly Traveller
Revised by A Turner March 5, 2003

Height measurements of Backshort to Detector to NTD chip

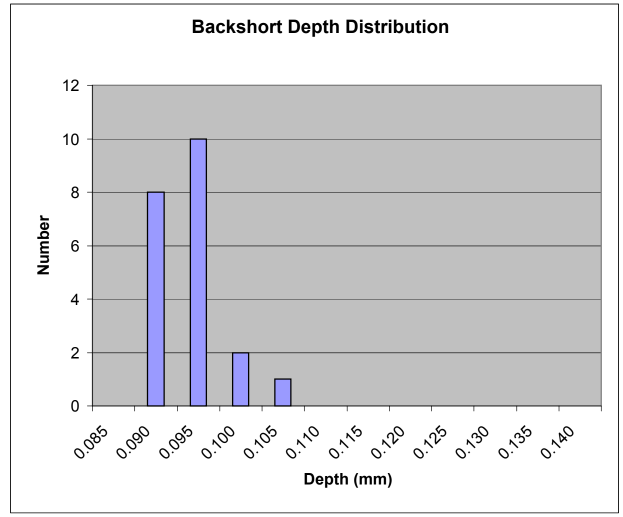
Device #	SLW 1.3
Date	23-May-03
Collected by	A Turner

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

Device Thickness Measurements		
Zero at	Measure at	Meas (mm)
1	1	0.0000
1	2	-1.0115
1	3	-1.0130
1	4	-1.0210
1	5	-0.0025
1	6	-1.0105
1	7	-1.0105
1	8	-1.0045
1	9	-1.0160
1	10	-1.0235
1	11	-1.0090
1	12	-1.0095
1	13	-1.0075
1	14	-1.0100
1	15	-1.0130
1	16	-0.0020
1	17	-1.0085
1	18	-1.0075
1	19	-1.0060
1	20	-0.0030

Targets	mm	tol (mm)
Stack thick	0.9130	0.0345
NTD chip	0.0250	0.0100
BS dist	0.113	0.011

Pillar Height Measurements						
Zero at	Pixel#	a (mm)	b(mm)	c(mm)	NTD chip (mm)	BS dist (mm)
1	DK1	-0.9100	-1.0165	-1.0380	0.0215	0.1065
1	A1	-0.9105	-1.0100	-1.0475	0.0375	0.0995
1	A2	-0.9110	-1.0135	-1.0450	0.0315	0.1025
1	A3	-0.9120	-1.0155	-1.0435	0.0280	0.1035
1	T1		-1.0110	-1.0295	0.0185	
1	B1	-0.9110	-1.0105	-1.0410	0.0305	0.0995
1	B2	-0.9120	-1.0080	-1.0440	0.0360	0.0960
1	B3	-0.9130	-1.0080	-1.0335	0.0255	0.0950
1	B4	-0.9130	-1.0125	-1.0475	0.0350	0.0995
1	T2		-1.0160	-1.0540	0.0380	
1	C1	-0.9110	-1.0110	-1.0495	0.0385	0.1000
1	C2	-0.9125	-1.0095	-1.0450	0.0355	0.0970
1	C3	-0.9130	-1.0070	-1.0290	0.0220	0.0940
1	C4	-0.9140	-1.0085	-1.0405	0.0320	0.0945
1	C5	-0.9150	-1.0125	-1.0455	0.0330	0.0975
1	D1	-0.9130	-1.0100	-1.0460	0.0360	0.0970
1	D2	-0.9130	-1.0095	-1.0310	0.0215	0.0965
1	D3	-0.9150	-1.0085	-1.0470	0.0385	0.0935
1	D4	-0.9150	-1.0090	-1.0255	0.0165	0.0940
1	E1	-0.9135	-1.0095	-1.0440	0.0345	0.0960
1	E2	-0.9150	-1.0085	-1.0325	0.0240	0.0935
1	E3	-0.9155	-1.0080	-1.0435	0.0355	0.0925
1	DK2	-0.9160	-1.0075	-1.0420	0.0345	0.0915



Stack Thickness (mm)	
Average	1.0113
max	1.0235
min	1.0045
p-p	0.0190
Backshort Thickness(mm)	
Average	0.9130
max	0.9100
min	0.9160
p-p	0.0060
Backshort Distance (mm)	
Average	0.0971
max	0.1065
min	0.0915
p-p	0.0150
NTD Chip Thickness(mm)	
Average	0.0308
max	0.0385
min	0.0165
p-p	0.0220

SLW Array-Backshort Assembly Map (Backshort Distance in mm)

Device	**SLW 1.3**
Date	**SLW BS 1.3**
Proc#	**37764**
By	**A Turner**
AIDS	**239773**

	DK1 0.1065		A1 0.0995		A2 0.1025		A3 0.1035			
T1		B1 0.0995		B2 0.096		B3 0.095		B4 0.0995		T2
	C1 0.1		C2 0.097		C3 0.094		C4 0.0945		C5 0.0975	
		D1 0.097		D2 0.0965		D3 0.0935		D4 0.094		
			E1 0.096		E2 0.0935		E3 0.0925		DK2 0.0915	

BS Range (mm)	
Low	0.102
High	0.124

BS Dist to web (mm)	
Average	0.0971
Max	0.1065
Min	0.0915
p-p	0.0150

Stack Thickness(mm)	
Average	1.0113
Max	1.0235
Min	1.0045
p-p	0.0190

BS Thickness (mm)	
Average	0.9130
Max	0.9100
Min	0.9160
p-p	0.0060

Alignment Measurement Summary
for
PFM SLW BDA
10209800-4 SN008

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) = (24.637, -33.703, 36.827)   (all distances in mm)

Nominal x,y position:

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

x-y shift from nominal:

(dx,dy) = (-0.050, 0.276)

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

Measured z dimension:

34.08 mm

Z shift from nominal

-0.115 mm

Rotation:

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

0.23 clockwise

Normal vector to feedhorn entrance plane:

(-0.00313, 0.00488, 0.99998)

which is 0.33 degrees from the z direction.

COLD ALIGNMENT MEASUREMENTS:

(BDA cooled from RmT to approximately 6-7 K)

Shifts on Cooling:

XY Shift of center of 300 mK stage on cooling:

(dx, dy) = (-0.20, 0.10)

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

0.08 degrees CCW

The z shift of the suspended portion of the BDA on cooling was -0.07 mm

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 relative to alignment pin hole:

(x, y) = (24.44, -33.60)

Rotation of feedhorn relative to xy axes (top view):

0.15 degrees clockwise

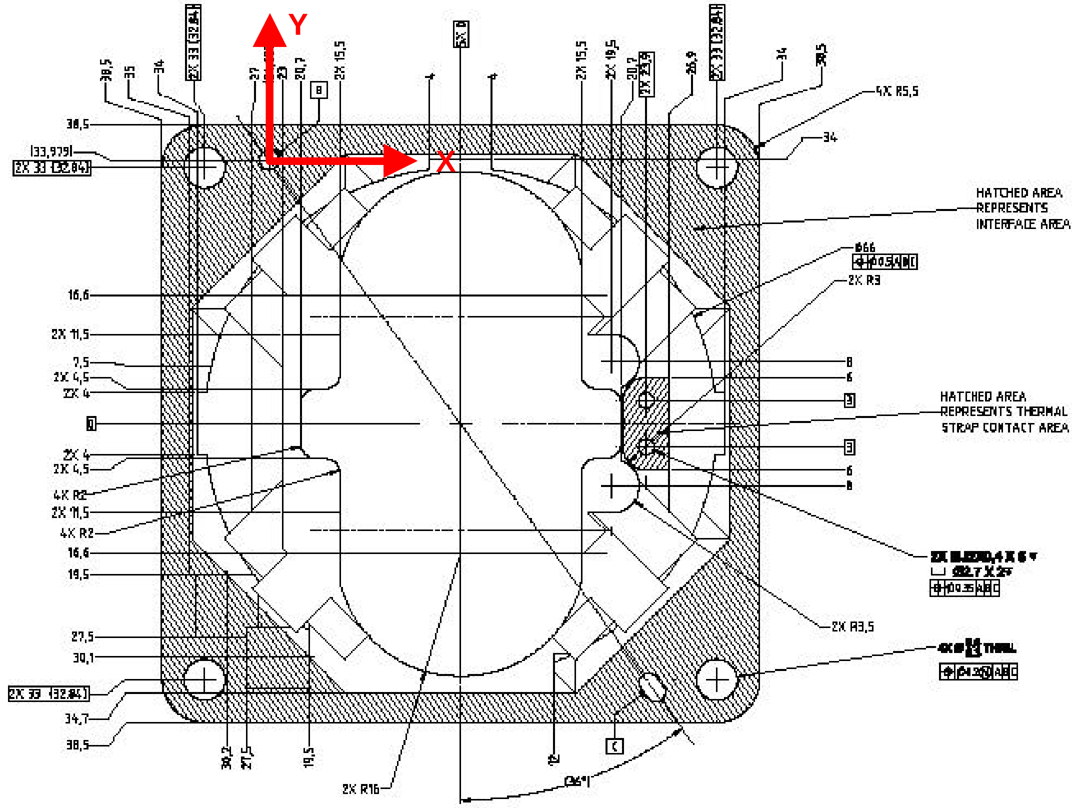


Figure 1 (excerpt from ICD dwg 10209721, with coordinate axes shown)

bottom (waveguide face) view of SLW feedhorn 10209843 X11 SN1
Inspection Data for true-position of waveguides with respect to alignment hole datum

thermal strap side

A3		A2		A1	
12.1236	6.7701	16.0302	6.7722	19.9409	6.7831
12.1351	6.7746	16.0464	6.7746	19.9577	6.7746
-0.0115	-0.0045	-0.0162	-0.0024	-0.0168	0.0085
0.0247	0.0400	0.0328	0.0400	0.0377	0.0400

key:

Pixel ID	
x meas	y meas
x nom	y nom
x err	y err
t.p. error	tp max err

(red) =out of spec

B4		B3		B2		B1	
10.1774	3.3833	14.0747	3.3821	17.9961	3.3859	21.8904	3.3849
10.1794	3.3873	14.0907	3.3873	18.0021	3.3873	21.9134	3.3873
-0.0020	-0.0040	-0.0160	-0.0052	-0.0060	-0.0014	-0.0230	-0.0024
0.0089	0.0400	0.0336	0.0400	0.0123	0.0400	0.0462	0.0400

hole (in feedhorn)
(hole is coord. origin)

C5		C4		C3		C2		C1	
8.2309	0.0049	12.1454	0.0057	16.0442	0.0043	19.9473	0.0078	23.8537	0.0043
8.2238	0.0000	12.1351	0.0000	16.0464	0.0000	19.9577	0.0000	23.8690	0.0000
0.0071	0.0049	0.0103	0.0057	-0.0022	0.0043	-0.0104	0.0078	-0.0153	0.0043
0.0173	0.0400	0.0235	0.0400	0.0097	0.0400	0.0260	0.0400	0.0318	0.0400

slot (in feedhorn)

D4		D3		D2		D1	
10.1797	-3.3984	14.0837	-3.3836	17.9947	-3.3813	21.9046	-3.3724
10.1794	-3.3873	14.0907	-3.3873	18.0021	-3.3873	21.9134	-3.3873
0.0003	-0.0111	-0.0070	0.0037	-0.0074	0.0060	-0.0088	0.0149
0.0222	0.0400	0.0158	0.0400	0.0191	0.0400	0.0346	0.0400

E3		E2		E1	
12.1446	-6.7773	16.0522	-6.7589	19.9482	-6.7630
12.1351	-6.7746	16.0464	-6.7746	19.9577	-6.7746
0.0095	-0.0027	0.0058	0.0157	-0.0095	0.0116
0.0198	0.0400	0.0335	0.0400	0.0300	0.0400

NOTE:
signs on y positions for
holes on x-axis are unknown
(were not recorded by vendor)

TABLE # 16818-1

JPL FEED HORN S/LW BDA 10209843

Dimensions measured on electroform mandrels. Mapping of mandrel # to final location in part is unknown. Dims in inches.

	DIST FROM DATUM +/- .0005	RESULT	DIA AT .150 DIST FROM DATUM +/- .0001 (Diameter at Feedhorn entrance)	RESULT	DIA AT TRANS ENTRANCE 1.9707 FROM DAT. +/-.0001 (Dia. at waveguide exit face location)	RESULT	DIA AT HORN ENTRANCE 1.93428 FROM DATUM +/- .0001 (Dia. at waveguide/feedhorn transition)	RESULT	DIA AT MID HORN - FROM DAT. DIST 1.04214	RESULT	RECORD DIMENSION .1000 FROM DAT. +/-.0005	RESULT	
#1	1.9907	1.9906	0.1495	.1496	0.01557	.0155	0.01557	.0155	0.08253	.0823	0.1000	.1003	
#2	1.9907	1.9903	0.1495	.1494	0.01557	.0156	0.01557	.0156	0.08253	.0823	0.1000	.1000	
#3	1.9907	1.9905	0.1495	.1494	0.01557	.0156	0.01557	.0155	0.08253	.0822	0.1000	.0999	
#4	1.9907	1.9908	0.1495	.1494	0.01557	.0156	0.01557	.0155	0.08253	.0825	0.1000	.0998	
#5	1.9907	1.9909	0.1495	.1495	0.01557	.0155	0.01557	.0156	0.08253	.0825	0.1000	.1002	NCR 12
~~#6~~	~~1.9907~~	~~1.9908~~	~~0.1495~~	~~.1499~~	~~0.01557~~	~~.0156~~	~~0.01557~~	~~.0156~~	~~0.08253~~	~~.0826~~	~~0.1000~~	~~.1001~~	SCRAP
#7	1.9907	1.9908	0.1495	.1496	0.01557	.0155	0.01557	.0155	0.08253	.0826	0.1000	.1000	
~~#8~~	~~1.9907~~	~~1.9906~~	~~0.1495~~	~~.1500~~	~~0.01557~~	~~.0155~~	~~0.01557~~	~~[illegible]~~	~~0.08253~~	~~.0826~~	~~0.1000~~	~~.0998~~	SCRAP
~~#9~~	~~1.9907~~	~~1.9908~~	~~0.1495~~	~~.1501~~	~~0.01557~~	~~.0156~~	~~0.01557~~	~~.0156~~	~~0.08253~~	~~.0826~~	~~0.1000~~	~~.1002~~	SCRAP
~~#10~~	~~1.9907~~	~~1.9907~~	~~0.1495~~	~~.1499~~	~~0.01557~~	~~.0156~~	~~0.01557~~	~~.0156~~	~~0.08253~~	~~.0826~~	~~0.1000~~	~~.1002~~	SCRAP
~~#11~~	~~1.9907~~	~~1.9908~~	~~0.1495~~	~~.1500~~	~~0.01557~~	~~.0156~~	~~0.01557~~	~~.0156~~	~~0.08253~~	~~.0826~~	~~0.1000~~	~~.1000~~	SCRAP
~~#12~~	~~1.9907~~	~~1.9905~~	~~0.1495~~	~~.1500~~	~~0.01557~~	~~.0156~~	~~0.01557~~	~~.0156~~	~~0.08253~~	~~.0826~~	~~0.1000~~	~~.1002~~	SCRAP
#13	1.9907	1.9908	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0825	0.1000	.1001	
#14	1.9907	1.9910	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0825	0.1000	.1000	
#15	1.9907	1.9908	0.1495	.1495	0.01557	.0156	0.01557	.0156	0.08253	.0824	0.1000	.1000	
#16	1.9907	1.9908	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0825	0.1000	.1000	
#17	1.9907	1.9908	0.1495	.1495	0.01557	.0155	0.01557	.0156	0.08253	.0825	0.1000	.1000	
~~#18~~	~~1.9907~~	~~1.9908~~	~~0.1495~~	~~.1499~~	~~0.01557~~	~~.0156~~	~~0.01557~~	~~.0156~~	~~0.08253~~	~~.0825~~	~~0.1000~~	~~.0999~~	SCRAP
#19	1.9907	1.9907	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0825	0.1000	.1000	
~~#20~~	~~1.9907~~	~~1.9908~~	~~0.1495~~	~~.1499~~	~~0.01557~~	~~.0156~~	~~0.01557~~	~~.0156~~	~~0.08253~~	~~.0825~~	~~0.1000~~	~~.1000~~	SCRAP
#21	1.9907	1.9906	0.1495	.1495	0.01557	.0155	0.01557	.0156	0.08253	.0825	0.1000	.1003	
#22	1.9907	1.9908	0.1495	.1496	0.01557	.0155	0.01557	.0155	0.08253	.0825	0.1000	.0999	
#23	1.9907	1.9906	0.1495	.1495	0.01557	.0155	0.01557	.0156	0.08253	.0825	0.1000	.0999	
#24	1.9907	1.9909	0.1495	.1496	0.01557	.0155	0.01557	.0156	0.08253	.0825	0.1000	.0998	
#25	1.9907	1.9906	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0826	0.1000	.1001	
#26	1.9907	1.9905	0.1495	.1496	0.01557	.0156	0.01557	.0155	0.08253	.0825	0.1000	.0998	
~~#27~~	~~1.9907~~	~~1.9909~~	~~0.1495~~	~~.1499~~	~~0.01557~~	~~.0156~~	~~0.01557~~	~~.0156~~	~~0.08253~~	~~.0826~~	~~0.1000~~	~~.1003~~	SCRAP
#28	1.9907	1.9907	0.1495	.1496	0.01557	.0155	0.01557	.0156	0.08253	.0825	0.1000	.0999	
~~#29~~	~~1.9907~~	~~1.9906~~	~~0.1495~~	~~.1499~~	~~0.01557~~	~~.0156~~	~~0.01557~~	~~.0155~~	~~0.08253~~	~~.0825~~	~~0.1000~~	~~.1002~~	SCRAP
#30	1.9907	1.9908	0.1495	.1494	0.01557	.0156	0.01557	.0156	0.08253	.0825	0.1000	.1001	
#31	1.9907	1.9907	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0826	0.1000	.1002	
#32	1.9907	1.9909	0.1495	.1495	0.01557	.0155	0.01557	.0156	0.08253	.0825	0.1000	.1000	
#33	1.9907	1.9908	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0826	0.1000	.1002	
~~#34~~	~~1.9907~~	~~1.9908~~	~~0.1495~~	~~.1499~~	~~0.01557~~	~~.0156~~	~~0.01557~~	~~.0156~~	~~0.08253~~	~~.0825~~	~~0.1000~~	~~.1003~~	SCRAP
#35	1.9907	1.9905	0.1495	.1495	0.01557	.0156	0.01557	.0156	0.08253	.0825	0.1000	.1003	
#36	1.9907	1.9908	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0826	0.1000	.1000	
#37	1.9907	1.9907	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0825	0.1000	.1001	
#38	1.9907	1.9907	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0824	0.1000	.1001	
#39	1.9907	1.9910	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0824	0.1000	.1002	
#40	1.9907	1.9905	0.1495	.1495	0.01557	.0155	0.01557	.0156	0.08253	.0824	0.1000	.1001	
#41	1.9907	1.9907	0.1495	.1495	0.01557	.0155	0.01557	.0156	0.08253	.0824	0.1000	.1000	
#42	1.9907	1.9911	0.1495	.1496	0.01557	.0156	0.01557	.0155	0.08253	.0824	0.1000	.1001	
#43	1.9907	1.9904	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0825	0.1000	.1003	
#44	1.9907	1.9909	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0825	0.1000	.0999	
#45	1.9907	1.9908	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0825	0.1000	.1000	
#46	1.9907	1.9910	0.1495	.1496	0.01557	.0155	0.01557	.0156	0.08253	.0823	0.1000	.0999	
#47	1.9907	1.9910	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0824	0.1000	.1001	
#48	1.9907	1.9907	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0824	0.1000	.0999	
~~#49~~	~~1.9907~~	~~1.9905~~	~~0.1495~~	~~.1500~~	~~0.01557~~	~~.0156~~	~~0.01557~~	~~.0156~~	~~0.08253~~	~~.0825~~	~~0.1000~~	~~.1003~~	SCRAP
#50	1.9907	1.9906	0.1495	.1495	0.01557	.0156	0.01557	.0156	0.08253	.0824	0.1000	.1000	
#51	1.9907	1.9905	0.1495	.1496	0.01557	.0155	0.01557	.0156	0.08253	.0825	0.1000	.0998	
#52	1.9907	1.9905	0.1495	.1496	0.01557	.0156	0.01557	.0156	0.08253	.0825	0.1000	.0997	

FOR SLW FILTER STACK EIDP

SEE SEPARATE FILE:

300mK_spec_filt_PFM_HSO_CDF_EIDP_055.pdf