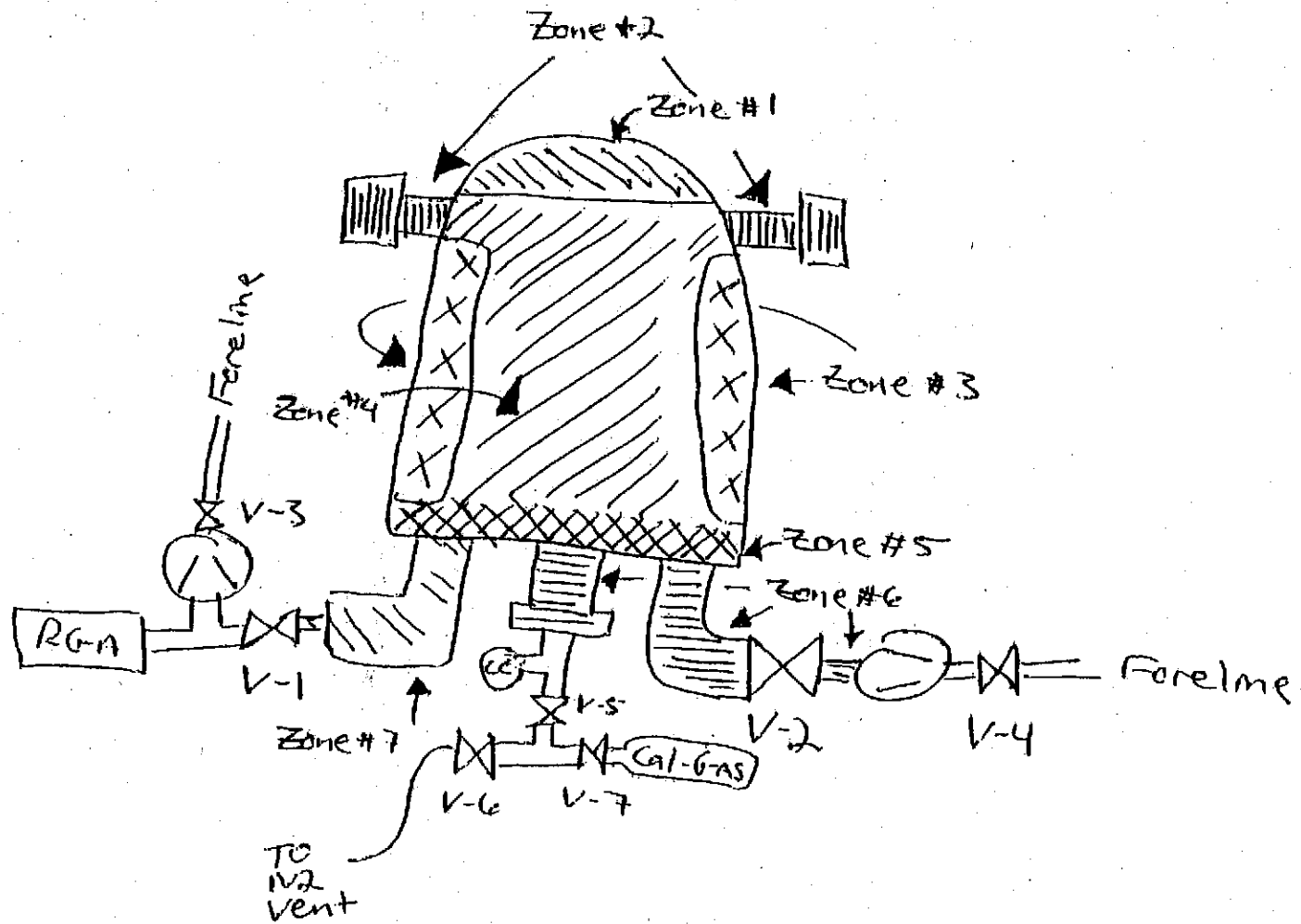# Summary of LHO Vacuum Bake Oven A RGA Data Generation

The individual parts which comprise a "load" are cleaned as per LIGO-E960022 or as allowed by waiver(s) and loaded into the bake oven. The oven is then pumped down through the main pump "arm" (through V-2, RGA arm is valved off at this point). A heating profile is programmed and baking of the system begins. A typical "heating profile" consists of ramping up to material type soak temperature, soaking for approximately 48 hours, ramping down to approximately 70C, soaking and then ramping down to near room temperature. While soaking at 70C, an RGA background scan is taken. V-1 is then opened and V-2 closed. Enough time is allowed for the system to come into pressure equilibrium and then an elevated load temperature RGA scan is taken. V-1 is then closed and V-2 opened. Following this elevated temperature scan, the load is ramped down to near room temperature and the baking portion of the process is complete. Throughout the baking, temperature data is taken to verify the actual temperatures in the various "heat zones" of the bake oven system.

Once at near room temperature, another RGA background (V-1 closed) scan is taken. Next, V-1 and the cal-gas are opened and V-2 closed. After a 30 minute pressure equilibration time, a "calibration" scan is taken. The calculated pressure of Argon (constituent of the "mixed" calibration gas) is determined using the leak rate of Argon and the pump speed of the RGA arm port as seen by the oven chamber and compared (ratio) to the maximum amp value measured for Argon in the calibration scan. This "torr/amp" ratio becomes the Calibration Factor for the given load, converting measured current to pressure.

Finally, the cal-gas is valved out and enough time is allotted to allow all traces of it to be pumped away. A "post-bake" scan is then taken. Approval of the post-bake scan is a collective "pass/fail" determination made by either Dennis Coyne (CalTech) or Stan Whitcomb (CalTech). The data collected during the "elevated temperature scan" is entered into a spreadsheet which then calculates what the outgassing rates of AMUs 41, 43, 53, 55 and 57 ought to be at room temperature. These calculations are used to determine the room temperature outgassing rates when the signals are below the RGA's sensitivity (noise floor).

Refer to the LHO Vacuum Bake Oven A logbook for the actual ordered events of the load # of interest.

Zone #2

Zone #1

Zone #3

Zone #4

Zone #5

Zone #6

Zone #7

Foreline

Foreline

RGA

V-3

V-1

V-2

V-4

V-5

V-6

V-7

Cal-Gas

TO
IV2
Vent

# LHO VACUUM BAKE OVEN A:

# CONTENTS LOAD #67

**B.S.C. BELLOW SERIAL NUMBER D972122-015**

**B.S.C. BELLOW SERIAL NUMBER D972122-055**

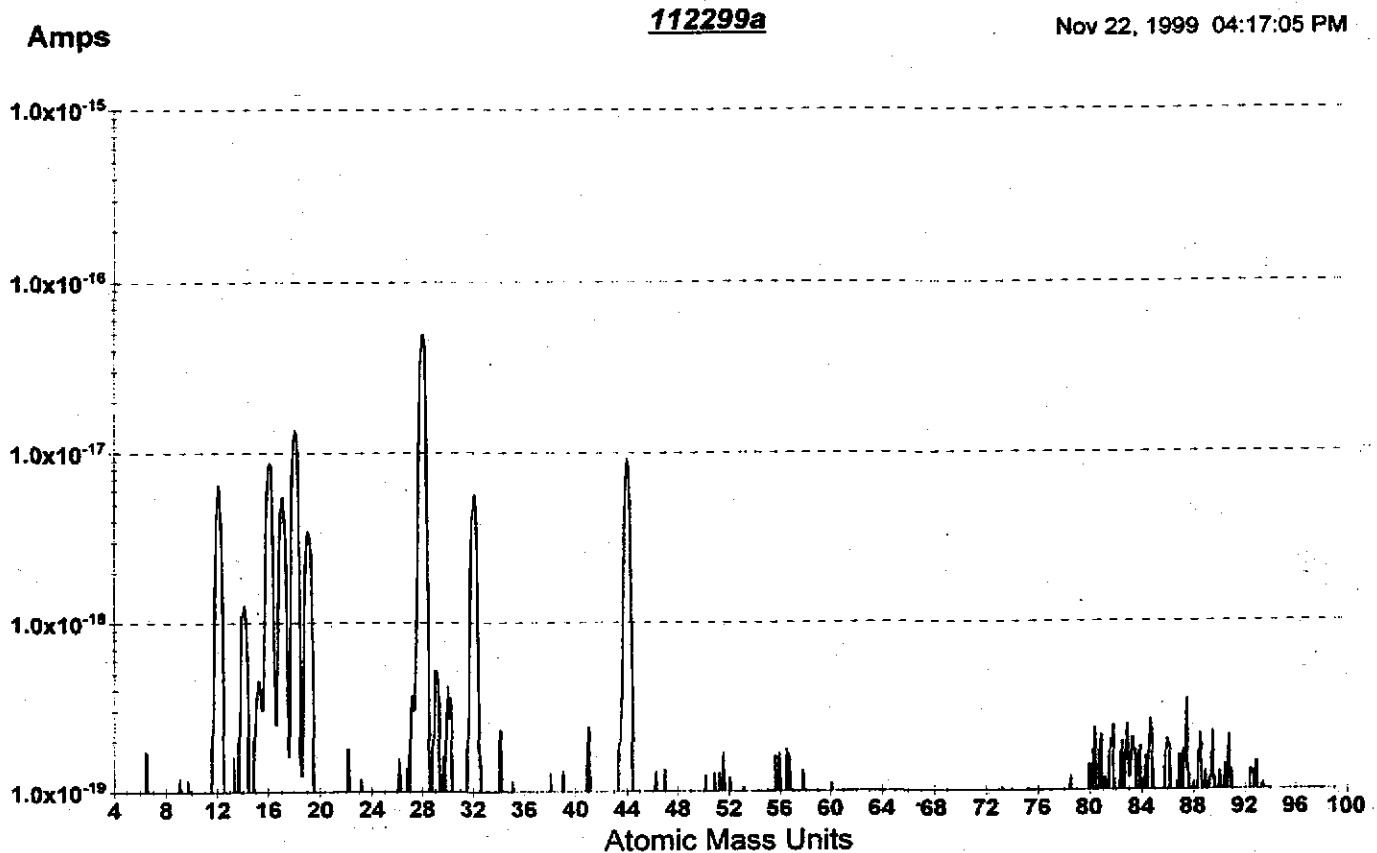**B.S.C. BELLOW SERIAL NUMBER D972122-057**

**ELLIPTICAL BAFFLE COUNTERWEIGHT SERIAL NUMBER D990173**

**ELLIPTICAL BAFFLE MOUNTING SCREW SERIAL NUMBER D990174**

**MISC. STAINLESS STEELE FASTNERS SERIAL NUMBER N/A**

# LHO VACUUM BAKE OVEN A LOAD 67



Legend:
- SETPOINT
- LOOP ONE TEMP
- LOOP TWO TEMP
- LOOP THREE TEMP
- LOOP FOUR TEMP
- LOOP FIVE TEMP
- LOOP SIX TEMP
- LOOP SEVEN TEMP

# LHO VACUUM BAKE OVEN A LOAD #67 ELEVATED TEMPERATURE BACKGROUND SCAN

## V-1 Closed

**Amps**

*112299a*

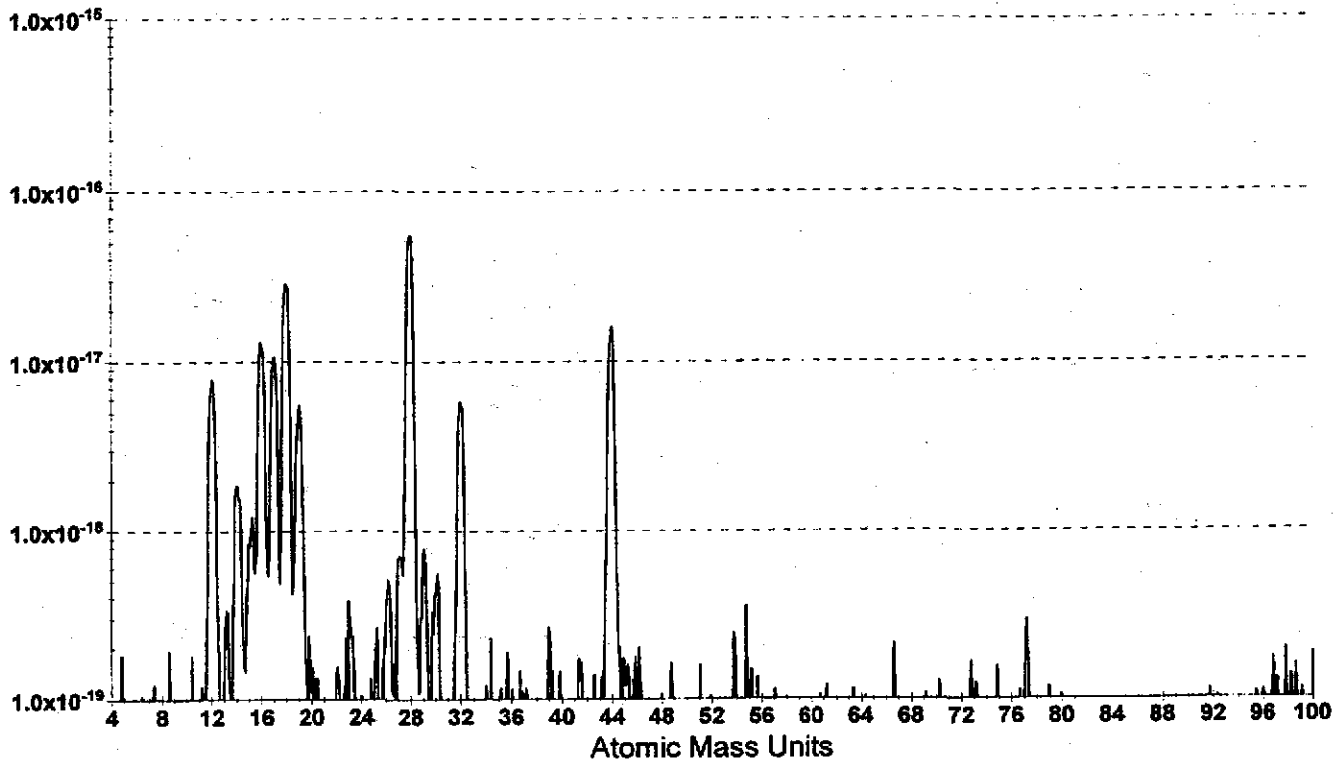Nov 22, 1999  04:17:05 PM



Atomic Mass Units

# LHO VACUUM BAKE OVEN A LOAD #67
# ELEVATED TEMPERATURE SCAN
### V-1 Open, Cal-Gas and V-2 Closed, 60°C

**Amps**

*112299b*

Nov 22, 1999  04:51:41 PM



**Atomic Mass Units**

# LHO Bake Oven A Load # 67

$1^{st}$ Order Desorption Outgassing Rate Estimates using $Q_{low} = SP_{low} = SP_{high}[e^{\wedge}(E_s/kT_{high})]/[e^{\wedge}(E_s/kT_{low})]$

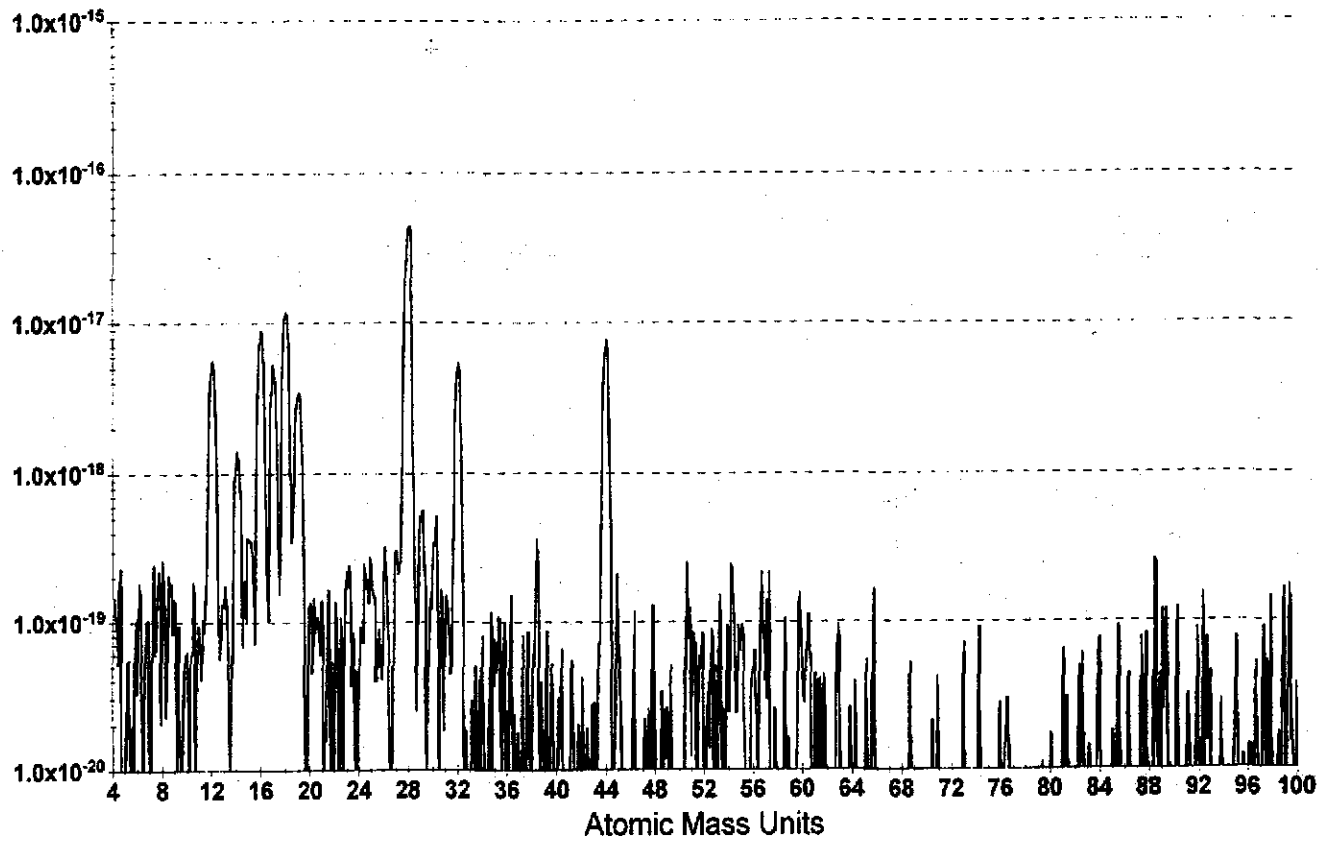| Number of units in bake load | Pump Speed (L/sec) | AMU | RGA background current (amps) | RGA current (amps) @ High Temp | Calibration Factor CF (torr/amps) | High Temp (K) | Low Temp (K) | Es/k | Extrapolated outgassing rate (torr*L/sec) @ $T_{low}$ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 5 | 41 | 9.60E-20 | 1.40E-19 | 1.00E+07 | 3.33E+02 | 2.96E+02 | 13000 | 1.67E-14 |
| 1 | 5 | 43 | 4.00E-19 | 8.90E-19 | 1.00E+07 | 3.33E+02 | 2.96E+02 | 8000 | 1.22E-12 |
| 1 | 5 | 53 | 1.00E-19 | below noise | 1.00E+07 | 3.33E+02 | 2.96E+02 | 13000 | #VALUE! |
| 1 | 5 | 55 | 0.00E+00 | 3.50E-19 | 1.00E+07 | 3.33E+02 | 2.96E+02 | 15000 | 6.28E-14 |
| 1 | 5 | 57 | 1.70E-19 | below noise | 1.00E+07 | 3.33E+02 | 2.96E+02 | 15000 | #VALUE! |

# LHO Vacuum Bake Oven A Load #67 RGA Background

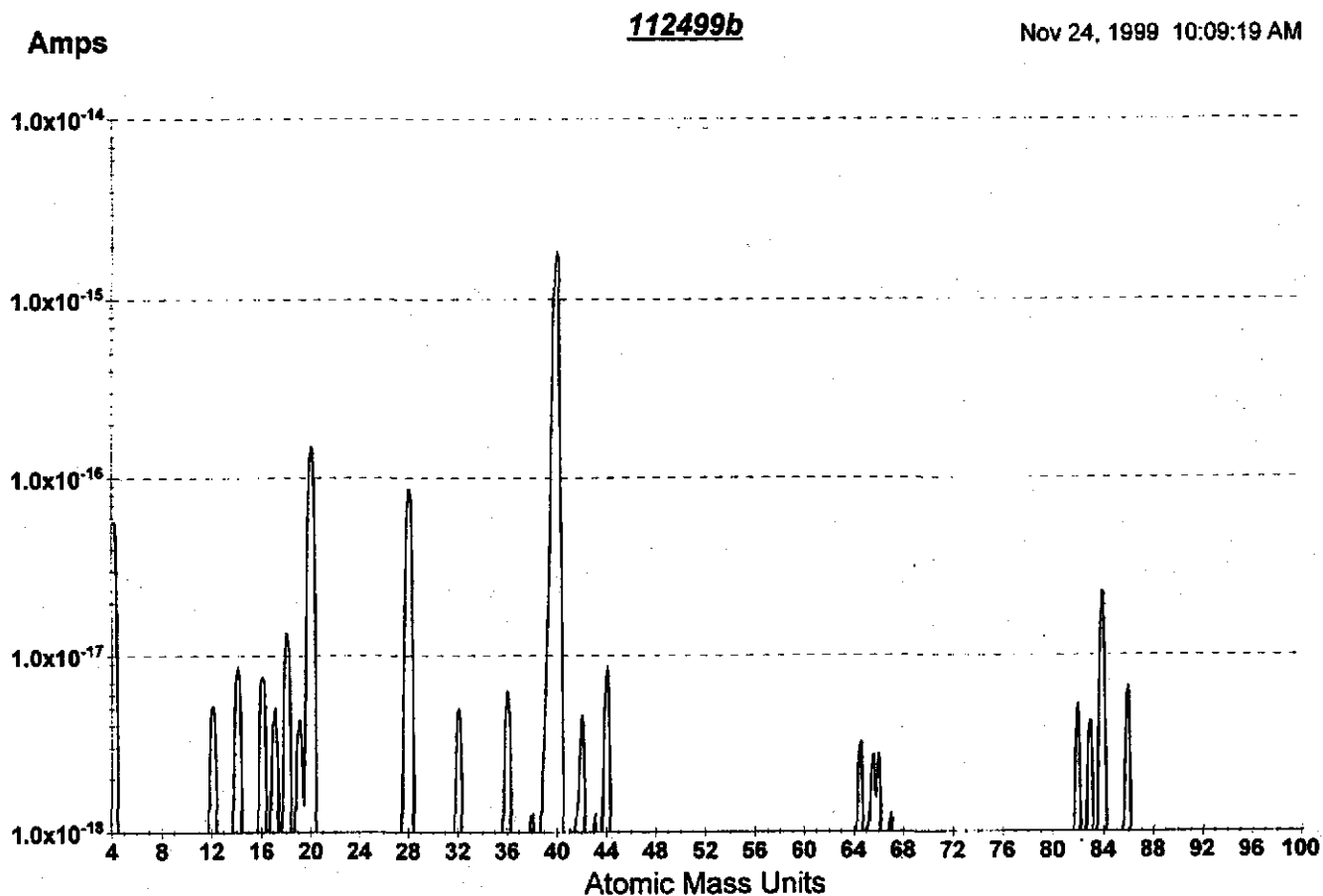V-1 closed, room temperature

**Amps**

_**112499a**_                    Nov 24, 1999  08:36:29 AM

# LHO Vacuum Bake Oven A Load #67 Calibration

V-1 and cal-gas open V-2 closed in pressure equilibrium at room temperature

**Amps**                    **_112499b_**                    Nov 24, 1999  10:09:19 AM



CF defined as $P_{(40)calc} / I_{(40)meas}$

$P_{(40)calc}$ = (leak rate) / (pump speed) = (1.1E-7torr•L/sec)(0.86) / (5 L/sec) = 1.8E-8 torr

$I_{(40)meas}$ =  1.8E-15 amps                    (taken from 112499b.asc)

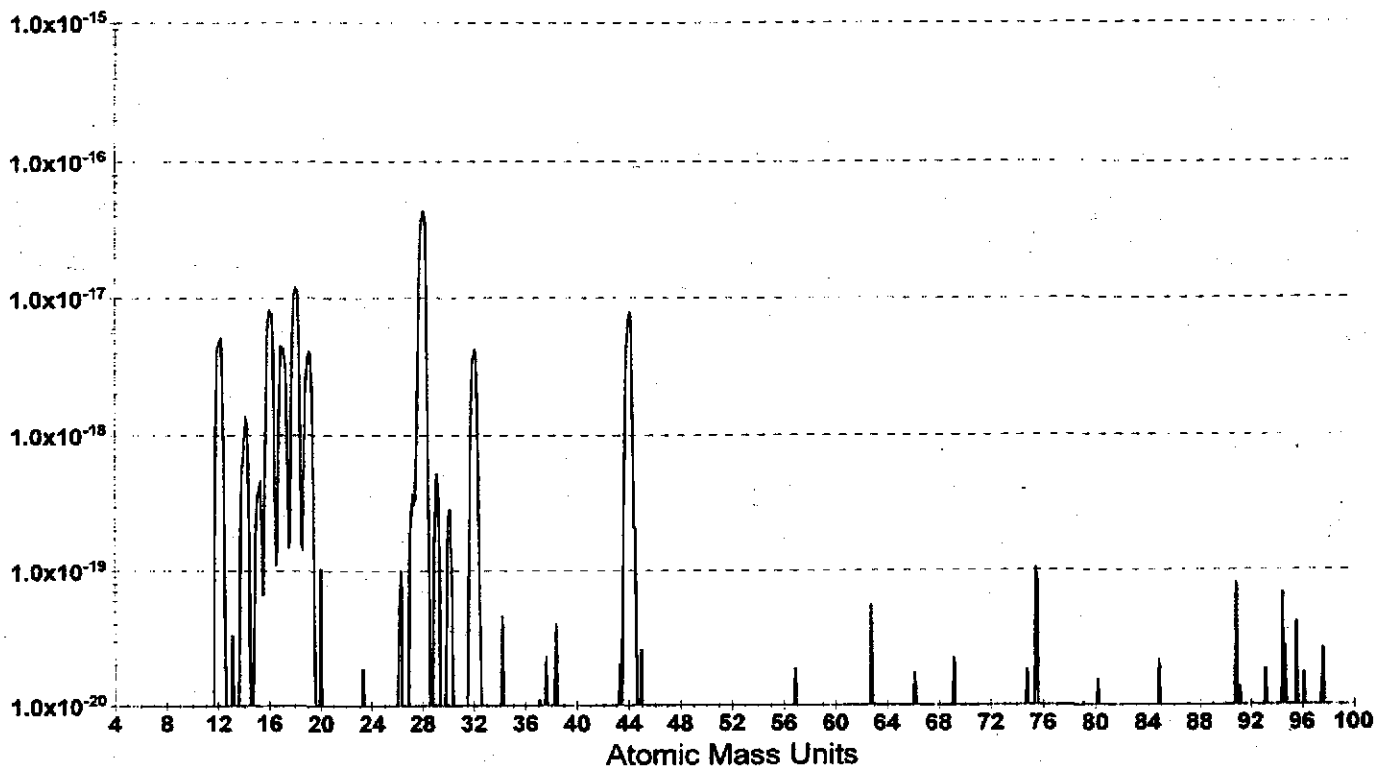CF = (1.8E-8 torr) / (1.8E-15 amps) = 1E7 torr/amps

# LHO Vacuum Bake Oven A Load #67 Post-Bake Scan Room Temp.

### V-1 open, Cal-Gas and V-2 Closed



*112499c*          Nov 24, 1999  12:23:01 PM

Amps vs. Atomic Mass Units

# LIG PROCESS TRAVELER

| Originator | Cognizant Engineer | Ext./Phone# | Project | Account Number |
|---|---|---|---|---|
| Michael Smith | Michael Smith | 2092 | COS | 5F515 |

| Dwg/Part Number | Rev | Part Description | Serial Number | Qty |
|---|---|---|---|---|
| | | ELLIPTICAL BAFFLE COUNTER WEIGHT ASSY | | |
| D990173 | 00 | Counterweight, Elliptical Baffle, CRES | | 1 |
| D990174 | 00 | Mounting Screw, Elliptical Baffle, CRES | | 2 |

**Used In (next higher assembly):** D990014-A-D, Elliptical LOS Baffle Assembly

| Vendor Name | PO/Contract Number |
|---|---|
| | |

**Data Package, Receiving/Inspection Remarks:**

| Inspection Required Y/N | Visual Damage Y/N | Comments | Name/ Initials | Date Comp. |
|---|---|---|---|---|
| N | N | | | |

**Process Flow:**

| # | Operation | Start Date | Work Area | Instructions | Name/ Initials | Date Comp. |
|---|---|---|---|---|---|---|
| 1 | Control Point | NA | NA | | NA | NA |
| 2 | Pack and ship | 4/14/99 | CIT | | M. Smith | |
| 4 | Clean parts | | LHO | CRES material, per LIGO-E960022 | B. Weaver | 4/19/99 |
| 5 | Vacuum Bake | | LHO | CRES material, per LIGO-E960022 | Kyle Ryan | 4-20-99 |

CLEAN PER 960022  11-18-99  LHO  SCANE

BARTIE RIVERA JR
B. RIVERA        11-18-99

# LIC PROCESS TRAVELER

**DCC Number:** E990159-00

| # | Operation | Start Date | Work Area | Instructions | Name/ Initials | Date Comp. |
|---|-----------|------------|-----------|--------------|----------------|------------|
| 6 | Control Point | | LHO | Review/approve RGA: scan # 112499C .RGA<br>#67 scan #_____<br>scan #_____<br>scan #_____<br>scan #_____<br>scan #_____<br>scan #_____<br>scan #_____<br><br>Note: attach RGA scan(s) to this traveler. | ~~Kyle Ryan~~ BRIVERA | 12/10/99 |
| 7 | Box for shipment | | | | | |

Table within row 7:

| No. | Qty per package | Part |
|-----|-----------------|------|
| 1 | 1 sets | metal parts |

(see also qty. for each shipping destination below)

# LIC PROCESS TRAVELER

**DCC Number:** | E990159-00

| # | Operation | Start Date | Work Area | Instructions | Name/ Initials | Date Comp. |
|---|-----------|-----------|-----------|--------------|----------------|------------|
| 8 | Ship | | | | | |

| No. | Ship Qty. | | | Part Description |
|-----|-----|-----|-------|------------------|
| | **LHO** | **LLO** | **Other** | |
| 1 | 1 assy | | | metal parts |

| | LHO: | Attn: Betsy Weaver, COS<br>LIGO Hanford Observatory (LHO)<br>Specific Purpose: ITMy elliptical baffle |
|---|------|-----|
| | LLO: | Attn: __NA_____<br>LIGO Livingston Observatory (LLO)<br>Specific Purpose: _____ |

**END:** Go to Traveler associated with next higher assembly processing

**Special Instructions (Handling/Packaging Constraints, Remarks, etc.) or Notes:**

Attention: Betsy Weaver, hold cleaned and baked parts for Michael Smith COS assembly on 4/19/99

Recleaning & Baking for cleanliness purposes. (BW) 11/17/99

E990428-00-X

# LIGO PROCESS TRAVELER

| Originator | Cognizant Engineer | Ext./Phone# | Project | Account Number |
|---|---|---|---|---|
| BARTTE RIVERA | MIKE FINE | 626.395.3307 | LIGO | 5FS11 |

| Dwg/Part Number | Rev | Part Description | Serial Number | Qty |
|---|---|---|---|---|
| DC70122 | | B.S.C. BELLOWS | 015, 035, 057 | 3 |

| Used In (next higher assembly): | B.S.C. TOP ASSEMBLY |
|---|---|

| Vendor Name | PO/Contract Number |
|---|---|
| SENIOR FLEXONICS | P PC. D99000 |

## Data Package, Receiving/Inspection Remarks:

| Inspection Required Y/N | Visual Damage Y/N | Comments | Name/Initials | Date Comp. |
|---|---|---|---|---|
| YES | | | B-RIVERA | 11·17·99 |

## Process Flow:

| # | Operation | Start Date | Work Area | Instructions | Name/Initials | Date Comp. |
|---|---|---|---|---|---|---|
| 1 | Clean & Vacuum Bake per LIGO Vacuum Prep. Form | 11·17·99 | CIT LHO | per E960022-A | B Rivera | 11·22·99 |
| 2 | Control Point | | NA | Review/approve RGA scan #112499C 12GA #67 | [signature] | 12/10/99 |
| 3 | Wrap & Tag vacuum clean parts per E960022-A | | CIT | \ per package | | |
| 4 | | | CIT | **Note: Copy this traveler and give to the DCC** | | |
| END: Go to Traveler associated with next higher assembly processing | | | | | | |

LIGO Form traveler-01 (5/98)

# LIGO PROCESS TRAVELER

E99c/198-00-X

Special Instructions (Handling/Packaging Constraints, Remarks, etc.) or Notes:

# LIGO PROCESS TRAVELER

DCC Number: E98____-00-X

Date Prepared: 1·3·99

| Originator | Cognizant Engineer | | | | Project | Account Number |
|---|---|---|---|---|---|---|
| B.RIVERA | R.Ryan | | | 8129 | LIGO | |

| Dwg/Part Number | Rev | Part Description | | Serial Number | | Qty |
|---|---|---|---|---|---|---|
| N/A | N/A | Custom Nipples for class 100 Purge Air connection to Beam 6/10 BSC4 KOR | | N/A | | 9 |

Used In (next higher assembly):

| Vendor Name | | PO/Contract Number |
|---|---|---|
| NOR-CAL | P | N/A |

**Data Package, Receiving/Inspection Remarks:**

| Inspection Required Y/N | Visual Damage Y/N | Comments | | Name/Initials | Date Comp. |
|---|---|---|---|---|---|
| YES | NO | | | B.RIVERA | 12·23·99 |

**Process Flow:**

| # | Operation | Start Date | Work Area | Instructions | Name/Initials | Date Comp. |
|---|---|---|---|---|---|---|
| 1 | Clean & Vacuum Bake per LIGO Vacuum Prep. Form | 12·23·99 | CIT LHO | per E960022-A | | |
| 2 | Control Point | | NA LHO | Review/approve RGA scan #1a8999C-RGA | B.RIVERA | 12·28·99 |
| 3 | Wrap & Tag vacuum clean parts per E960022-A | 1·3·00 | CIT LHO | ____1____ per package | SW | 1/4/00 |
| 4 | | | CIT | | B.RIVERA | 1·3·00 |

END: Go to Traveler associated with next higher assembly processing

**Note: Copy this traveler and give to the DCC**

LIGO Form traveler-01 (5/98)

N.B.: A copy of this traveler must be submitted to the DCC each time the original is shipped with the associated part(s) and when the traveler has been completed.

Page 1 of 2

# LIGO PROCESS TRAVELER

**Special Instructions (Handling/Packaging Constraints, Remarks, etc.) or Notes:**

DCC Number: E98_____00-X