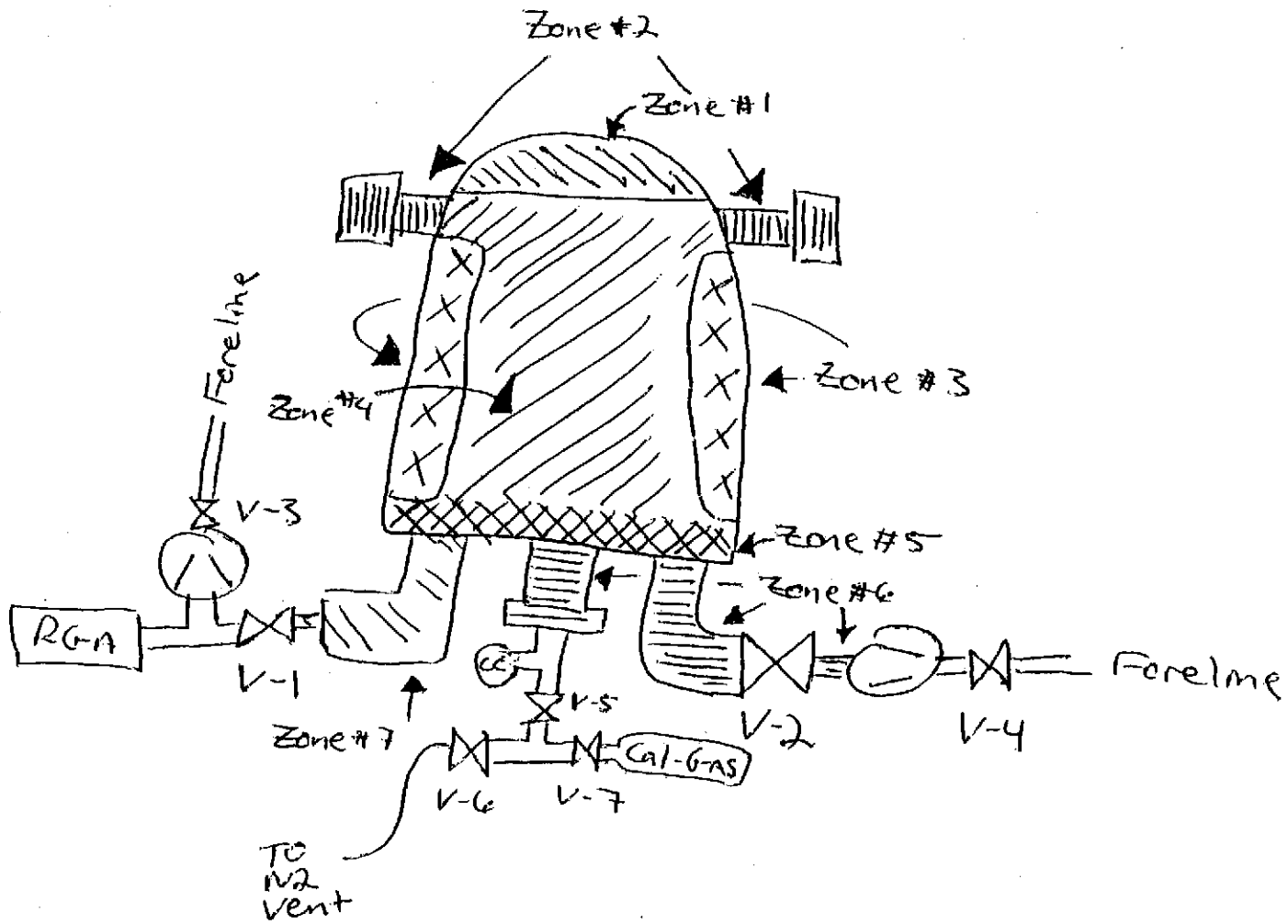# Summary of Vacuum Bake Oven RGA Data Generation

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 pumped down through the main pump "arm" (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 and then ramping down to approximately 70C and soaked. At this point, an RGA background scan is taken, V-1 is opened and an elevated load temperature RGA scan is taken and V-1 closed. This data is entered into a spreadsheet which then calculates what the partial pressures of AMUs 41, 43, 53, 55 and 57 ought to be at room temperature. Following this elevated temperature scan, the load is ramped down to near room temperature. Throughout the baking, temperature data (trendplot) is taken to verify the actual temperatures in the various "zones" of the bake oven system.

Once at near room temperature, another RGA background (V-1 closed) scan is taken. The partial pressures of AMUs 41, 43, 53, 55 and 57 taken from this background scan will get subtracted from the corresponding values measured on the final "Post Bake Scan". Following this scan, V-1 and the cal-gas are opened and V-2 closed. After a 30 min partial pressure equilibration time, a second RGA scan is taken in "amp vs. amu" mode. The calculated pressure of Argon (constituent of the "mixed" calibration gas) is determined and compared (ratio) to the peak amp value recorded for Argon by the RGA 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. This post-bake scan data is reviewed as both an analog graph (.rga file extensions) and an ASCII table (.asc file extensions) form. The highest current value between +/- 0.5 AMU of the amu of interest appearing in the ASCII table is entered into a spreadsheet. This spreadsheet then calculates the offgassing rate of AMUs 41, 43, 53, 55 and 57.

Refer to the LHO Bake Oven A logbook for the actual ordered events.

Zone #2

Zone #1

Foreline

V-3

Zone #4

Zone #3

RGA

V-1

Zone #7

Zone #5

Zone #6

CC

V-5

V-2

V-4

Foreline

V-6

V-7

Cal-Gas

TO
N2
Vent

LHO VACUUM BAKE OVEN A: CONTENTS LOAD #55

B.S.C. BELLOW SERIAL NUMBER-045

B.S.C. BELLOW SERIAL NUMBER-048

B.S.C. BELLOW SERIAL NUMBER-053

H.A.M. BELLOW ROTATABLE FLANGE SERIAL NUMBER N/A

L55occ.   E990173-00-x

LIGO PROCESS TRAVELER

DCC Number: [E98____-00-X]
Date Prepared: [8.30.99]

Originator	Cognizant Engineer	Ext./Phone#	Project	Account Number
B. RIVERA	MIKE FINE	(626.395.3307	LIGO	5FS11

Dwg/Part Number	Rev	Part Description	Serial Number	Qty
D972122	F	BSC BELLOW	053,045,048	3

Used In (next higher assembly):	BSC TOP ASSEMBLY

Vendor Name	PO/Contract Number
SENIOR FLEXONICS	P DCE 299000

Data Package, Receiving/Inspection Remarks:

Inspection Required Y/N	Visual Damage Y/N	Comments	Name/ Initials	Date Comp.
YES	NO	GREY "SMUDGES" (OXIDE) AROUND OUTSIDE OF BELLOWS ATTEMPTED TO REMOVE WITH SOLVENTS DOSS NOT COME OFF	B RIVERA	8.30.99

Process Flow:

#	Operation	Start Date	Work Area	Instructions	Name/ Initials	Date Comp.
1	Clean & Vacuum Bake per LIGO Vacuum Prep. Form		CIT LIGO/H.	per E960022-A	B RIVERA	8.30.99
2	Control Point		NA	Review/approve RGA scan # 090799 C.RGA	EW	9/14/99
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)

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:

BELLOWS REMOVED FROM VACUUM CHAMBER & INSPECTED BY JOHN WORDEN

BELLOWS WILL HAVE TO BE REWORKED USING AN "ARKANAS" STONE

THEN REPACKAGED VERBALLY APPROVED BY D. COYNE & TO BE TREATED

AS U.H.V. CLEAN PARTS 9.8.99 R RIVERA

X-POP3-Rcpt: brivera@apex
Date: Wed, 08 Sep 1999 09:25:40 -0700
From: Dennis Coyne <coyne@ligo.caltech.edu>
Organization: Caltech/LIGO
X-Mailer: Mozilla 3.01Gold (Win95; I)
To: "Bartie J. Rivera" <rivera_b@ligo-wa.caltech.edu>
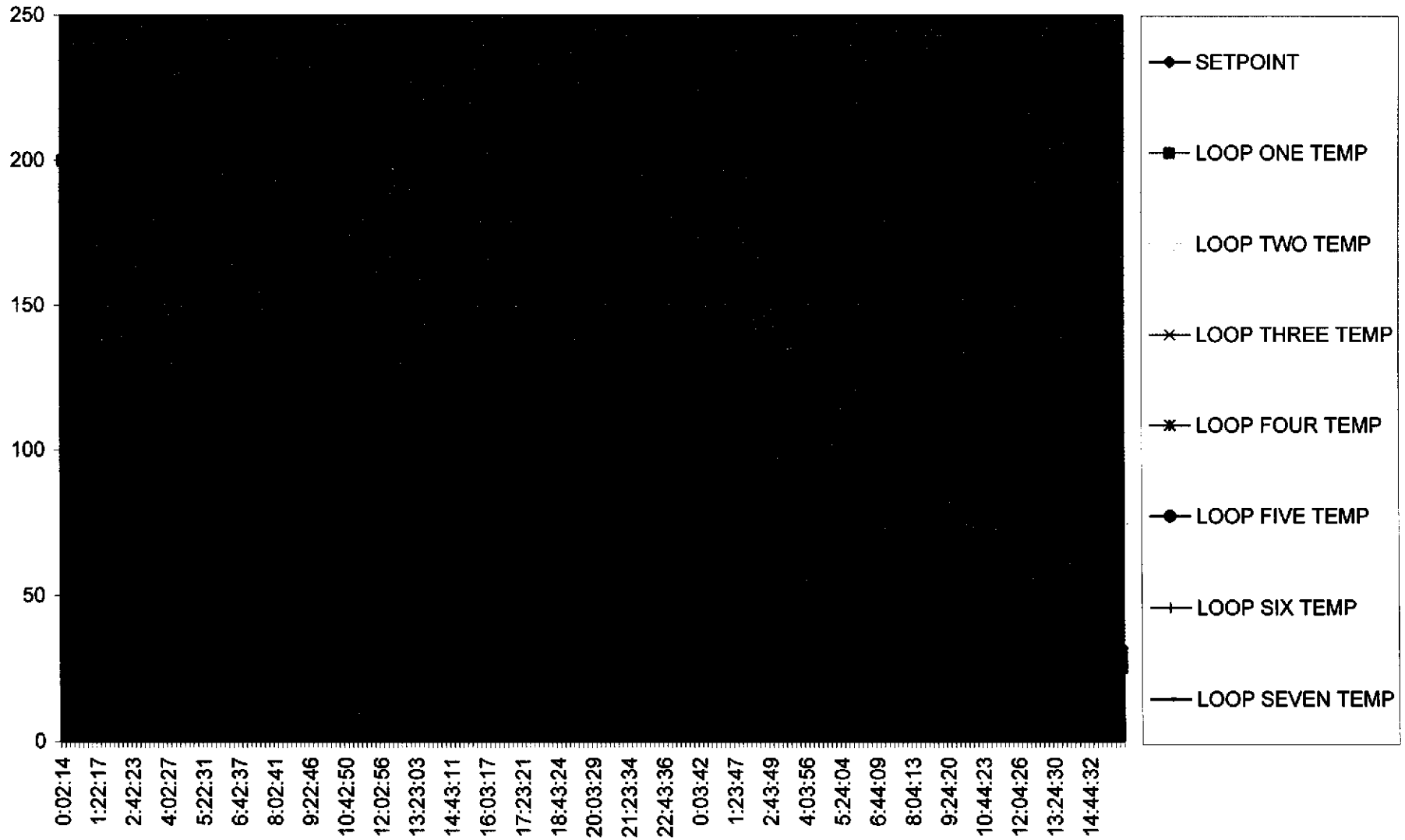Subject: Re: scan approval load 55

Bartie,
I approve load 55 based upon review of the RGA scan.
    Dennis

Bartie J. Rivera wrote:
>
> Hello Dennis,
>
> I am faxing scans of load 55 for approval to
> 626-304-9834.
>
> Thanks
> Bartie

--
Dennis Coyne (Detector Installation Manager)
LIGO Laboratory, Caltech, Physics Department
626.395.2034 @CIT / 225.686.3168 @Livingston / 509.372.8166 @Hanford
cell 626.695.8350

LHO VACUUM BAKE OVEN A LOAD 55

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

Y-axis: 0, 50, 100, 150, 200, 250

X-axis (time): 0:02:14, 1:22:17, 2:42:23, 4:02:27, 5:22:31, 6:42:37, 8:02:41, 9:22:46, 10:42:50, 12:02:56, 13:23:03, 14:43:11, 16:03:17, 17:23:21, 18:43:24, 20:03:29, 21:23:34, 22:43:36, 0:03:42, 1:23:47, 2:43:49, 4:03:56, 5:24:04, 6:44:09, 8:04:13, 9:24:20, 10:44:23, 12:04:26, 13:24:30, 14:44:32

LHO VACUUM BAKE OVEN A LOAD #55 ELEVATED TEMPERATURE BACKGROUND SCAN

V-1 Closed

Amps

090399a

Sep 03, 1999 09:57:02 AM

Atomic Mass Units
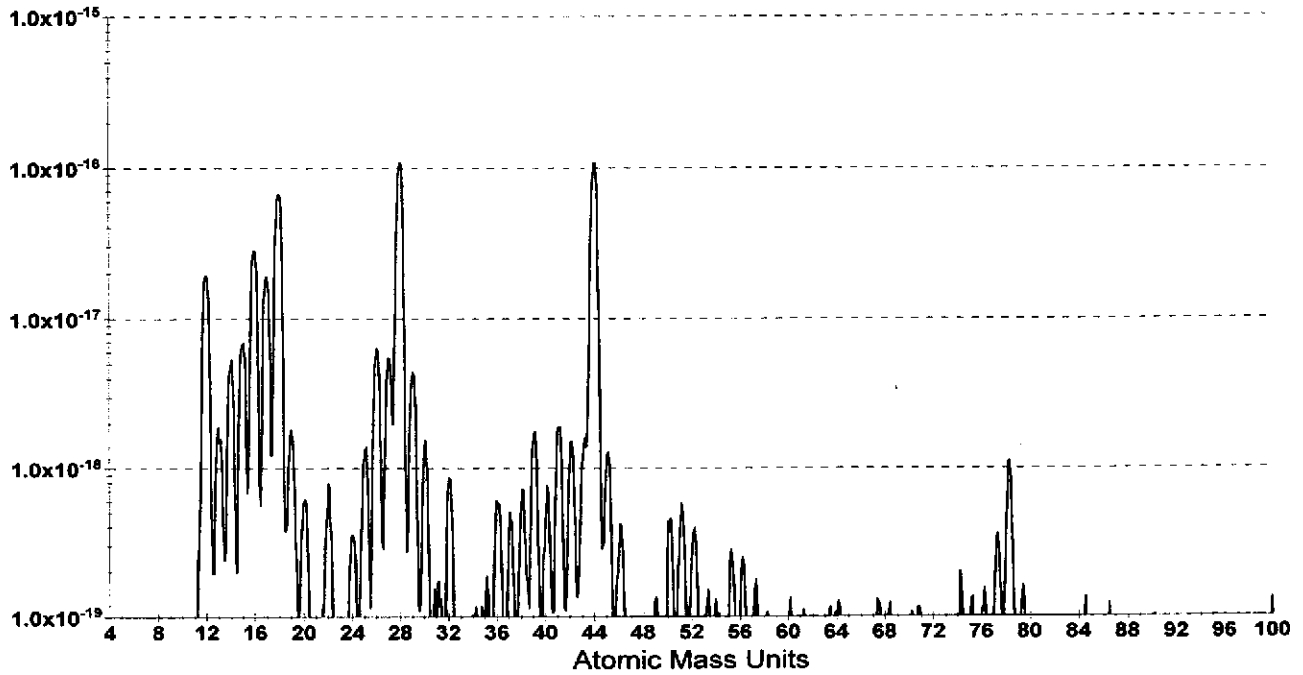
LHO VACUUM BAKE OVEN A LOAD #55
ELEVATED TEMPERATURE SCAN

V-1 Open, Cal-Gas and V-2 Closed, 70°C

Amps   **_090399b_**   Sep 03, 1999 10:45:31 AM
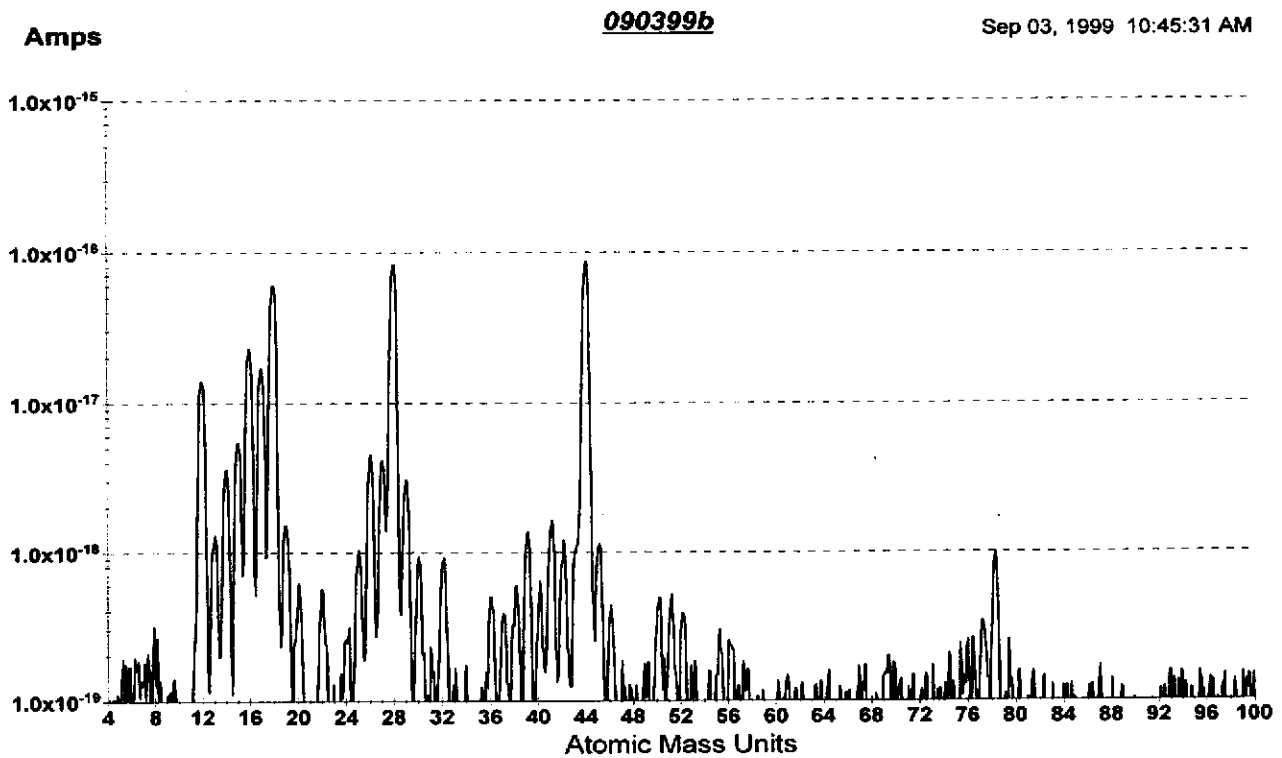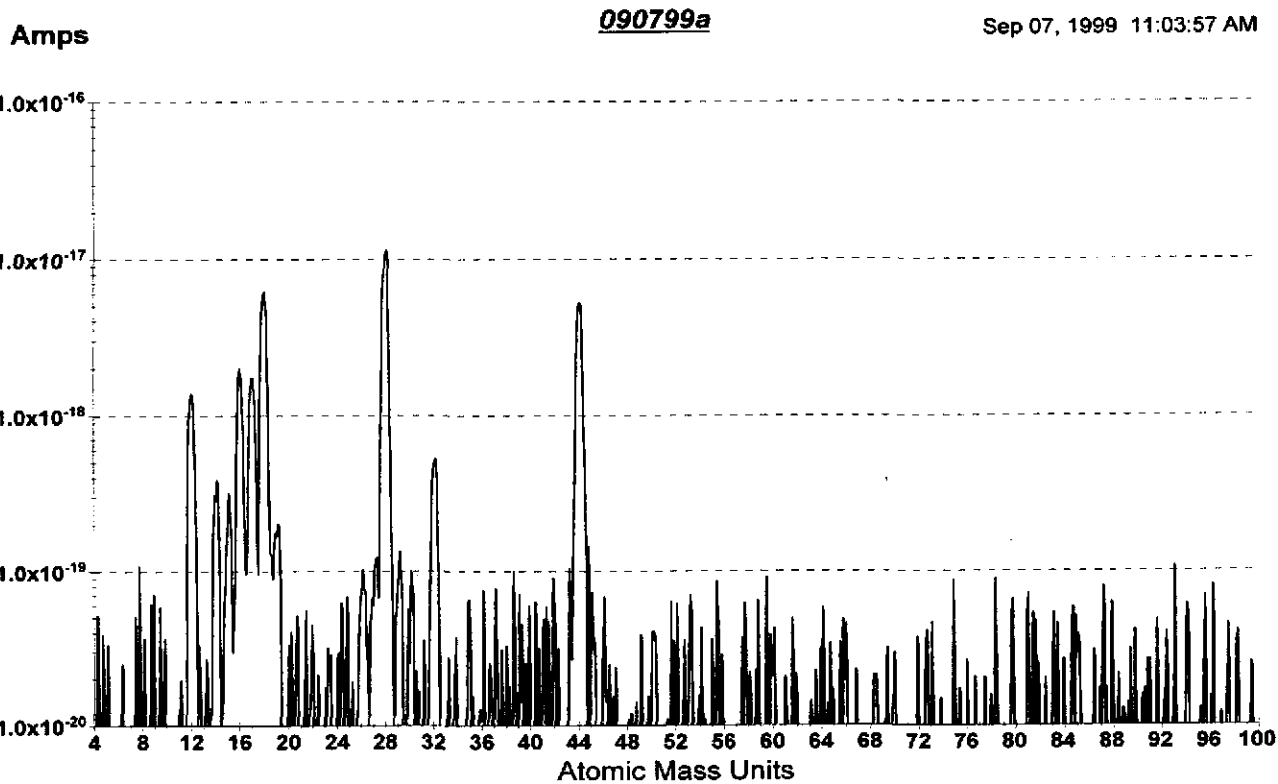
LHO Bake Oven A Load # 55

1st 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) @ T_{high}	Calibration Factor CF (torr/amps)	T_{high} (K)	T_{low} (K)	Es/k	Extrapolated outgassing rate (torr*L/sec) @ T_{low}
1	5	41	1.90E-18	1.60E-18	2.00E+07	3.43E+02	2.96E+02	13000	below noise
1	5	43	1.60E-18	1.20E-18	2.00E+07	3.43E+02	2.96E+02	8000	below noise
1	5	53	1.50E-19	1.80E-19	2.00E+07	3.43E+02	2.96E+02	13000	7.30E-15
1	5	55	2.80E-19	3.00E-19	2.00E+07	3.43E+02	2.96E+02	15000	1.93E-15
1	5	57	1.70E-19	1.80E-19	2.00E+07	3.43E+02	2.96E+02	15000	9.65E-16

LHO Vacuum Bake Oven A Load #55 RGA background

V-1 Closed, Room Temp

Amps
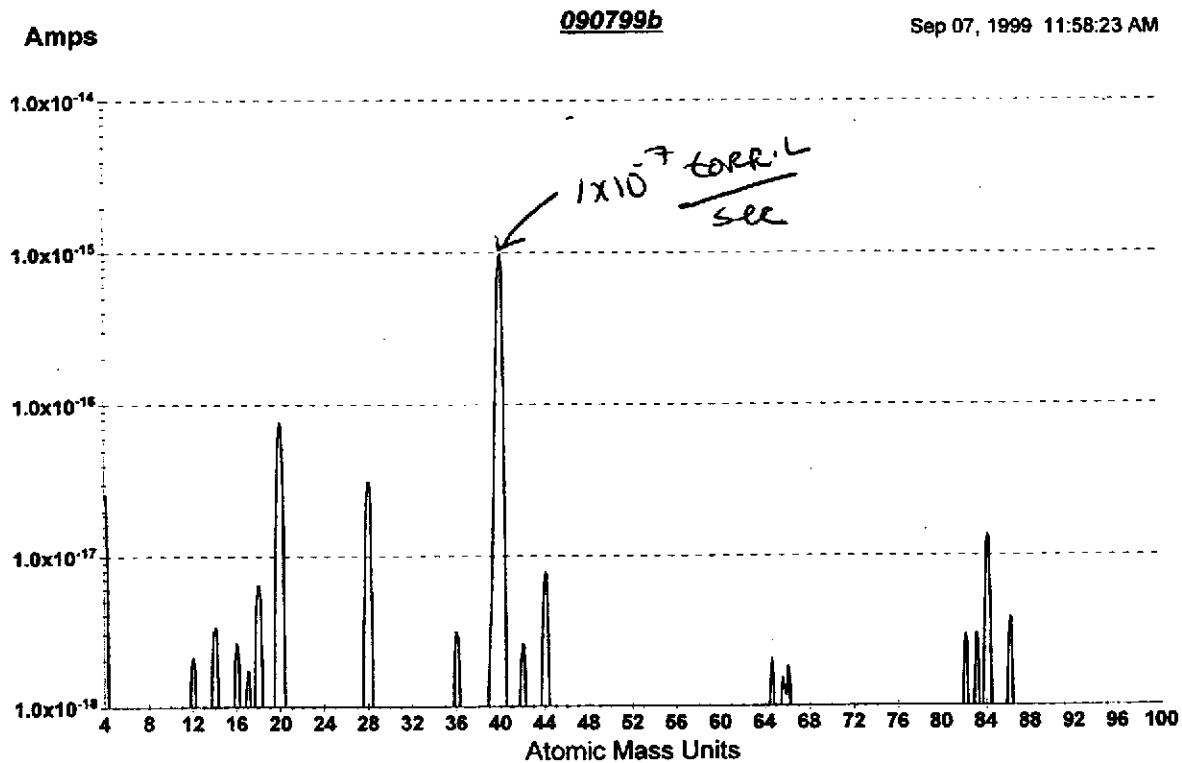
_**090799a**_

Sep 07, 1999 11:03:57 AM

LHO Vacuum Bake Oven A Load #55 Calibration

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

LHO Vacuum Bake Oven A Load #55 Calibration

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

Amps   <u>090799b</u>   Sep 07, 1999 11:58:23 AM

$1 \times 10^{-7} \dfrac{torr \cdot L}{sec}$

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

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

$I_{(meas)}$ = 1E-15 amps

CF = (1.8E-8 torr) / (1E-15 amps) = 2E7 torr/amps

LHO Vacuum Bake Oven A Load #55 Post-Bake Scan Room Temp

V-1 Open, Cal-gas and V-2 Closed

Amps

090799c   Sep 07, 1999 12:41:25 PM

1×10^{-10} torr·L / sec

Atomic Mass Units