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(NASA-CR-115559) ATMOSPHERIC CONTAMINANT
SENSOR. BOOK 2: APPENDICES Final Report
B.W. Scott, et al (Perkin-Elmer Corp.)
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A circular stamp from the NASA STI Facility, Registration. The text "RECEIVED" is at the top, "NASA STI FACILITY" is in the middle, and "REGISTRATION" is at the bottom. The date "12/18/79" is stamped on the right side. A handwritten number "223460" is visible on the left side.

**Manned Spacecraft Center
R&D Procurement Branch
Houston, Texas**

APPENDICES

APPENDIX 1 - Project Notes

APPENDIX 2 - Functional Test Report

APPENDIX 1
PROJECT NOTES

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B.W. Scott
12 July 1971

APPENDIX 1

Contract No. 30249
Project Note No. 1

INTERFACE SPECIFICATION

Subtraction of F114 Fragment From F12

Table 2 spectra is included for reference. The subtraction is accomplished by means of a three position switch or equivalent, whose function is described below:

Position 1: Ion potential - 576 V
 Display A: (85 to 87) signal, this is F12 and F114 interference
 Display B: (101 to 103) signal - 0.2X (85 to 87) signal this is F11

Position 2: The ion potential is dropped to 432V
 Display A: Nothing
 Display B: (135-137) signal collected on 101 collector this is F114. 2.6X (135 to 137) is stored for Position 3.

Position 3: Ion potential returned to 576V
 Display A: (85 to 87) signal - 2.6X (135 to 137) signal this is F12 corrected for F114 interference
 Display B: Same as Display in Position 1.

The switch automatically returns to Position 1 when released at Position 3. Thus the calculation for correcting (85 to 87) for F114 interference is automatically performed.

Note that the Freons will not be present on the submarine simultaneously. They occur in pairs F11 - F12; and F12 - F114. Thus for the first pair the switch is not used.

The technical analysis behind this specification will be released in a Project Note shortly.

TABLE 2

Spectra of F12, F11 and F114 including only peaks occurring at 85-87 and 101-103 and 135-137 expressed in units of N₂ sensitivity.

F12	mass	85-87	101-103	
Specific Peak Height		0.498	0.096	
F11		85-87	101-103	
		0	0.438	
F114		85-87	100-103	135-137
		0.573	0.091	0.259

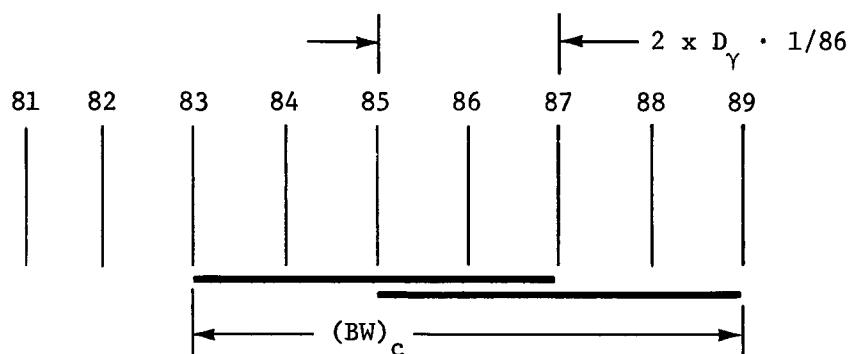
SLIT WIDTHS, BEAM WIDTHS, AND RESOLUTION
FOR $m/e = 85$ AND 101

With reference to Figure 7, use results for exit boundary angle $\theta = -14$ degrees. It is assumed:

S_o		= 0.012 in
α		= <u>+2</u> degrees
β		= 0.005 (total)
B		= 4030 gauss
V_{ACC}		= 596 volts
X (object coordinate)		= -3.101 in
Y (object coordinate)		= 0.824 in
Entry Angle		= 5 degrees
Object Distance		= 3.11 in
Magnetic Field Angle	$m/e = 85$	= 55.76 degrees
Magnetic Field Angle	$m/e = 101$	= 54.61 degrees
Image Distance	$m/e = 85$	= 2.146 in
Image Distance	$m/e = 101$	= 2.344 in
Radius	$m/e = 85$	= 3.171 in
Radius	$m/e = 101$	= 3.450 in

The two principal peaks of Freon 12 are m/e 85 and 87 and for Freon 11 they are m/e - 101 and 103. Therefore, adjust resolving slits to receive simultaneously the two principal peaks.

m/e	85	101
Magnification	-0.467	-0.484
BW	0.0417 in	0.044 in
Aberration	0.036 in	0.038 in
Mass Dispersion Coefficient	0.95 in	0.99 in



m/e 85

$$BW = 0.042$$

$$D_\sigma = 0.011 \text{ in}$$

$$BW_e = 2 D_\gamma \cdot 1/86 + BW$$

$$(BW_e) = 0.022 + 0.042 = 0.064 \text{ in}$$

$$S = (BW)_e \frac{1 + \frac{t}{b}}{1 - \frac{t}{b}}$$

t/b	S	S - BW _e	($\Delta V/V$) _{S-BW_e}
0.1	0.078	0.014	0.015
0.2	0.096	0.032	0.0336

m/e 101

$$BW = 0.044$$

$$D_{\gamma} \cdot \frac{1}{102} = 0.0097 \text{ in}$$

$$BW_e = 2 \times D_{\gamma} \frac{1}{102} + BW$$

$$= 0.063 \approx 0.064$$

$$\text{Slit Width} = \frac{0.078}{\tan 25^\circ} = \frac{0.078}{0.477} = 0.1638$$

$$= 41.6 \text{ min}$$

$$\frac{0.096}{0.477} = 0.202 = 51.3 \text{ min}$$

t/b	S	S - BW	$(\Delta V/V)_{S-BW_e}$
0.1	0.078	0.014	0.014
0.2	0.096	0.032	0.032

If 1 mass is collected

m/e 85

t/b	S	S - BW	$\Delta V/V$
0.1	0.051	0.009	0.0095
0.2	0.063	0.021	0.022
0.3	0.078	0.036	0.038

m/e 101

t/b	S	S - BW	$\Delta V/V$
0.1	0.054	0.010	0.010
0.2	0.066	0.022	0.022
0.3	0.082	0.038	0.038

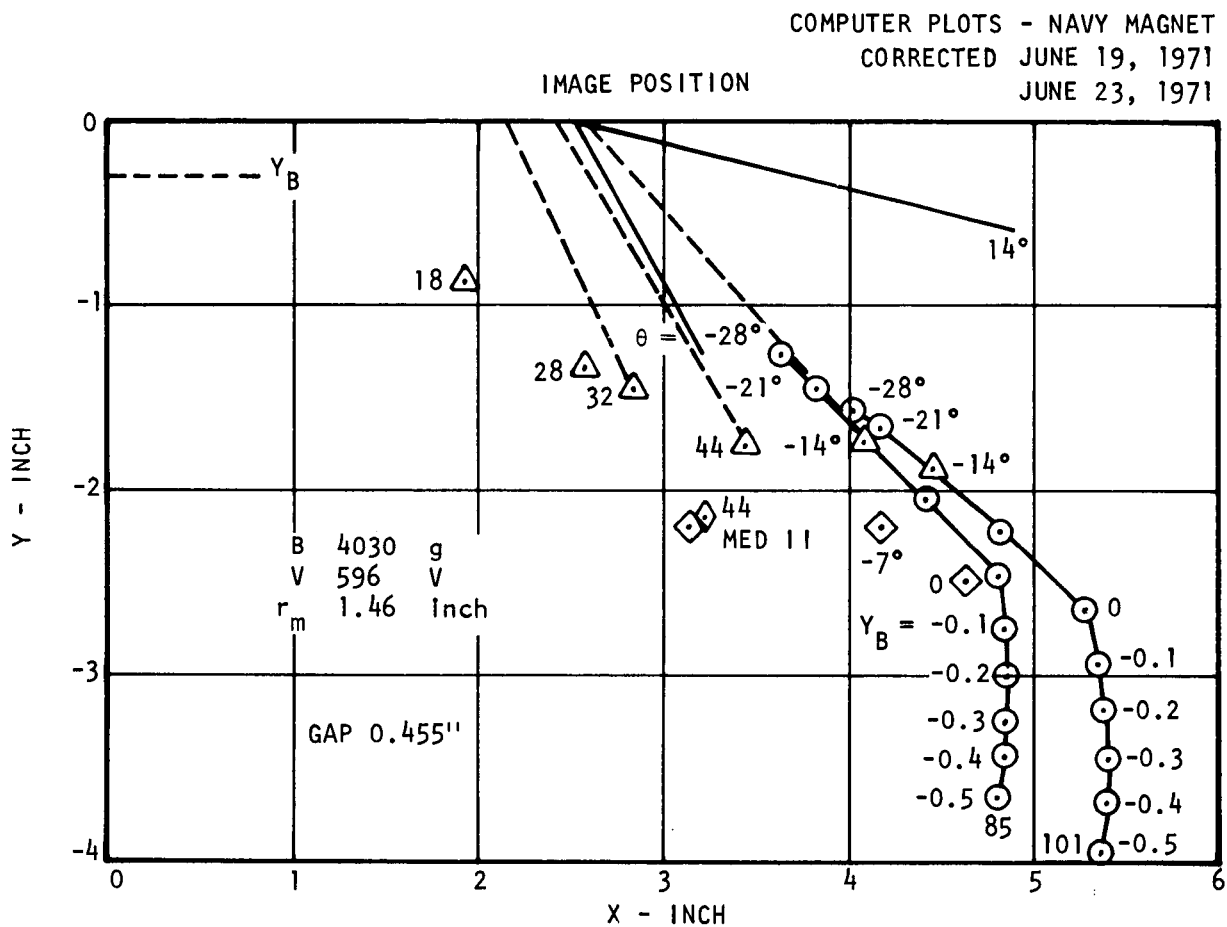


FIGURE 7. Computer Data of May 4 and 5, 1971

TOTITE ANALYZER SUBSYSTEM PARAMETERS

The following parameters will be defined in the project note: Leak conductance; ion source and analyzer partial pressure; ion source conductance; ion pumping speed; source sensitivity; ion current; electrometer feedback resistor; and isolation amplifier gain.

Table 3 lists the maximum partial pressures, where the total pressure is 760 torr.

TABLE 3

<u>Constituent</u>	<u>m/e</u>	<u>Range</u>	<u>Maximum</u>
*H ₂	2	0 - 40 torr	40 torr
H ₂ O	18	0 - 44 torr	44 torr
N ₂	28	0 - 800 torr	800 torr
*O ₂	32	60 - 200 torr	200 torr
*CO ₂	44	0 - 25 torr	25 torr
*Freon 12	85	0 - 0.228 torr	0.228 torr (300 ppm)
*Freon 11	101	0 - 0.38 torr	0.038 torr (50 ppm)
*Freon 114	135(101)	0 - 0.228 torr	0.228 torr (300 ppm)

*These will be displayed

The freon detection presents a problem of studying cross-interferences of three peaks; 85, 101 and 135. This problem will be discussed in a separate note. M/e 135 is measured at the 101 bucket by reducing voltage.

To evaluate P_g and P_a, a source pressure of 1×10^{-4} torr for air is assumed, a source conductance of 50 cc/sec for N₂ and an ion pumping speed of 20 l/sec for N₂ and the following pumping speeds for other gases.

TABLE 4

<u>Constituent</u>	<u>Pumping Speed</u>
H ₂	37.8
H ₂ O	20
N ₂	20

TABLE 4 (Cont)

<u>Constituent</u>	<u>Pumping Speed</u>
O ₂	13.9
CO ₂	20
F12	20
F11	20
F114	20

It was not certain whether the conductance of the Varian leak is viscous or molecular in nature, therefore both cases were considered. The viscous type leak enhances the sensitivity to the high molecular weight Freons.

The sensitivity ratio of the Freons to Nitrogen is taken from the memorandum by L. Hall dated 1 March 1971 in which he reported measuring 5 ppm with the Med II instrument.

TABLE 5

m/e	H ₂		H ₂ O	N ₂	O ₂	CO ₂	Freon 12		Freon 11		Freon 114	
	40 torr	2	18	28	32	44	85	(mol wt 120)	101	(mol wt 135)	135	(mol wt 170)
Full scale pressure	40 torr		44	800	200	25	0.228	0.038	0.038	0.228		
Molecular leak	25 x 10 ⁻⁶ cc sec ⁻¹		8.4 x 10 ⁻⁶	6.6 x 10 ⁻⁶	6.3 x 10 ⁻⁶	5.3 x 10 ⁻⁶	3.2 x 10 ⁻⁶	3.01 x 10 ⁻⁶	3.01 x 10 ⁻⁶	2.69 x 10 ⁻⁶		
Viscous leak	6.6 x 10 ⁻⁶ cc sec ⁻¹		6.6 x 10 ⁻⁶	6.6 x 10 ⁻⁶	6.6 x 10 ⁻⁶	6.6 x 10 ⁻⁶	6.6 x 10 ⁻⁶	6.6 x 10 ⁻⁶	6.6 x 10 ⁻⁶	6.6 x 10 ⁻⁶		
Molecular flow	1 x 10 ⁻³ torr cc sec ⁻¹		0.277 x 10 ⁻³	4.02 x 10 ⁻³	1.26 x 10 ⁻³	0.1325 x 10 ⁻³	0.730 x 10 ⁻⁶	0.114 x 10 ⁻⁶	0.114 x 10 ⁻⁶	0.614 x 10 ⁻⁶		
Viscous flow	0.264 x 10 ⁻³ torr cc sec ⁻¹		0.218 x 10 ⁻³	4.02 x 10 ⁻³	1.32 x 10 ⁻³	0.165 x 10 ⁻³	1.51 x 10 ⁻⁶	0.251 x 10 ⁻⁶	0.251 x 10 ⁻⁶	1.51 x 10 ⁻⁶		
Source conductance	194 cc sec ⁻¹		62.4	50	46.8	39.9	24.1	22.7	22.7	20.2		
Pump speed	37.8 L sec ⁻¹		20	20	13.9	20	20	20	20	20		
Molecular anal press	2.65 x 10 ⁻⁸ torr		1.39 x 10 ⁻⁸	2.01 x 10 ⁻⁷	9.05 x 10 ⁻⁷	6.64 x 10 ⁻⁹	3.65 x 10 ⁻¹¹	0.57 x 10 ⁻¹¹	0.57 x 10 ⁻¹¹	3.07 x 10 ⁻¹¹		
Viscous anal press	0.699 x 10 ⁻⁸ torr		1.09 x 10 ⁻⁸	2.01 x 10 ⁻⁷	9.50 x 10 ⁻⁷	8.25 x 10 ⁻⁹	7.55 x 10 ⁻¹¹	1.26 x 10 ⁻¹¹	1.26 x 10 ⁻¹¹	7.55 x 10 ⁻¹¹		
Molecular source press	5.15 x 10 ⁻⁶ torr		4.44 x 10 ⁻⁶	80.3 x 10 ⁻⁶	26.9 x 10 ⁻⁶	3.32 x 10 ⁻⁶	3.03 x 10 ⁻⁸	0.502 x 10 ⁻⁸	0.502 x 10 ⁻⁸	3.03 x 10 ⁻⁸		
Viscous source press	1.36 x 10 ⁻⁶ torr		3.60 x 10 ⁻⁶	80.3 x 10 ⁻⁶	28.3 x 10 ⁻⁶	4.13 x 10 ⁻⁶	6.27 x 10 ⁻⁸	1.11 x 10 ⁻⁸	1.11 x 10 ⁻⁸	7.50 x 10 ⁻⁸		
Pump differential	194		320	399	299	500	832	885	885	990		
Specific N ₂ source sensitivity	0.16		0.70	1	0.75	1.1	0.5	0.5	0.5	0.5		
Source sensitivity	0.8 x 10 ⁻⁶ A torr ⁻¹		3.5 x 10 ⁻⁶	5 x 10 ⁻⁶	3.75 x 10 ⁻⁶	5.5 x 10 ⁻⁶	2.5 x 10 ⁻⁶	2.5 x 10 ⁻⁶	2.5 x 10 ⁻⁶	2.5 x 10 ⁻⁶		
Molecular leak Ion current	4.13 x 10 ⁻¹² A		2.07 x 10 ⁻¹¹	5.34 x 10 ⁻¹⁰	101 x 10 ⁻¹²	18.25 x 10 ⁻¹²	7.57 x 10 ⁻¹⁴	2.0 x 10 ⁻¹⁴	2.0 x 10 ⁻¹⁴	7.57 x 10 ⁻¹⁴		
Viscous leak Ion current	1.09 x 10 ⁻¹² A		12.6 x 10 ⁻¹²	5.34 x 10 ⁻¹⁰	106 x 10 ⁻¹²	22.8 x 10 ⁻¹²	15.65 x 10 ⁻¹⁴	4.3 x 10 ⁻¹⁴	4.3 x 10 ⁻¹⁴	18.75 x 10 ⁻¹⁴		
Feedback resistor	1 x 10 ¹²		1 x 10 ¹¹	1.5 x 10 ¹⁰	5 x 10 ¹⁰	2 x 10 ¹¹	3 x 10 ¹²	3 x 10 ¹²	3 x 10 ¹²	3 x 10 ¹²		
Output	4.0 V		4.4 V	8.0 V	2.0 V	2.5 V						

INTERFACE SPECIFICATION

Slit Widths, Locations

The locations of the images were deduced by computer calculations, using part of the "monster" program, with field plots.

Following data was used: Object location $X = -7.76$ cm, $y = 1.247$
 Ion voltage = 576V
 Average field = 3970 gauss
 Initial ray angle at object = 11°

All coordinates refer to magnet, corner is 0, 0; exit boundary is $y = 0$

Coordinates of Images:

TABLE 6

<u>m/e</u>	<u>X(cm)</u>	<u>Y(cm)</u>	<u>Ray Slope dy/dx</u>	<u>Ctn⁻¹ dy/dx</u>
2	0.84	0.98	3.00	18.5°
18	3.97	-2.5	7.42	7.5°
28	5.62	-4.02	3.75	15°
32	6.20	-4.43	3.08	18°
44	7.92	-5.63	2.46	22°
85	10.67	-5.62	1.58	32.3°
101	11.72	-6.25	1.50	33.6°

Slope of Ideal Focal Plane

Lower masses $dy/dx = 0.7 = 34^\circ$
 85 and 101 $dy/dx = 0.6 = 31^\circ$

TABLE 7

Collector Slit Widths (perpendicular to beam)

<u>m/e</u>	<u>Resolution O Cross Talk</u>	<u>ΔV Top</u>	<u>Beam Width</u>	<u>Slit Widths Normal to Beams</u>
2	2.2	--	0.0045"	0.100"
18	18.8	17.9	0.0163"	0.050"

TABLE 7 (Cont)

<u>m/e</u>	<u>Resolution</u> <u>0 Cross Talk</u>	<u>ΔV Top</u>	<u>Beam Width</u>	<u>Slit Widths</u> <u>Normal to Beams</u>
28	10.0	23.8	0.0200"	0.140"
32	10.0	22.4	0.215"	0.160"
44	12.0	20.5	0.026"	0.180"
101	33.4	16.0	0.064"	0.096"
85	28.3	16.8	0.064"	0.096"

This assumes object width = 0.012 in
 $x = +2$ degrees
 $\beta = 0.005 V_0$

The collector slit widths were calculated to satisfy the criteria in the table above. The m/e of 85 and 101 were actually three masses wide to include both of the freon peaks near mass 85 and both near 101.

The focal plane of 34° is referenced to the coordinate system used in the magnet plots. When referenced to the optic axis, it is 45° .

TABLE 8

<u>m/e</u>	<u>Ray Ctn⁻¹</u> <u>dy/dx</u>	<u>Ray-plane</u> <u>Angle</u>	<u>Sin r-p</u>	<u>Slit Width/</u> <u>Sin r-p</u>
2	18.5	37.5	0.60876	0.164 in
18	7.5	48.5	0.749	0.0668 in
28	15.0	41.0	0.656	0.210 in
32	18.0	38.0	0.616	0.250 in
44	22.0	34.0	0.559	0.275 in
85	32.3	23.6	0.401	0.239 in
101	33.6	22.3	0.380	0.250 in

The right hand column of Table 8 is the slit width in the focal plane.

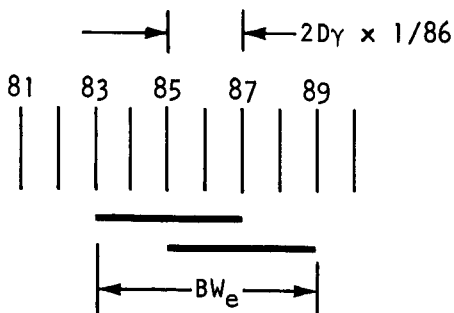
SLIT WIDTHS, BEAM WIDTHS, AND RESOLUTION FOR $m/e = 85$ AND 101

With reference to Figure 7, use results for exit boundary angle $\theta = -14$ degrees.
It is assumed:

S_o		= 0.012 in
α		= +2 degrees
β		= 0.005
B		= 4030 gauss
V_{acc}		= 596 volts
x (object coordinate)		= -3.101 in
y (object coordinate)		= 0.824 in
Entry angle		= 5 degrees
Object distance		= 3.11 in
Magnetic field angle	$m/e = 85$	= 55.76 degrees
Magnetic field angle	$m/e = 101$	= 54.61 degrees
Image distance	$m/e = 85$	= 2.146 in
Image distance	$m/e = 101$	= 2.344 in
Radius	$m/e = 85$	= 3.171 in
Radius	$m/e = 101$	= 3.456 in

The two principal peaks of Freon 12 are m/e 85 and 87 and for Freon 11 they are m/e 101 and 103. Therefore, adjust resolving slits to receive simultaneously the two principal peaks.

m/e	85	101
Magnification	-0.467	-0.484
BW	0.0417 in	0.044 in
Aberrations	0.036 in	0.038 in
Mass dispersion coefficient	0.95	0.99 in



H.G. Voorhies
13 July 1971

APPENDIX 1

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m/e 85

$$BW = 0.042$$

$$D_Y 1/86 = 0.011 \text{ in}$$

$$BW_e = 2 D_Y 1/86 + BW$$

$$(BW_e) = 0.022 + 0.042 = 0.064 \text{ in}$$

$$S = (BW)_e \frac{1 + \frac{t}{b}}{1 - \frac{t}{b}}$$

t/b	S	S-BW _e	(ΔV/V) _{S-BW_e}
0.1	0.078	0.014	0.015
0.2	0.096	0.032	0.0336

m/e 101

$$BW = 0.044$$

$$D_Y 1/102 = 0.0097 \text{ in}$$

$$BW_e = 2 \times D_Y 1/102 + BW$$

$$= 0.063 \approx 0.064$$

t/b	S	S-BW	(ΔV/V) _{S-BW_e}
0.1	0.078	0.014	0.014
0.2	0.096	0.032	0.032

H.G. Voorhies
13 July 1971

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If 1 mass is collected

m/e 85

t/b	S	S-BW	$\Delta V/V$
0.1	0.051	0.009	0.0095
0.2	0.063	0.021	0.022
0.3	0.078	0.036	0.038

m/e 101

t/b	S	S-BW	$\Delta V/V$
0.1	0.054	0.010	0.010
0.2	0.066	0.022	0.022
0.3	0.082	0.038	0.038

CORRECTIONS FOR F11, 12, 114 INTERFERENCES

Characteristics of Freons

Freon 11	Trichlorofluoromethane CCl_3F (p42B)	MW 137.38
Freon 12	Dichlorodifluoromethane CCl_2F_2 (p32B)	MW 120.93
Freon 114	1, 2-Dichlorotetrafluoroethane $\text{C}_2\text{Cl}_2\text{F}_4$ (p62B)	MW 170.926

Spectra

F12	m =	85	87	50	101	103			
		1000	318	159	135	120			
F11	m =	101	103	35	66				
		1000	604	163	148				
F114	m =	85	135	87	31	137	50	101	100
		1000	452	316	219	143	106	84	74
									52

Sensitivities

Values obtained from Al Ebert, DuPont Freon Prod. Div. 609-299-5000, Ext 2828

	<u>Butane</u>	<u>Nitrogen</u>
F12	B 0.539	N 0.378
F11	B 0.389	N 0.273
F114	B 0.621	N 0.435

The problem is to correct the m/e 85, 87 readings of F12 for the m/e 85, 87 fragments from F114, and to correct the m/e 101, 103 readings of F11 for the m/e 101, 103 fragments from F12. F12 can appear with F11 or F12 can appear with F114, but F11 will not appear with F114.

A $V^{1/2}$ correction will be made to account approximately for sensitivity loss when m/e 135, 137 from F114 is measured on the m/e 101, 103 collector. The normal operating voltage is 576 volts.

$$101 \times 576 \text{ V} = 135. \quad V \rightarrow V = 432 \text{ volts.}$$

For the F12, F114 combination.

$$I_{F114} \text{ (m/e 135, 137 at 135, 137 coll)} =$$

$$I_{F114} \text{ (m/e 135, 137 at 101, 103 coll)} \times \sqrt{\frac{576}{432}}$$

$$I_{F114} \text{ (m/e 85, 87 at 85, 87 coll)} =$$

$$I_{F114} \text{ (m/e 135, 137 at 101, 103 coll)} \times \sqrt{\frac{576}{432}} \frac{1000 + 316}{452 + 143} =$$

$$I_{F114} \text{ (m/e 135, 137 at 101, 103 coll)} \times 2.55$$

For the F12, F11 combination.

$$I_{F12} \text{ (m/e 101, 103 at 101, 103 coll)} =$$

$$I_{F12} \text{ (m/e 85, 87 at 85, 87 coll)} \times \frac{135 + 120}{1000 + 318} =$$

$$I_{F12} \text{ (m/e 85, 87 at 85, 87 coll)} \times 0.194$$

Summary

$$\text{m/e 85, 87 coll, } I(F12) = I(85, 87 \text{ coll}) - I_{F114} \text{ (m/e 135, 137 at 101, 103 coll)} \times 2.6$$

$$\text{m/e 101, 103 coll, } I(F11) = I(101, 103 \text{ coll}) - I_{F12} \text{ (m/e 85, 87 at 85, 87 coll)} \times 0.19$$

There is an unestimated uncertainty in these corrections due to uncertainty in sensitivities and uncertainty in voltage corrections to sensitivities. In final analysis, corrections will have to be determined experimentally.

FILAMENT CHARACTERISTIC DEFINITION FOR U.S. NAVY M.S.

The effective resistance of the filament, i.e., the resistance from one feed-through pin to the other on the ion source housing will be nominally 0.75 ohms. The expected tolerance for this filament resistance, including variations between units and lifetime characteristics is from 0.4 to 1.2 ohms (absolute). This resistance is only from one header pin to the other, and does not include:

- a. Contact resistance at the connection to the feedthroughs
- b. Wire resistance in cabling
- c. Contact resistance in the filament switching relay
- d. Transformer impedance in the filament supply
- e. Other resistive elements in the filament supply.

The maximum filament power required will nominally be 3.1 $\pm$ 0.5 watts (for variations among units).

Thus the voltage and current requirements (dc or rms) can be found by substituting the above value variations into the following expressions, and looking at the worst case results:

$$V = (PR)^{1/2}$$

$$I = \left(\frac{P}{R} \right)^{1/2}$$

where:

V = filament voltage

I = filament current

P = filament power

R = filament resistance

The emission regulator shall also be designed such that if the regulator is set to supply no emission current, the filament shall remain cold upon application of power to the electronics (i.e., the filament shall not flash or pulse and then turn off).

ANALYZER POWER SUPPLY SPECIFICATION

The ion source to be used is 30003, with the power supply to be basically the same as Med II. The basic difference in requirements between 30003 and Navy is the increased ion energy. If the voltage of each electrode, referred to anode is increased by 400 V we have the desired energy of approximately 580 V.

The voltages and adjustments required were therefore established by studying the differences encountered in the final versions of 30003 S/N's 1 through 5. The range encountered is compared with Med II Nominal in Table 9.

In the 30249 Navy supply we must provide the additional focus voltage, IFB, and we must provide additional range to the Z-axis focusing. These both require changes in the low current string.

To provide for bringing the F114, m/e 135, into the m/e 101 collector, we must drop the ion electrode potentials by the factor 0.748 and the electron electrode potentials by the constant amount, 144 V. These design requirements are shown in Table 10.

Design Deviations From Med II

- a. Provision for dropping ion potential
- b. Z-axis focus approaches ion accelerator potential
- c. Electron focus must have four voltages instead of three
- d. Electron focuses must go below and above filament potential
- e. A meter shall be installed across an appropriate resistor at the bottom of the low current string for monitoring voltage.

TABLE 9
Analyzer Voltages

	**Range in 30003	Range +400 V	Med II Nominal
Ion Accelerator	160 - 178	560 - 578	580
Ion Repeller	170 - 185	570 - 585	580 - 605
Ion Focus A	142 - 178	542 - 578	370 - 580
Ion Focus B	0 - 160	400 - 560	370 - 580*
Z-Axis, A, B	157 - 179	557 - 579	265 - 370
Anode	210 - 250	610 - 650	780
Filament	79 - 67	479 - 467	490
Electron Accelerator	211 - 274	611 - 674	780
Fil Shield No. 1, No. 2	43 - 61	443 - 461	475 - 490
Electron Focus A, B	56 - 81	456 - 481	505 - 545

*Not present in Med II

**Range encountered in final values of S/N 1 through 5.

0.013 inch clearance between IFB and exit slit and between IFB and IFA will be the largest gradient (580 V).

B.W. Scott
13 July 1971

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TABLE 10
30249 Design Values

	Range	Nominal	F114	Remarks*
Ion Accelerator	580 *-5 to -15	580	432	w/r Repeller
Ion Repeller	580 to 605 * 5 to 15	595	443	w/r Repeller
Ion Focus A	388 to 580	570	424	
Ion Focus B	58 to 196	150	112	
Z-Axis A, B	196 to 388	350	261	
Anode	780 *300	780 *300	580	w/r Filament
Filament	490 *-105	490 -105	290	w/r Repeller
Electron Accelerator	780 *300	780 *300	580	w/r Filament
Fil Shield No. 1, No. 2	465 to 490 *0 to -15	480 *0 to -15	280	w/r Filament
Electron Focus A, B	465 to 550 *-25 to +60	490 0	290	w/r Filament

ION SOURCE LOCATION TOLERANCES

Two studies enable an estimate of image motions when the source is mislocated. The first is a computer study in which the boundaries of a perfect magnet with no fringe fields were varied. The image positions were plotted against exit boundary position, leaving source location fixed. Varying the exit face y coordinate is equivalent to an opposite motion in the object y coordinate. The worst case, $e/m = 101$, resulted in an image motion of -0.15 in for an object motion of $+0.1$ inch.

The second study was actually an error in source location in the initial computer trajectory plots. 0.5 in X movement in source location made image variations of less than 0.1 inch.

An error in launch direction, in the first approximation makes no change in image locations, since the image is by definition, an α focus point.

Mechanical department assures that 0.001 in translation and 0.1° launch direction tolerances can be retained upon removal and replacement of a doweled source assembly. This precision will assure a total image location tolerance of 0.0015 and a tolerance along the focal plane of 0.001 . The direction of motion is shown in Figure 8.

This information may be of some use in knowing how the foci behave during the magnet movement of the initial tuneup. The results indicate that intuition probably fails. To summarize; (1) for horizontal magnet motion parallel to the exit boundary, the images follow the magnet, (2) with magnet motion perpendicular to the exit boundary, the image also follow the magnet but the motion is amplified at the high masses by 1.5 . At the lower masses the movement is less, thus the focal plane rotates during Y-axis magnet movement.

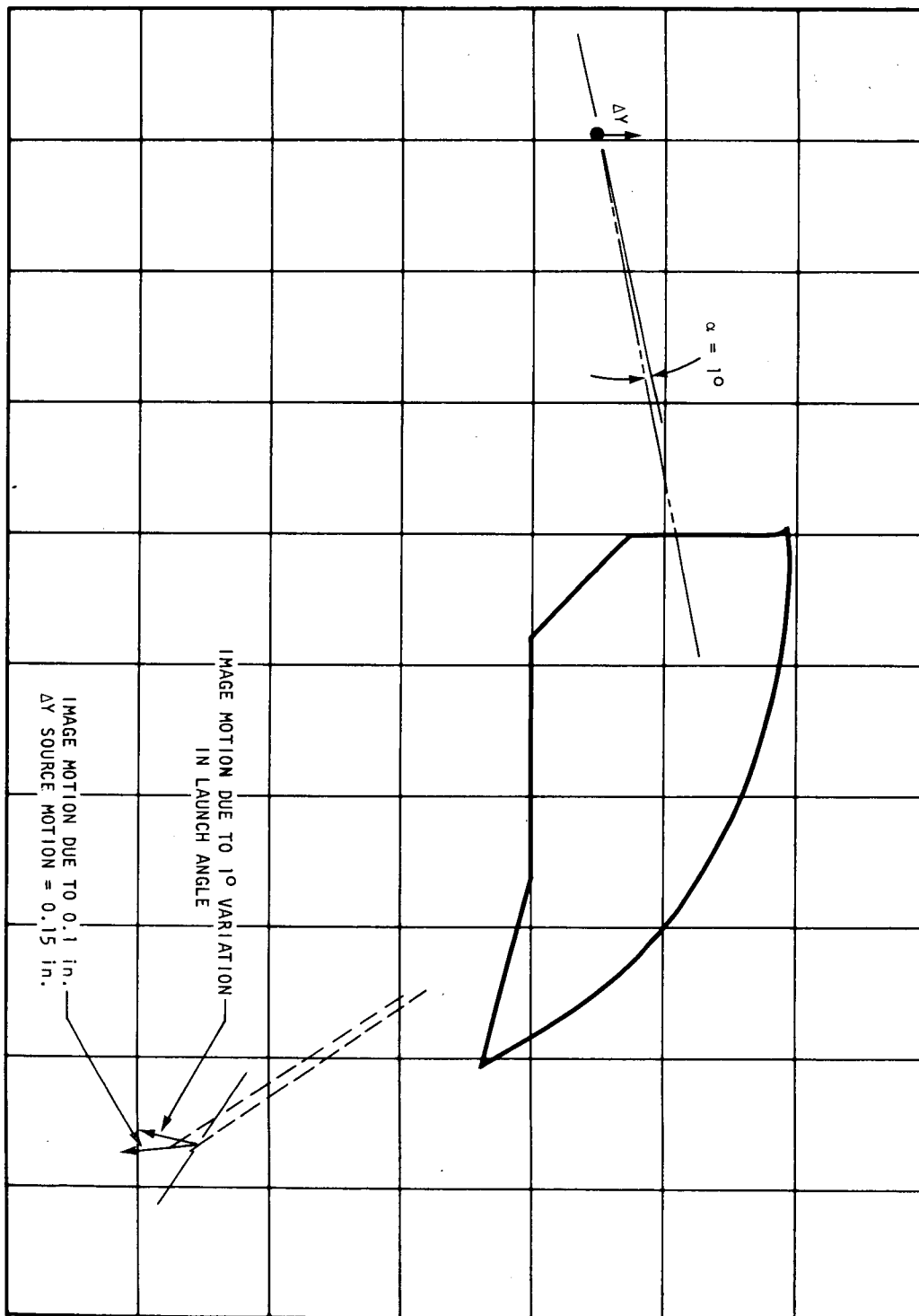


FIGURE 8. Direction of Motion

VARIAN VALVE CLOSING

Four Varian valves have been tested on a leak conductance test station to examine their degree of closure upon heating power failure. The valves were heated to 100°C, adjusted to a leak conductance of 5×10^{-6} cc sec⁻¹ (4×10^{-6} torr liter sec⁻¹), then allowed to cool. Their conductance was recorded as a function of time and temperature. The results are outlined in Table 11 and a typical conductance vs time is plotted in Figure 9. Closure vs temperature is plotted in Figure 10. Time for the 1500 cc 30249 system to rise to 10^{-2} torr is included in Table 11. This is considered to be the maximum time period that the system can be without power for the ion pump to be restarted without roughing. If the valve did not close at all, the pressure would rise to 10^{-2} torr in 66 minutes.

TABLE 11

Valve S/N	Time to 2/3 Close	Time to Close	Max Pressure	Time to 10^{-2} torr
No. 1	15 min	20 min	1.5×10^{-3}	> 24 hr
No. 2	6 min	8 min	0.6×10^{-3}	> 24 hr
No. 3	10 min	--		10 hr
No. 4	20 min	--		5 hr

With no thermal coefficient

Conclusions

These tests very definitely indicate the proximity of our desired set point to a knee in the temperature coefficient curve of the valve conductance. Because of this knee, the valve closes rapidly to approximately 10^{-6} torr liter sec⁻¹. Two of the valves tested continued to close rapidly to fully closed. The other two closed more slowly below the knee and remained with a measurable conductance at room temperature. Even if the valve is misadjusted to double our design value, it is estimated that a power failure of a few hours would not necessitate rough pumping the system.

It is therefore recommended that the mechanical valve closer be abandoned and the thermal coefficient relied on to close the valve when power fails.

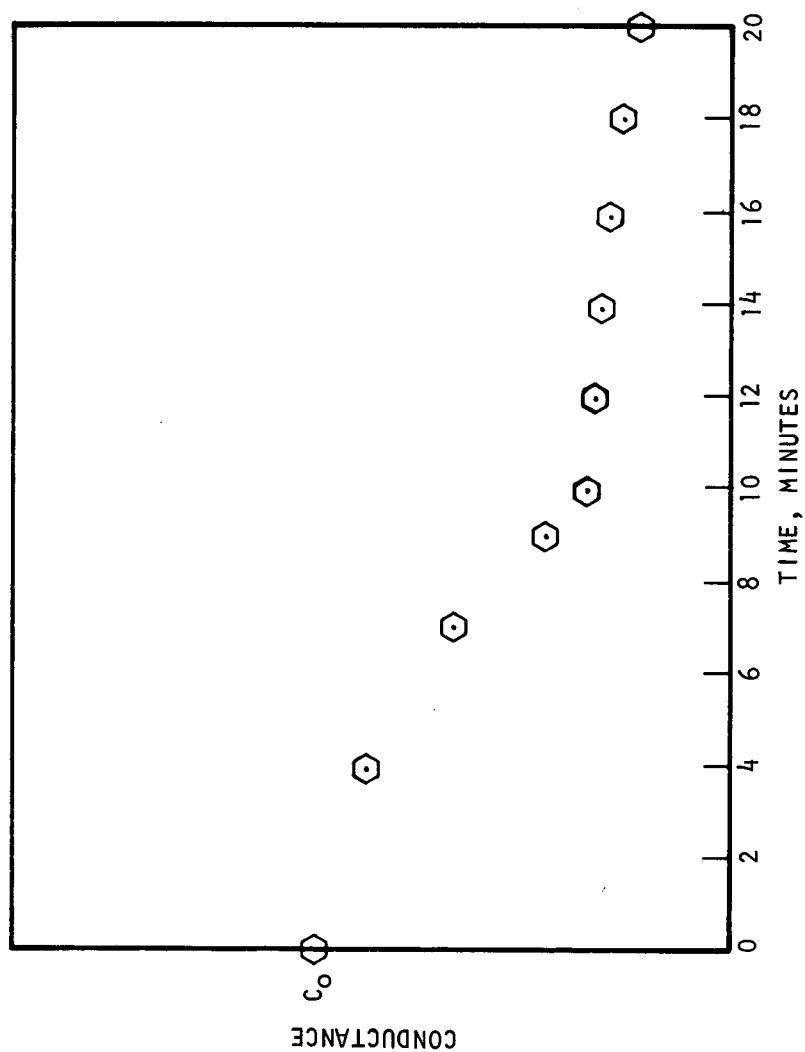


FIGURE 9. Typical Conductance vs Time of
Varian Adjustable Leak

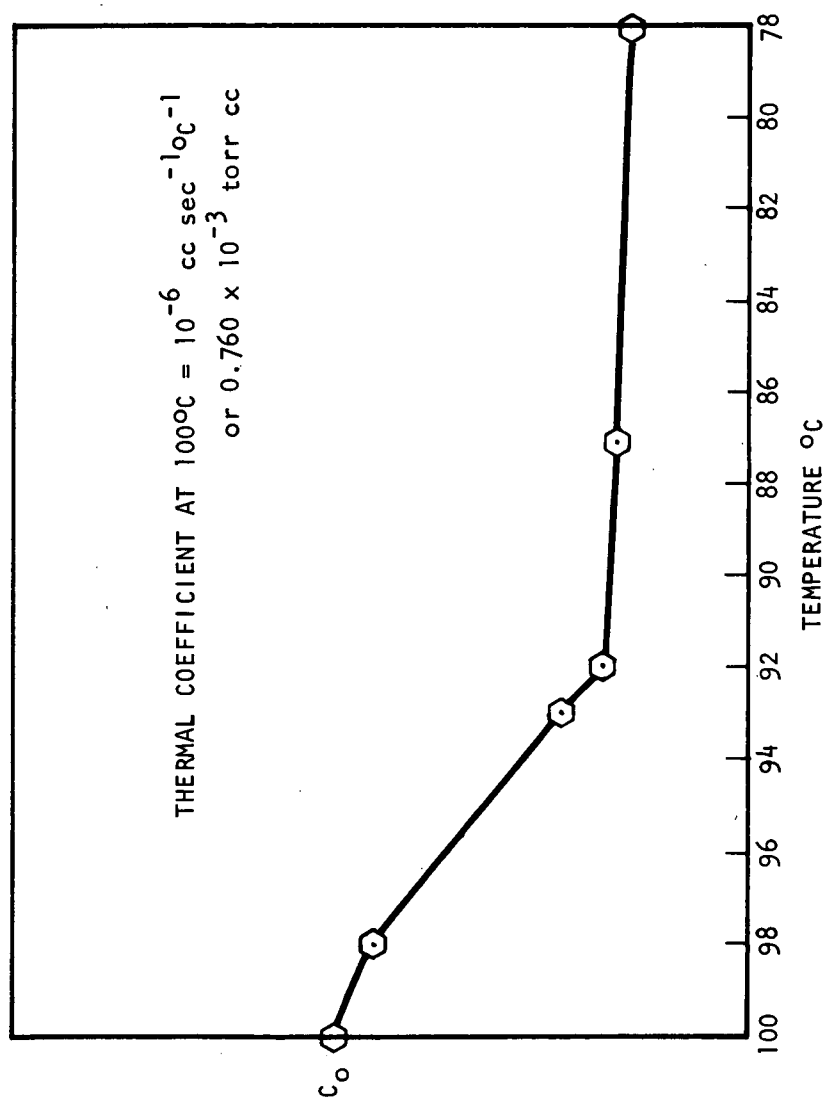


FIGURE 10. Closure vs Temperature

SECONDARY ELECTRONS GENERATED IN COLLECTOR BUCKETS

It is well established experimentally and theoretically that the maximum energy of secondary electrons emitted by the impact of ions on metal surfaces is $E_j - 2\phi$.

E_j = Ionization potential of ion

ϕ = Electron work function of metal

This is approximately 5 eV for the ions and metals used in 30249.

The radius of curvature of an electron in a magnetic field is

$$R = \frac{3.37}{B} \quad V \quad \text{cm}$$

V = Electron energy eV

B = Magnetic field gauss

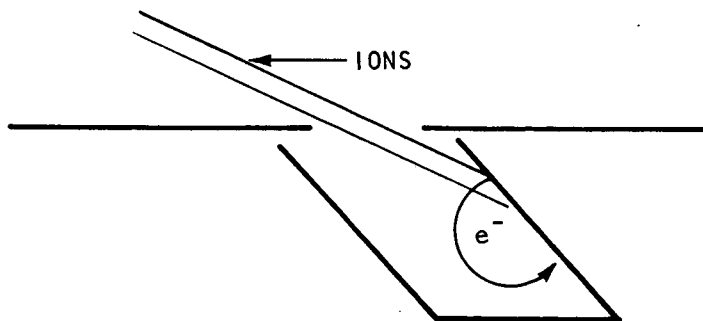
Worst case would be the 101 bucket where the magnetic field is least.

B = 50 gauss

$$R = \frac{3.37}{50} \quad 5 \quad \text{cm} = 15 \text{ mm} = 60 \text{ mil}$$

$$2R = 0.120 \text{ in.}$$

Note that the electrons will curve in the field in such a way that most electrons tend to go deeper in the bucket (shown below), since most electrons come off in the normal direction.



B.W. Scott
20 July 1971

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Design collector bucket so that point of ion impact is greater than 0.12 inches below slit.

SAMPLE LINE CHARACTERISTICS

It has been suggested that a 300 foot transport line may be used with the 30249 MS System. In this note the pressure drops and delay time will be calculated so that compatibility with available transport pumps can be considered.

V = Volume of line 0.150 ID, Length 300 ft = 1.03 liter

Q = Flow in atm liters per minute = $1.685 \times 10^{-5} (P_2^2 - P_1^2)$

P_2, P_1 are pressures at the extreme ends of the line in torr.

Δt = Delay $\cong \frac{V}{Q}$ minutes

The total pressure drops in the line filters 2 Nupro SS4F7 and 2 millipore GS are derived from the manufacturer's data sheets. Flows, pressure drops and delays are shown in Table 12.

TABLE 12

<u>Flow</u> <u>Atm Liter Min⁻¹</u>	<u>Line</u> <u>Drop, Torr</u>	<u>Filter Drop, Torr</u> <u>Nupro + Millipore</u>	<u>Delay, Min</u>
0.25	10	0.55 + 7.3	4.12
0.5	20	1.1 + 14.7	2.06
1.0	40	2.2 + 31.3	1.03
1.5	61	2.7 + 38.6	0.69
2.0	83	3.6 + 62.6	0.52

MOVEMENT OF $m/e = 2$ IMAGE BY ION SOURCE SHIELD

The computer program used to calculate the image positions and beam widths in 30249 Project Note No. 3 utilized a magnetic field plot in which the ion source shielding was omitted. In this note, we will report an investigation of the movement of this image point when the magnetic field is perturbed by the source shield.

To check this image motion, the previous field plot was used, together with the computer generated trajectory and a new plot of the perturbed field along the trajectory. An outline of these data is shown in Table 13.

TABLE 13

Position X Coordinate	B, Gauss	Change ΔB , Due to Shield
-7.25 cm	23 gauss	-11 gauss
-4.0 cm	110 gauss	-18 gauss
-3.0	211 gauss	-12 gauss
-2.0	338 gauss	- 7 gauss
-1.25	1100 gauss	- 4 gauss
-0.5	2000 gauss	- 1 gauss
+0.5	3960 gauss	0 gauss
+0.85	3960 gauss	0 gauss

Perturbation Scheme

If sufficiently small increments are taken, the motion of a charged particle in a magnetic field can be described by a series of straight lines. The angle between each line and the next is given by:

$$\alpha = \tan^{-1} \frac{\ell}{R}$$

ℓ = line segment length, meters

$$R = \frac{3.37}{B} \times 10^{-2} \sqrt{\frac{M}{m}} V \text{ meters}$$

M = ion mass, au

m = electron mass, au

B = magnetic field, gauss

V = ion energy, eV

Thus the deviation from a straight line trajectory that occurs in a distance ℓ is given by:

$$X = \frac{\ell^2}{R}$$

differentiating with respect to R

$$\frac{-dx}{dR} = \frac{\ell^2}{R^2}$$

Thus, the change in X, ΔX , due to a change in R, ΔR is given by

$$-\Delta X = \frac{\ell^2}{R^2} \Delta R = \frac{X}{R} \Delta R$$

but from the relation between R and B it is found that

$$\frac{-\Delta R}{R} = \frac{\Delta B}{B}$$

so the perturbation of the trajectory is given by

$$\Delta X = X \frac{\Delta B}{B}$$

Dividing the trajectory in equal segments (10 segments) we see that the total deviation due to a perturbation must be multiplied by the number of segments left to traverse. Thus, the deviation occurring in the first segment causes the particle to go at a slightly different angle for all of the segments. The further deviation occurring in the second segment is active for only nine segments, etc.

Thus, in summary, the deviation, X, occurring in each segment is taken from the computer calculations of the unperturbed trajectory. From this, each ΔX is calculated using the measured perturbed field. The total deviation is found by multiplying each deviation X by the number of segments of path length over which it is effective.

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26 July 1971

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Outlines of calculations are shown in Table 14 and the trajectory is shown schematically in Figure 11.

TABLE 14

<u>Segment</u>	<u>B</u>	<u>ΔB</u>	<u>X</u>	$\Delta X = \frac{X \Delta B}{B}$ Mils	<u>Total ΔX Mils</u>
1	23	-11	2.0 mil	1.0	1.0
2	50	-13	4.0 mil	1.0	3.0
3	75	-15	6.0 mil	1.2	6.2
4	110	-18	8.0 mil	1.3	10.7
5	211	-12	16.0 mil	0.8	16.0
6	338	-7	20.0 mil	0.5	21.8
7	1100	-4	40.0 mil	0.16	28.56
8	2000	-1	100.0 mil	0.015	34.53
9	3960	-0	--	0	41.51

Conclusions

The total deviation due to the ion source shield is approximately 0.045 inch in the direction shown in Figure 11. The coordinates of the image given in Project Note No. 3 should be changed to X = 0.93 cm, Y = 1.02 cm.

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26 July 1971

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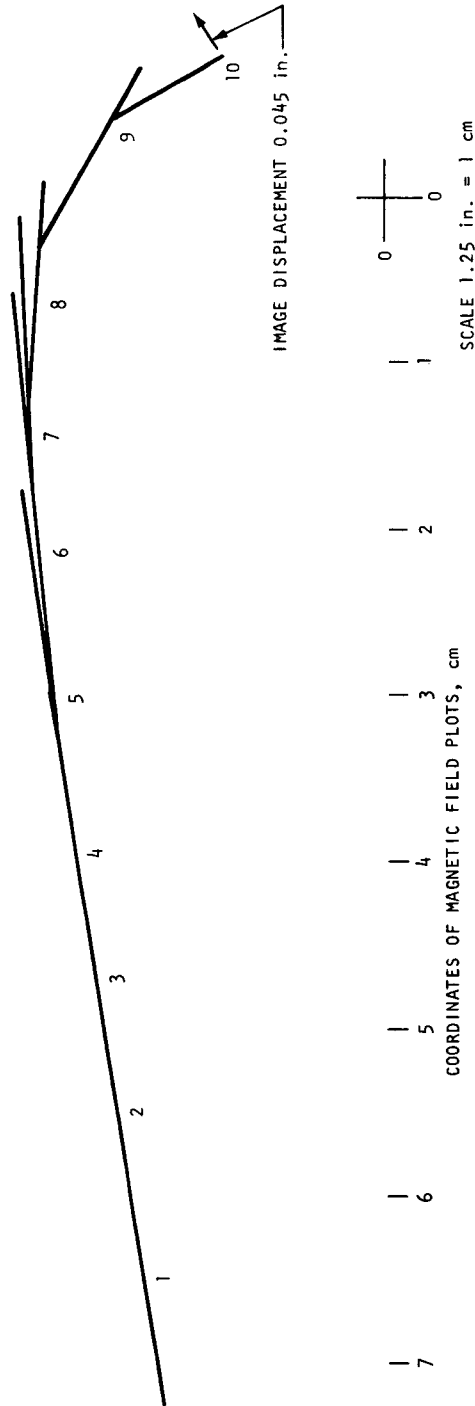


FIGURE 11. Path Segments Used to Calculate Perturbation of Trajectory by Source Shield

MATERIALS OF CONSTRUCTION, TOTITE

Introduction

The question of optimum aluminum alloys to be utilized in Totite primary and secondary structures has been investigated. Of primary concern is structural strength before and after welding; workability of the material; corrosion resistance; and availability. In the interest of aiding mechanical design personnel, information dealing with structural properties is presented for two common weldable aluminum alloys in Table 15.

Discussion

The structural design concept of Totite chassis and secondary structure employs light gauge (to 0.125") aluminum sheet and extruded shapes. It is anticipated that the primary means of fastening will be fusion welding with riveted and/or bolted connections utilized as required. In the interests of simplifying the procurement aspect, it is recommended that the entire structural system be fabricated from a weldable alloy. It is recognized that many suitable alloys exist and it is not the intent here to limit the choice to the materials shown. However, there are other important factors to be considered such as availability and cost. While alloys 5083, 5456, etc., offer higher strength in the welded condition, they may be more expensive and not readily available.

One of the primary concerns of the Navy is material corrosion and both alloys shown are corrosion resistant. However, 6061-T6 is considered one of the best, if not the best, and from past experience, the Navy has a preference for 6061.

From a workability standpoint, 5052 shows a slight advantage. This can be verified by a comparison of minimum bend radii tables (Ref: Alcoa Structural Handbook) for the two materials. For example, in 0.125 inch material the minimum bend radii are: 5052, 0-1t; 6061-T6, 1-1/2-3t (t = material thickness). For structures and components which are subcontracted, there may be a cost advantage with 5052 material.

Conclusion

For welded structures, it is felt that 6061-T6 is the best choice. This is based on the significantly higher strengths in both the welded and unwelded conditions. Although 5052 is corrosion resistant and slightly more workable, it would appear that the Navy's preference for the corrosion resistance of 6061 offsets the disadvantage of the slightly larger bend radii required.

T. Morris
16 September 1971

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TABLE 15

	Unwelded			Welded		
	Tensile Ultimate	Tensile Yield	Shear Yield	Tensile Ultimate	Tensile Yield	Shear Yield
6061-T6	42,000	35,000	20,000	24,000	20,000	12,000
5052-H32	31,000	23,000	13,000	25,000	13,000	7,500

Note: Values shown are in units of lbs/in^2

Reference: Alcoa Handbook of Design Stresses for Aluminum, pp 90-96

APPENDIX 2
FUNCTIONAL TEST REPORT

APPENDIX 2

Test Document No. TP 82-0023

Release Date 12/21/71

Revision:

ACCEPTANCE TEST PROCEDURE

FOR

ATMOSPHERIC CONTAMINANT SENSORS

CONTRACT NAS9-12066

SPO NUMBER 30249

W. R. Knepper
B. W. Scott
Prepared By *Joseph H. Stuart* Date *20 Dec 71*
Approved By *[Signature]* Date *12-20-71*
Approved By *J. E. Baker* Date *12/20/71*
Approved By *R. L. Stubblefield* Date *12/20/71*

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Test Document No. TP 82-0023

TEST DOCUMENT REVISION RECORD

<u>REVISION</u>	<u>DATE</u>	<u>ECN NO.</u>	<u>AFFECTED PAGES</u>	<u>EFFECTIVITY</u>
Issue 1	12/20/71	--	1 thru 42	
Original	12/21/71	--	1 thru 42	

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1. SCOPE

1.1 This document specifies the procedure to be used for the acceptance tests of the Atmospheric Contaminant Sensors, hereinafter referred to as the ACS, defined by Exhibit A, Statement of Work for Atmospheric Contaminant Sensor, 20 May 1971, and Perkin-Elmer Aerospace Division drawing 344800.

1.2 This document applies only to the preproduction units designed and fabricated under NASA Contract NAS9-12066. Since these systems are preproduction units the performance specifications, as noted in the Statement of Work, are considered only as design goals. Therefore, the inability of the ACS to meet any of these design goals during acceptance test shall not be considered as the basis for rejection.

1.3 These preproduction units may, at the discretion of the supplier, be delivered for field installation and preliminary testing prior to the initiation and/or completion of the acceptance test.

1.4 Because of the maintainable nature of the ACS it may, at any time, be adjusted, recalibrated, or repaired before, after or during acceptance test.

2. APPLICABLE DOCUMENTS

2.1 The following documents shall be used during the acceptance test:

- | | | |
|----|---------|------------------------------------|
| a. | 345400 | Installation Drawing |
| b. | 344800 | Contract End Item Assembly Drawing |
| c. | 82-0023 | Acceptance Test Procedure |
| d. | TBD | Operation Manual, ACS |

3. TEST CONDITIONS, EQUIPMENT, FACILITIES AND TOLERANCES

3.1 GENERAL. The test conditions, equipment, facilities and tolerances under which the tests in Section 5 shall be conducted are specified below.

3.2 TEST CONDITIONS. Unless otherwise specified herein, all tests shall be conducted under the following conditions and verified prior to performing each test:

- a. Standard Conditions shall be as follows:
- (1) Test temperature shall be 65 to 85°F
 - (2) Relative humidity shall not exceed 90%

- (3) Barometric pressure shall be laboratory ambient
- (4) Ambient illumination shall be the prevailing laboratory ambient.
- b. Unless otherwise specified, test equipment error shall not exceed one-fourth of the allowable tolerance of the measured value. Where this is not possible, known error may be used to correct the measurements. The ACS outputs shall be observed only on its internal meters and the limitations of these devices will not be subject to the above restrictions.
- c. All data sheets shall be stamped and dated as specified in Section 6, Data Sheets.

3.3 TEST EQUIPMENT

3.3.1 The items listed in Table 1, or their equivalents, are required to conduct the tests specified herein. All test equipment shall be calibrated per the appropriate calibration procedure and the next calibration due date shall be shown on a calibration decal. Prior to performing the tests specified herein, the test equipment required shall be surveyed to verify that the calibration due dates are not violated.

3.4 FACILITIES

3.4.1 The tests shall be conducted at the Perkin-Elmer Aerospace Division facilities, 2855 Metropolitan Place, Pomona, California.

4. PRECAUTIONARY ITEMS

4.1 The ACS unit contains a pump down valve and a vent valve both of which are located on the analyzer assembly. Operation of either of these valves can cause the analyzer to be vented. While the system is protected against harmful effects due to excessive internal pressure, a sudden venting of the analyzer might not allow time for these protective devices to operate, in which case damage might occur. Utmost caution shall be exercised to insure that these valves are not opened during acceptance testing of the ACS.

4.2 The ACS also contains a heated variable leak valve, located on the analyzer, which is utilized to admit a gas sample into the mass spectrometer. This valve shall be opened only when the following controls are on: POWER (circuit breaker and lamp); L.V.P/S (switch); and ION PUMP (switch and lamp); and ROUGH COMP (lamp). The rotary switch below the analog test meter shall be in the Ip (200 μ A) position. When opening the valve it is necessary to turn the handle CCW several revolutions before any indication will appear on the analog test meter. Even so, the valve shall be opened cautiously because when it does start to open the ion pump current will rise very rapidly. When closing the inlet leak valve do NOT overtighten. Finger tight is sufficient.

TABLE 16. TEST EQUIPMENT

Description & Model No.	Manufacturer	Calibration Procedure	Accuracy
Pressure Gauge 0-50 inHg 61A-1B-0050	Wallace-Tiernan	Manufacturer	0.066% of F.S.
Variac, 60 Hz, 120 V ac 10A			
VOM 630A	Triplett	Manufacturer	+1.5%
Scale			
Standard Mixture (Approx) 78% N ₂ 18% O ₂ 1% A 1% CO ₂ 1.5% H ₂ 100 ppm F12 100 ppm F14	Precision Gas Products	Manufacturer	Vendor Certification
Mixture No. 1 (Approx) 75% N ₂ 22% O ₂ 1% A 2% CO ₂ 0.5% H ₂	Precision Gas Products	Manufacturer	Vendor Certification
Freon 11/Nitrogen Mixture (Approx) 50 ppm F11 Balance N ₂	Precision Gas Products	Manufacturer	Vendor Certification
Nitrogen Gas	Poxco	Manufacturer	Vendor Certification
Standard Inlet System 343442	Perkin-Elmer	Manufacturer	N/A

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5. TEST PROCEDURES

Verification testing of the performance characteristics of the CAS is given in the following paragraphs. Any of the tests in the following sections may, at the discretion of the Technical Monitor, be deleted or replaced by test data taken during functional testing.

5.1 INITIAL SETUP. This Acceptance Test Procedure shall not be performed from a cold turn on, but rather after the unit is in a full up functional condition with all calibrations performed.

5.1.1 Verify that all digital displays are working by pressing the DISPLAY TEST switch and noting that all digital displays read 1888. Record acceptance or rejection on Test Data Sheet.

5.1.2 The ACS operational controls shall be initially set as indicated below. Record acceptance or rejection on Test Data Sheet.

CONTROL	TYPE	POSITION	LOCATION
POWER	Breaker	ON	Power Panel
POWER	Indicator Lamp	ON	Power Panel
L.V. P/S	Toggle Switch	ON	Power Panel
ION PUMP	Toggle Switch	ON	Power Panel
ION PUMP	Indicator Lamp	ON	Power Panel
ROUGH COMP	Indicator Lamp	ON	Power Panel
M.S. P/S	Toggle Switch	ON	Power Panel
TC OVERRIDE	Toggle Switch	OFF	Power Panel
FILAMENT PREHEAT	Indicator Lamp	OFF	Power Panel
SAMPLE PUMP	Toggle Switch	ON	Power Panel
STANDBY, FILAMENT	Pushbutton Switch/Lamp	OFF	Test Panel
ON, FILAMENT	Pushbutton Switch/Lamp	ON	Test Panel
HEATERS	Toggle Switch	ON	Power Panel
VARIABLE LEAK	Valve	CLOSED	Analyzer
SAMPLE INLET	Valve	CLOSED	Flow Control Panel
SAMPLE OUTLET	Valve	CLOSED	Flow Control Panel
FLOW CONTROL	Needle Valve	NOMINAL	Flow Control Panel
ANALOG TEST METER	Rotary Switch	I _{AN}	Test Panel
DIGITAL TEST METER	Rotary Switch	P _{AMB}	Test Panel

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5.1.3 The ACS input voltage shall be supplied from a Variac which is set for 115 $\pm$ 1 volts ac output. Record on Test Data Sheet.

5.2 NOMINAL CONDITIONS. The following nominal conditions shall be observed. Record on Test Data Sheet.

PARAMETER	TITLE	VALVE	LOCATION
Hydrogen Output	H ₂	$\leq$ 1.0 torr	Output DVM
Oxygen Output	O ₂	$\leq$ 1.0 torr	Output DVM
Carbon Dioxide Output	CO ₂	$\leq$ 0.6 torr	Output DVM
Freon 12 Output	F12	$\leq$ 5 M torr [†]	Output DVM
Freon 114 Output	F11/F114	$\leq$ 5 M torr [†]	Output DVM
Sample Flow	SAMPLE FLOW	Zero SCFH	Flow Panel
Thermocouple Gauge	TC	TBD*	Analog Test Meter
Ion Pump Current	I _P (200 μ A)	$\leq$ 5 μ A	Analog Test Meter
Electron Accelerator Current	I _{EA}	TBD*	Analog Test Meter
Anode Current	I _{AN}	TBD*	Analog Test Meter
Source Temp Indicator	TS	TBD*	Digital Test Meter
Valve Temp Indicator	TV	TBD*	Digital Test Meter
Accelerator Voltage	V _{ACC}	TBD*	Digital Test Meter
	+5	500 $\pm$ 5	Digital Test Meter
	-15	1500 $\pm$ 15	Digital Test Meter
	+15	1500 $\pm$ 15	Digital Test Meter
	+24	310 $\pm$ 20	Digital Test Meter
Nitrogen Output	N ₂	$\leq$ 4 torr	Digital Test Meter
Water Output	H ₂ O	$\leq$ 1 torr	Digital Test Meter

[†]Read only after pressing the FREON UPDATE switch and waiting for the lamp to go off.

*Value to be determined during functional test.

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PARAMETER	TITLE	VALVE	LOCATION
Inlet Pressure	P _{AMB}	Local Ambient Pressure <u>+2</u> torr	Digital Test Meter
Hydrogen Electrometer	1	1 or 2**	Digital Test Meter
Water Electrometer	2	1 or 2**	Digital Test Meter
Nitrogen Electrometer	3	1 or 2**	Digital Test Meter
Oxygen Electrometer	4	1 or 2**	Digital Test Meter
Carbon Dioxide Electrometer	5	1 or 2**	Digital Test Meter
Freon 12 Electrometer	6	1 or 2**	Digital Test Meter
Freon 11/114 Electrometer	7	1 or 2**	Digital Test Meter

5.3 ZERO CHECK. The zero check test shall be conducted as follows:

- a. Press the XERO CHECK switch and hold until Steps b and c are completed. Record acceptance or rejection on Test Data Sheet.
- b. Observe the outputs as indicated by the OUTPUT DVM displays. Record on Test Data Sheet.
- c. Exercise the DIGITAL TEST METER switch and record all of the outputs indicated on Test Data Sheet.
- d. Release ZERO CHECK switch.

5.4 FUNCTIONAL TEST. The functional test shall be conducted as follows:

- a. Attach Standard Mixture gas sample bottle to the sample inlet port and record its composition on Test Data Sheet.
- b. Establish a sample flow of 0.05 $\pm$ 0.01 SCFH as indicated on the flowmeter. Allow sufficient time for complete purging of the inlet system. Record flow rate on Test Data Sheet.

**Equivalent to 0.010 to 0.020 volts.

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- c. Set DIGITAL TEST METER on P.AMB and verify that sample inlet pressure is being maintained in the indicated range. Record pressure on Test Data Sheet.

$$P_{AMB} \leq P_{SAMPLE} \leq P_{AMB} + 10 \text{ torr}$$

- d. Set ANALOG TEST METER switch to I_p (200 μA) and the DIGITAL TEST METER switch to position 3. Then admit the sample by opening the inlet leak valve. Initially, watch the ion pump current and keep it near TBD*. Observe for 5 minutes and reset the valve as necessary to stay within $\pm 10 \mu A$. Record on Test Data Sheet.
- e. Press the FREON UPDATE switch and after the indicator lamp goes off record all outputs and the P.AMB indicator pressure on Test Data Sheet.
- f. Compute the required outputs as indicated on the Test Data Sheets and compare the observed and required values. Record on Test Data Sheet.

5.5 INPUT VOLTAGE TEST. The input voltage test shall be conducted as follows:

- a. Set the input voltage Variac for 126.5 ± 1.0 V ac. Observe and record all indicated outputs on Test Data Sheet.
- b. Compare against required outputs as indicated in Paragraph 5.4, Step f. Record acceptance or rejection on Test Data Sheet.
- c. Reset the input voltage Variac for 103.5 ± 1 V ac. Observe and record all indicated outputs on Test Data Sheet.
- d. Compare against required outputs as indicated in Paragraph 5.4, Step f. Record acceptance or rejection on Test Data Sheet.
- e. Reset the input voltage Variac for 115 ± 1 V ac. Record on Test Data Sheet.

5.6 MIXTURE CHANGE TEST. The mixture change test shall be conducted as follows:

- a. Close the SAMPLE IN valve and disconnect the Standard Mixture from the sample inlet.
- b. Attach Mixture No. 1 and purge the inlet system. Reestablish the flow and pressure settings at nominal values. Record on Test Data Sheet.

*Value to be determined during functional test.

- c. Allow 10 minutes for restabilization and observe all outputs. Record outputs on Test Data Sheet.
- d. Compute the required outputs and compare against indicated values. Record on Test Data Sheet.

5.7 AUTOMATIC RATIO CIRCUIT TEST. The purpose of this test is to verify the operation of the automatic ratio circuit system.

- a. Record the ion pump current on Test Data Sheet.
- b. Increase the ion pump current by 10% by opening the variable leak valve. Observe and record the outputs and compare them to the calculated values in Paragraph 5.6, Step d. Record on Test Data Sheet.
- c. Decrease the ion pump current by 20% by closing the variable leak valve. Observe and record the outputs and compare them to the calculated values in Paragraph 5.6, Step d. Record on Test Data Sheet.
- d. Reset the VARIABLE INLET LEAK valve to the original ion pump current setting of Paragraph 5.4, Step d. Record on Test Data Sheet.

5.8 FREON 11 TEST. The Freon 11 test shall be conducted as follows:

- a. Close the SAMPLE IN valve and disconnect Mixture No. 1. Attach dry N₂ and purge the inlet system for 10 minutes.
- b. Set FREON MODE switch to the F11/F12 position.
- c. Press FREON UPDATE switch and record the F11 background, while sampling dry N₂, on Test Data Sheet.
- d. Close SAMPLE IN valve and disconnect dry N₂ sample. Attach the Freon 11/N₂ mixture and purge the inlet system for 10 minutes. Record F11/N₂ mixture level on Test Data Sheet.
- e. Establish nominal flow and pressure levels. Record on Test Data Sheet.
- f. Record N₂, F11, and F12 outputs on Test Data Sheet.
- g. Compute the required outputs and compare against actual values. Record acceptance or rejection on Test Data Sheet.

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5.9 PRESSURE TEST. The pressure test shall be conducted as follows:

- a. Close the SAMPLE IN valve and disconnect the Freon 11/N₂ mixture. Attach the Standard Inlet System (SIS) which has been modified with a 0 to 50 inHg pressure gauge. Set up to introduce STP Mixture over a variable pressure range with the SIS. Purge in ACS inlet system.
- b. Establish a nominal flow at a pressure of 30 inHg. Record the indicated outputs then compute the required outputs and compare to actual values. Record acceptance or rejection on Test Data Sheet.
- c. Establish a nominal flow at a pressure of 20 inHg. Record the indicated outputs then compute the required outputs and compare to actual values. Record acceptance or rejection on Test Data Sheet.
- d. Establish a nominal flow at a pressure of 40 inHg. Record the indicated outputs then compute the required outputs and compare to actual values. Record acceptance or rejection on Test Data Sheet.
- e. Close the SAMPLE IN valve and disconnect the SIS. Set up nominal pressure and flow conditions on laboratory ambient air and allow ACS to stabilize. Record all indicated outputs on Test Data Sheet.

5.10 REDUNDANT FILAMENT TEST. The redundant filament test shall be conducted as follows:

- a. Record all indicated outputs on Test Data Sheet. Set FILAMENT SELECT switch to the redundant filament, which has not been in use. Allow five minutes for restabilization. Observe and record the indicated outputs on Test Data Sheet.
- b. Compute the expected outputs and compare the observed values to expected values. Record on Test Data Sheet.

5.11 DEGAS TEST. The degas test shall be conducted as follows:

- a. Close VARIABLE INLET LEAK valve and allow 10 minutes for stabilization.
- b. Turn HEATER switch to DEGAS mode and observe the outputs. They should begin to go up as the heaters warm up. The water output in particular should rise. Record acceptance or rejection on Test Data Sheet.
- c. Set HEATER switch to ON after temperature rise is confirmed and allow to restabilize.

5.12 OVERPRESSURE PROTECTION TEST. The overpressure protection test shall be conducted as follows:

- a. Close SAMPLE IN valve and attach a dry N₂ sample bottle. Establish nominal flow and pressure conditions. Record ion pump current on Test Data Sheet.
- b. Slowly increase analyzer pressure by opening the HEATED VARIABLE INLET LEAK valve while observing the pressure on the I_p (200 μ A) range of the ANALOG TEST meter. When full scale is reached switch to the I_p (200 mA) range and continue to open slowly. When the ion pump current reaches approximately 1 mA the FIL A ON indicator lamp shall go off and the FIL STANDBY indicator lamp shall remain off. Record on Test Data Sheet.
- c. Continue slowly increasing the internal pressure. At a pump current level of about 5 mA the sound of a relay should be audible, which completely turns the filament off. The FILAMENT PREHEAT indicator lamp will remain ON. Record on Test Data Sheet.
- d. In order to prevent a possible loss of vacuum requiring roughing of the mass spectrometer an alternate test was substituted. The inlet leak valve was closed and the system was turned off. Then the POWER circuit breaker, L.V. P/S and ION PUMP switches were turned on. As the thermocouple gauge warms up its output is observed at the TC position of the ANALOG TEST METER. The output will first go up, thereby simulating a high internal pressure. Even though the ION PUMP switch is ON, the ion pump should remain inhibited as indicated by an OFF condition on the I.P. ON indicator lamp. When the TC output reaches approximately 1 mA the ROUGH COMP. indicator lamp should light and then the I.P. ON indicator lamp will light. By rapidly switching the ANALOG TEST METER to I_p (200 μ A) the pressure pulse will be observed as the ion pump restores background pressure. Set ANALOG TEST meter to TC.

CAUTION

This paragraph shall be read and understood in its entirety before continuing with testing.

Continue to increase the internal pressure until the TC output reads approximately 1 mA on the ANALOG TEST meter. At 1 mA on this scale the ion pump shall automatically turn off, causing the ROUGH COMP. and I.P. ON indicator lamps to go off. When this occurs, close the VARIABLE INLET LEAK valve immediately and immediately throw the TC OVERRIDE switch. This will allow the ion pump to restart and prevent a venting. Record on Test Data Sheet.

- e. With the VARIABLE INLET LEAK valve closed, allow the system to pump back down. As this happens the filament preheat relay should be audible at 5 mA and the STANDBY indicator lamp shall light at 1 mA.

5.13 LOSS OF POWER TEST. The loss of power test shall be conducted as follows:

- a. After the STANDBY indicator lamp lights, turn the analyzer ON. Open the VARIABLE INLET LEAK valve and reset to the value recorded in Paragraph 5.13, Step a. Record on Test Data Sheet.
- b. Unplug the system from the power outlet and wait 30 minutes. Record on Test Data Sheet.
- c. Replug system into power outlet and observe the pump down cycle as specified in Paragraph 5.13. If the TC output indicates that the pressure is too high for the ion pump to restart, throw the TC OVER-RIDE switch and attempt to restart. If the pressure is too high the system will have to be roughed down. Record acceptance or rejection on Test Data Sheet.

5.14 SPARES TEST. As an alternative to actual testing of the spare electronics plug-in cards, the NASA Technical Monitor may accept calibration data, which has been run on the system with the spare plug-in cards installed prior to initiation of this acceptance test. Records of this test data shall be included with the Test Data Sheets and referenced in Section 5.14 thereof. At the discretion of the NASA Technical Monitor, the spare electronics plug-in cards can be tested by subjecting the ACS to the Functional Tests (Paragraph 5.4) with the new set of cards in place. Record all data on Test Data Sheet.

5.15 WORKMANSHIP. Inspect workmanship that in general is in accordance with MIL-E-5400. Record acceptance or rejection on Test Data Sheet.

5.16 EXTERNAL DIMENSIONS. Verify all external dimensions as specified in installation drawing 345400. Record acceptance or rejection on Test Data Sheet.

APPENDIX 2

ATMOSPHERE CONTAMINANT SENSOR

PART NO. 344800 SERIAL NO. 001

ACCEPTANCE TEST DATA

APPENDIX 2

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6. DATA SHEETS

6.1 GENERAL

6.1.1 This section contains all of the data sheets necessary to record the data requirements of Section 5. The applicable Section 5 paragraph is referenced for each data requirement. Additional data sheets are available from the Seller's Quality Assurance Group.

Test Conducted by <u>M. Rueda</u>	Date <u>12/20/71</u>
Test Verified by <u>M. Rueda</u>	Date <u>12-20-71</u>
Test Surveillance <u>B. C. Schults</u>	Date <u>12-20-71</u>
<u>R. H. Stubbelfield</u>	Date <u>12-21-71</u>
	Date _____

6.1.2 The survey of all test equipment, in compliance with the requirement of Section 3.3, shall be verified in this section.

All test equipment within current calibration dates: (✓) YES ☒ NO ☐

Survey Conducted by <u>M. Rueda</u>	Date <u>12/20/71</u>
Survey Verified by <u>M. Rueda</u>	Date <u>12-20-71</u>
Survey Surveillance <u>B. C. Schults</u>	Date <u>12-20-71</u>
<u>R. H. Stubbelfield</u>	Date <u>12-21-71</u>

APPENDIX 2

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 1 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001

3.2 TEST CONDITIONS

- 3.2a (1) Test temperature shall be 65 to 85°F.
 (2) Relative humidity shall be < 90%.
 (3) Barometric Pressure (lab ambient)
 (4) Illumination (lab prevailing)

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ACTUAL

77 °F

45 %

739 torr

(✓) OK ☒

 DEC 20 1971
 STAMP/DATE

5. TEST PROCEDURES

5.1 INITIAL SETUP

- 5.1.1 All digital displays functional (1888)

(✓) ACPT ☒ REJ ☐

 DEC 20 1971
 STAMP/DATE

- 5.1.2 ACS controls set as specified.

(✓) ACPT ☒ REJ ☐

 DEC 20 1971
 STAMP/DATE

- 5.1.3 Variac setting shall be 115.0 ±1.0 V ac.

115 V ac

 DEC 20 1971
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5.2 NOMINAL CONDITIONS

H₂O shall be ≤ 2.0 torr.

1.6 torr

O₂ shall be ≤ 5.0 torr.

0.01 torr

CO₂ shall be ≤ 0.6 torr.

0.2 torr

F12 shall be ≤ 5 ppm⁺

22 ppm

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 STAMP/DATE

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 2 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001

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3.2 TEST CONDITIONS

5.2 (Cont)

F114 shall be ≤ 5 ppm.

SAMPLE FLOW shall be 1.0 SCFH.

TC gauge shall be (TBD)

I_p (200 μA scale) shall be $\leq 5 \mu A$.

I_{EA} shall be (TBD)

I_{AN} shall be $37.5 \pm 1.0 \mu A$

TS indicator shall be (TBD)

TV indicator shall be (TBD)

V_{ACC} shall be (TBD)

+5 shall be 500 ± 5

-15 shall be 1500 ± 15

+15 shall be 1500 ± 15

+24 shall be 310 ± 20

N_2 output shall be ≤ 4 torr.

H_2O output shall be ≤ 1 torr

P. _{AMB} shall be amb press ± 2 torr

1 (H_2 Elcmtr) shall be 0.01 or 0.02

2 (H_2O Elcmtr) shall be 0.01 or 0.02

ACTUAL

0 ppm

0 SCFH

.26A

3 μA

120 ~~uA~~

37.5 μA

7.53 V

7.78

443.4

4.78

14.5V

14.56V

27.6-28.4V

001 torr

0.9 torr

AMB 739 Torr

P. _{AMB} 733 Torr

.11

.03

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6.2 FUNCTIONAL TEST DATA SHEETS (Sheet 3 of 21)REFERENCE PARAGRAPHSERIAL NUMBER 001

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3.2 TEST CONDITIONS

5.2 (Cont)

ACTUAL

3 (N₂ Elcmtr) shall be 0.01 or 0.020.014 (O₂ Elcmtr) shall be 0.01 or 0.020.01-25 (CO₂ Elcmtr) shall be 0.01 or 0.020.01

6 (F12 Elcmtr) shall be 0.01 or 0.02

There are arbitrary set points that do not affect system performance.

7 (F11/114 Elcmtr) shall be 0.01 or 0.02

0.01

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 STAMP/DATE

5.3 ZERO CHECK

- a. ZERO CHECK switch held until Steps b and c (✓) ACPT ☒ REJ ☐
- are completed.


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- b. Outputs indicated by OUTPUT DVM displays shall be:

H₂ (≤ 2.0 torr)0.7O₂ (≤ 5 torr)000CO₂ (≤ 0.6 torr)0.1

F12 (≤ 5 ppm)

25

F114 (≤ 5 ppm)

00

This reading results from the action of the Freon correction circuitry and does not reflect a true zero level. A true zero level is obtained by operating the system on a sample gas which does not contain Freon 12. See paragraph 5.6 c, line 5. nAR


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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 4 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001



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5. TEST PROCEDURES

5.3 (Cont)

ACTUAL

c. DIGITAL TEST METER outputs shall be:

V_{ACC}

265
REQUIRED

262V

N_2 (≤ 4 torr)

0.01

H_2O (≤ 1 torr)

0.1

(H_2 Elcmtr) 0.01 or 0.02

.05

(H_2O Elcmtr) 0.01 or 0.02

.01

(N_2 Elcmtr) 0.01 or 0.02

.01

(O_2 Elcmtr) 0.01 or 0.02

.01

(CO_2 Elcmtr) 0.01 or 0.02

.01

(F12 Elcmtr) 0.01 or 0.02

.00

(F11/114 Elcmtr) 0.01 or 0.02

.00

*These are arbitrary
set points which
do not affect system
performance.*

mar



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5.4 FUNCTIONAL TEST

a. Standard Mixture composition *cyl # 6347 P/O 18951-H*

N_2

78.48%

O_2

18.0 %

CO_2

1.02 %

A

1.01 %



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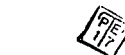
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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 5 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001



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5. TEST PROCEDURES

5.4a. (Cont)

H₂

F12

F114

Cylinder Number 6347

ACTUAL

1.47 %

104 ppm

100 ppm



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b. Flow rate shall be 0.05 +0.01 SCFH

.05 SCFH



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c. Ambient Pressure

739
AMBIENT

745 torr



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d. Ion Pump current

100 μ A

~~Nitrogen electrometer output (700 $\pm$ 10)~~
Not applicable mex

7.98 V



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e. Outputs

H₂

10.9 torr

O₂

134 torr

CO₂

7.1 torr

F114

74 M torr



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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 6 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001

5. TEST PROCEDURES

5.4e. (Cont)

F12

N₂

H₂O

P. AMB

ACTUAL

76 M torr

586-7 torr

0.6 torr

744.5 torr



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f. Required values

REQUIRED

$$P_{H_2} = \frac{745}{(P. AMB)} \times \frac{1.47}{(\%H_2)} \times \frac{1}{100} =$$

10.95 +4 torr

$$P_{O_2} = \frac{745}{(P. AMB)} \times \frac{18}{(\%O_2)} \times \frac{1}{100} =$$

134 +10 torr

$$P_{CO_2} = \frac{745}{(P. AMB)} \times \frac{1.02}{(\%CO_2)} \times \frac{1}{100} =$$

7.6 + 1.3 torr

$$P_{F114} = \frac{745}{(P. AMB)} \times \frac{100}{(ppm F114)} \times \frac{1}{1000} =$$

75 + 23 M torr

$$P_{F12} = \frac{745}{(P. AMB)} \times \frac{104}{(ppm F12)} \times \frac{1}{1000} =$$

77 +23 M torr

$$P_{N_2} = \frac{745}{(P. AMB)} \times \frac{78.48}{(\%N_2)} \times \frac{1}{100} =$$

585 torr

$$P_{H_2O} =$$

0 torr*

*No tolerance. Information only.

All readings within tolerance.

(✓) ACPT ☒ REJ



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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 7 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001

DEC 20 1971
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5. TEST PROCEDURES

5.5 INPUT VOLTAGE TEST

ACTUAL

a. High line Variac setting (126.5 $\pm$ 1.0 V ac)

126 V ac

Outputs

H₂

10.9 torr

O₂

134 torr

CO₂

7.1 torr

F114

75 M torr

F12

77 M torr

N₂

586 torr

H₂O

0.6 torr

P. AMB

744 torr

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STAMP/DATE

b. All readings within tolerance

(✓) ACPT ✓ REJ

DEC 20 1971
STAMP/DATE

c. Low line Variac setting (103.5 $\pm$ 1 V ac)

103 V ac

Outputs

H₂

10.9 torr

O₂

134 torr

CO₂

7.2 torr

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 8 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001



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5. TEST PROCEDURES

5.5c. (Cont)

F114

77 M torr

F12

71 M torr

N₂

586 torr

H₂O

0.4 torr

P. AMB

744 torr



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d. All readings within tolerance

(✓) ACPT ✓ REJ



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e. Nominal line Variac setting (115 ±1 V ac)

115 V ac



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5.6 MIXTURE CHANGE TEST

b. Mixture Number 1 Composition

N₂

74.36 %

O₂

22.1 %

CO₂

2.03 %

A

1.02 %

H₂

0.49 %



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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 9 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001

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5. TEST PROCEDURES

5.6b. (Cont)

F12

ACTUAL

0 ppm

F114

0 ppm

Cylinder Number 5309 P/O 18961 H

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Sample flow (0.05 $\pm$ 0.01 SCFH)

.04 SCFH

Sample pressure ($P_{\text{ambient}} \leq P_{\text{sample}} \leq P_{\text{ambient}} + 2 \text{ torr}$)

745 torr

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c. Restabilize for minimum of 10 min.

11 min

Outputs

H₂

4.1 torr

O₂

165 torr

CO₂

15.2 torr

F114

004 M torr

F12

000 M torr

N₂

554 torr

H₂O

0.5 torr

P. _{AMB}

745 torr

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 10 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001

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5. TEST PROCEDURES

5.6d. Required Values

REQUIRED

$$\begin{aligned}
 P_{H_2} &= \frac{\quad}{(P_{AMB})} \times \frac{0.49}{(\%H_2)} \times \frac{1}{100} = \underline{3.7} \pm 4 \text{ torr} \\
 P_{O_2} &= \frac{\quad}{(P_{AMB})} \times \frac{22.1}{(\%O_2)} \times \frac{1}{100} = \underline{165} \pm 10 \text{ torr} \\
 P_{CO_2} &= \frac{\quad}{(P_{AMB})} \times \frac{2.03}{(\%CO_2)} \times \frac{1}{100} = \underline{15.1} \pm 1.3 \text{ torr} \\
 P_{F114} &= \frac{\quad}{(P_{AMB})} \times \frac{0}{(\text{ppm F114})} \times \frac{1}{1000} = \underline{0} \pm 23 \text{ M torr} \\
 P_{F12} &= \frac{\quad}{(P_{AMB})} \times \frac{0}{(\text{ppm F12})} \times \frac{1}{1000} = \underline{0} \pm 23 \text{ M torr} \\
 P_{N_2} &= \frac{\quad}{(P_{AMB})} \times \frac{74.36}{(\%N_2)} \times \frac{1}{100} = \underline{554} \text{ torr} \\
 P_{H_2O} &= \underline{0} \text{ torr*}
 \end{aligned}$$

*No tolerance. Information only.

All readings within tolerance.

(✓) ACPT ☒ REJ ☐

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5.7 AUTOMATIC RATIO CIRCUIT TEST

a. Ion pump current

101 μA

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 11 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001

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5. TEST PROCEDURES

ACTUAL

5.7b. Ion pump current increased by 10%.

111 μ A

Outputs

H₂

4.1 torr

O₂

165 torr

CO₂

15.3 torr

N₂

555 torr

All readings within tolerance

(✓) ACPT ☒ REJ ☐

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c. Ion pump current decreased by 20%.

89 μ A

Outputs

H₂

4.2 torr

O₂

165 torr

CO₂

15.2 torr

N₂

554 torr

All readings within tolerance

(✓) ACPT ☒ REJ ☐

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d. Ion pump current reset to value recorded in Step a above.

100 μ A

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 12 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001

5. TEST PROCEDURES

5.8 FREON 11 TEST

c. F11 background output (≤ 4 M torr)

d. Freon 11/ N_2 Composition

Cylinder Number 4549 9018961H

e. Flow (0.05 ± 0.01 SCFH)

Sample pressure ($P_{AMB} \leq P_{SAMPLE} \leq P_{AMB} + 10$ torr)

f. Outputs

F11

F12

P_{AMB}

g. Computed outputs

$$F11 = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\text{ppm F11})} \times \frac{1}{\quad} =$$

$$N_2 = \frac{\quad}{(P_{AMB})}$$

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ACTUAL

3 M torr
DEC 20 1971
STAMP/DATE

42 ppm

DEC 20 1971
STAMP/DATE

.04 SCFH

744 torr
DEC 20 1971
STAMP/DATE

34 M torr

1 M torr

744 torr
DEC 20 1971
STAMP/DATE

31 +3.8 M torr
-2.5 M torr
MPR

739 torr*
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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 13 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001



5. TEST PROCEDURES

5.8g. (Cont)

ACTUAL

F12 =

0 M torr*

*Information only

All outputs are within tolerance.

(✓) ACPT ✓ REJ



5.9 PRESSURE TEST

b. Flow rate (0.05 $\pm$ 0.01 SCFH)

0.05 SCFH

Inlet pressure (30 $\pm$ 1 inHg)

30.04 inHg

Outputs

H₂

10.9 torr

O₂

138 torr

CO₂

7.2 torr

F114

76 M torr

F12

81 M torr

N₂

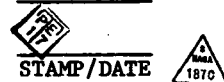
599 torr

H₂O

0.8 torr

P_{AMB}

761 torr



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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 14 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001

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STAMP/DATE

5. TEST PROCEDURES

5.9 (Cont)

Required values

ACTUAL

REQUIRED

$$\begin{aligned}
 P_{H_2} &= \frac{\quad}{(P. AMB)} \times \frac{1.47}{(\%H_2)} \times \frac{1}{100} = \underline{11.22} \pm 4 \text{ torr} \\
 P_{O_2} &= \frac{\quad}{(P. AMB)} \times \frac{18}{(\%O_2)} \times \frac{1}{100} = \underline{137} \pm 10 \text{ torr} \\
 P_{CO_2} &= \frac{\quad}{(P. AMB)} \times \frac{1.02}{(\%CO_2)} \times \frac{1}{100} = \underline{7.8} \pm 1.3 \text{ torr} \\
 P_{F114} &= \frac{\quad}{(P. AMB)} \times \frac{100}{(\text{ppm F114})} \times \frac{1}{1000} = \underline{76} \pm 23 \text{ M torr} \\
 P_{F12} &= \frac{\quad}{(P. AMB)} \times \frac{104}{(\text{ppm F12})} \times \frac{1}{1000} = \underline{79} \pm 23 \text{ M torr} \\
 P_{N_2} &= \frac{\quad}{(P. AMB)} \times \frac{78.48}{(\%N_2)} \times \frac{1}{100} = \underline{599} \text{ torr} \\
 P_{H_2O} &= \underline{0} \text{ torr*}
 \end{aligned}$$

*No tolerance. Information only.

All readings within tolerance.

(✓) ACPT ✓ REJ

~~P_{AMB} (torr) ± 2 torr = inlet pressure~~
~~(inHg) x 25.4~~

(✓) ACPT ✓ REJ

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 15 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001

5. TEST PROCEDURES

5.9c. Flow rate (0.05 $\pm$ 0.01 SCFH)

Inlet pressure (20 $\pm$ 1 inHg)

Outputs

H₂

O₂

CO₂

F114

F12

N₂

H₂O

P_{AMB}

Required Values

$$P_{H_2} = \frac{\quad}{(P_{AMB})} \times \frac{1.47}{(\%H_2)} \times \frac{1}{100} =$$

$$P_{O_2} = \frac{\quad}{(P_{AMB})} \times \frac{18}{(\%O_2)} \times \frac{1}{100} =$$

$$P_{CO_2} = \frac{\quad}{(P_{AMB})} \times \frac{1.02}{(\%CO_2)} \times \frac{1}{100} =$$

$$P_{F114} = \frac{\quad}{(P_{AMB})} \times \frac{100}{(ppm F114)} \times \frac{1}{1000} =$$

$$P_{F12} = \frac{\quad}{(P_{AMB})} \times \frac{104}{(ppm F12)} \times \frac{1}{1000} =$$



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ACTUAL

.05 SCFH

20.05 inHg
50.9 TORR

8.1 torr

91-2 torr

4.6 torr

47 M torr

48 M torr

399 torr

1.9 torr

509 torr

REQUIRED

7.5 $\pm$ 4 torr

92 $\pm$ 10 torr

5.2 $\pm$ 1.3 torr

51 $\pm$ 23 M torr

53 $\pm$ 23 M torr



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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 16 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001



DEC 20 1971



STAMP/DATE

5.9c. (Cont)

REQUIRED

$$P_{N_2} = \frac{\quad}{(P_{AMB})} \times \frac{78.48}{(\%N_2)} \times \frac{1}{100} = \underline{399} \text{ torr}$$

$$P_{H_2O} = \underline{0} \text{ torr*}$$

*No tolerance. Information only.

All readings within tolerance

(✓) ACPT ☒ REJ ☐

~~P. AMB (torr) +2 torr = Inlet pressure~~
(inHg) x 25.4 *mkc*

(✓) ACPT ☐ REJ ☐



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STAMP/DATE

d. Flow rate (0.05 ±0.01 SCFH)

Inlet pressure (40 ±1 inHg)

H₂

O₂

CO₂

F114

F12

N₂

H₂O

P. AMB

.05 SCFH

40. inHg
1010 Torr
14.0 torr

188 torr

10.4 torr

116 M torr

115 M torr

770 torr

0.9 torr

990 torr



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APPENDIX 2

TP 82-0023

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 17 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001

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5. TEST PROCEDURES

5.9d (Cont)

REQUIRED

$$\begin{aligned}
 P_{H_2} &= \frac{\quad}{(P. AMB)} \times \frac{1.47}{(\%H_2)} \times \frac{1}{100} = \underline{14.9} \pm 4 \text{ torr} \\
 P_{O_2} &= \frac{\quad}{(P. AMB)} \times \frac{18}{(\%O_2)} \times \frac{1}{100} = \underline{183} \pm 10 \text{ torr} \\
 P_{CO_2} &= \frac{\quad}{(P. AMB)} \times \frac{1.02}{(\%CO_2)} \times \frac{1}{100} = \underline{10.4} \pm 1.3 \text{ torr} \\
 P_{F114} &= \frac{\quad}{(P. AMB)} \times \frac{100}{(\text{ppm F114})} \times \frac{1}{1000} = \underline{102} \pm 23 \text{ M torr} \\
 P_{F12} &= \frac{\quad}{(P. AMB)} \times \frac{104}{(\text{ppm F12})} \times \frac{1}{1000} = \underline{106} \pm 23 \text{ M torr} \\
 P_{N_2} &= \frac{\quad}{(P. AMB)} \times \frac{78.48}{(\%N_2)} \times \frac{1}{100} = \underline{797} \text{ torr} \\
 P_{H_2O} &= \underline{0} \text{ torr*}
 \end{aligned}$$

*No tolerance. Information only.

All readings within tolerance.

(✓) ACPT ☒ REJ ☐

(✓) ACPT ☐ REJ ☐

~~P_{AMB} (torr) = 25.4 Inlet pressure~~
(inHg) x 25.4

DEC 20 1971
STAMP/DATE

5.10 REDUNDANT FILAMENT TEST

ACTUAL

a. Outputs

	FIL #1	FIL #2
H ₂	<u>0.6</u>	<u>0.7</u> torr
O ₂	<u>153</u>	<u>152</u> torr

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APPENDIX 2

TP 82-0023

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 18 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001



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STAMP/DATE

5. TEST PROCEDURES

5.10a. (Cont)

ACTUAL

	FIL #1	FIL #2
CO ₂	<u>0.7</u>	<u>1.5</u> torr
F114	<u>6.0</u>	<u>0</u> M torr
F12	<u>0</u>	<u>12</u> M torr
N ₂	<u>568</u>	<u>565</u> torr
H ₂ O	<u>8.4</u>	<u>8.9</u> torr
P _{AMB}	<u>733</u>	<u>734</u> torr



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STAMP/DATE

b. Required Values

REQUIRED

P _{H₂} =		<u>0</u> +4 torr
P _{O₂} =	$\frac{738 - 7.5}{(P_{AMB} - P_{H_2O})} \times \frac{20.99}{100}$	= <u>153</u> +10 torr
P _{CO₂} =	$\frac{0.03}{(P_{AMB} - P_{H_2O})} \times \frac{1}{100}$	= <u>0.2</u> +1.3 torr
P _{N₂} =	$\frac{78.03}{(P_{AMB} - P_{H_2O})} \times \frac{1}{100}$	= <u>570</u> torr
P _{H₂O} =	Computed Value	= <u>7.5</u> torr
F114 =		<u>0</u> +11 M torr
F12 =		<u>0</u> +11 M torr



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APPENDIX 2

TP 82-0023

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 19 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001



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STAMP/DATE

5. TEST PROCEDURES

5.10b. (Cont)

All readings within tolerance.

REQUIRED

(✓) ACPT ✓ REJ



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STAMP/DATE

5.11 DEGAS TEST

b. Outputs rise

ACTUAL

(✓) ACPT ✓ REJ



DEC 20 1971



STAMP/DATE

5.12 OVERPRESSURE PROTECTION TEST

a. Flow rate (0.05 $\pm$ 0.01 SCFH)

Ambient Pressure

— ambient

Ion pump current

0.05 SCFH

— torr

— μ A



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STAMP/DATE

The omission of this data has no effect upon the test results. mpe

b. ON indicator lamp switched off.

(✓) ACPT ✓ REJ

STANDBY indicator lamp off

(✓) ACPT ✓ REJ

Ion pump current (approx 1 mA)

(✓) ACPT ✓ REJ



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STAMP/DATE

c. Relay sound audible

(✓) ACPT ✓ REJ

Filament off

(✓) ACPT ✓ REJ



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STAMP/DATE

APPENDIX 2

TP 82-0023

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 20 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 006



DEC 20 1971



STAMP/DATE

5. TEST PROCEDURES

5.12c. (Cont)

ACTUAL

FILAMENT PREHEAT indicator ON

(✓) ACPT ☒ REJ ☐

Ion pump current (approx 5 mA)

(✓) ACPT ☒ REJ ☐



DEC 20 1971



STAMP/DATE

d. Entire Paragraph read

(✓) ☐

Ion pump OFF

(✓) ACPT ☒ REJ ☐

ROUGH COMP lamp OFF

(✓) ACPT ☒ REJ ☐

I.P. lamp OFF

(✓) ACPT ☒ REJ ☐

TC indication (Approx 1 mA)

(✓) ACPT ☒ REJ ☐



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STAMP/DATE

e. Preheat relay audible (5 mA)

(✓) ACPT ☒ REJ ☐

STANDBY lights (1 mA)

(✓) ACPT ☒ REJ ☐



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STAMP/DATE

5.13 LOSS OF POWER TEST

a. Flow rate (0.05 $\pm$ 0.01 SCFH)

Ambient pressure

NA ambient

Ion pump current

MPR

.05 SCFH

739 torr

100 μ A



DEC 20 1971



STAMP/DATE

APPENDIX 2

TP 82-0023

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 21 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 001

5. TEST PROCEDURES

5.13b. Power off at

c. Power on at

Observe pump down

 DEC 20 1971 
STAMP/DATE

ACTUAL

1755 min

 DEC 20 1971 
STAMP/DATE

1625 min

(✓) ACPT ☒ REJ ☐

 DEC 20 1971 
STAMP/DATE

APPENDIX 2

TP 82-0023

6.3 SPARES FUNCTIONAL TEST DATA SHEET (Sheet 1 of 3)

REFERENCE PARAGRAPH

SERIAL NUMBER _____

STAMP/DATE

5. TEST PROCEDURES

5.14 SPARES TEST *

(Follow procedure of Paragraph 5.4.)

a. Standard Mixture composition

ACTUAL

N₂

_____ %

O₂

_____ %

CO₂

_____ %

A

_____ %

H₂

_____ %

F12

_____ ppm

F114

_____ ppm

Cylinder Number _____

STAMP/DATE

b. Flow rate shall be 0.05 $\pm$ 0.01 SCFH

_____ SCFH

STAMP/DATE

c. Ambient Pressure _____ ambient

_____ torr

STAMP/DATE

d. Ion Pump Current

_____ μ A

Nitrogen electrometer output (700 $\pm$ 10)

STAMP/DATE

* Calibration test records substituted for this test and appended. *mpk*

($\checkmark$) YES ($\checkmark$) NO ()

PE
8

12/1/71

1810

STAMP/DATE

34

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6.3 SPARES FUNCTIONAL TEST DATA SHEET (Sheet 2 of 3)REFERENCE PARAGRAPH

SERIAL NUMBER _____

STAMP/DATE

5. TEST PROCEDURES

5.14 (Cont)

ACTUAL

e. Outputs

H₂

_____ torr

O₂

_____ torr

CO₂

_____ torr

F114

_____ M torr

F12

_____ M torr

N₂

_____ torr

H₂O

_____ torr

P_{AMB}

_____ torr

*See footnote on
page 34.*STAMP/DATE

f. Required Values

REQUIRED

$$P_{H_2} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\%H_2)} \times \frac{1}{100} = \quad \pm 4 \text{ torr}$$

$$P_{O_2} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\%O_2)} \times \frac{1}{100} = \quad \pm 10 \text{ torr}$$

$$P_{CO_2} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\%CO_2)} \times \frac{1}{100} = \quad \pm 1.3 \text{ torr}$$

$$P_{F114} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\text{ppm F114})} \times \frac{1}{1000} = \quad \pm 23 \text{ M torr}$$

$$P_{F12} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\text{ppm F12})} \times \frac{1}{1000} = \quad \pm 23 \text{ M torr}$$

STAMP/DATE

APPENDIX 2

TP 82-0023

6.3 SPARES FUNCTIONAL TEST DATA SHEET (Sheet 3 of 3)

REFERENCE PARAGRAPH

SERIAL NUMBER

5. TEST PROCEDURES

5.14 (Cont)

$$P_{N_2} = \frac{P_{AMB}}{(P_{AMB})} \times \frac{(\%N_2)}{100} =$$

$$P_{H_2O} =$$

*No tolerance. Information only.

REF. APPENDIX I 878

STAMP/DATE

REQUIRED

torr*

(✓) ACPT REJ

12/4/71

STAMP/DATE

5.15 WORKMANSHIP

Workmanship verified

(✓) ACPT REJ

12/21/71

STAMP/DATE

5.16 EXTERNAL DIMENSIONS

Dimensions verified

(✓) ACPT REJ

12/21/71

STAMP/DATE

APPENDIX 2

ADDENDUM

ELECTROMAGNETIC CONDUCTED INTERFERENCE TEST

5.17 ELECTROMAGNETIC CONDUCTED INTERFERENCE TEST

5.17.1 TEST SETUP AND PROCEDURE. The test setup shall be as follows:

- a. Make the basic test setup shown in Figure 12. Stamp Test Data Sheet.
- b. Operate measurement equipment as specified in manufacturer's instructions.
- c. The limits shall be as shown in Figure 13. Record acceptance or rejection of this requirement on Test Data Sheet. Record actual measurements on Test Data Sheet including meter reading and all appropriate correction factors.
- d. Repeat Paragraphs b and c, above, for the 115 V ac supply lines using line stabilization capacitors (LSC's) and band-reject filter to remove the 2nd, 3rd and 4th harmonics of the power line frequency.

5.17.2 TEST SETUP AND PROCEDURE. The test setup shall be as follows:

- a. Make the basic test setup shown in Figure 12. Stamp Test Data Sheet.
- b. Operate the measurement equipment as specified in manufacturer's instructions. Perform all measurements utilizing peak detector on the RFI meter.
- c. The limits shall be as shown in Figure 14. Record acceptance or rejection of this requirement on Test Data Sheet. Record actual measurements on Test Data Sheet including meter reading and all appropriate correction factors.
- d. Repeat Steps a through c for the other leads of Paragraph 5.17.1d.

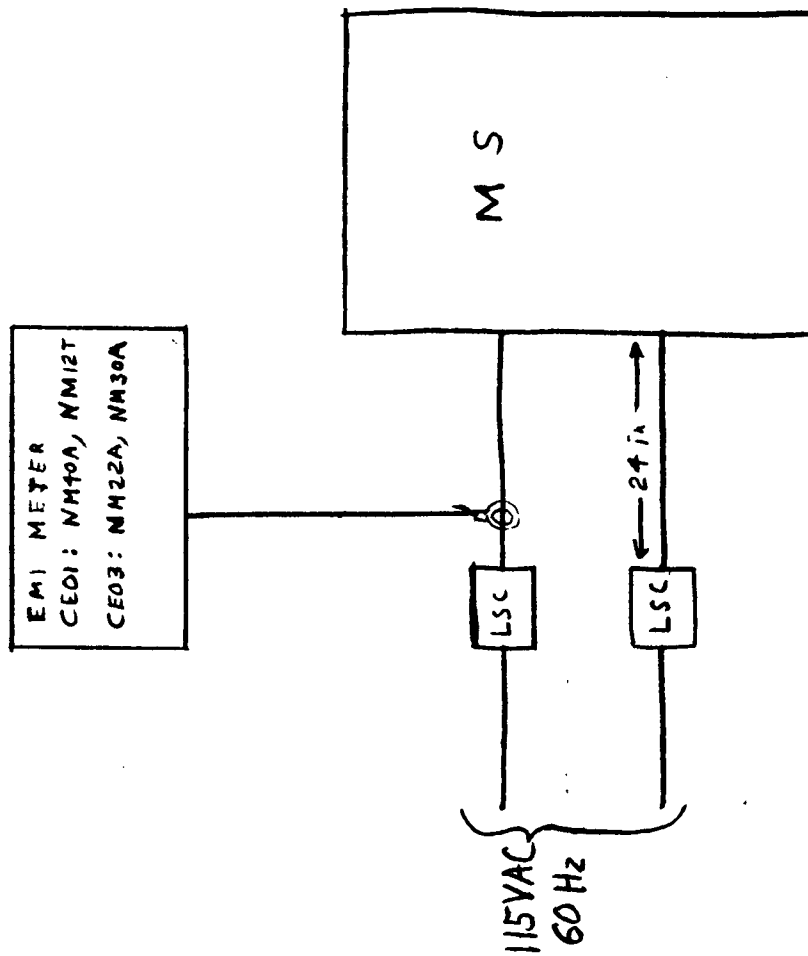


FIGURE 12. Test Setup

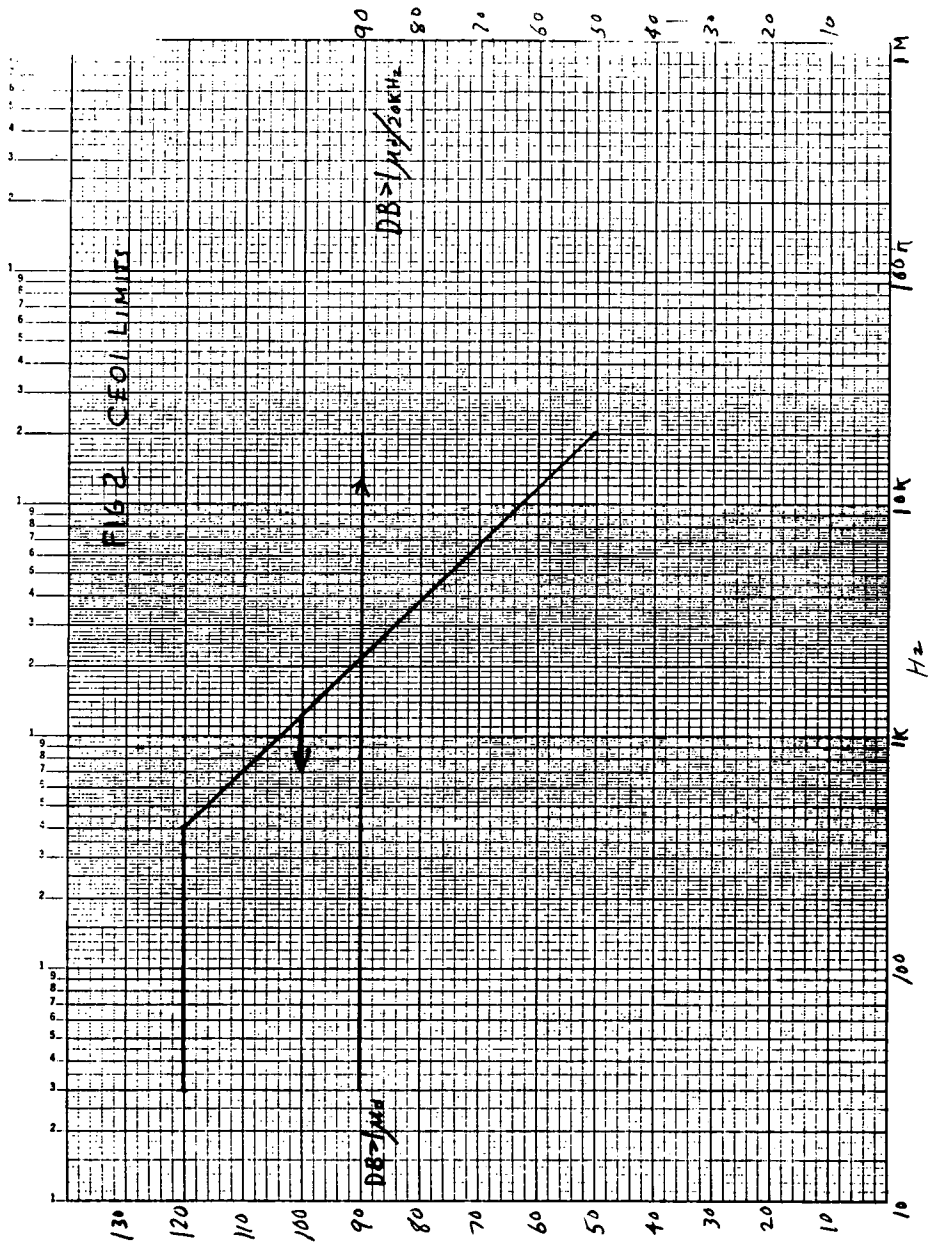


FIGURE 13. CE01 Limits

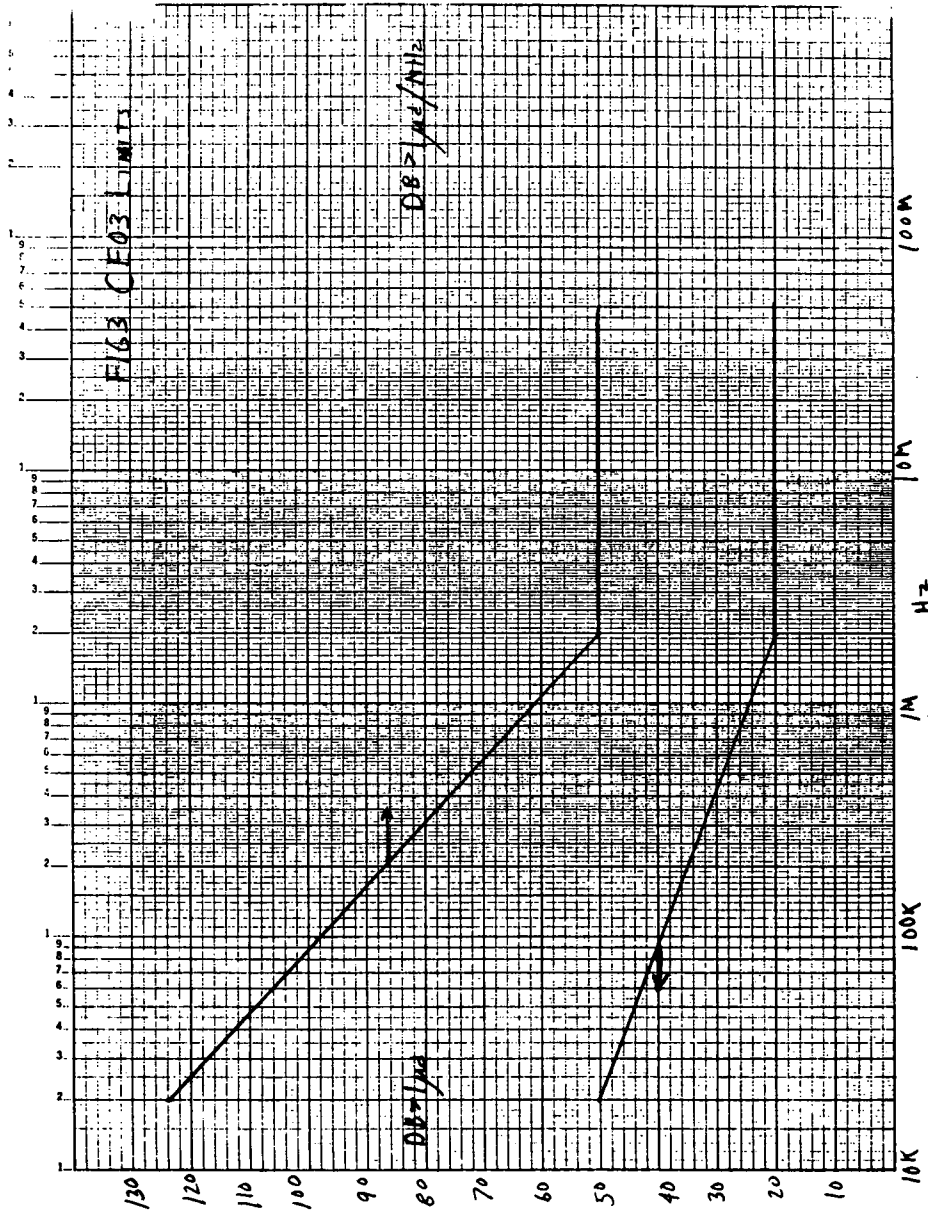
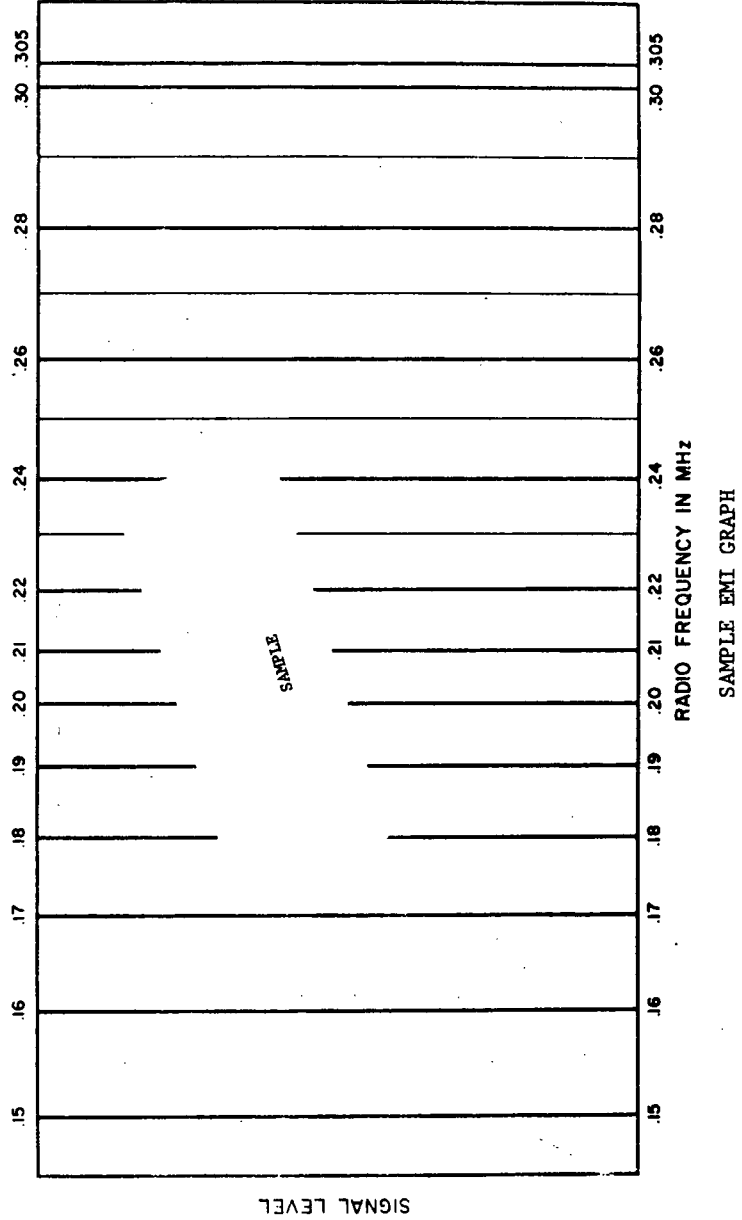


FIGURE 14. CE03 Limits

STODDART
ELECTRO SYSTEMS

APC GRAPH PAPER

Test Specimen: _____ Company: _____
 Technician: _____ Date: _____
 Type of Interference: _____ Receiver Calibration Date: _____ Data Page No: _____
 Test Condition: _____ Receiver: SES NM-22A, band I Scan Speed: _____



APPENDIX 2

ADDENDUM

TP 82-0023

PERKIN-ELMER

INTERFERENCE TEST

DATA SHEET

EQUIPMENT _____	DATE OF TEST _____
MODEL NO. _____	SERIAL NO. _____
EMI METER _____	SERIAL NO. _____
PICKUP DEVICE _____	MODEL NO. _____
TEST _____	MODEL _____
	TEST BY _____
	CERTIFIED _____
	SERIAL NO. _____
	POSITION _____

[illegible]

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PAGE _____

SAMPLE INTERFERENCE TEST DATA SHEET

APPENDIX 2

ADDENDUM

TP 82-0023

6.4 ELECTROMAGNETIC COMPATIBILITY TEST DATA SHEET (Sheet 1 of 1)

REFERENCE PARAGRAPH

SERIAL NUMBER

DEC 20 1971
STAMP/DATE

5. TEST PROCEDURES

5.17 ELECTROMAGNETIC CONDUCTED INTERFERENCE TEST

5.17.1 Test Setup and Procedure

a. Test set up as shown in Figure 1.

ACTUAL
DEC 20 1971
STAMP/DATE

c. Limits not exceeded

(✓) OK

Data Sheets attached

DEC 20 1971
STAMP/DATE

d. (b) and (c) repeated for 115 V RTN

(c) Limits not exceeded

(✓) OK

Data Sheets attached

DEC 20 1971
STAMP/DATE

5.17.2 Test Setup and Procedure

a. Test set up as shown in Figure 1.

DEC 20 1971
STAMP/DATE

c. Limits not exceeded

(✓) OK

Data Sheets attached

DEC 20 1971
STAMP/DATE

d. (b) and (c) repeated for 115 V RTN

(c) Limits not exceeded

(✓) OK

Data Sheets attached

DEC 20 1971
STAMP/DATE

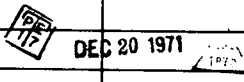
APPENDIX 2

PERKIN-ELMER

INTERFERENCE TEST

DATA SHEET

EQUIPMENT ATMOS CONT SENSORDATE OF TEST 12-20-71MODEL NO. _____ SERIAL NO. 1TEST BY F. DOIRONEMI METER NM 22A SERIAL NO. 417-16CERTIFIED Due 10 July 72PICKUP DEVICE Current Probe MODEL NO. 91550-1SERIAL NO. BF 486TEST CONDUCTED EMI MODEL _____POSITION 115 V HIGH

MEASUREMENT		CW	PCW	BB			
DET: FUNCTION		FI	QP	PK	SEL.	RMS	AVG
FREQUENCY	AMBIENT	METER READING	BANDWIDTH FACTOR	PICKUP FACTOR	CORRECTED VALUE	SPEC. LIMIT	
K HERTZ		db ABOVE 1 MICROVOLT DB7/MV/MHz					
160		43	40	-5	78		
290		22		-9	53		
600		-3		-11	26		
800		-5		-12	23		
990		17		-12	45		
MEGA HERTZ							
1.4		-6		-13	21		
1.95		-6		-13	21		
3.0		-11		-13	16		
4.0		-8		-14	18		
5.0		-9		-14	17		
7.0		-10			16		
11.0		-10			16		
15.0		-9			17		
18.0		-5			21		
20.0		-5			21		
23.0		-7			19		
25.0		-8			18		
30.0		-7	40	-14	19		
							

APPENDIX 2

PERKIN-ELMER

INTERFERENCE TEST

DATA SHEET

EQUIPMENT ATMOS CONT SENSOR

DATE OF TEST 12-20-71

MODEL NO. _____ SERIAL NO. 1

TEST BY F. DOIRON

EMI METER NM 12T SERIAL NO. AH-47

CERTIFIED Due July 72

PICKUP DEVICE CURRENT PROBE MODEL NO. 91550-1

SERIAL NO. BF 486

TEST CONDUCTED EMI MODEL

POSITION 115 VNHGN

[illegible]

APPENDIX 2

PERKIN-ELMER

INTERFERENCE TEST

DATA SHEET

EQUIPMENT	ATMOS CONT SENSOR		DATE OF TEST	12-20-71	
MODEL NO.		SERIAL NO.	1	TEST BY	F DOIRON
EMI METER	NM 12T	SERIAL NO.	AH 47	CERTIFIED	Due July 72
PICKUP DEVICE	CURRENT PROBE	MODEL NO.	91550-1	SERIAL NO.	BF-486
TEST	CONDUCTED EMI	MODEL		POSITION	115 V LOW

[illegible]

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PAGE _____

APPENDIX 2

PERKIN-ELMER

INTERFERENCE TEST

DATA SHEET

EQUIPMENT ATMOS CONT SENSOR

DATE OF TEST 12-20-71

MODEL NO. _____ SERIAL NO. 1

TEST BY F. Doiron

EMI METER NM 40A SERIAL NO. 740-5

CERTIFIED Due July 72

PICKUP DEVICE CURRENT PROBE MODEL NO. 91550-1

SERIAL NO. 553-25

TEST CONDUCTED EMI MODEL

POSITION 115 V LOW

[illegible]

APPENDIX 2


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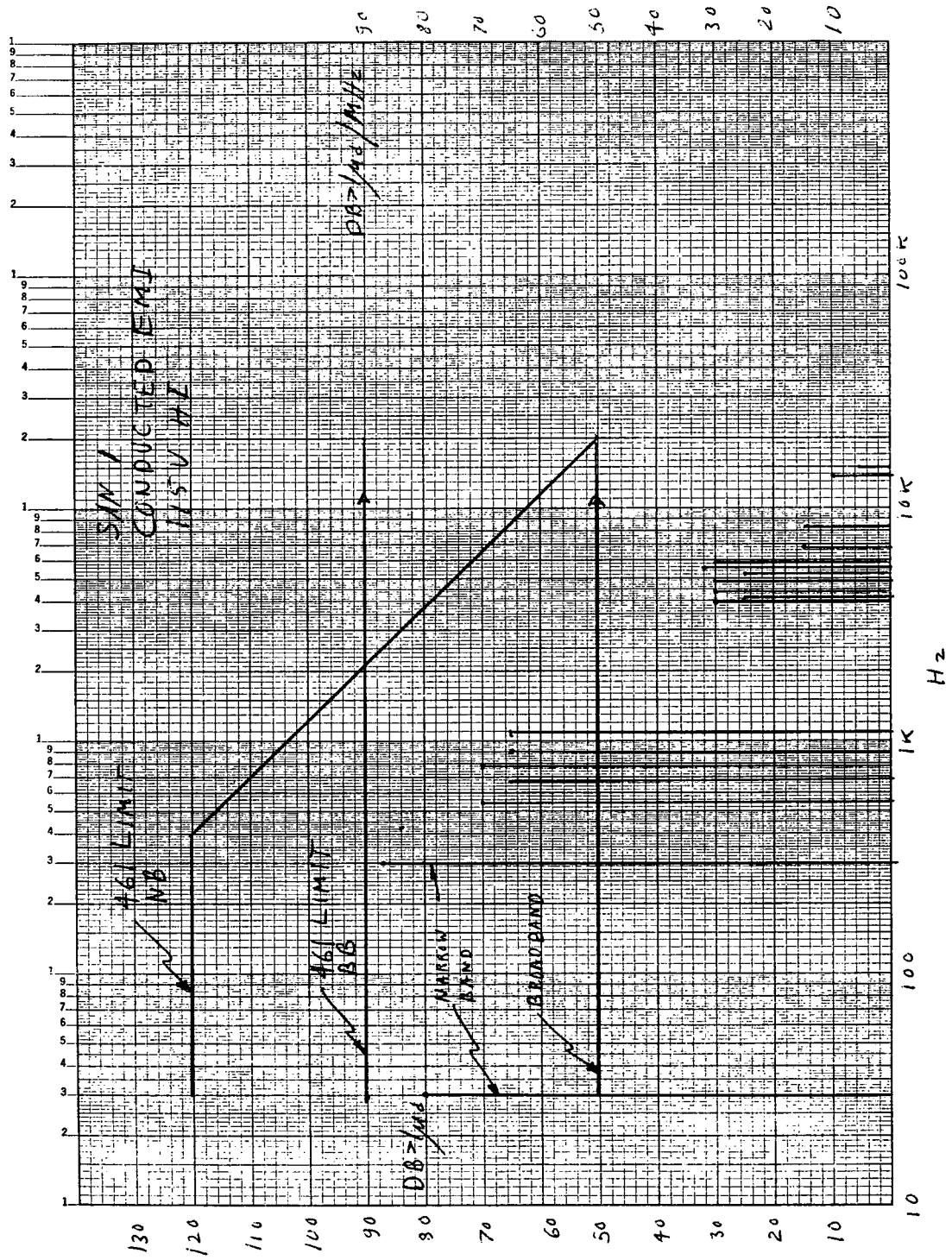
INTERFERENCE TEST

DATA SHEET

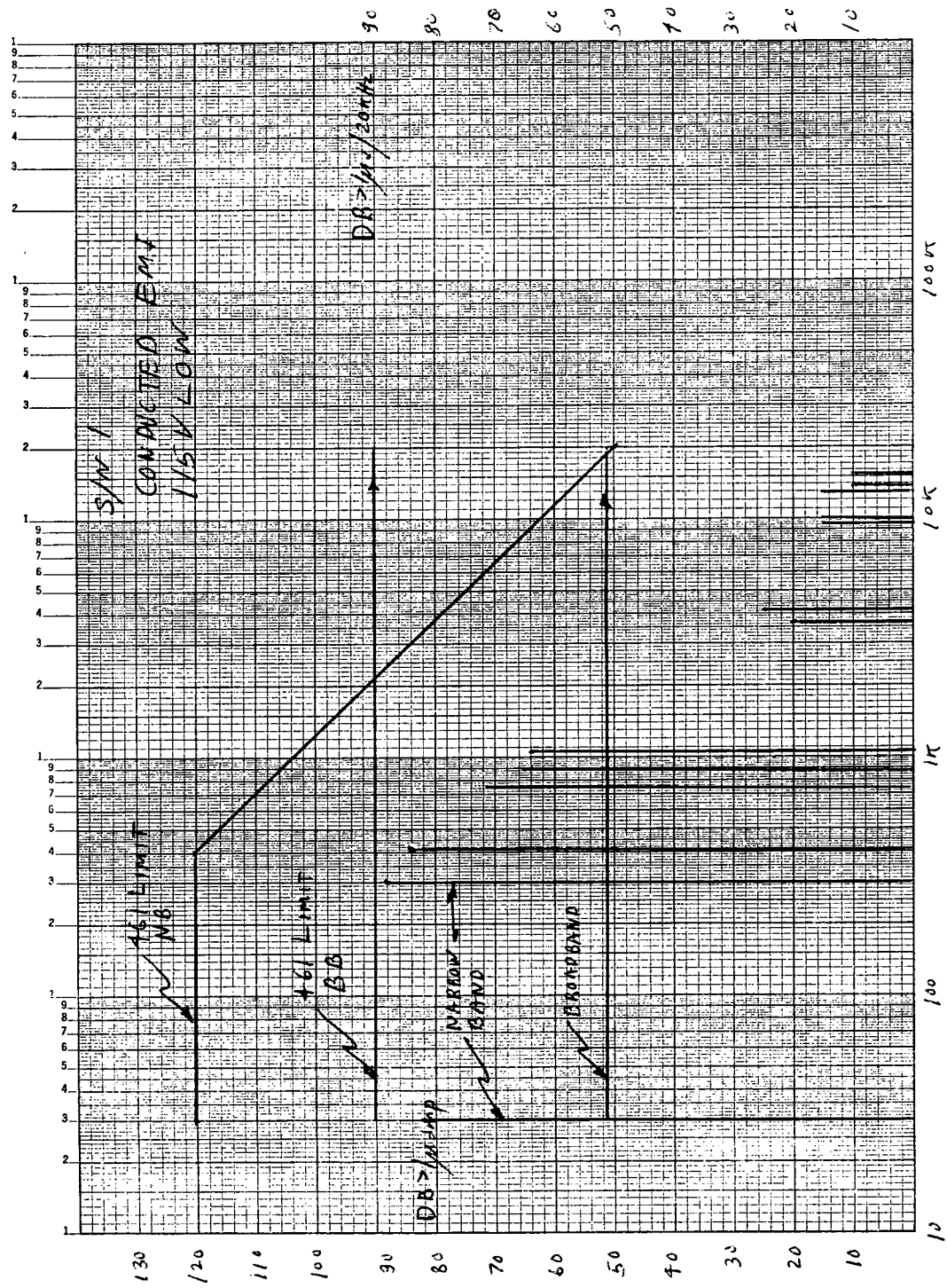
EQUIPMENT ANALOG CONT S DATE OF TEST 12-20-71
 MODEL NO. SERIAL NO. 1 TEST BY F D J 101
 EMI METER 11M42A SERIAL NO. 790-5 CERTIFIED Dec 30, 72
 PICKUP DEVICE Current Probe MODEL NO. 91550-1 SERIAL NO. 553-25
 TEST Conducted EMI MODEL POSITION 115 V H:

MEASUREMENT		(CW)	PCW	(BB)			
DET: FUNCTION		FI	QP	(PK)	(SEL)	RMS	AVG
FREQUENCY	AMBIENT	METER READING	BANDWIDTH FACTOR	PICKUP FACTOR	CORRECTED VALUE	SPEC. LIMIT	
Wideband		<u>uV</u>					
		<u>31 X 10²</u>	<u>NOMOGRAPH</u>		<u>50 DB/μV/mHz</u>		
Narrowband			<u>CORRECTION</u>				
30 HERTZ		<u>1.2 X 10²</u>	<u>CHART</u>		<u>80 DB/μV/mHz</u>		
300 HERTZ		<u>2.4 X 10³</u>			<u>87</u>		
420 HERTZ		<u>2.5 X 10³</u>			<u>84</u>		
540 HERTZ		<u>0.7 X 10³</u>			<u>70</u>		
660 HERTZ		<u>0.6 X 10³</u>			<u>65</u>		
780 HERTZ		<u>1.2 X 10³</u>			<u>70</u>		
900 HERTZ		<u>0.7 X 10³</u>			<u>65</u>		
1.05 KHERTZ		<u>0.7 X 10³</u>			<u>65</u>		
3.9 KHERTZ		<u>4.5 X 10</u>			<u>30</u>		
4.6 KHERTZ		<u>4.5 X 10</u>			<u>30</u>		
4.1 KHERTZ		<u>3 X 10</u>			<u>25</u>		
4.4 KHERTZ		<u>5 X 10</u>			<u>30</u>		
4.8 KHERTZ		<u>5 X 10</u>			<u>30</u>		
5.2 KHERTZ		<u>5 X 10</u>			<u>25</u>		
5.5 KHERTZ		<u>7 X 10</u>			<u>32</u>		
5.7 KHERTZ		<u>6 X 10</u>			<u>28</u>		
5.9 KHERTZ		<u>7 X 10</u>			<u>30</u>		
6.8 KHERTZ		<u>2 X 10</u>			<u>15</u>		
8.3 KHERTZ		<u>2.5 X 10</u>			<u>15</u>		
10.5 KHERTZ		<u>2.25 X 10</u>			<u>15</u>		
12.7 KHERTZ		<u>2 X 10</u>			<u>15</u>		
14.3 KHERTZ		<u>1 X 10</u>			<u>10</u>		
14.7 KHERTZ		<u>2 X 10</u>			<u>10</u>		
15.0 KHERTZ		<u>1.4 X 10</u>			<u>5</u>		

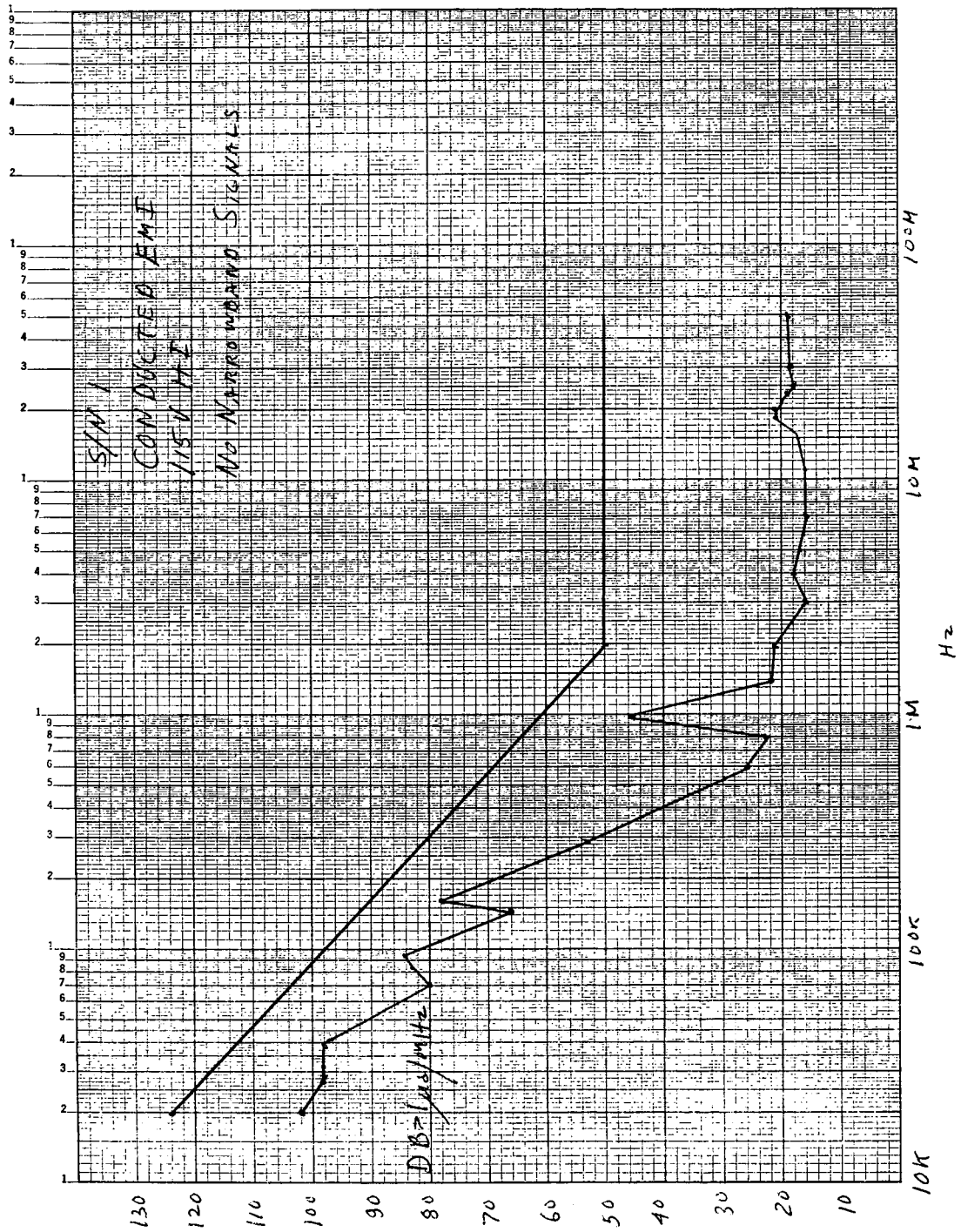
APPENDIX 2



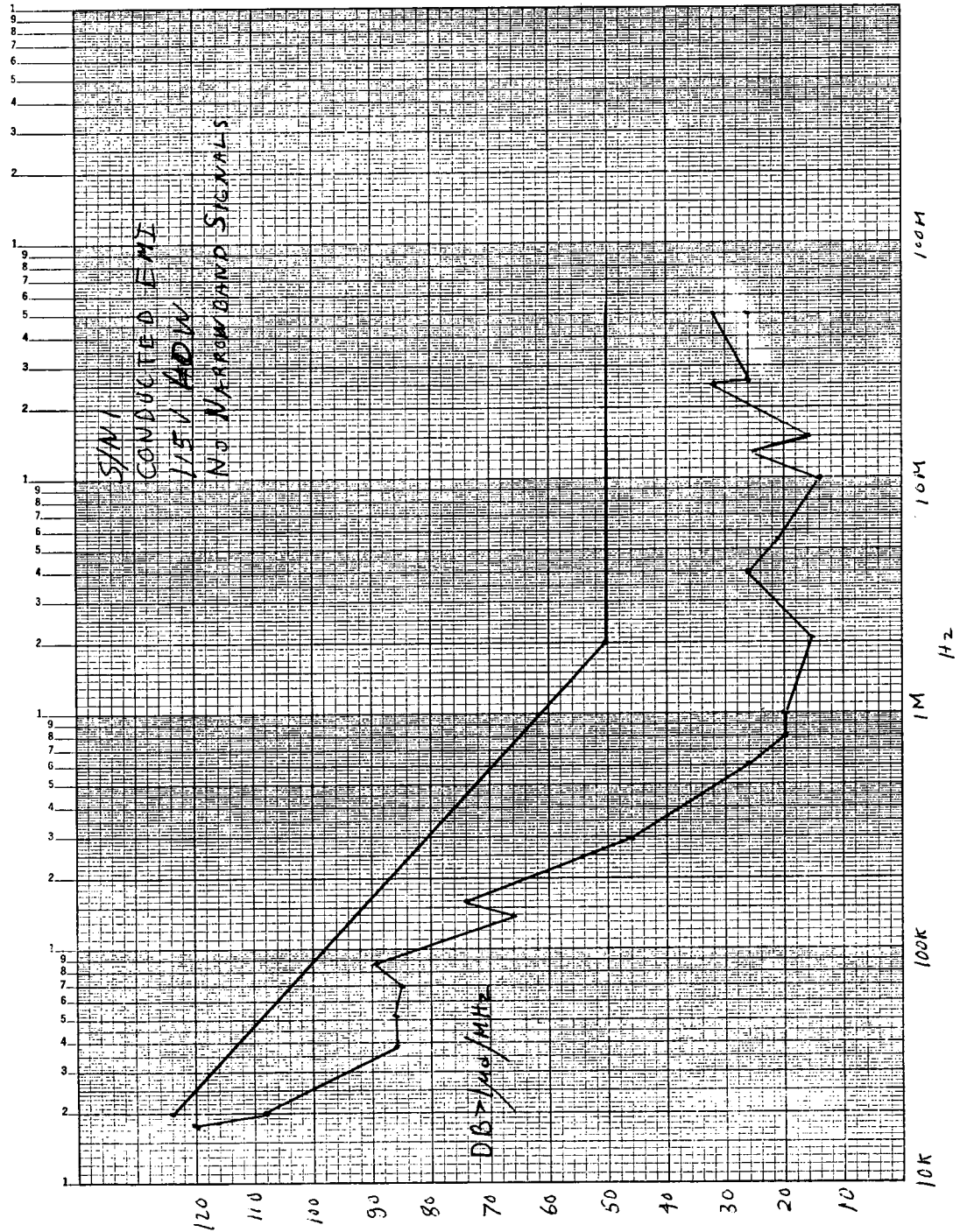
APPENDIX 2



APPENDIX 2



APPENDIX 2



APPENDIX 2

ATMOSPHERE CONTAMINANT SENSOR

PART NO. 344800 SERIAL NO. 002

ACCEPTANCE TEST DATA

APPENDIX 2

TP 82-0023

6. DATA SHEETS

6.1 GENERAL

6.1.1 This section contains all of the data sheets necessary to record the data requirements of Section 5. The applicable Section 5 paragraph is referenced for each data requirement. Additional data sheets are available from the Seller's Quality Assurance Group.

Test Conducted by M. Knebler Date 12-21-71
 Test Verified by J. B. By Date 12-21-71
 Test Surveillance B. E. Shelton Date 12-21-71
 _____ Date _____
 _____ Date _____

6.1.2 The survey of all test equipment, in compliance with the requirement of Section 3.3, shall be verified in this section.

All test equipment within current calibration dates: (✓) YES ☒ NO ☐
 Survey Conducted by M. Knebler Date 12-21-71
 Survey Verified by J. B. By Date 12-21-71
 Survey Surveillance B. E. Shelton Date 12-21-71
 _____ Date _____

APPENDIX 2

TP 82-0023

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 1 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

12-21-71 
STAMP/DATE

3.2 TEST CONDITIONS

ACTUAL

3.2a (1) Test temperature shall be 65 to 85°F.

76 °F

(2) Relative humidity shall be < 90%.

34 %

(3) Barometric Pressure (lab ambient)

733 torr

(4) Illumination (lab prevailing)

(✓) OK ✓

12-21-71 
STAMP/DATE

5. TEST PROCEDURES

5.1 INITIAL SETUP

5.1.1 All digital displays functional (1888)

(✓) ACPT ✓ REJ

STAMP/DATE

5.1.2 ACS controls set as specified.

(✓) ACPT ✓ REJ

12/21/71 
STAMP/DATE

5.1.3 Variac setting shall be 115.0 $\pm$ 1.0 V ac.

115 V ac
12-21-71 
STAMP/DATE

5.2 NOMINAL CONDITIONS

~~H₂~~ shall be $\leq$ 2.0 torr.

1.3 torr

O₂ shall be $\leq$ 5.0 torr.

1.0 torr

CO₂ shall be $\leq$ 0.6 torr.

0.5 torr

F12 shall be $\leq$ 5 ppm⁺

0.00 ppm
12-21-71 
STAMP/DATE

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 2 of 21)REFERENCE PARAGRAPHSERIAL NUMBER 002

DEC 21 1977



STAMP/DATE

3.2 TEST CONDITIONS

5.2 (Cont)

ACTUAL

F114 shall be ≤ 5 ppm.000 ppmSAMPLE FLOW shall be 9 MRF 10 SCFH.0 SCFH

TC gauge shall be (TBD)

2 μ A I_p (200 μ A scale) shall be ≤ 5 μ A.10 μ A I_{EA} shall be (TBD)146 I_{AN} shall be 37.5 ± 1.0 μ A37.5 μ A

TS indicator shall be (TBD)

7.91 V

TV indicator shall be (TBD)

8.19 V_{ACC} shall be (TBD)423+5 shall be 500 ± 0.05 4.90-15 shall be 1500 ± 15 14.6+15 shall be 1500 ± 15 14.8+24 shall be 310 ± 20 27.9-28.7 N_2 output shall be ≤ 4 torr.003 torr H_2O output shall be ≤ 1 torr0.8 torr P_{AMB} shall be amb press ± 2 torrAMB 737

The tolerance specified is an engineering target value and is not critical to instrument performance.

 P_{AMB} 7371 (H_2 Elcmtr) shall be 0.01 or 0.02.142 (H_2O Elcmtr) shall be 0.01 or 0.02.03

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APPENDIX 2

TP 82-0023

6.2 FUNCTIONAL TEST DATA SHEETS (Sheet 3 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

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3.2 TEST CONDITIONS

5.2 (Cont)

ACTUAL

3 (N₂ Elcmtr) shall be 0.01 or 0.02

.02

4 (O₂ Elcmtr) shall be 0.01 or 0.02

.01

5 (CO₂ Elcmtr) shall be 0.01 or 0.02

.04

6 (F12 Elcmtr) shall be 0.01 or 0.02

.01

7 (F11/114 Elcmtr) shall be 0.01 or 0.02

.05

Due to high background as stated on page 14. mjk.

STAMP/DATE

5.3 ZERO CHECK

- a. ZERO CHECK switch held until Steps b and c (✓) ACPT ✓ REJ
are completed.

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- b. Outputs indicated by OUTPUT DVM displays shall be:

H₂ (≤ 2.0 torr)

0.1

O₂ (≤ 5 torr)

0-1

CO₂ (≤ 0.6 torr)

0.1

F12 (≤ 5 ppm)

000

F114 (≤ 5 ppm)

000

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 4 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

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5. TEST PROCEDURES

5.3 (Cont)

ACTUAL

c. DIGITAL TEST METER outputs shall be:

V_{ACC}	<u>265</u>	<u>332</u>
	REQUIRED	
N_2 (≤ 4 torr)		<u>1.0</u>
H_2O (≤ 1 torr)		<u>0.1</u>
(H_2 Elcmtr) 0.01 or 0.02		<u>.02</u>
(H_2O Elcmtr) 0.01 or 0.02		<u>.01</u>
(N_2 Elcmtr) 0.01 or 0.02		<u>.01</u>
(O_2 Elcmtr) 0.01 or 0.02		<u>.01</u>
(CO_2 Elcmtr) 0.01 or 0.02		<u>.01</u>
(F12 Elcmtr) 0.01 or 0.02		<u>.01</u>
(F11/114 Elcmtr) 0.01 or 0.02		<u>.01</u>

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5.4 FUNCTIONAL TEST

a. Standard Mixture composition

N_2	<u>78.48 %</u>
O_2	<u>18.0 %</u>
CO_2	<u>1.02 %</u>
A	<u>1.01 %</u>

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 5 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

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5. TEST PROCEDURES

5.4a. (Cont)

H₂

ACTUAL

1.47 %

F12

104 ppm

F114

100 ppm

Cylinder Number 6347

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b. Flow rate shall be 0.05 $\pm$ 0.01 SCFH

0.05 SCFH

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c. Ambient Pressure

733
AMBIENT

740 torr

DEC 21 1971
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d. Ion Pump current

150 μ A

~~Nitrogen electrometer output (700 $\pm$ 10)~~
Not applicable. mekr

DEC 21 1971
STAMP/DATE



e. Outputs

H₂

9.5 torr

O₂

134 torr

CO₂

7.7 torr

F114

76 M torr

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 6 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

5. TEST PROCEDURES

5.4e. (Cont)

F12

N₂

H₂O *MR*

P. AMB

STAMP/DATE



ACTUAL

77 M torr

582 torr

1.0 torr

740 torr

STAMP/DATE

DEC 21 1971



REQUIRED

f. Required values

$$P_{H_2} = \frac{740}{(P. AMB)} \times \frac{1.47}{(\%H_2)} \times \frac{1}{100} = \underline{10.9} \pm 4 \text{ torr}$$

$$P_{O_2} = \frac{740}{(P. AMB)} \times \frac{18}{(\%O_2)} \times \frac{1}{100} = \underline{133} \pm 10 \text{ torr}$$

$$P_{CO_2} = \frac{740}{(P. AMB)} \times \frac{1.02}{(\%CO_2)} \times \frac{1}{100} = \underline{7.5} \pm 1.3 \text{ torr}$$

$$P_{F114} = \frac{740}{(P. AMB)} \times \frac{100}{(\text{ppm F114})} \times \frac{1}{1000} = \underline{74} \pm 23 \text{ M torr}$$

$$P_{F12} = \frac{740}{(P. AMB)} \times \frac{104}{(\text{ppm F12})} \times \frac{1}{1000} = \underline{77} \pm 23 \text{ M torr}$$

$$P_{N_2} = \frac{740}{(P. AMB)} \times \frac{79.68}{(\%N_2)} \times \frac{1}{100} = \underline{581} \text{ torr}$$

$$P_{H_2O} = \underline{0} \text{ torr*}$$

*No tolerance. Information only.

All readings within tolerance.

(✓) ACPT ☒ REJ ☐

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 7 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

5. TEST PROCEDURES

5.5 INPUT VOLTAGE TEST

- a. High line Variac setting (126.5 $\pm$ 1.0 V ac)

Outputs

H₂

O₂

CO₂

F114

F12

N₂

H₂O

P. AMB

ACTUAL

126.5 V ac

9.9 torr

134 torr

7.7 torr

73 M torr

73 M torr

581 torr

1.4 torr

740 torr

STAMP/DATE

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STAMP/DATE



- b. All readings within tolerance

(✓) ACPT ✓ REJ

STAMP/DATE

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- c. Low line Variac setting (103.5 $\pm$ 1 V ac)

Outputs

H₂

O₂

CO₂

9.2 torr

134 torr

7.6 torr

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 8 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

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5. TEST PROCEDURES

5.5c. (Cont)

F114

77 M torr

F12.

79 M torr

N₂

583 torr

H₂O

0.9 torr

P. AMB

740-1 torr

STAMP/DATE

d. All readings within tolerance

(✓) ACPT ✓ REJ

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e. Nominal line Variac setting (115 +1 V ac)

115 V ac

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STAMP/DATE



5.6 MIXTURE CHANGE TEST

b. Mixture Number 1 Composition

N₂

74.36 %

O₂

22.1 %

CO₂

2.03 %

A

1.02 %

H₂

.49 %

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 9 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

5. TEST PROCEDURES

5.6b. (Cont)

F12

ACTUAL

00 ppm

F114

00 ppm

Cylinder Number 5309

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Sample flow (0.05 $\pm$ 0.01 SCFH)

05 SCFH

Sample pressure ($P_{\text{ambient}} \leq P_{\text{sample}} \leq P_{\text{ambient}}$
+10 torr)
mp

740 torr

STAMP/DATE

c. Restabilize for minimum of 10 min.

10 min

Outputs

H₂

3.9 torr

O₂

163 torr

CO₂

15.3 torr

F114

001 M torr

F12

000 M torr

N₂

551 torr

H₂O

1.2 torr

P_{AMB}

740 torr

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 10 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

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5. TEST PROCEDURES

5.6d. Required Values

REQUIRED

$$\begin{aligned}
 P_{H_2} &= \frac{740}{(P_{AMB})} \times \frac{.49}{(\%H_2)} \times \frac{1}{100} = \underline{3.6} \pm 4 \text{ torr} \\
 P_{O_2} &= \frac{740}{(P_{AMB})} \times \frac{22.1}{(\%O_2)} \times \frac{1}{100} = \underline{164} \pm 10 \text{ torr} \\
 P_{CO_2} &= \frac{740}{(P_{AMB})} \times \frac{2.03}{(\%CO_2)} \times \frac{1}{100} = \underline{15.0} \pm 1.3 \text{ torr} \\
 P_{F114} &= \frac{740}{(P_{AMB})} \times \frac{00}{(\text{ppm F114})} \times \frac{1}{1000} = \underline{0} \pm 23 \text{ M torr} \\
 P_{F12} &= \frac{740}{(P_{AMB})} \times \frac{00}{(\text{ppm F12})} \times \frac{1}{1000} = \underline{0} \pm 23 \text{ M torr} \\
 P_{N_2} &= \frac{740}{(P_{AMB})} \times \frac{74.36}{(\%N_2)} \times \frac{1}{100} = \underline{550} \text{ torr} \\
 P_{H_2O} &= \underline{0} \text{ torr*}
 \end{aligned}$$

*No tolerance. Information only.

All readings within tolerance.

(✓) ACPT ☒ REJ ☐

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5.7 AUTOMATIC RATIO CIRCUIT TEST

a. Ion pump current

150 μ A

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 11 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

5. TEST PROCEDURES

5.7b. Ion pump current increased by 10%.

Outputs

H₂

O₂

CO₂

N₂

All readings within tolerance

STAMP/DATE

ACTUAL

165 μ A

3.8 torr

163 torr

15.3 torr

551 torr

(☒) ACPT ☒ REJ

STAMP/DATE

135 μ A

Outputs

H₂

O₂

CO₂

N₂

All readings within tolerance

4.2 torr

163 torr

15.3 torr

551 torr

(☒) ACPT ☒ REJ

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d. Ion pump current reset to value recorded in Step a above.

150 μ A

STAMP/DATE

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 12 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

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5. TEST PROCEDURES

5.8 FREON 11 TEST

ACTUAL

c. F11 background output (≤ 4 M torr) *This is due to a background partial pressure within the instrument.* 62 M torr
MPK

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d. Freon 11/N₂ Composition

42 ppm

Cylinder Number 4549

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e. Flow (0.05 $\pm$ 0.01 SCFH)

.05 SCFH

Sample pressure ($P_{AMB} \leq P_{SAMPLE} \leq P_{AMB} + 10$ torr)

740 torr

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f. Outputs

F11 *The correct F11 reading within tolerance is obtained by subtracting the background observed in step 5.8 c. from the output recorded here,* 91 M torr

F12 0 M torr

P_{AMB} 740 torr

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g. Computed outputs *i.e. 91 - 62 = 29 m torr* ± 3.8 m torr

F11 = $\frac{740}{(P_{AMB})} \times \frac{42}{(\text{ppm F11})} \times 1 = \text{MPK}$ 31 ± 2.5 ppm MPK

N₂ = $\frac{740}{(P_{AMB})}$ 740 torr*

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 13 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

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5. TEST PROCEDURES

5.8g. (Cont)

F12 =

*Information only

All outputs are within tolerance.

ACTUAL

0 M torr*

(✓) ACPT ☒ REJ

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5.9 PRESSURE TEST

b. Flow rate (0.05 $\pm$ 0.01 SCFH)

0.05 SCFH

Inlet pressure (30 $\pm$ 1 inHg)

30 inHg

Outputs

H₂

9.9 torr

O₂

138 torr

CO₂

7.8 torr

F114

75 M torr

F12

76 M torr

N₂

599 torr

H₂O

2.8 torr

P. AMB

762 torr

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 14 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

5. TEST PROCEDURES

5.9 (Cont)

Mixture # 6347 mkr

Required values

$$P_{H_2} = \frac{76.2}{(P_{AMB})} \times \frac{1.47}{(\%H_2)} \times \frac{1}{100} =$$

$$P_{O_2} = \frac{76.2}{(P_{AMB})} \times \frac{18}{(\%O_2)} \times \frac{1}{100} =$$

$$P_{CO_2} = \frac{76.2}{(P_{AMB})} \times \frac{1.02}{(\%CO_2)} \times \frac{1}{100} =$$

$$P_{F114} = \frac{76.2}{(P_{AMB})} \times \frac{100}{(ppm F114)} \times \frac{1}{1000} =$$

$$P_{F12} = \frac{76.2}{(P_{AMB})} \times \frac{104}{(ppm F12)} \times \frac{1}{1000} =$$

$$P_{N_2} = \frac{76.2}{(P_{AMB})} \times \frac{78.48}{(\%N_2)} \times \frac{1}{100} =$$

$$P_{H_2O} =$$

ACTUAL

REQUIRED

$$\frac{11.2}{3.7} \pm 4 \text{ torr}$$

$$\frac{137}{168} \pm 10 \text{ torr}$$

$$\frac{7.77}{7.77} \pm 1.3 \text{ torr}$$

$$\frac{76.2}{76.2} \pm 23 \text{ M torr}$$

$$\frac{79}{79} \pm 23 \text{ M torr}$$

$$\frac{598}{567} \text{ torr mkr}$$

$$\frac{0}{0} \text{ torr*}$$

*No tolerance. Information only.

All readings within tolerance.

(✓) ACPT ✓ REJ

~~P_{AMB} (torr) ± 2 torr = Inlet pressure~~

~~(inHg) = 25.4~~

Not applicable
mkr

~~(✓) ACPT REJ~~

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 15 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002DEC 21 1971
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5. TEST PROCEDURES

ACTUAL

5.9c. Flow rate (0.05 $\pm$ 0.01 SCFH).04 SCFHInlet pressure (20 $\pm$ 1 inHg)20 inHg

Outputs

H₂7.7 torrO₂91 torrCO₂5.3 torr

F114

42 M torr

F12

45 M torrN₂398 torrH₂O2.9 torrP_{AMB}508 torr

Required Values

REQUIRED

$$P_{H_2} = \frac{508}{(P_{AMB})} \times \frac{1.47}{(\%H_2)} \times \frac{1}{100} =$$

7.46 $\pm$ 4 torr

$$P_{O_2} = \frac{508}{(P_{AMB})} \times \frac{18}{(\%O_2)} \times \frac{1}{100} =$$

91 $\pm$ 10 torr

$$P_{CO_2} = \frac{508}{(P_{AMB})} \times \frac{1.02}{(\%CO_2)} \times \frac{1}{100} =$$

5.18 $\pm$ 1.3 torr

$$P_{F114} = \frac{508}{(P_{AMB})} \times \frac{100}{(ppm F114)} \times \frac{1}{1000} =$$

50.8 $\pm$ 23 M torr

$$P_{F12} = \frac{508}{(P_{AMB})} \times \frac{104}{(ppm F12)} \times \frac{1}{1000} =$$

53 $\pm$ 23 M torrDEC 21 1971
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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 16 of 21)

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5.9c. (Cont)

$$P_{N_2} = \frac{5.08}{(P_{AMB})} \times \frac{78.48}{(\%N_2)} \times \frac{1}{100} = \frac{399}{278} \text{ torr}$$

$$P_{H_2O} = 0 \text{ torr*}$$

*No tolerance. Information only.

All readings within tolerance

(✓) ACPT ✓ REJ

~~$P_{AMB} \text{ (torr)} \pm 2 \text{ torr} = \text{Inlet pressure}$~~
 ~~$(\text{inHg}) \times 25.4$~~ *not applicable*
mer

~~(✓) ACPT REJ~~

d. Flow rate (0.05 $\pm$ 0.01 SCFH)

Inlet pressure (40 $\pm$ 1 inHg)

H₂

O₂

CO₂

F114

F12

N₂

H₂O

P_{AMB}

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0.05 SCFH

40 inHg

11.5 torr

184 torr

10.7 torr

119 M torr

117 M torr

795 torr

2.1 torr

1011 torr

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 17 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

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5. TEST PROCEDURES

5.9d (Cont)

REQUIRED

$$\begin{aligned}
 P_{H_2} &= \frac{1016}{(P_{AMB})} \times \frac{1.47}{(\%H_2)} \times \frac{1}{100} = \underline{14.9} \pm 4 \text{ torr} \\
 P_{O_2} &= \frac{1016}{(P_{AMB})} \times \frac{18}{(\%O_2)} \times \frac{1}{100} = \underline{18.3} \pm 10 \text{ torr} \\
 P_{CO_2} &= \frac{1016}{(P_{AMB})} \times \frac{1.02}{(\%CO_2)} \times \frac{1}{100} = \underline{10.4} \pm 1.3 \text{ torr} \\
 P_{F114} &= \frac{1016}{(P_{AMB})} \times \frac{100}{(\text{ppm F114})} \times \frac{1}{1000} = \underline{102} \pm 23 \text{ M torr} \\
 P_{F12} &= \frac{1016}{(P_{AMB})} \times \frac{104}{(\text{ppm F12})} \times \frac{1}{1000} = \underline{106} \pm 23 \text{ M torr} \\
 P_{N_2} &= \frac{1016}{(P_{AMB})} \times \frac{78.48}{(\%N_2)} \times \frac{1}{100} = \underline{797} \text{ torr} \\
 P_{H_2O} &= \underline{0} \text{ torr*}
 \end{aligned}$$

*No tolerance. Information only.

All readings within tolerance.

(✓) ACPT ✓ REJ

~~P_{AMB} (torr) ± 2 torr = Inlet pressure~~

(✓) ACPT REJ

~~(inHg) ± 25.4~~

not applicable
MPR

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STAMP/DATE

5.10 REDUNDANT FILAMENT TEST

ACTUAL

a. Outputs

FIL #1

FIL #2

H₂

.9

.9 torr

O₂

152

152 torr

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 18 of 21)

REFERENCE PARAGRAPH

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5. TEST PROCEDURES

5.10a. (Cont)

ACTUAL

	FIL #1	FIL #2
CO ₂	<u>1.4</u>	<u>1.5</u> torr
F114	<u>002</u>	<u>001</u> M torr
F12	<u>000</u>	<u>000</u> M torr
N ₂	<u>567</u>	<u>567</u> torr
H ₂ O	<u>6.0</u>	<u>5.5</u> torr
P _{AMB}	<u>734</u>	<u>733</u> torr

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b. Required Values

REQUIRED

$P_{H_2} =$ 0 ± 4 torr
 $P_{O_2} = \frac{725.4}{(P_{AMB} - P_{H_2O})} \times \frac{20.99}{100} =$ 152 ± 10 torr
 $P_{CO_2} = \frac{725.4}{(P_{AMB} - P_{H_2O})} \times \frac{0.03}{100} =$ 0.2 ± 1.3 torr
 $P_{N_2} = \frac{725.4}{(P_{AMB} - P_{H_2O})} \times \frac{78.03}{100} =$ 566 torr
 $P_{H_2O} =$ Computed Value $=$ 7.2 torr
 F114 $=$ 0 ± 11 M torr
 F12 $=$ 0 ± 11 M torr

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 19 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

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5. TEST PROCEDURES

5.10b. (Cont)

All readings within tolerance.

REQUIRED

(✓) ACPT ✓ REJ

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5.11 DEGAS TEST

b. Outputs rise

ACTUAL

(✓) ACPT ✓ REJ

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STAMP/DATE

5.12 OVERPRESSURE PROTECTION TEST

a. Flow rate (0.05 $\pm$ 0.01 SCFH)

Ambient Pressure 43.737 ambient

Ion pump current

0.05 SCFH

756 torr

100 μ A

DEC 21 1977
STAMP/DATE

b. ON indicator lamp switched off.

STANDBY indicator lamp off

Ion pump current (approx 1 mA)

(✓) ACPT ✓ REJ

(✓) ACPT ✓ REJ

(✓) ACPT ✓ REJ

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c. Relay sound audible

Filament off

(✓) ACPT ✓ REJ

(✓) ACPT ✓ REJ

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 20 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

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5. TEST PROCEDURES

5.12c. (Cont)

ACTUAL

FILAMENT PREHEAT indicator ON

(✓) ACPT ☒ REJ ☐

Ion pump current (approx 5 mA)

(✓) ACPT ☒ REJ ☐

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d. Entire Paragraph read

(✓) ☐

Ion pump OFF

(✓) ACPT ☒ REJ ☐

ROUGH COMP lamp OFF

(✓) ACPT ☒ REJ ☐

I.P. lamp OFF

(✓) ACPT ☒ REJ ☐

TC indication (Approx 1 mA)

(✓) ACPT ☒ REJ ☐

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e. Preheat relay audible (5 mA)

(✓) ACPT ☒ REJ ☐

STANDBY lights (1 mA)

(✓) ACPT ☒ REJ ☐

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5.13 LOSS OF POWER TEST

a. Flow rate (0.05 $\pm$ 0.01 SCFH)

Ambient pressure

~~7.60~~ ambient

Ion pump current

~~150~~ μ A

.05 SCFH

7.60 torr

150 μ A

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NA 6 MA

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 21 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002-

5. TEST PROCEDURES

5.13b. Power off at

c. Power on at

Observe pump down

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ACTUAL

1708 min

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1738 min

(✓) ACPT ☒ REJ ☐

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6.3 SPARES FUNCTIONAL TEST DATA SHEET (Sheet 1 of 3)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

DEC 21 1971
STAMP/DATE

5. TEST PROCEDURES

5.14 SPARES TEST

(Follow procedure of Paragraph 5.4.)

Not applicable. There are no spares with this unit. mkr

a. Standard Mixture composition	ACTUAL
N ₂	_____ %
O ₂	_____ %
CO ₂	_____ %
A	_____ %
H ₂	_____ %
F12	_____ ppm
F114	_____ ppm
Cylinder Number _____	_____ STAMP/DATE
b. Flow rate shall be 0.05 $\pm$ 0.01 SCFH	_____ SCFH
	_____ STAMP/DATE
c. Ambient Pressure _____ ambient	_____ torr
	_____ STAMP/DATE
d. Ion Pump Current _____ μ A	
Nitrogen electrometer output (700 $\pm$ 10)	_____ STAMP/DATE

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6.3 SPARES FUNCTIONAL TEST DATA SHEET (Sheet 2 of 3)

REFERENCE PARAGRAPH

SERIAL NUMBER 002



DEC 21 1971

STAMP/DATE

5. TEST PROCEDURES

5.14 (Cont)

e. Outputs

H₂

O₂

CO₂

F114

F12

N₂

H₂O

P_{AMB}

N/A
MIR

_____ torr

_____ torr

_____ torr

_____ M torr

_____ M torr

_____ torr

_____ torr

_____ torr

STAMP/DATE

f. Required Values

REQUIRED

$$P_{H_2} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\%H_2)} \times \frac{1}{100}$$

= _____ +4 torr

$$P_{O_2} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\%O_2)} \times \frac{1}{100}$$

= _____ +10 torr

$$P_{CO_2} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\%CO_2)} \times \frac{1}{100}$$

= _____ +1.3 torr

$$P_{F114} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\text{ppm F114})} \times \frac{1}{1000}$$

= _____ +23 M torr

$$P_{F12} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\text{ppm F12})} \times \frac{1}{1000}$$

= _____ +23 M torr

STAMP/DATE

APPENDIX 2

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6.3 SPARES FUNCTIONAL TEST DATA SHEET (Sheet 3 of 3)

REFERENCE PARAGRAPH

SERIAL NUMBER 002



DEC 21 1971

STAMP/DATE

5. TEST PROCEDURES

5.14 (Cont)

N/A *mpk*

REQUIRED

$$P_{N_2} = \frac{\quad}{(P. AMB)} \times \frac{\quad}{(\%N_2)} \times \frac{1}{100} = \quad \text{torr.}$$

$$P_{H_2O} = \quad \text{torr*}$$

*No tolerance. Information only.

(✓) ACPT REJ

STAMP/DATE

5.15 WORKMANSHIP

Workmanship verified

(✓) ACPT REJ



DEC 21 1971

STAMP/DATE



5.16 EXTERNAL DIMENSIONS

Dimensions verified

(✓) ACPT REJ



DEC 21 1971

STAMP/DATE



APPENDIX 2

ADDENDUM

ELECTROMAGNETIC CONDUCTED INTERFERENCE TEST

APPENDIX 2

ADDENDUM

TP 82-0023

5.17 ELECTROMAGNETIC CONDUCTED INTERFERENCE TEST

5.17.1 TEST SETUP AND PROCEDURE. The test setup shall be as follows:

- a. Make the basic test setup shown in Figure 12. Stamp Test Data Sheet.
- b. Operate measurement equipment as specified in manufacturer's instructions.
- c. The limits shall be as shown in Figure 13. Record acceptance or rejection of this requirement on Test Data Sheet. Record actual measurements on Test Data Sheet including meter reading and all appropriate correction factors.
- d. Repeat Paragraphs b and c, above, for the 115 V ac supply lines using line stabilization capacitors (LSC's) and band-reject filter to remove the 2nd, 3rd and 4th harmonics of the power line frequency.

5.17.2 TEST SETUP AND PROCEDURE. The test setup shall be as follows:

- a. Make the basic test setup shown in Figure 12. Stamp Test Data Sheet.
- b. Operate the measurement equipment as specified in manufacturer's instructions. Perform all measurements utilizing peak detector on the RFI meter.
- c. The limits shall be as shown in Figure 13. Record acceptance or rejection of this requirement on Test Data Sheet. Record actual measurements on Test Data Sheet including meter reading and all appropriate correction factors.
- d. Repeat Steps a through c for the other leads of Paragraph 5.17.1d.

APPENDIX 2

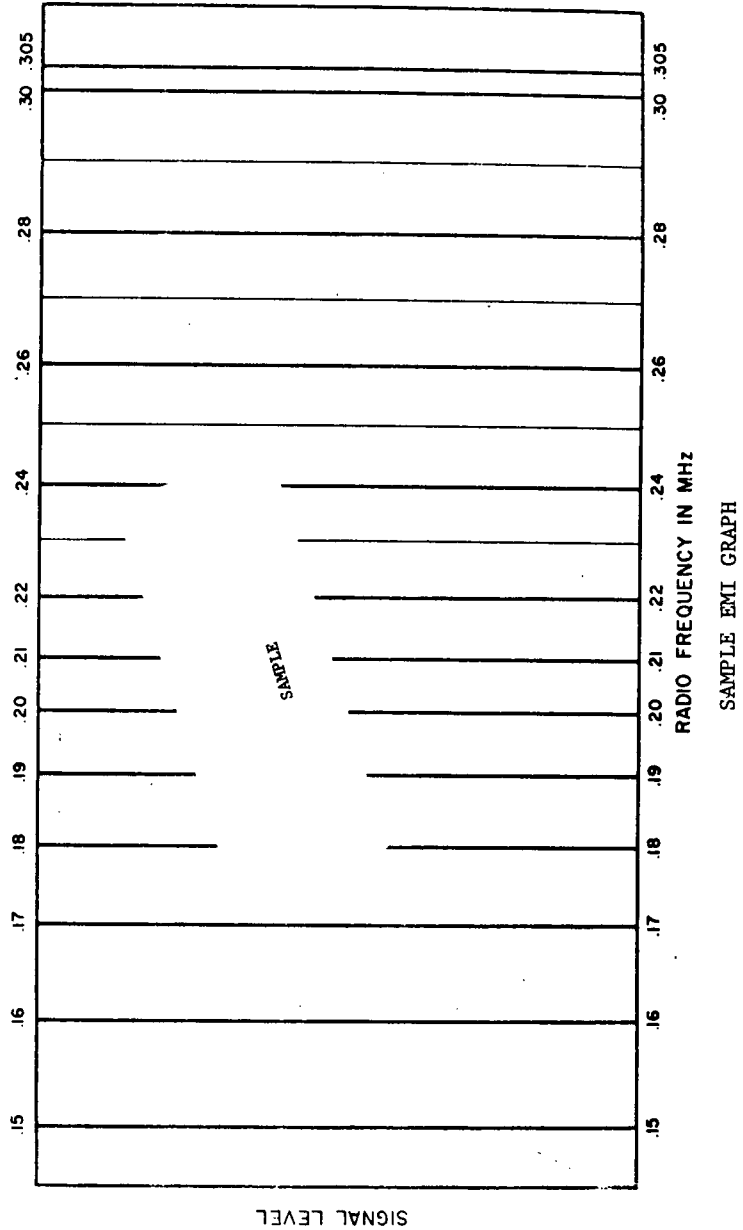
ADDENDUM

TP 82-0023

STODART ELECTRO SYSTEMS

APC GRAPH PAPER

Test Specimen: _____ Company: _____
 Technician: _____ Date: _____
 Type of Interference: _____ Receiver Calibration Date: _____ Data Page No: _____
 Test Condition: _____ Receiver: SES NM-22A, band I Scan Speed: _____



APPENDIX 2

ADDENDUM

TP 82-0023

PERKIN-ELMER

INTERFERENCE TEST

DATA SHEET

EQUIPMENT _____	DATE OF TEST _____
MODEL NO. _____	SERIAL NO. _____
EMI METER _____	SERIAL NO. _____
PICKUP DEVICE _____	MODEL NO. _____
TEST _____	MODEL _____
	POSITION _____
	CERTIFIED _____
	TEST BY _____

[illegible]

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PAGE _____

SAMPLE INTERFERENCE TEST DATA SHEET

APPENDIX 2

ADDENDUM

TP 82-0023

6.4 ELECTROMAGNETIC COMPATIBILITY TEST DATA SHEET (Sheet 1 of 1)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

STAMP/DATE

5. TEST PROCEDURES

5.17 ELECTROMAGNETIC CONDUCTED INTERFERENCE TEST

5.17.1 Test Setup and Procedure

a. Test set up as shown in Figure 1.

ACTUAL

DEC 22 1971
12/22/71
STAMP/DATE

c. Limits not exceeded

(✓) OK

Data Sheets attached

DEC 22 1971
12/22/71
STAMP/DATE

d. (b) and (c) repeated for 115 V RTN

(c) Limits not exceeded

(✓) OK

Data Sheets attached

DEC 22 1971
12/22/71
STAMP/DATE

5.17.2 Test Setup and Procedure

a. Test set up as shown in Figure 1.

DEC 22 1971
12/22/71
STAMP/DATE

c. Limits not exceeded

(✓) OK

Data Sheets attached

DEC 22 1971
12/22/71
STAMP/DATE

d. (b) and (c) repeated for 115 V RTN

(c) Limits not exceeded

(✓) OK

Data Sheets attached

DEC 22 1971
12/22/71
STAMP/DATE

PERKIN-ELMER

INTERFERENCE TEST

DATA SHEET

EQUIPMENT	27 MOS CNT SENSOR	DATE OF TEST	12-22-71
MODEL NO.		SERIAL NO.	2
EMI METER	NA 43A	SERIAL NO.	740-5
PICKUP DEVICE	CURRENT PROBE	CERTIFIED	Dec 2-72
TEST	CONDUCTED EMI	SERIAL NO.	653 28
	MODEL	POSITION	115 V 20

[illegible]

APPENDIX 2

PERKIN-ELMER

INTERFERENCE TEST

DATA SHEET

EQUIPMENT	A.M.S. CONT. STATION	
MODEL NO.		SERIAL NO. 2
EMI METER	12410A	SERIAL NO. 7405
PICKUP DEVICE	CURRENT PROBE	MODEL NO. 91330
TEST	CONDUCTED LMT	MODEL

DATE OF TEST 12-22-11
TEST BY 1 DCB/CR
CERTIFIED 12-22-11
SERIAL NO. 523 25
POSITION 12-22-11

[illegible]

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PAGE _____

APPENDIX 2

PERKIN-ELMER

INTERFERENCE TEST

DATA SHEET

EQUIPMENT	ATMOS CONT SENSOR		DATE OF TEST	12-22-72
MODEL NO.		SERIAL NO.	TEST BY	F. DEIRON
EMI METER	NM 32A	SERIAL NO.	CERTIFIED	Dec 7-72
PICKUP DEVICE	CURRENT PROBE	MODEL NO.	SERIAL NO.	BF 486
TEST	CONDUCTED EMI	MODEL	POSITION	115V 11.

[illegible]

APPENDIX 2

PERKIN-ELMER

INTERFERENCE TEST

DATA SHEET

EQUIPMENT	ATMIS COAT SILVER	DATE OF TEST	12/22/71
MODEL NO.		SERIAL NO.	2
EMI METER	NM 127	SERIAL NO.	ALL 47
PICKUP DEVICE	CURRENT PROBE	SERIAL NO.	B1 486
TEST	UNDETECTED EMI	POSITION	100V H.

[illegible]

APPENDIX 2

PERKIN-ELMER

INTERFERENCE TEST

DATA SHEET

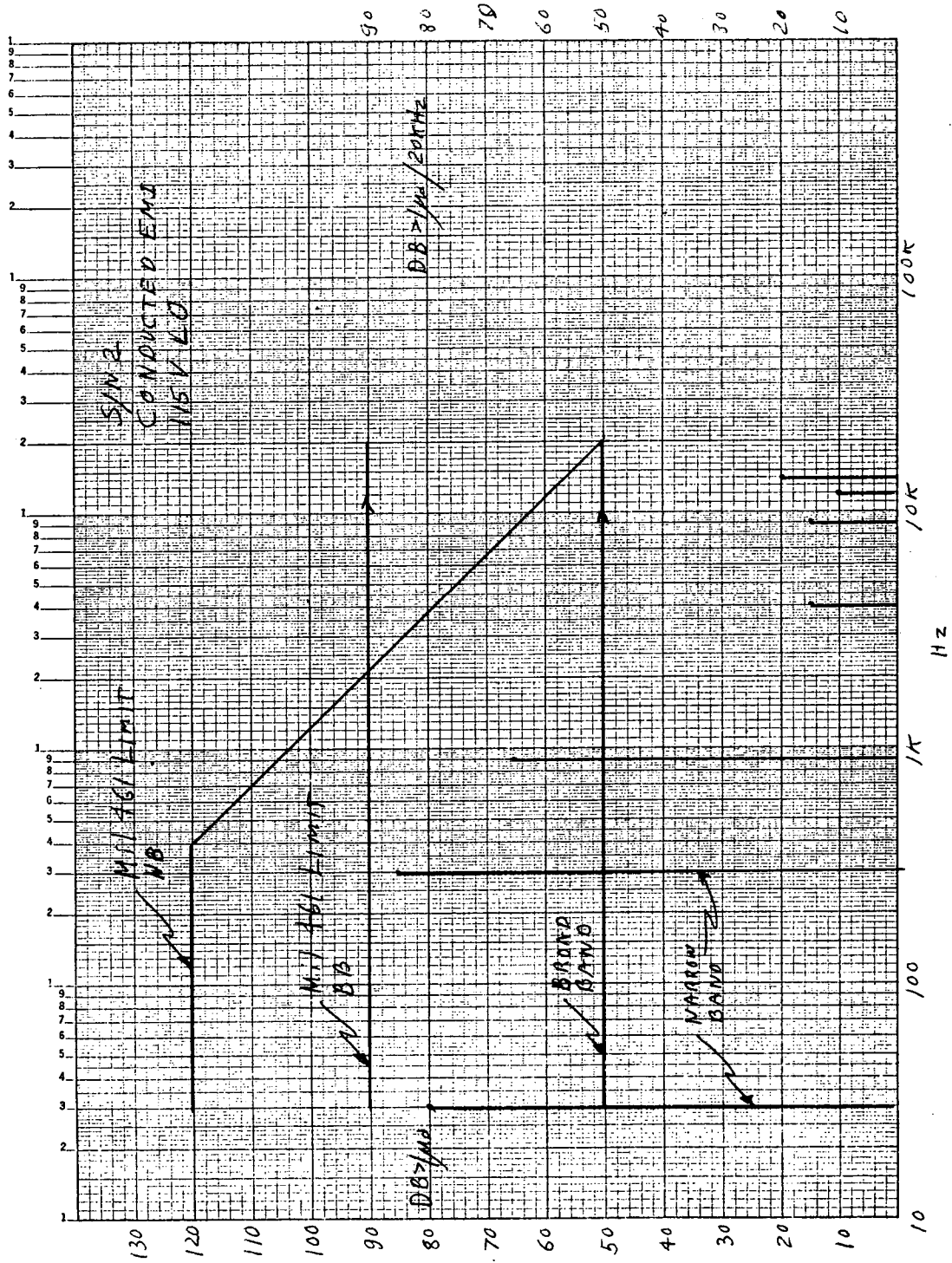
EQUIPMENT A.M.S. CONT. DEAFEN DATE OF TEST 12-22-11
MODEL NO. _____ SERIAL NO. 2 TEST BY F. DUBOIN
EMI METER MM-12T SERIAL NO. AP 41 CERTIFIED D. 1-72
PICKUP DEVICE CURRENT PROBE MODEL NO. 41560 1 SERIAL NO. RF 486
TEST CLAMPED TO PAIR MODEL _____ POSITION 115640

[illegible]

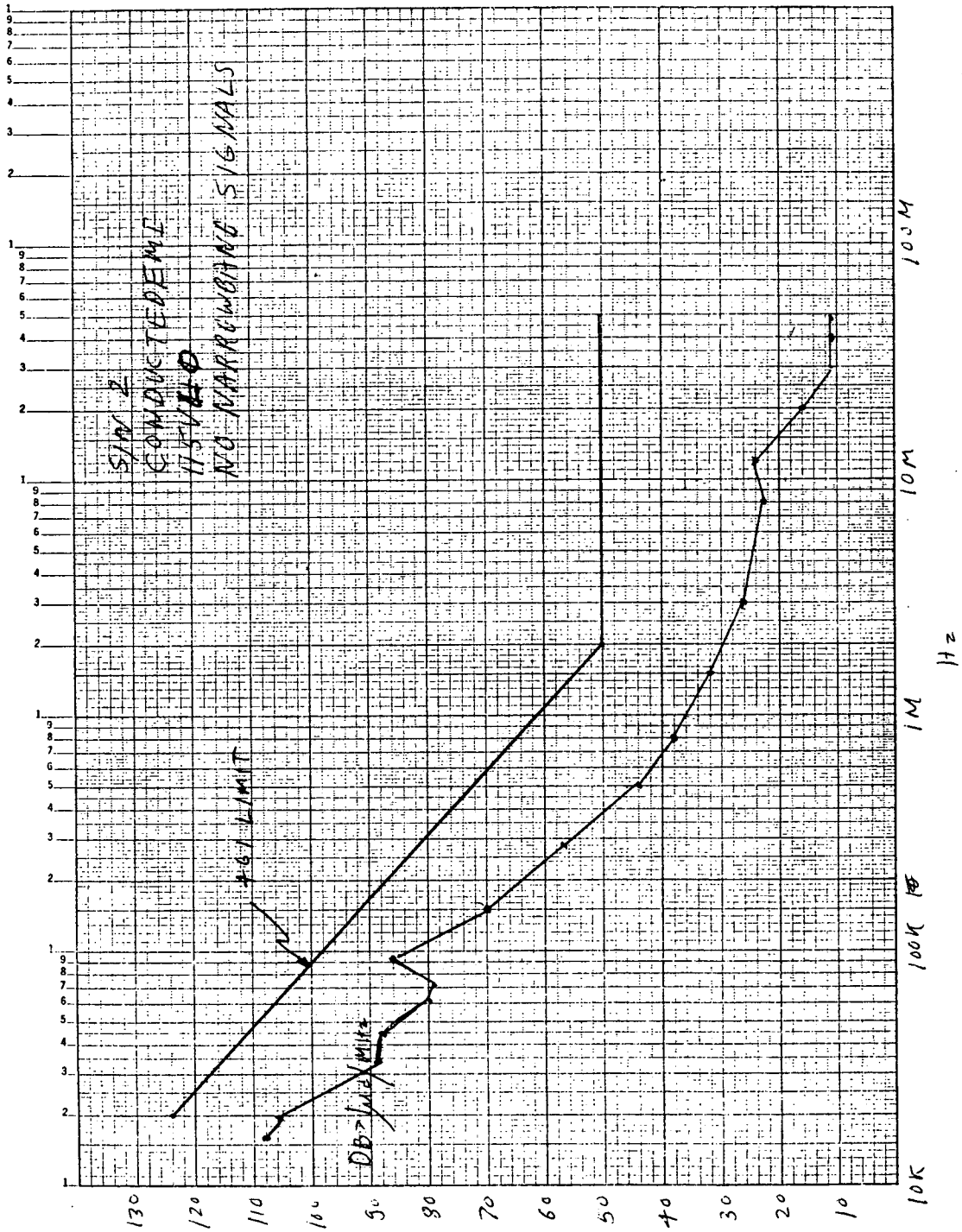
C-176

PAGE _____

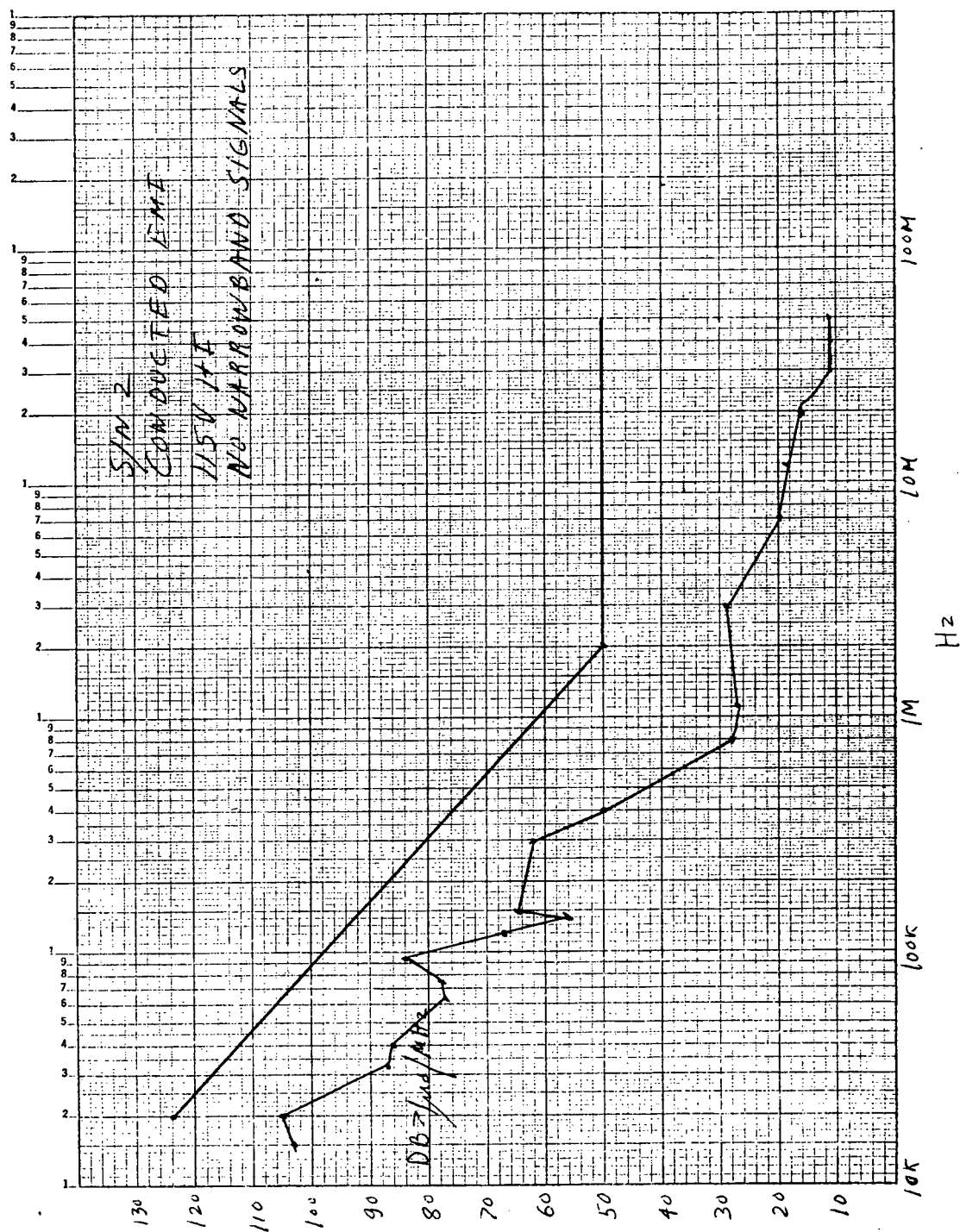
APPENDIX 2



APPENDIX 2



APPENDIX 2



APPENDIX 2

ATMOSPHERE CONTAMINANT SENSOR

PART NO. 344800 SERIAL NO. 002

SUPPLEMENTAL TEST DATA

APPENDIX 2

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6. DATA SHEETS

6.1 GENERAL

6.1.1 This section contains all of the data sheets necessary to record the data requirements of Section 5. The applicable Section 5 paragraph is referenced for each data requirement. Additional data sheets are available from the Seller's Quality Assurance Group.

Test Conducted by Jim Hager Date 27 Jan 72
 Test Verified by J. J. Strain Date 27 Jan 72
 Test Surveillance B. E. Schell Date 27 Jan 72
 _____ Date _____
 _____ Date _____

6.1.2 The survey of all test equipment, in compliance with the requirement of Section 3.3, shall be verified in this section.

All test equipment within current calibration dates: (✓) YES ~~NO~~
 Survey Conducted by _____ Date _____
 Survey Verified by J. J. Strain Date 27 Jan 72
 Survey Surveillance B. E. Schell Date 27 Jan 72
 _____ Date _____

APPENDIX 2

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 1 of 21)

<u>REFERENCE PARAGRAPH</u>	<u>SERIAL NUMBER</u> _____	<u>STAMP/DATE</u>
3.2 TEST CONDITIONS		ACTUAL
3.2a (1) Test temperature shall be 65 to 85°F.		_____ °F
(2) Relative humidity shall be < 90%.		_____ %
(3) Barometric Pressure (lab ambient)		_____ torr
(4) Illumination (lab prevailing)	(✓) OK _____	
		<u>STAMP/DATE</u>
5. TEST PROCEDURES		
5.1 INITIAL SETUP		
5.1.1 All digital displays functional (1888)	(✓) ACPT _____ REJ _____	
		<u>STAMP/DATE</u>
5.1.2 ACS controls set as specified.	(✓) ACPT _____ REJ _____	
		<u>STAMP/DATE</u>
5.1.3 Variac setting shall be 115.0 <u>±</u> 1.0 V ac.		_____ V ac
		<u>STAMP/DATE</u>
5.2 NOMINAL CONDITIONS		
H ₂ O shall be ≤ 2.0 torr.		_____ torr
O ₂ shall be ≤ 5.0 torr.		_____ torr
CO ₂ shall be ≤ 0.6 torr.		_____ torr
F12 shall be ≤ 5 ppm ⁺		_____ ppm
		<u>STAMP/DATE</u>

APPENDIX 2

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 2 of 21)

REFERENCE PARAGRAPH	SERIAL NUMBER _____	STAMP/DATE _____
3.2 TEST CONDITIONS		
5.2 (Cont)		ACTUAL
F114 shall be ≤ 5 ppm.		_____ ppm
SAMPLE FLOW shall be 1.0 SCFH.		_____ SCFH
TC gauge shall be (TBD)		_____
I_p (200 μA scale) shall be $\leq 5 \mu A$.		_____ μA
I_{EA} shall be (TBD)		_____
I_{AN} shall be $37.5 \pm 1.0 \mu A$		_____ μA
TS indicator shall be (TBD)		_____ V
TV indicator shall be (TBD)		_____
V_{ACC} shall be (TBD)		_____
+5 shall be 500 ± 5		_____
-15 shall be 1500 ± 15		_____
+15 shall be 1500 ± 15		_____
+24 shall be 310 ± 20		_____
N_2 output shall be ≤ 4 torr.		_____ torr
H_2O output shall be ≤ 1 torr		_____ torr
P_{AMB} shall be amb press ± 2 torr		AMB _____
		P. AMB _____
1 (H_2 Elcmtr) shall be 0.01 or 0.02		_____
2 (H_2O Elcmtr) shall be 0.01 or 0.02		_____
		STAMP/DATE _____

APPENDIX 2

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6.2 FUNCTIONAL TEST DATA SHEETS (Sheet 3 of 21)

<u>REFERENCE PARAGRAPH</u>	<u>SERIAL NUMBER</u> _____	<u>STAMP/DATE</u>
3.2 TEST CONDITIONS		
5.2 (Cont)		ACTUAL
3 (N ₂ Elcmtr) shall be 0.01 or 0.02		_____
4 (O ₂ Elcmtr) shall be 0.01 or 0.02		_____
5 (CO ₂ Elcmtr) shall be 0.01 or 0.02		_____
6 (F12 Elcmtr) shall be 0.01 or 0.02		_____
7 (F11/114 Elcmtr) shall be 0.01 or 0.02		_____
		<u>STAMP/DATE</u>
5.3 ZERO CHECK		
a. ZERO CHECK switch held until Steps b and c (✓) ACPT___REJ___ are completed.		
		<u>STAMP/DATE</u>
b. Outputs indicated by OUTPUT DVM displays shall be:		
H ₂ (≤ 2.0 torr)		_____
O ₂ (≤ 5 torr)		_____
CO ₂ (≤ 0.6 torr)		_____
F12 (≤ 5 ppm)		_____
F114 (≤ 5 ppm)		_____
		<u>STAMP/DATE</u>

APPENDIX 2

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 4 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER _____

STAMP/DATE

5. TEST PROCEDURES

5.3 (Cont)

ACTUAL

c. DIGITAL TEST METER outputs shall be:

V_{ACC}

REQUIRED

N_2 (≤ 4 torr)

H_2O (≤ 1 torr)

(H_2 Elcmtr) 0.01 or 0.02

(H_2O Elcmtr) 0.01 or 0.02

(N_2 Elcmtr) 0.01 or 0.02

(O_2 Elcmtr) 0.01 or 0.02

(CO_2 Elcmtr) 0.01 or 0.02

(F12 Elcmtr) 0.01 or 0.02

(F11/114 Elcmtr) 0.01 or 0.02

STAMP/DATE

5.4 FUNCTIONAL TEST

a. Standard Mixture composition

N_2

78.46 %

O_2

18.0 %

CO_2

1.02 %

A

1.01 %

STAMP/DATE

APPENDIX 2

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 5 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

MM. 1/27/72
STAMP/DATE

5. TEST PROCEDURES

5.4a. (Cont)

ACTUAL

H₂

1.47 %

F12

1.4 ppm

F114

1.2 ppm

Cylinder Number 6347

MM. 1/27/72
STAMP/DATE

b. Flow rate shall be 0.05 $\pm$ 0.01 SCFH

0.045 SCFH

MM. 1/27/72
STAMP/DATE

c. Ambient Pressure

AMBIENT

736.5 torr

MM. 1/27/72
STAMP/DATE

d. Ion Pump current

100 μ A

~~Nitrogen electrometer output (700 $\pm$ 10)~~

REPL TO 1st ATP. MM.

MM. 1/27/72
STAMP/DATE

e. Outputs

H₂

9.7 torr

O₂

136 torr

CO₂

7.3 torr

F114

76 M torr

MM. 1/27/72
STAMP/DATE

APPENDIX 2

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 6 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

5. TEST PROCEDURES

5.4e. (Cont)

F12

N₂H₂O

P. AMB

ACTUAL

80 M torr581 torr2.8 torr741 torrMMH 1/27/72
STAMP/DATE

f. Required values

REQUIRED

$$P_{H_2} = \frac{741}{(P. AMB)} \times \frac{1.47}{(\%H_2)} \times \frac{1}{100} = \underline{10.89} \pm 4 \text{ torr}$$

$$P_{O_2} = \frac{741}{(P. AMB)} \times \frac{1.8}{(\%O_2)} \times \frac{1}{100} = \underline{133.38} \pm 10 \text{ torr}$$

$$P_{CO_2} = \frac{741}{(P. AMB)} \times \frac{1.02}{(\%CO_2)} \times \frac{1}{100} = \underline{7.56} \pm 1.3 \text{ torr}$$

$$P_{F114} = \frac{741}{(P. AMB)} \times \frac{100}{(\text{ppm F114})} \times \frac{1}{1000} = \underline{74.1} \pm 23 \text{ M torr}$$

$$P_{F12} = \frac{741}{(P. AMB)} \times \frac{104}{(\text{ppm F12})} \times \frac{1}{1000} = \underline{77.06} \pm 23 \text{ M torr}$$

$$P_{N_2} = \frac{741}{(P. AMB)} \times \frac{78.48}{(\%N_2)} \times \frac{1}{100} = \underline{581.53} \text{ torr}$$

$$P_{H_2O} = \underline{2.5} \text{ torr*}$$

*No tolerance. Information only.

All readings within tolerance.

(✓) ACPT ☒ REJ ☐MMH 1/27/72
STAMP/DATE

APPENDIX 2

TP 82-0023

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 7 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER _____

STAMP/DATE

5. TEST PROCEDURES

5.5 INPUT VOLTAGE TEST

ACTUAL

- a. High line Variac setting (126.5 $\pm$ 1.0 V ac)

_____ V ac

Outputs

H₂

_____ torr

O₂

_____ torr

CO₂

_____ torr

F114

_____ M torr

F12

_____ M torr

N₂

_____ torr

H₂O

_____ torr

P. AMB

_____ torr

STAMP/DATE

- b. All readings within tolerance

(✓) ACPT___REJ___

STAMP/DATE

- c. Low line Variac setting (103.5 $\pm$ 1 V ac)

_____ V ac

Outputs

H₂

_____ torr

O₂

_____ torr

CO₂

_____ torr

STAMP/DATE

APPENDIX 2

TP 82-0023

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 8 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER _____

STAMP/DATE

5. TEST PROCEDURES

5.5c. (Cont)

F114

_____ M torr

F12

_____ M torr

N₂

_____ torr

H₂O

_____ torr

P. AMB

_____ torr

STAMP/DATE

d. All readings within tolerance

(✓) ACPT _____ REJ _____

STAMP/DATE

e. Nominal line Variac setting (115 ±1 V ac)

_____ V ac

STAMP/DATE

5.6 MIXTURE CHANGE TEST

b. Mixture Number 1 Composition

N₂

74.36 %

O₂

22.1 %

CO₂

2.03 %

A

1.02 %

H₂

0.49 %

STAMP/DATE

APPENDIX 2

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 9 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 202

MM. 1/27/72
STAMP/DATE

5. TEST PROCEDURES

5.6b. (Cont)

ACTUAL

F12

00 ppm

F114

00 ppm

Cylinder Number 5309

MM. 1/27/72
STAMP/DATE

Sample flow (0.05 $\pm$ 0.01 SCFH)

0.045 SCFH

Sample pressure ($P_{\text{ambient}} \leq P_{\text{sample}} \leq P_{\text{ambient}} + 2$ torr)

742 torr

MM. 1/27/72
STAMP/DATE

c. Restabilize for minimum of 10 min.

10 min

Outputs

H₂

3.6 torr

O₂

16.6 torr

CO₂

14.6 torr

F114

7 M torr

F12

0 M torr

N₂

551 torr

H₂O

1.6 torr

P_{AMB}

742 torr

MM. 1/27/72
STAMP/DATE

APPENDIX 2



TP 82-0023

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 10 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

MM 1/27/72
STAMP/DATE

5. TEST PROCEDURES

5.6d. Required Values

REQUIRED

$$\begin{aligned}
 P_{H_2} &= \frac{742}{(P.AMB)} \times \frac{0.49}{(\%H_2)} \times \frac{1}{100} = \underline{3.64} \pm 4 \text{ torr} \\
 P_{O_2} &= \frac{742}{(P.AMB)} \times \frac{22.1}{(\%O_2)} \times \frac{1}{100} = \underline{163.88} \pm 10 \text{ torr} \\
 P_{CO_2} &= \frac{742}{(P.AMB)} \times \frac{2.03}{(\%CO_2)} \times \frac{1}{100} = \underline{15.26} \pm 1.3 \text{ torr} \\
 P_{F114} &= \frac{742}{(P.AMB)} \times \frac{\quad}{(ppm F114)} \times \frac{1}{1000} = \underline{0} \pm 23 \text{ M torr} \\
 P_{F12} &= \frac{742}{(P.AMB)} \times \frac{\quad}{(ppm F12)} \times \frac{1}{1000} = \underline{0} \pm 23 \text{ M torr} \\
 P_{N_2} &= \frac{742}{(P.AMB)} \times \frac{74.36}{(\%N_2)} \times \frac{1}{100} = \underline{551.75} \text{ torr} \\
 P_{H_2O} &= \underline{2.0} \text{ torr*}
 \end{aligned}$$

*No tolerance. Information only.

All readings within tolerance.

(✓) ACPT ☒ REJ ☐

MM 1/27/72
STAMP/DATE

5.7 AUTOMATIC RATIO CIRCUIT TEST

a. Ion pump current

10.0
7.2 μA
MM 1/27/72
STAMP/DATE

APPENDIX 2

TP 82-0023

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 11 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

Stamp 1/27/72
STAMP/DATE

5. TEST PROCEDURES

ACTUAL

5.7b. Ion pump current increased by 10%.

110 μ A

Outputs

H₂

3.6 torr

O₂

16.5 torr

CO₂

14.6 torr

N₂

551 torr

All readings within tolerance

(☒) ACPT ☐ REJ

Stamp 1/27/72
STAMP/DATE

c. Ion pump current decreased by 20%.

80 μ A

Outputs

H₂

3.8 torr

O₂

16.6 torr

CO₂

14.5 torr

N₂

550 torr

All readings within tolerance

(☒) ACPT ☐ REJ

Stamp 1/27/72
STAMP/DATE

d. Ion pump current reset to value recorded in Step a above.

100 μ A

Stamp 1/27/72
STAMP/DATE

APPENDIX 2

TP 82-0023

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 12 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

JML 1/27/72
STAMP/DATE

5. TEST PROCEDURES

5.8 FREON 11 TEST

ACTUAL

c. F11 background output (≤ 4 M torr)

9 M torr

JML 1/27/72
STAMP/DATE

d. Freon 11/N₂ Composition

42 ppm

Cylinder Number 4549

JML 1/27/72
STAMP/DATE

e. Flow (0.05 $\pm$ 0.01 SCFH)

0.045 SCFH

Sample pressure ($P_{AMB} \leq P_{SAMPLE} \leq P_{AMB} + 10$ torr)

742 torr

JML 1/27/72
STAMP/DATE

f. Outputs

F11

33 M torr

F12

2 M torr

P_{AMB}

742 torr

JML 1/27/72
STAMP/DATE

g. Computed outputs

$$F11 = \frac{742}{(P_{AMB})} \times \frac{42}{(\text{ppm F11})} \times \frac{1}{1000} =$$

31.16 $\pm$ 2.5 M torr

$$N_2 = \frac{742}{(P_{AMB})}$$

742 torr*

JML 1/27/72
STAMP/DATE

APPENDIX 2

TP 82-0023

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 13 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002

mmh 1/27/12
STAMP/DATE

5. TEST PROCEDURES

5.8g. (Cont)

ACTUAL

F12 =

2 M torr*

*Information only

All outputs are within tolerance.

(✓) ACPT ☒ REJ ☐

mmh 1/27/12
STAMP/DATE

5.9 PRESSURE TEST

b. Flow rate (0.05 $\pm$ 0.01 SCFH)

_____ SCFH

Inlet pressure (30 $\pm$ 1 inHg)

_____ inHg

Outputs

H₂

_____ torr

O₂

_____ torr

CO₂

_____ torr

F114

_____ M torr

F12

_____ M torr

N₂

_____ torr

H₂O

_____ torr

P_{AMB}

_____ torr

mmh 1/27/12
STAMP/DATE

APPENDIX 2

TP 82-0023

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 14 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER _____

STAMP/DATE

5. TEST PROCEDURES

5.9 (Cont)

ACTUAL

REQUIRED

Required values

$P_{H_2} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\%H_2)} \times \frac{1}{100}$	=	_____ <u>+4</u> torr
$P_{O_2} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\%O_2)} \times \frac{1}{100}$	=	_____ <u>+10</u> torr
$P_{CO_2} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\%CO_2)} \times \frac{1}{100}$	=	_____ <u>+1.3</u> torr
$P_{F114} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(ppm F114)} \times \frac{1}{1000}$	=	_____ <u>+23</u> M torr
$P_{F12} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(ppm F12)} \times \frac{1}{1000}$	=	_____ <u>+23</u> M torr
$P_{N_2} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\%N_2)} \times \frac{1}{100}$	=	_____ torr
$P_{H_2O} =$		_____ torr*

*No tolerance. Information only.

All readings within tolerance.

(✓) ACPT___REJ___

P_{AMB} (torr) +2 torr = Inlet pressure
(inHg) x 25.4

(✓) ACPT___REJ___

STAMP/DATE

APPENDIX 2

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 15 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER _____

5. TEST PROCEDURES

5.9c. Flow rate (0.05 $\pm$ 0.01 SCFH)

Inlet pressure (20 $\pm$ 1 inHg)

Outputs

H₂

O₂

CO₂

F114

F12

N₂

H₂O

P. AMB

Required Values

$$P_{H_2} = \frac{\text{_____}}{(P. AMB)} \times \frac{\text{_____}}{(\%H_2)} \times \frac{1}{100} =$$

$$P_{O_2} = \frac{\text{_____}}{(P. AMB)} \times \frac{\text{_____}}{(\%O_2)} \times \frac{1}{100} =$$

$$P_{CO_2} = \frac{\text{_____}}{(P. AMB)} \times \frac{\text{_____}}{(\%CO_2)} \times \frac{1}{100} =$$

$$P_{F114} = \frac{\text{_____}}{(P. AMB)} \times \frac{\text{_____}}{(\text{ppm F114})} \times \frac{1}{1000} =$$

$$P_{F12} = \frac{\text{_____}}{(P. AMB)} \times \frac{\text{_____}}{(\text{ppm F12})} \times \frac{1}{1000} =$$

STAMP/DATE

ACTUAL

_____ SCFH

_____ inHg

_____ torr

_____ torr

_____ torr

_____ M torr

_____ M torr

_____ torr

_____ torr

_____ torr

REQUIRED

_____ $\pm$ 4 torr

_____ $\pm$ 10 torr

_____ $\pm$ 1.3 torr

_____ $\pm$ 23 M torr

_____ $\pm$ 23 M torr

STAMP/DATE

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 16 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER _____

STAMP/DATE

5.9c. (Cont)

REQUIRED

$$P_{N_2} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\%N_2)} \times \frac{1}{100} = \quad \text{torr}$$

$$P_{H_2O} = \quad \text{torr}^*$$

*No tolerance. Information only.

All readings within tolerance

(✓) ACPT REJ

P_{AMB} (torr) ±2 torr = Inlet pressure
(inHg) x 25.4

(✓) ACPT REJ

STAMP/DATE

d. Flow rate (0.05 +0.01 SCFH)

 SCFH

Inlet pressure (40 +1 inHg)

 inHg

H₂

 torr

O₂

 torr

CO₂

 torr

F114

 M torr

F12

 M torr

N₂

 torr

H₂O

 torr

P_{AMB}

 torr

STAMP/DATE

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 17 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER _____

STAMP/DATE

5. TEST PROCEDURES

5.9d (Cont)

REQUIRED

$$\begin{aligned}
 P_{H_2} &= \frac{\text{P. AMB}}{(\text{P. AMB})} \times \frac{(\%H_2)}{(\%H_2)} \times \frac{1}{100} = \text{_____} +4 \text{ torr} \\
 P_{O_2} &= \frac{\text{P. AMB}}{(\text{P. AMB})} \times \frac{(\%O_2)}{(\%O_2)} \times \frac{1}{100} = \text{_____} +10 \text{ torr} \\
 P_{CO_2} &= \frac{\text{P. AMB}}{(\text{P. AMB})} \times \frac{(\%CO_2)}{(\%CO_2)} \times \frac{1}{100} = \text{_____} +1.3 \text{ torr} \\
 P_{F114} &= \frac{\text{P. AMB}}{(\text{P. AMB})} \times \frac{(\text{ppm F114})}{(\text{ppm F114})} \times \frac{1}{1000} = \text{_____} +23 \text{ M torr} \\
 P_{F12} &= \frac{\text{P. AMB}}{(\text{P. AMB})} \times \frac{(\text{ppm F12})}{(\text{ppm F12})} \times \frac{1}{1000} = \text{_____} +23 \text{ M torr} \\
 P_{N_2} &= \frac{\text{P. AMB}}{(\text{P. AMB})} \times \frac{(\%N_2)}{(\%N_2)} \times \frac{1}{100} = \text{_____} \text{ torr} \\
 P_{H_2O} &= \text{_____} \text{ torr*}
 \end{aligned}$$

*No tolerance. Information only.

All readings within tolerance.

(✓) ACPT ___ REJ ___

P. AMB (torr) ± 2 torr = Inlet pressure
(inHg) x 25.4

(✓) ACPT ___ REJ ___

STAMP/DATE

5.10 REDUNDANT FILAMENT TEST

ACTUAL

a. Outputs

FIL #1

FIL #2

H₂

0.4

0.5 torr

O₂

154

154 torr

STAMP/DATE

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 18 of 21)REFERENCE PARAGRAPHSERIAL NUMBER 002MMH 12/12
STAMP/DATE

5. TEST PROCEDURES

5.10a. (Cont)

ACTUAL

	FIL #1	FIL #2	
CO ₂	<u>0.9</u>	<u>1.6</u>	torr
F114	<u>9</u>	<u>11</u>	M torr
F12	<u>1</u>	<u>1</u>	M torr
N ₂	<u>569</u>	<u>569</u>	torr
H ₂ O	<u>6.0</u>	<u>6.4</u>	torr
P _{AMB}	<u>736</u>	<u>736</u>	torr

MMH 12/12
STAMP/DATE

b. Required Values

REQUIRED

P _{H₂} =	<u>0</u>	+4 torr
P _{O₂} = $\frac{736}{(P_{AMB} - P_{H_2O})} \times \frac{20.99}{100} \times \frac{1}{100}$	=	<u>153.23</u> +10 torr
P _{CO₂} = $\frac{736}{(P_{AMB} - P_{H_2O})} \times \frac{0.03}{100} \times \frac{1}{100}$	=	<u>0.22</u> +1.3 torr
P _{N₂} = $\frac{736}{(P_{AMB} - P_{H_2O})} \times \frac{78.03}{100} \times \frac{1}{100}$	=	<u>569.62</u> torr
P _{H₂O} = Computed Value	=	<u>6.57</u> torr
F114 =	<u>0</u>	+11 M torr
F12 =	<u>0</u>	+11 M torr

MMH 12/12
STAMP/DATE

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 19 of 21)

<u>REFERENCE PARAGRAPH</u>	<u>SERIAL NUMBER</u> _____	<u>STAMP/DATE</u>
5. TEST PROCEDURES		
5.10b. (Cont)		REQUIRED
All readings within tolerance.	(✓) ACPT__REJ__	
		<u>STAMP/DATE</u>
5.11 DEGAS TEST		ACTUAL
b. Outputs rise	(✓) ACPT__REJ__	
		<u>STAMP/DATE</u>
5.12 OVERPRESSURE PROTECTION TEST		
a. Flow rate (0.05 $\pm$ 0.01 SCFH)		_____ SCFH
Ambient Pressure _____ ambient		_____ torr
Ion pump current _____		_____ μ A
		<u>STAMP/DATE</u>
b. ON indicator lamp switched off.	(✓) ACPT__REJ__	
STANDBY indicator lamp off	(✓) ACPT__REJ__	
Ion pump current (approx 1 mA)	(✓) ACPT__REJ__	
		<u>STAMP/DATE</u>
c. Relay sound audible	(✓) ACPT__REJ__	
Filament off	(✓) ACPT__REJ__	
		<u>STAMP/DATE</u>

APPENDIX 2

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 20 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER _____

STAMP/DATE

5. TEST PROCEDURES

5.12c. (Cont)

ACTUAL

FILAMENT PREHEAT indicator ON

(✓) ACPT__ REJ__

Ion pump current (approx 5 mA)

(✓) ACPT__ REJ__

STAMP/DATE

d. Entire Paragraph read

(✓) _____

Ion pump OFF

(✓) ACPT__ REJ__

ROUGH COMP lamp OFF

(✓) ACPT__ REJ__

I.P. lamp OFF

(✓) ACPT__ REJ__

TC indication (Approx 1 mA)

(✓) ACPT__ REJ__

STAMP/DATE

e. Preheat relay audible (5 mA)

(✓) ACPT__ REJ__

STANDBY lights (1 mA)

(✓) ACPT__ REJ__

STAMP/DATE

5.13 LOSS OF POWER TEST

a. Flow rate (0.05 $\pm$ 0.01 SCFH)

0.045 SCFH

Ambient pressure

737 ambient

737 torr

Ion pump current

125 μ A

9/14/72
STAMP/DATE

APPENDIX 2

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 21 of 21)

REFERENCE PARAGRAPH

SERIAL NUMBER 002-

5. TEST PROCEDURES

5.13b. Power off at

c. Power on at

Observe pump down

gmh. 1/27/72
STAMP/DATE

ACTUAL

1603 min

gmh. 1/27/72
STAMP/DATE

1609 min

(✓) ACPT ☒ REJ ☐

gmh. 1/27/72
STAMP/DATE

APPENDIX 2

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6.3 SPARES FUNCTIONAL TEST DATA SHEET (Sheet 1 of 3)

REFERENCE PARAGRAPH

SERIAL NUMBER _____

STAMP/DATE

5. TEST PROCEDURES

5.14 SPARES TEST

(Follow procedure of Paragraph 5.4.)

a. Standard Mixture composition

ACTUAL

N₂

_____%

O₂

_____%

CO₂

_____%

A

_____%

H₂

_____%

F12

_____ppm

F114

_____ppm

Cylinder Number _____

STAMP/DATE

b. Flow rate shall be 0.05 +0.01 SCFH

_____SCFH

STAMP/DATE

c. Ambient Pressure _____ ambient

_____torr

STAMP/DATE

d. Ion Pump Current

_____μA

Nitrogen electrometer output (700 ±10)

STAMP/DATE

APPENDIX 2

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6.3 SPARES FUNCTIONAL TEST DATA SHEET (Sheet 2 of 3)

REFERENCE PARAGRAPH

SERIAL NUMBER

STAMP/DATE

5. TEST PROCEDURES

5.14 (Cont)

ACTUAL

e. Outputs

H₂

_____ torr

O₂

_____ torr

CO₂

_____ torr

F114

_____ M torr

F12

_____ M torr

N₂

_____ torr

H₂O

_____ torr

P_{AMB}

_____ torr

STAMP/DATE

f. Required Values

REQUIRED

$$P_{H_2} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\%H_2)} \times \frac{1}{100}$$

= _____ +4 torr

$$P_{O_2} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\%O_2)} \times \frac{1}{100}$$

= _____ +10 torr

$$P_{CO_2} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\%CO_2)} \times \frac{1}{100}$$

= _____ +1.3 torr

$$P_{F114} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(ppm F114)} \times \frac{1}{1000}$$

= _____ +23 M torr

$$P_{F12} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(ppm F12)} \times \frac{1}{1000}$$

= _____ +23 M torr

STAMP/DATE

APPENDIX 2

TP 82-0023

6.3 SPARES FUNCTIONAL TEST DATA SHEET (Sheet 3 of 3)

REFERENCE PARAGRAPH

SERIAL NUMBER _____

STAMP/DATE

5. TEST PROCEDURES

5.14 (Cont)

REQUIRED

$$P_{N_2} = \frac{\quad}{(P_{AMB})} \times \frac{\quad}{(\%N_2)} \times \frac{1}{100} = \quad \text{torr}$$

$$P_{H_2O} = \quad \text{torr*}$$

*No tolerance. Information only.

(✓) ACPT__REJ__

STAMP/DATE

5.15 WORKMANSHIP

Workmanship verified

(✓) ACPT__REJ__

STAMP/DATE

5.16 EXTERNAL DIMENSIONS

Dimensions verified

(✓) ACPT__REJ__

STAMP/DATE

APPENDIX 2

ADDENDUM

TP 82-0023

6.4 ELECTROMAGNETIC COMPATIBILITY TEST DATA SHEET (Sheet 1 of 1)

<u>REFERENCE PARAGRAPH</u>	<u>SERIAL NUMBER</u> _____	<u>STAMP/DATE</u>
5. TEST PROCEDURES		
5.17 ELECTROMAGNETIC CONDUCTED INTERFERENCE TEST		
5.17.1 Test Setup and Procedure		ACTUAL
a. Test set up as shown in Figure 1.		<u>STAMP/DATE</u>
c. Limits not exceeded	(✓) _____	OK
Data Sheets attached		<u>STAMP/DATE</u>
d. (b) and (c) repeated for 115 V RTN		
(c) Limits not exceeded	(✓) _____	OK
Data Sheets attached		<u>STAMP/DATE</u>
5.17.2 Test Setup and Procedure		
a. Test set up as shown in Figure 1.		<u>STAMP/DATE</u>
c. Limits not exceeded	(✓) _____	OK
Data Sheets attached		<u>STAMP/DATE</u>
d. (b) and (c) repeated for 115 V RTN		
(c) Limits not exceeded	(✓) _____	OK
Data Sheets attached		<u>STAMP/DATE</u>