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FINAL REPORT

ATMOSPHERIC CONTAMINANT SENSOR

BOOK 2 OF 3 - APPENDICES

By Burton W. Scott
and J. H. Stuart

April 1972

Perkin-Elmer SPO No. 30249

OFFICE OF PRIME RESPONSIBILITY

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APPENDICES

APPENDIX 1

PROJECT NOTES

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 N_2 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

H.G. Voorhies

APPENDIX 1

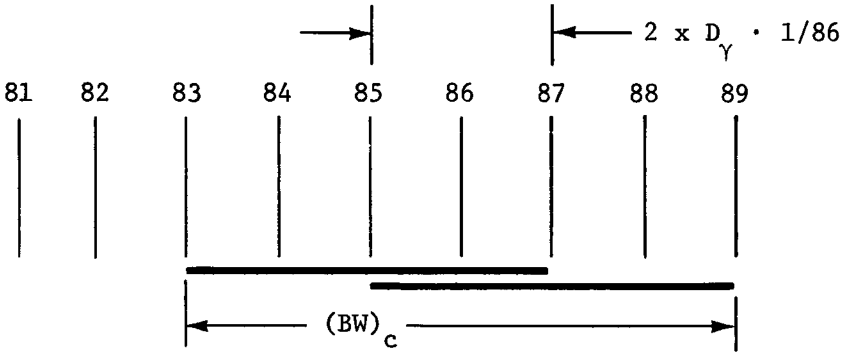
SLIT WIDTHS, BEAM WIDTHS, AND RESOLUTION FOR m/e = 85 AND 101

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 (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

$BW = 0.042$

$D_\sigma = 0.011$ in

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

$(BW_e) = 0.022 + 0.042 = 0.064$ 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

$$BW = 0.044$$

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

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

$$= 0.063 \approx 0.064$$

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

$$= 41.6 \text{ min}$$

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

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	ΔV/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	ΔV/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

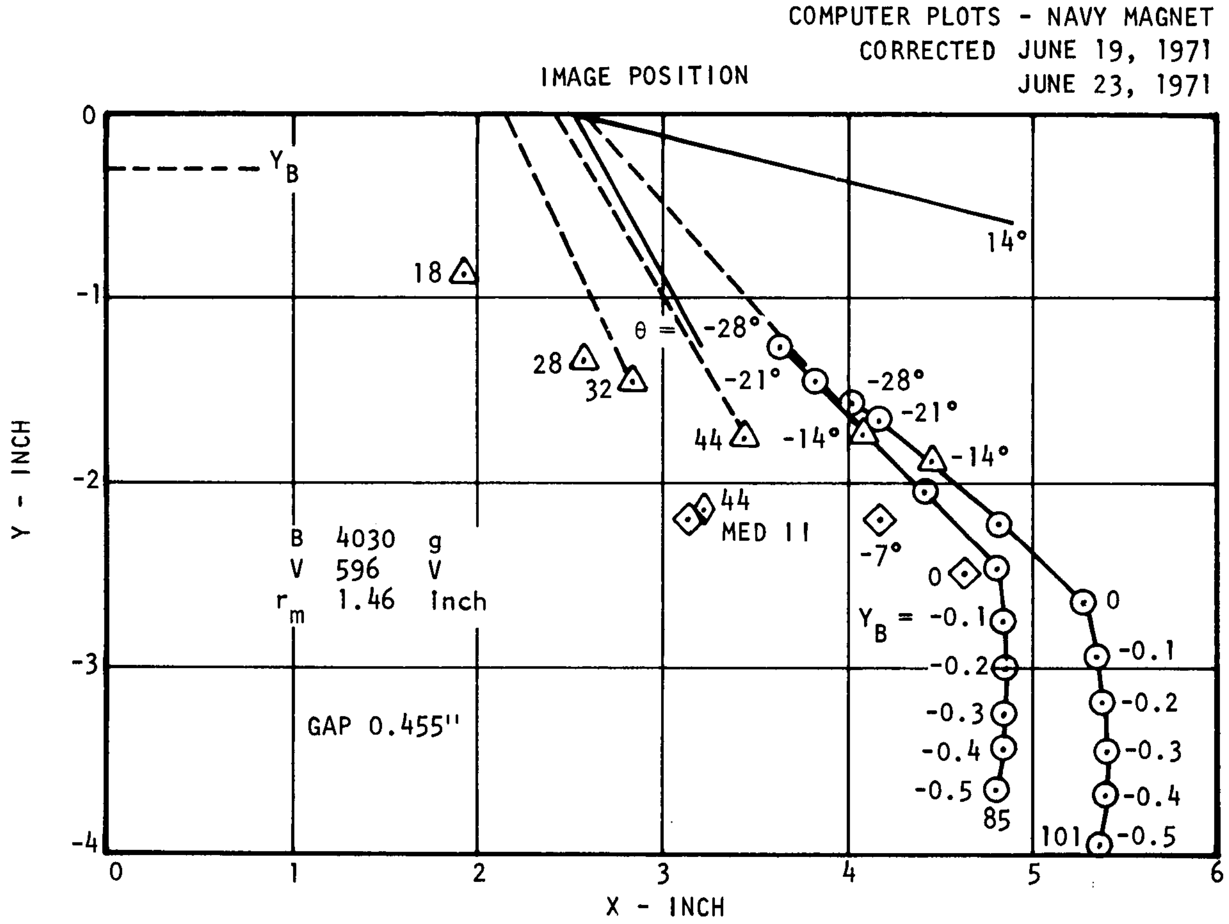


FIGURE 7. Computer Data of May 4 and 5, 1971

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12 July 1971

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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

Constituent	m/e	Range	Maximum
*H_2	2	0 - 40 torr	40 torr
H_2O	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_s and P_a, a source pressure of 1×10^{-4} torr for air is assumed, a source conductance of 50 cc/sec for N_2 and an ion pumping speed of 20 l/sec for N_2 and the following pumping speeds for other gases.

TABLE 4

Constituent	Pumping Speed
H_2	37.8
H_2O	20
N_2	20

TABLE 4 (Cont)

Constituent	Pumping Speed
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

	H_2	H_2O	N_2	O_2	CO_2	Freon 12	Freon 11	Freon 114
m/e	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	0.228
Molecular leak	25×10^{-6} cc sec^{-1}	8.4×10^{-6}	6.6×10^{-6}	6.3×10^{-6}	5.3×10^{-6}	3.2×10^{-6}	3.01×10^{-6}	2.69×10^{-6}
Viscous leak	6.6×10^{-6} cc sec^{-1}	6.6×10^{-6}	6.6×10^{-6}	6.6×10^{-6}	6.6×10^{-6}	6.6×10^{-6}	6.6×10^{-6}	6.6×10^{-6}
Molecular flow	1×10^{-3} torr cc sec^{-1}	0.277×10^{-3}	4.02×10^{-3}	1.26×10^{-3}	0.1325×10^{-3}	0.730×10^{-6}	0.114×10^{-6}	0.614×10^{-6}
Viscous flow	0.264×10^{-3} torr cc sec^{-1}	0.218×10^{-3}	4.02×10^{-3}	1.32×10^{-3}	0.165×10^{-3}	1.51×10^{-6}	0.251×10^{-6}	1.51×10^{-6}
Source conductance	194 cc sec^{-1}	62.4	50	46.8	39.9	24.1	22.7	20.2
Pump speed	37.8 L sec^{-1}	20	20	13.9	20	20	20	20
Molecular anal press	2.65×10^{-8} torr	1.39×10^{-8}	2.01×10^{-7}	9.05×10^{-7}	6.64×10^{-9}	3.65×10^{-11}	0.57×10^{-11}	3.07×10^{-11}
Viscous anal press	0.699×10^{-8} torr	1.09×10^{-8}	2.01×10^{-7}	9.50×10^{-7}	8.25×10^{-9}	7.55×10^{-11}	1.26×10^{-11}	7.55×10^{-11}
Molecular source press	5.15×10^{-6} torr	4.44×10^{-6}	80.3×10^{-6}	26.9×10^{-6}	3.32×10^{-6}	3.03×10^{-8}	0.502×10^{-8}	3.03×10^{-8}
Viscous source press	1.36×10^{-6} torr	3.60×10^{-6}	80.3×10^{-6}	28.3×10^{-6}	4.13×10^{-6}	6.27×10^{-8}	1.11×10^{-8}	7.50×10^{-8}
Pump differential	194	320	399	299	500	832	885	990
Specific N_2 source sensitivity	0.16	0.70	1	0.75	1.1	0.5	0.5	0.5
Source sensitivity	0.8×10^{-6} A $torr^{-1}$	3.5×10^{-6}	5×10^{-6}	3.75×10^{-6}	5.5×10^{-6}	2.5×10^{-6}	2.5×10^{-6}	2.5×10^{-6}
Molecular leak Ion current	4.13×10^{-12} A	2.07×10^{-11}	5.34×10^{-10}	101×10^{-12}	18.25×10^{-12}	7.57×10^{-14}	2.0×10^{-14}	7.57×10^{-14}
Viscous leak Ion current	1.09×10^{-12} A	12.6×10^{-12}	5.34×10^{-10}	106×10^{-12}	22.8×10^{-12}	15.65×10^{-14}	4.3×10^{-14}	18.75×10^{-14}
Feedback resistor	1×10^{12}	1×10^{11}	1.5×10^{10}	5×10^{10}	2×10^{11}	3×10^{12}	3×10^{12}	3×10^{12}
Output	4.0 V	4.4 V	8.0 V	2.0 V	2.5 V			

B.W. Scott
12 July 1971

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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

m/e	X(cm)	Y(cm)	Ray Slope dy/dx	Ctn^{-1} dy/dx
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°
85 and 101 dy/dx = 0.6 = 31°

TABLE 7

Collector Slit Widths (perpendicular to beam)

m/e	Resolution 0 Cross Talk	ΔV Top	Beam Width	Slit Widths Normal to Beams
2	2.2	--	0.0045"	0.100"
18	18.8	17.9	0.0163"	0.050"

TABLE 7 (Cont)

m/e	Resolution 0 Cross Talk	ΔV Top	Beam Width	Slit Widths Normal to Beams
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
$x = \pm 2$ degrees
$\beta = 0.005\ V_o$

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

m/e	Ray Ctn^{-1} dy/dx	Ray-plane Angle	Sin r-p	Slit Width/ Sin r-p
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.

H.G. Voorhies
13 June 1971

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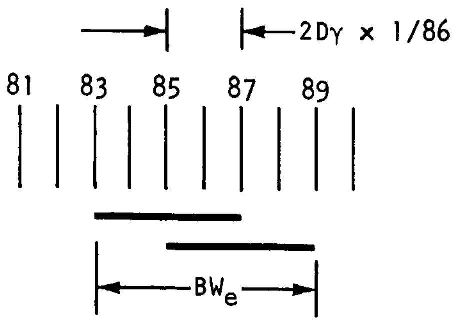
SLIT WIDTHS, BEAM WIDTHS, AND RESOLUTION FOR m/e = 85 AND 101

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



m/e 85

$BW = 0.042$

$D_\gamma\ 1/86 = 0.011$ in

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

$(BW_e) = 0.022 + 0.042 = 0.064$ in

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

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

m/e 101

$BW = 0.044$

$D_\gamma\ 1/102 = 0.0097$ in

$BW_e = 2 \times D_\gamma\ 1/102 + BW$

$= 0.063 \approx 0.064$

t/b	S	S-BW	$(\Delta V/V)_{S-BWe}$
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

H.G. Voorhies
13 July 1971

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CORRECTIONS FOR F11, 12, 114 INTERFERENCES

Characteristics of Freons

Freon 11	Trichlorofluoromethane $CC\ell_3F$ (p42B)	MW 137.38
Freon 12	Dichlorodifluoromethane $CC\ell_2F_2$ (p32B)	MW 120.93
Freon 114	1, 2-Dichlorotetrafluoroethane $C_2\ C\ell_4F_4$ (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	103
		1000	452	316	219	143	106	84	74	52

Sensitivities

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

	Butane	Nitrogen
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 x 576 V = 135. V → V = 432 volts.

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For the F12, F114 combination.

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

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

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

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

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

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

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

m/e 101, 103 coll, I(F11) = I(101, 103 coll) - I_{F12} (m/e 85, 87 at 85, 87 coll) x 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.

R. Lehotsky
13 July 1971

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

The effective resistance of the filament, i.e., the resistance from one feedthrough 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 ±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:

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

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).

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13 July 1971

APPENDIX 1

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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).

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

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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.

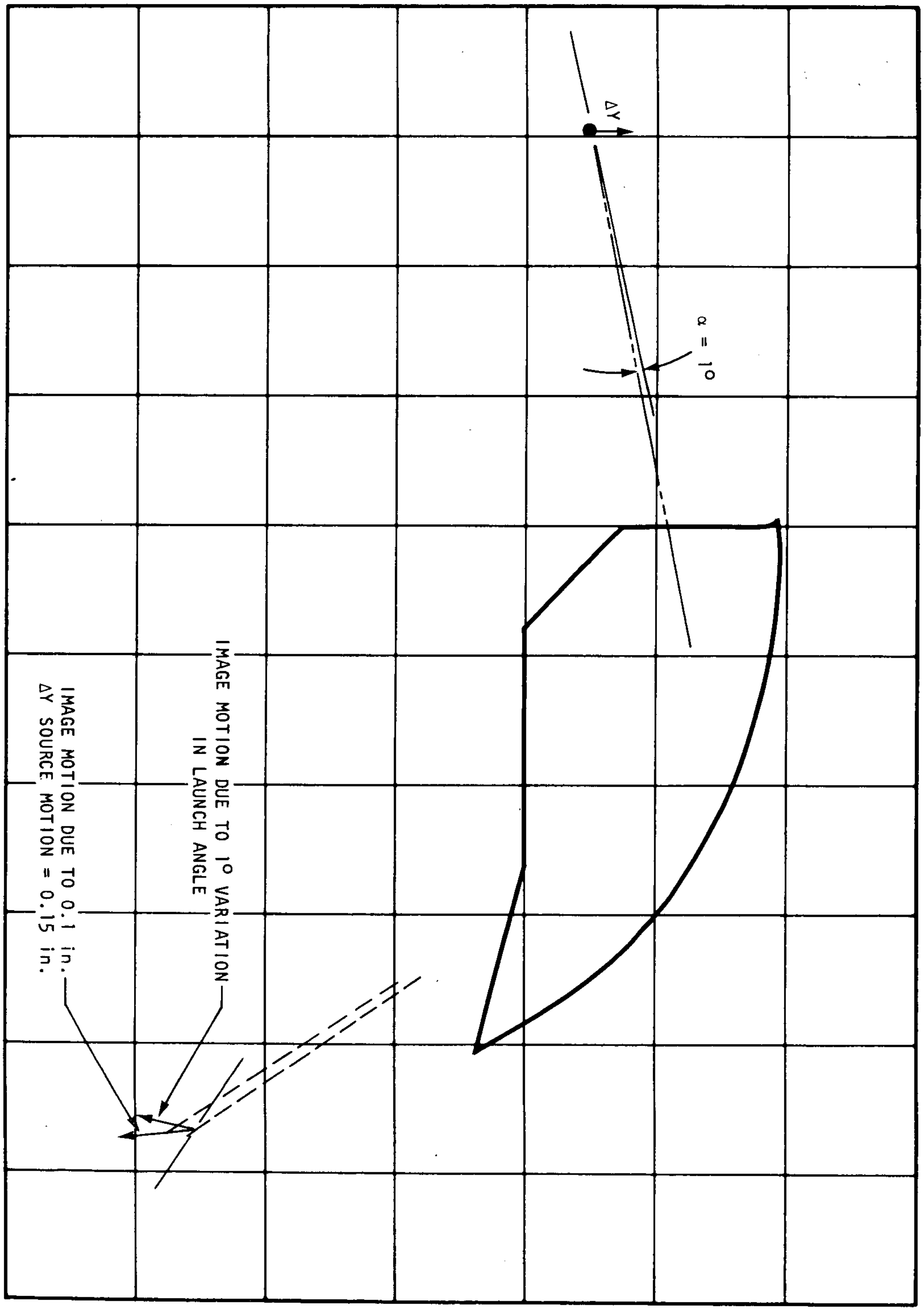

FIGURE 8. Direction of Motion

B.W. Scott
20 July 1971

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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.

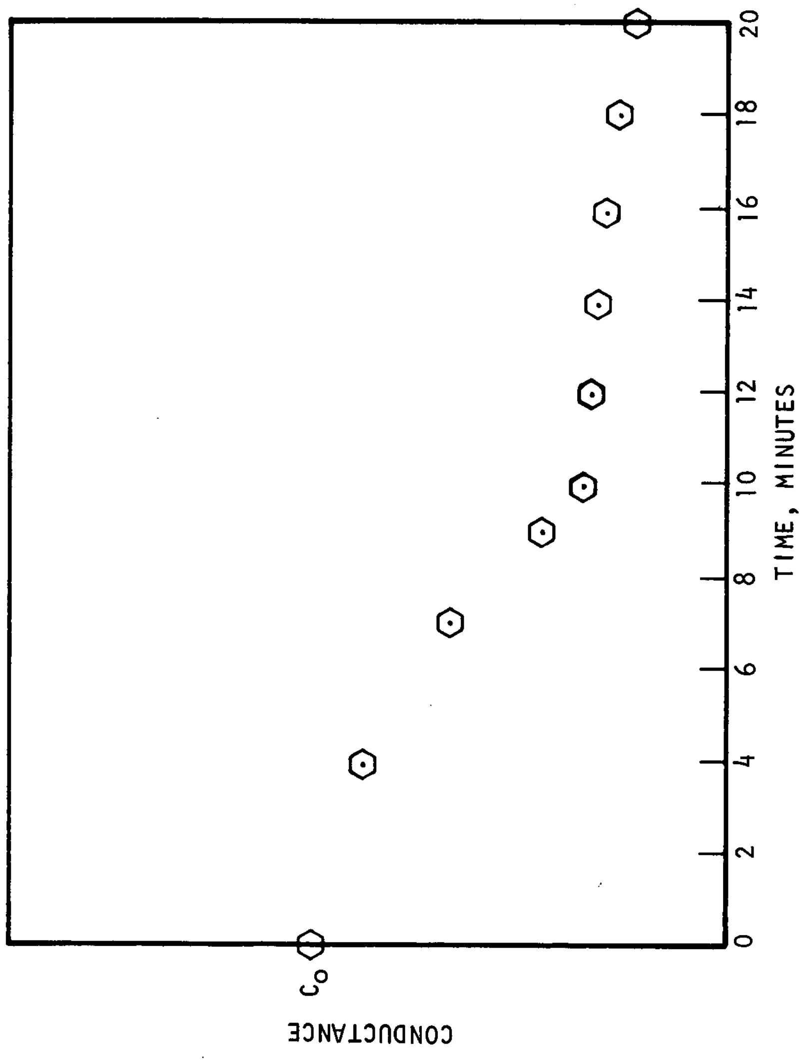

FIGURE 9. Typical Conductance vs Time of Varian Adjustable Leak

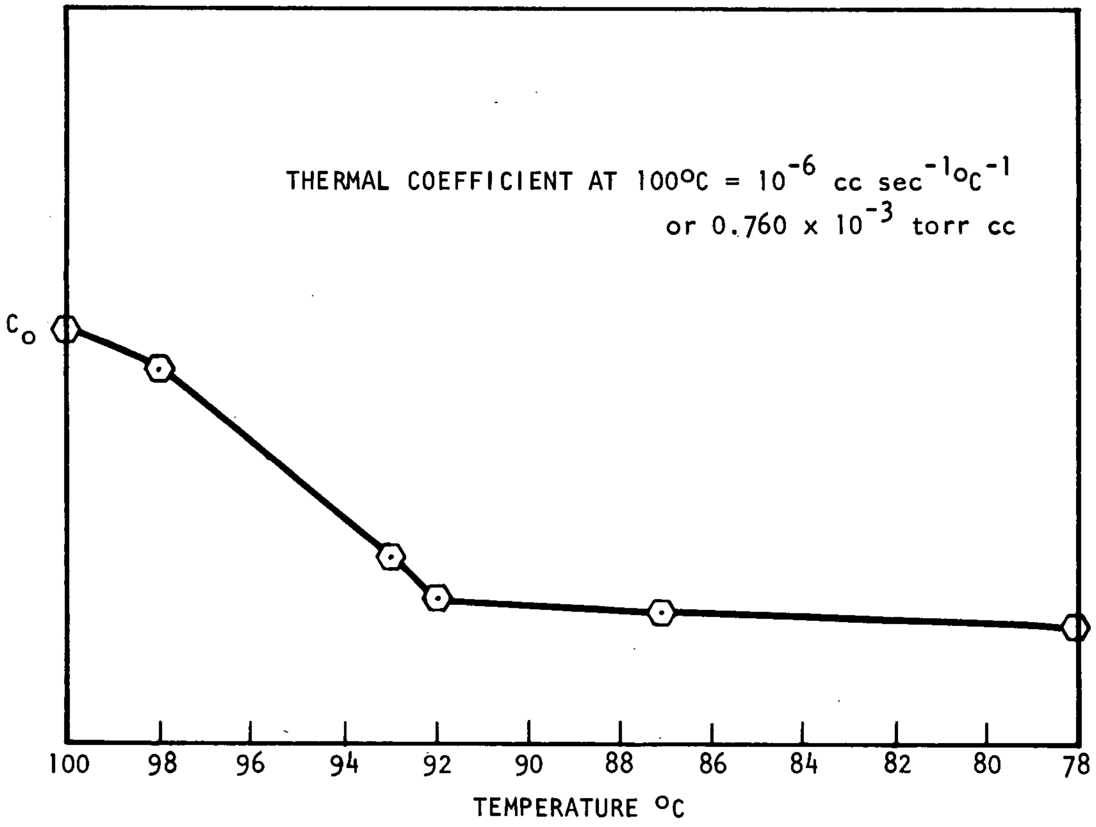

FIGURE 10. Closure vs Temperature

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20 July 1971

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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

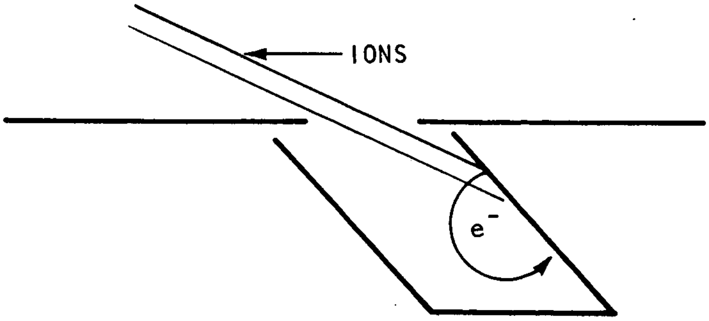
Worst case would be the 101 bucket where the magnetic field is least.

B = 50 gauss

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

2R = 0.120 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.



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

B.W. Scott
26 July 1971

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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.

$\Delta t = \text{Delay} \cong \frac{V}{Q}$ 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

Flow Atm Liter Min^{-1}	Line Drop, Torr	Filter Drop, Torr Nupro + Millipore	Delay, Min
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

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26 July 1971

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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

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

APPENDIX 1

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

TABLE 14

Segment	B	ΔB	X	$\Delta X = \frac{X\,\Delta B}{B}$ Mils	Total ΔX Mils
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.

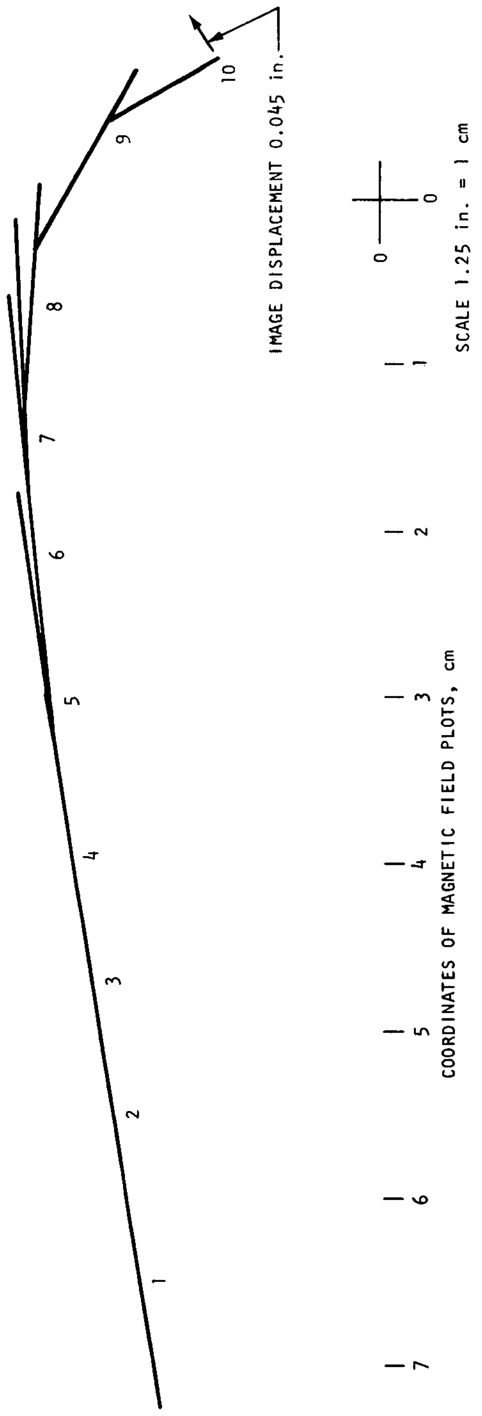

FIGURE 11. **Path Segments Used to Calculate Perturbation of Trajectory by Source Shield**

T. Morris
16 September 1971

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Project Note No. 13
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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 ad 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

B. W. Scott
Prepared By Joseph H. Stuart Date 20 Dec 71

Approved ~~By~~ Date 12-20-71

Approved By 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

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

APPENDIX 2

TP 82-0023

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APPENDIX 2

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 μA) 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 F114	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

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

5.1.3 The ACS input voltage shall be supplied from a Variac which is set for 115 ±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 μA)	$\leq$ 5 μA	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 ±5	Digital Test Meter
	-15	1500 ±15	Digital Test Meter
	+15	1500 ±15	Digital Test Meter
	+24	310 ±20	Digital Test Meter
Nitrogen Output	N_2	$\leq$ 4 torr	Digital Test Meter
Water Output	H_2O	$\leq$ 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.

PARAMETER	TITLE	VALVE	LOCATION
Inlet Pressure	P_{AMB}	Local Ambient Pressure ±2 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 ±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.

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 ±10 μA. 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 N_2 and purge tne 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 N_2, on Test Data Sheet.

d. Close SAMPLE IN valve and disconnect dry N_2 sample. Attach the Freon $11/N_2$ mixture and purge the inlet system for 10 minutes. Record $F11/N_2$ mixture level on Test Data Sheet.

e. Establish nominal flow and pressure levels. Record on Test Data Sheet.

f. Record N_2, 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.

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

a. Close the SAMPLE IN valve and disconnect the Freon 11/N_2 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 N_2 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 μA) 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 μA) 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 tne 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 OVERRIDE 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

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. Ruedke Date 12/20/71

Test Verified by Date 12-20-71

Test Surveillance B. C. Shelton Date 12-20-71

R. L. Stubblefield Date 12-21-71

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. Ruedke Date 12/20/71

Survey Verified by Date 12-20-71

Survey Surveillance B. C. Shelton Date 12-20-71

R. L. Stubblefield Date 12-21-71

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 1 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 001

PE 17 DEC 20 1971 NASA 1870
STAMP/DATE

3.2 TEST CONDITIONS

ACTUAL

3.2a (1) Test temperature shall be 65 to 85°F. 77 °F

(2) Relative humidity shall be < 90%. 45 %

(3) Barometric Pressure (lab ambient) 739 torr

(4) Illumination (lab prevailing) (✓) OK ✓

PE 17 DEC 20 1971 NASA 1870
STAMP/DATE

5. TEST PROCEDURES

5.1 INITIAL SETUP

5.1.1 All digital displays functional (1888) (✓) ACPT ✓ REJ__

PE 17 DEC 20 1971 NASA 1870
STAMP/DATE

5.1.2 ACS controls set as specified. (✓) ACPT ✓ REJ__

PE 17 DEC 20 1971 NASA 1870
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5.1.3 Variac setting shall be 115.0 ±1.0 V ac. 115 V ac

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5.2 NOMINAL CONDITIONS

H_2O shall be $\leq$ 2.0 torr. 1.6 torr

O_2 shall be $\leq$ 5.0 torr. .001 torr

CO_2 shall be $\leq$ 0.6 torr. 0.2 torr

F12 shall be $\leq$ 5 ppm^+ 22 ppm

PE 17 DEC 20 1971 NASA 1870
STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 2 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 001

PE 117 DEC 20 1971 S NASA 187C
STAMP/DATE

3.2 TEST CONDITIONS

5.2 (Cont)

	ACTUAL
F114 shall be $\leq$ 5 ppm.	0 ppm
SAMPLE FLOW shall be 1.0 SCFH.	0 SCFH
TC gauge shall be (TBD)	.2μA
I_p (200 μA scale) shall be $\leq$ 5 μA.	3 μA
I_{EA} shall be (TBD)	120 ma
I_{AN} shall be 37.5 ±1.0 μA	37.5 μA
TS indicator shall be (TBD)	7.53 V
TV indicator shall be (TBD)	7.78
V_{ACC} shall be (TBD)	4413.4
+5 shall be 500 ±5	4.78
-15 shall be 1500 ±15	14.5 V
+15 shall be 1500 ±15	14.5-6 V
+24 shall be 310 ±20	27.6-28.4 V
N_2 output shall be $\leq$ 4 torr.	001 torr
H_2O output shall be $\leq$ 1 torr	0.9 torr
$P._{AMB}$ shall be amb press ±2 torr	AMB 739 TORR
	$P._{AMB}$ 733 TORR
1 (H_2 Elcmtr) shall be 0.01 or 0.02	.11
2 (H_2O Elcmtr) shall be 0.01 or 0.02	.03

PE 117 DEC 20 1971 S NASA 187C
STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEETS (Sheet 3 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 001

PE 17 DEC 20 1971 NASA 187C
STAMP/DATE

3.2 TEST CONDITIONS

5.2 (Cont)

	ACTUAL
3 (N_2 Elcmtr) shall be 0.01 or 0.02	0.01
4 (O_2 Elcmtr) shall be 0.01 or 0.02	0.01-2
5 (CO_2 Elcmtr) shall be 0.01 or 0.02	0.01
6 (F12 Elcmtr) shall be 0.01 or 0.02	0.00
7 (F11/114 Elcmtr) shall be 0.01 or 0.02	0.01

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

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STAMP/DATE

5.3 ZERO CHECK

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

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STAMP/DATE

b. Outputs indicated by OUTPUT DVM displays shall be:

H_2 ($\leq$ 2.0 torr)	0.7
O_2 ($\leq$ 5 torr)	000
CO_2 ($\leq$ 0.6 torr)	0.1
F12 ($\leq$ 5 ppm)	25
F114 ($\leq$ 5 ppm)	00

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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 5.6c, line 5. MAR

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 4 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 001

PE 17 DEC 20 1971 6 NASA 187C
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5. TEST PROCEDURES

5.3 (Cont)

ACTUAL

c. DIGITAL TEST METER outputs shall be:

V_{ACC} 265 REQUIRED 262 V

N_2 ($\leq$ 4 torr) 001

H_2O ($\leq$ 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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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 5 of 21)

REFERENCE PARAGRAPH	SERIAL NUMBER 001	PE 17 DEC 20 1971 NASA 187C STAMP/DATE
5. TEST PROCEDURES		
5.4a. (Cont)		ACTUAL
H_2		1.47 %
F12		104 ppm
F114		100 ppm
Cylinder Number 6347		PE 17 DEC 20 1971 NASA 187C STAMP/DATE
b. Flow rate shall be 0.05 ±0.01 SCFH		.05 SCFH PE 17 DEC 20 1971 NASA 187C STAMP/DATE
c. Ambient Pressure	739 AMBIENT	745 torr PE 17 DEC 20 1971 NASA 187C STAMP/DATE
d. Ion Pump current		100 μA
~~Nitrogen electrometer output (700 ±10)~~Ω Not applicable mex		7.98 V PE 17 DEC 20 1971 NASA 187C STAMP/DATE
e. Outputs		
H_2		10.9 torr
O_2		134 torr
CO_2		7.1 torr
F114		74 M torr PE 17 DEC 20 1971 NASA 187C STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 6 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 001

DEC 20 1971
STAMP/DATE

5. TEST PROCEDURES

5.4e. (Cont)

	ACTUAL
F12	76 M torr
N_2	586.7 torr
H_2O	0.6 torr
$P._{AMB}$	744.5 torr

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f. Required values — REQUIRED

$$P_{H_2} = \frac{745}{(P._{AMB})} \times \frac{1.47}{(\%H_2)} \times \frac{1}{100} = 10.95 \pm 4 \text{ torr}$$

$$P_{O_2} = \frac{745}{(P._{AMB})} \times \frac{18}{(\%O_2)} \times \frac{1}{100} = 134 \pm 10 \text{ torr}$$

$$P_{CO_2} = \frac{745}{(P._{AMB})} \times \frac{1.02}{(\%CO_2)} \times \frac{1}{100} = 7.6 \pm 1.3 \text{ torr}$$

$$P_{F114} = \frac{745}{(P._{AMB})} \times \frac{100}{(\text{ppm F114})} \times \frac{1}{1000} = 75 \pm 23 \text{ M torr}$$

$$P_{F12} = \frac{745}{(P._{AMB})} \times \frac{104}{(\text{ppm F12})} \times \frac{1}{1000} = 77 \pm 23 \text{ M torr}$$

$$P_{N_2} = \frac{745}{(P._{AMB})} \times \frac{78.48}{(\%N_2)} \times \frac{1}{100} = 585 \text{ torr}$$

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

*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 001

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STAMP/DATE

5. TEST PROCEDURES

5.5 INPUT VOLTAGE TEST

	ACTUAL
a. High line Variac setting (126.5 ±1.0 V ac)	126 V ac
Outputs	
H_2	10.9 torr
O_2	134 torr
CO_2	7.1 torr
F114	75 M torr
F12	77 M torr
N_2	586 torr
H_2O	0.6 torr
$P._{AMB}$	744 torr

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b. All readings within tolerance (✓) ACPT ✓ REJ ___

PE 17 DEC 20 1971 NASA 187C
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c. Low line Variac setting (103.5 ±1 V ac)	103 V ac
Outputs	
H_2	10.9 torr
O_2	134 torr
CO_2	7.2 torr

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 8 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 001

DEC 20 1971
STAMP/DATE

5. TEST PROCEDURES

5.5c. (Cont)

F114	77 M torr
F12	71 M torr
N_2	586 torr
H_2O	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

N_2	74.36 %
O_2	22.1 %
CO_2	2.03 %
A	1.02 %
H_2	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) ACTUAL

F12 0 ppm

F114 0 ppm

Cylinder Number 5309 P/o 18961 H

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Sample flow (0.05 ±0.01 SCFH) .04 SCFH

Sample pressure ($P_{ambient} \leq P_{sample} \leq P_{ambient}$ +2 torr) 745 torr

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c. Restabilize for minimum of 10 min. 11 min

Outputs

H_2 4.1 torr

O_2 165 torr

CO_2 15.2 torr

F114 004 M torr

F12 000 M torr

N_2 554 torr

H_2O 0.5 torr

$P._{AMB}$ 745 torr

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6.2 <u>FUNCTIONAL TEST DATA SHEET</u> (Sheet 10 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 001

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5. TEST PROCEDURES

5.6d. Required Values

REQUIRED

$$P_{H_2} = \underset{(P._{AMB})}{\underline{\hspace{2.5cm}}} \times \underset{(\%H_2)}{\underline{0.49}} \times \frac{1}{100} = \underline{3.7} \pm 4 \text{ torr}$$

$$P_{O_2} = \underset{(P._{AMB})}{\underline{\hspace{2.5cm}}} \times \underset{(\%O_2)}{\underline{22.1}} \times \frac{1}{100} = \underline{165} \pm 10 \text{ torr}$$

$$P_{CO_2} = \underset{(P._{AMB})}{\underline{\hspace{2.5cm}}} \times \underset{(\%CO_2)}{\underline{2.03}} \times \frac{1}{100} = \underline{15.1} \pm 1.3 \text{ torr}$$

$$P_{F114} = \underset{(P._{AMB})}{\underline{\hspace{2.5cm}}} \times \underset{(ppm\ F114)}{\underline{0}} \times \frac{1}{1000} = \underline{0} \pm 23 \text{ M torr}$$

$$P_{F12} = \underset{(P._{AMB})}{\underline{\hspace{2.5cm}}} \times \underset{(ppm\ F12)}{\underline{0}} \times \frac{1}{1000} = \underline{0} \pm 23 \text{ M torr}$$

$$P_{N_2} = \underset{(P._{AMB})}{\underline{\hspace{2.5cm}}} \times \underset{(\%N_2)}{\underline{74.36}} \times \frac{1}{100} = \underline{554} \text{ torr}$$

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

*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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STAMP/DATE

5. TEST PROCEDURES

ACTUAL

5.7b. Ion pump current increased by 10%. 111 µA

Outputs

H_2 4.1 torr

O_2 165 torr

CO_2 15.3 torr

N_2 555 torr

All readings within tolerance (✓) ACPT ✓ REJ ___

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c. Ion pump current decreased by 20%. 89 µA

Outputs

H_2 4.2 torr

O_2 165 torr

CO_2 15.2 torr

N_2 554 torr

All readings within tolerance (✓) ACPT ✓ REJ ___

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d. Ion pump current reset to value recorded in Step a above. 100 µA

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 12 of 21)

PE 117 DEC 20 1971 NASA 187C
STAMP/DATE

REFERENCE PARAGRAPH SERIAL NUMBER 001

5. TEST PROCEDURES

5.8 FREON 11 TEST

ACTUAL

c. F11 background output ($\leq$ 4 M torr) 3 M torr

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d. Freon 11/N_2 Composition 42 ppm

Cylinder Number 4549 P/o 18961 H

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e. Flow (0.05 ±0.01 SCFH .04 SCFH

Sample pressure ($P._{AMB} \leq P_{SAMPLE} \leq P._{AMB}$ +10 torr) 744 torr

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f. Outputs

F11 34 M torr

F12 1 M torr

$P._{AMB}$ 744 torr

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g. Computed outputs

$$F11 = \frac{\qquad}{(P._{AMB})} \times \frac{\qquad}{(ppm\ F11)} \times \frac{1}{\qquad} =$$

31 ±3.8 M torr ~~±2.5 ppm~~

$$N_2 = \frac{\qquad}{(P._{AMB})}$$

739 torr*

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 13 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 001

PE 17 S NASA 187C
STAMP/DATE

5. TEST PROCEDURES

5.8g. (Cont)

	ACTUAL
F12 =	0 M torr*

*Information only

All outputs are within tolerance. (✓) ACPT ✓ REJ ___

PE 17 S NASA 187C
STAMP/DATE

5.9 PRESSURE TEST

b. Flow rate (0.05 ±0.01 SCFH)	.05 SCFH
Inlet pressure (30 ±1 inHg)	30.04 inHg
Outputs	
H_2	10.9 torr
O_2	138 torr
CO_2	7.2 torr
F114	76 M torr
F12	81 M torr
N_2	599 torr
H_2O	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

DEC 20 1971 S NASA 187C
STAMP/DATE

5. TEST PROCEDURES

5.9 (Cont)

ACTUAL

Required values

REQUIRED

$P_{H_2} = \frac{\rule{2cm}{0.4pt}}{(P._{AMB})} \times \frac{1.47}{(\%H_2)} \times \frac{1}{100} = \underline{11.22} \pm 4$ torr

$P_{O_2} = \frac{\rule{2cm}{0.4pt}}{(P._{AMB})} \times \frac{18}{(\%O_2)} \times \frac{1}{100} = \underline{137} \pm 10$ torr

$P_{CO_2} = \frac{\rule{2cm}{0.4pt}}{(P._{AMB})} \times \frac{1.02}{(\%CO_2)} \times \frac{1}{100} = \underline{7.8} \pm 1.3$ torr

$P_{F114} = \frac{\rule{2cm}{0.4pt}}{(P._{AMB})} \times \frac{100}{(ppm\ F114)} \times \frac{1}{1000} = \underline{76} \pm 23$ M torr

$P_{F12} = \frac{\rule{2cm}{0.4pt}}{(P._{AMB})} \times \frac{104}{(ppm\ F12)} \times \frac{1}{1000} = \underline{79} \pm 23$ M torr

$P_{N_2} = \frac{\rule{2cm}{0.4pt}}{(P._{AMB})} \times \frac{78.48}{(\%N_2)} \times \frac{1}{100} = \underline{599}$ torr

$P_{H_2O} =$ 0 torr*

*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)

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STAMP/DATE

REFERENCE PARAGRAPH SERIAL NUMBER 001

5. TEST PROCEDURES

		ACTUAL
5.9c.	Flow rate (0.05 ±0.01 SCFH)	.05 SCFH
	Inlet pressure (20 ±1 inHg)	20.05 inHg 509 TORR
	Outputs	
	H_2	8.1 torr
	O_2	91-2 torr
	CO_2	4.6 torr
	F114	47 M torr
	F12	48 M torr
	N_2	399 torr
	H_2O	1.9 torr
	$P._{AMB}$	509 torr

Required Values REQUIRED

$$P_{H_2} = \frac{\underline{\qquad}}{(P._{AMB})} \times \frac{1.47}{(\%H_2)} \times \frac{1}{100} = 7.5 \pm 4 \text{ torr}$$

$$P_{O_2} = \frac{\underline{\qquad}}{(P._{AMB})} \times \frac{18}{(\%O_2)} \times \frac{1}{100} = 92 \pm 10 \text{ torr}$$

$$P_{CO_2} = \frac{\underline{\qquad}}{(P._{AMB})} \times \frac{1.02}{(\%CO_2)} \times \frac{1}{100} = 5.2 \pm 1.3 \text{ torr}$$

$$P_{F114} = \frac{\underline{\qquad}}{(P._{AMB})} \times \frac{100}{(\text{ppm F114})} \times \frac{1}{1000} = 51 \pm 23 \text{ M torr}$$

$$P_{F12} = \frac{\underline{\qquad}}{(P._{AMB})} \times \frac{104}{(\text{ppm F12})} \times \frac{1}{1000} = 53 \pm 23 \text{ M torr}$$

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STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 16 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 001

PE 115 DEC [illegible] 1971 S NASA 187C
STAMP/DATE

5.9c. (Cont)

REQUIRED

$P_{N_2} = \frac{\quad}{(P._{AMB})} \times \frac{78.48}{(\%N_2)} \times \frac{1}{100}$ = 399 torr

P_{H_2O} = 0 torr*

*No tolerance. Information only.

All readings within tolerance (✓) ACPT ✓ REJ___

~~$P._{AMB}$ (torr) ±2 torr = Inlet pressure (inHg) x 25.4~~ (✓) ACPT___ REJ___

PE 115 DEC [illegible] 1971 S NASA 187C
STAMP/DATE

d. Flow rate (0.05 ±0.01 SCFH) .05 SCFH

Inlet pressure (40 ±1 inHg) 40. inHg
1016 TORR

H_2 14.0 torr

O_2 188 torr

CO_2 10.4 torr

F114 116 M torr

F12 115 M torr

N_2 770 torr

H_2O 0.9 torr

$P._{AMB}$ 990 torr

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STAMP/DATE

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 17 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 001

PE 15 DEC 20 1971 187C
STAMP/DATE

5. TEST PROCEDURES

5.9d (Cont) REQUIRED

$P_{H_2} = \underset{(P._{AMB})}{\underline{\qquad}} \times \underset{(\%H_2)}{\underline{1.47}} \times \frac{1}{100}$ = 14.9 ±4 torr

$P_{O_2} = \underset{(P._{AMB})}{\underline{\qquad}} \times \underset{(\%O_2)}{\underline{18}} \times \frac{1}{100}$ = 183 ±10 torr

$P_{CO_2} = \underset{(P._{AMB})}{\underline{\qquad}} \times \underset{(\%CO_2)}{\underline{1.02}} \times \frac{1}{100}$ = 10.4 ±1.3 torr

$P_{F114} = \underset{(P._{AMB})}{\underline{\qquad}} \times \underset{(ppm\ F114)}{\underline{100}} \times \frac{1}{1000}$ = 102 ±23 M torr

$P_{F12} = \underset{(P._{AMB})}{\underline{\qquad}} \times \underset{(ppm\ F12)}{\underline{104}} \times \frac{1}{1000}$ = 106 ±23 M torr

$P_{N_2} = \underset{(P._{AMB})}{\underline{\qquad}} \times \underset{(\%N_2)}{\underline{78.48}} \times \frac{1}{100}$ = 797 torr

P_{H_2O} = 0 torr*

*No tolerance. Information only.

All readings within tolerance. (✓) ACPT ✓ REJ___

~~P_{AMB} (torr) ±2 torr = Inlet pressure (inHg) x 25.4~~ MK (✓) ACPT___ REJ___

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5.10 REDUNDANT FILAMENT TEST

a. Outputs

	ACTUAL	
	FIL #1	FIL #2
H_2	0.6	0.7 torr
O_2	153	152 torr

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STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 18 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 001

PE 115 DEC 20 1971 S NASA 187C
STAMP/DATE

5. TEST PROCEDURES

5.10a. (Cont)

	ACTUAL FIL #1	ACTUAL FIL #2		
CO_2	0.7	1.5	torr	
F114	6.0	0	M torr	11
F12	0	12	M torr	11
N_2	568	565	torr	
H_2O	8.4	8.9	torr	
$P._{AMB}$	733	734	torr	

PE 115 DEC 20 1971 S NASA 187C
STAMP/DATE

b. Required Values — REQUIRED

P_{H_2} = 0 ± 4 torr

$P_{O_2} = \frac{738 - 7.5}{(P._{AMB} - P_{H_2O})} \times \frac{20.99}{} \times \frac{1}{100}$ = 153 ± 10 torr

$P_{CO_2} = \frac{}{(P._{AMB} - P_{H_2O})} \times \frac{0.03}{} \times \frac{1}{100}$ = 0.2 ± 1.3 torr

$P_{N_2} = \frac{}{(P._{AMB} - P_{H_2O})} \times \frac{78.03}{} \times \frac{1}{100}$ = 570 torr

P_{H_2O} = Computed Value = 7.5 torr

F114 = 0 ± 11 M torr

F12 = 0 ± 11 M torr

PE 115 DEC 20 1971 S NASA 187C
STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 19 of 21)

PE 115 DEC 20 1971 NASA 187C
STAMP/DATE

REFERENCE PARAGRAPH SERIAL NUMBER 001

5. TEST PROCEDURES

5.10b. (Cont) REQUIRED

All readings within tolerance. (✓) ACPT ✓ REJ ___

PE 115 DEC 20 1971 NASA 187C
STAMP/DATE

5.11 DEGAS TEST ACTUAL

b. Outputs rise (✓) ACPT ✓ REJ ___

PE 115 DEC 20 1971 NASA 187C
STAMP/DATE

5.12 OVERPRESSURE PROTECTION TEST

a. Flow rate (0.05 ±0.01 SCFH) .05 SCFH

Ambient Pressure — ambient — torr

Ion pump current — μA

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

PE 115 DEC 20 1971 NASA 187C
STAMP/DATE

b. ON indicator lamp switched off. (✓) ACPT ✓ REJ ___

STANDBY indicator lamp off (✓) ACPT ✓ REJ ___

Ion pump current (approx 1 mA) (✓) ACPT ✓ REJ ___

PE 115 DEC 20 1971 NASA 187C
STAMP/DATE

c. Relay sound audible (✓) ACPT ✓ REJ ___

Filament off (✓) ACPT ✓ REJ ___

PE 115 DEC 20 1971 NASA 187C
STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 20 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 006 PE 15 DEC 20 1971 S NASA 187C
STAMP/DATE

5. TEST PROCEDURES

5.12c. (Cont) ACTUAL

FILAMENT PREHEAT indicator ON (✓) ACPT ✓ REJ ___
Ion pump current (approx 5 mA) (✓) ACPT ✓ REJ ___
PE 15 DEC 20 1971 S NASA 187C
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 ___
PE 15 DEC 20 1971 S NASA 187C
STAMP/DATE

e. Preheat relay audible (5 mA) (✓) ACPT ✓ REJ ___
STANDBY lights (1 mA) (✓) ACPT ✓ REJ ___
PE 15 DEC 20 1971 S NASA 187C
STAMP/DATE

5.13 LOSS OF POWER TEST

a. Flow rate (0.05 ±0.01 SCFH) .05 SCFH
Ambient pressure NA ambient 739 torr
Ion pump current mfl 100 μA
PE 15 DEC 20 1971 S NASA 187C
STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 21 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 001

DEC 20 1971 B NASA 187C
STAMP/DATE

5. TEST PROCEDURES

ACTUAL

5.13b. Power off at 1755 min

DEC 20 1971 B NASA 187C
STAMP/DATE

c. Power on at 1625 min

Observe pump down (✓) ACPT ✓ REJ ___

DEC 20 1971
STAMP/DATE

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
N_2	__________%
O_2	__________%
CO_2	__________%
A	__________%
H_2	__________%
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

---

* Calibration test records substituted for this test and appended.

(✓) YES (✓) NO ( )

PE 8 12/21/91 NASA 187C

STAMP/DATE

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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

H_2 __________torr

O_2 __________torr

CO_2 __________torr

F114 __________M torr

F12 __________M torr

N_2 __________torr

H_2O __________torr

$P._{AMB}$ __________torr

See footnote on page 34.

__________ STAMP/DATE

f. Required Values REQUIRED

$P_{H_2} = \frac{\_\_\_\_\_\_}{(P._{AMB})} \times \frac{\_\_\_\_\_\_}{(\%H_2)} \times \frac{1}{100} =$ _______ ±4 torr

$P_{O_2} = \frac{\_\_\_\_\_\_}{(P._{AMB})} \times \frac{\_\_\_\_\_\_}{(\%O_2)} \times \frac{1}{100} =$ _______ ±10 torr

$P_{CO_2} = \frac{\_\_\_\_\_\_}{(P._{AMB})} \times \frac{\_\_\_\_\_\_}{(\%CO_2)} \times \frac{1}{100} =$ _______ ±1.3 torr

$P_{F114} = \frac{\_\_\_\_\_\_}{(P._{AMB})} \times \frac{\_\_\_\_\_\_}{(\text{ppm F114})} \times \frac{1}{1000} =$ _______ ±23 M torr

$P_{F12} = \frac{\_\_\_\_\_\_}{(P._{AMB})} \times \frac{\_\_\_\_\_\_}{(\text{ppm F12})} \times \frac{1}{1000} =$ _______ ±23 M torr

__________ STAMP/DATE

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

REFERENCE PARAGRAPH SERIAL NUMBER__________

STAMP/DATE

5. TEST PROCEDURES

See footnote on page 34

5.14 (Cont)

REQUIRED

$$P_{N_2} = \underset{(P._{AMB})}{\underline{\hspace{3cm}}} \times \underset{(\%N_2)}{\underline{\hspace{3cm}}} \times \frac{1}{100} = \underline{\hspace{3cm}}\text{torr}$$

$$P_{H_2O} = \underline{\hspace{3cm}}\text{torr*}$$

*No tolerance. Information only.

Ref. Appendix I BTB

(✓) ACPT ✓ REJ___

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STAMP/DATE

5.15 WORKMANSHIP

Workmanship verified

(✓) ACPT ✓ REJ___

PE 52 12/21/71 S NASA 187C

STAMP/DATE

5.16 EXTERNAL DIMENSIONS

Dimensions verified

(✓) ACPT ✓ REJ___

PE 52 12-21/71 S NASA 187C

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.

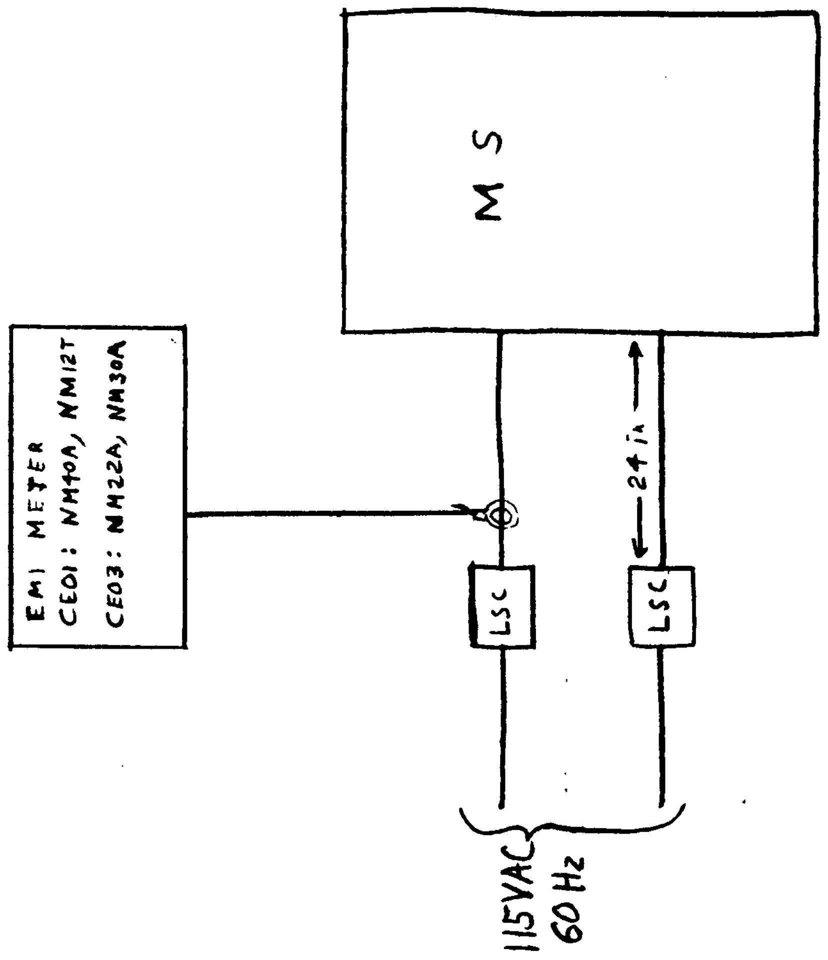


FIGURE 12. Test Setup

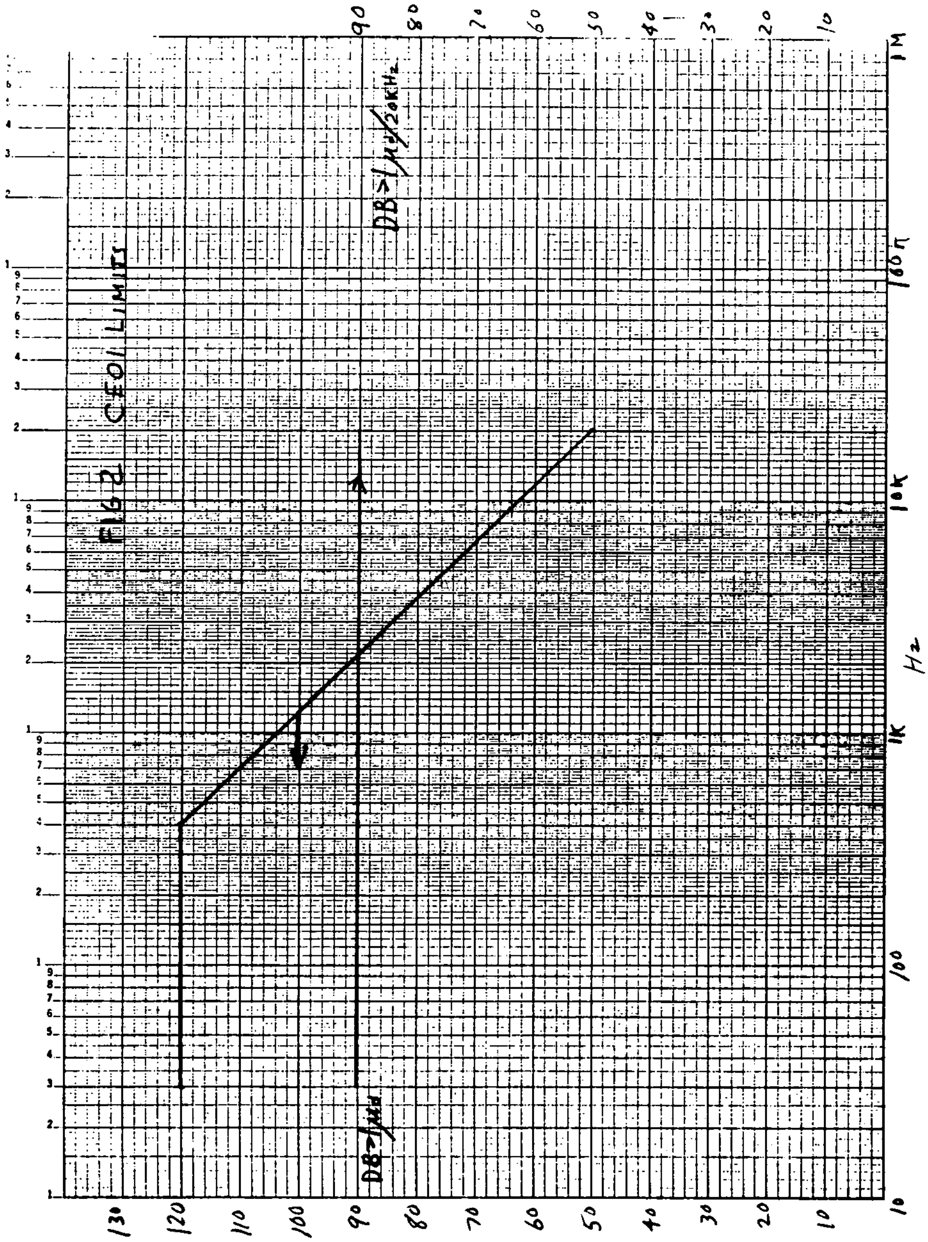


FIGURE 13. CE01 Limits

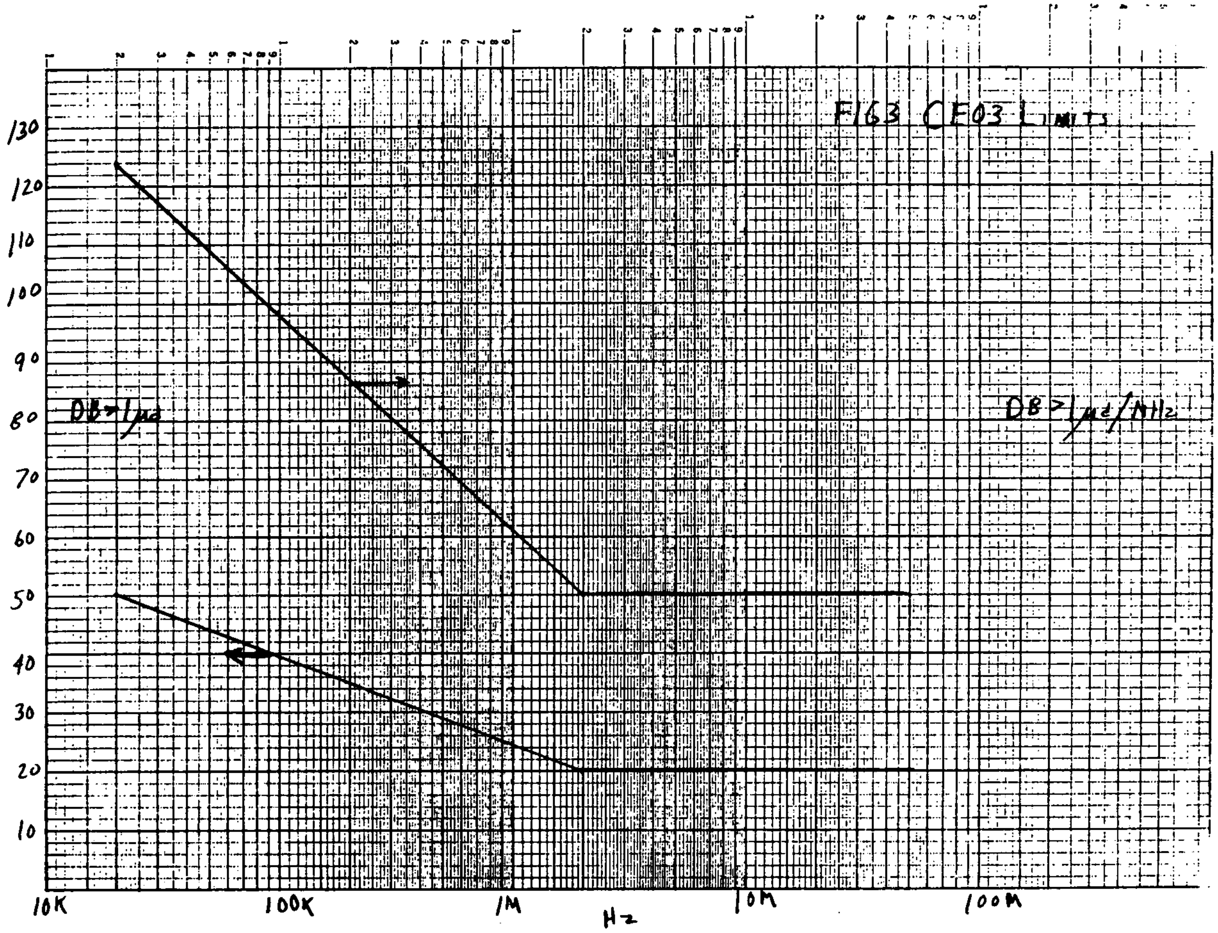


FIGURE 14. CE03 Limits

APPENDIX 2

ADDENDUM

TP 82-0023

STODDART
ELECTRO SYSTEMS

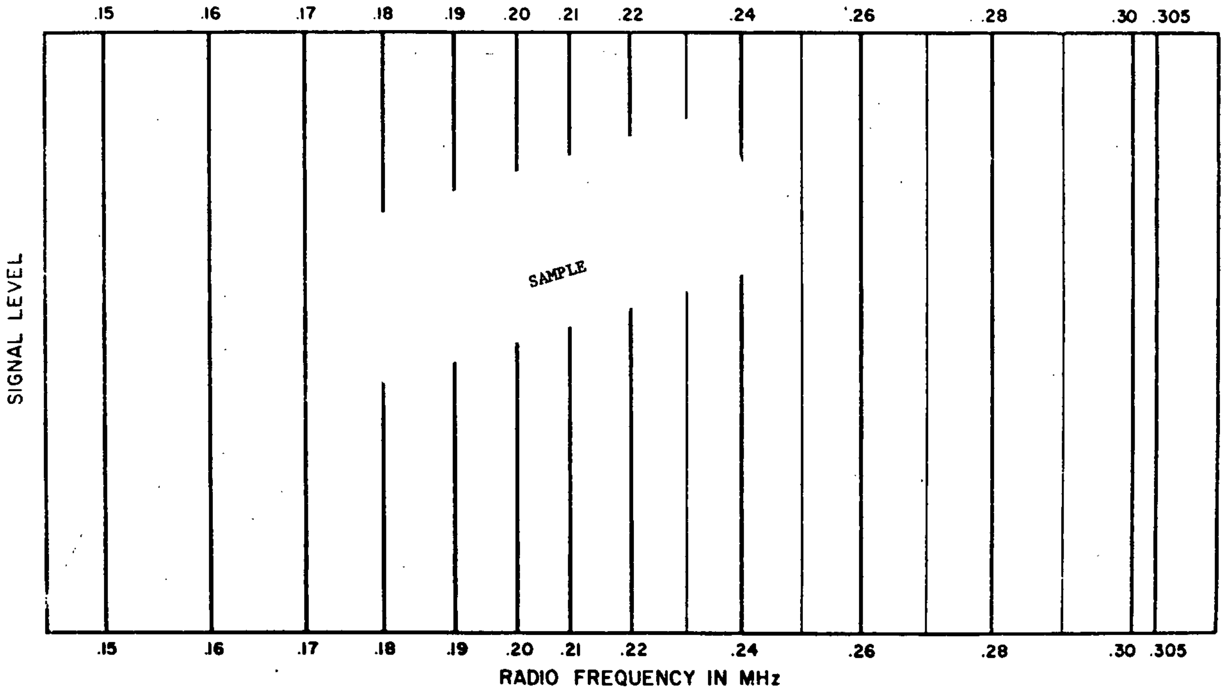
APC GRAPH PAPER

Company: ________________

Test Specimen: ________________ Technician: ________________ Date: ________

Type of Interference: ________________ Receiver Calibration Date: ________ Data Page No: ____

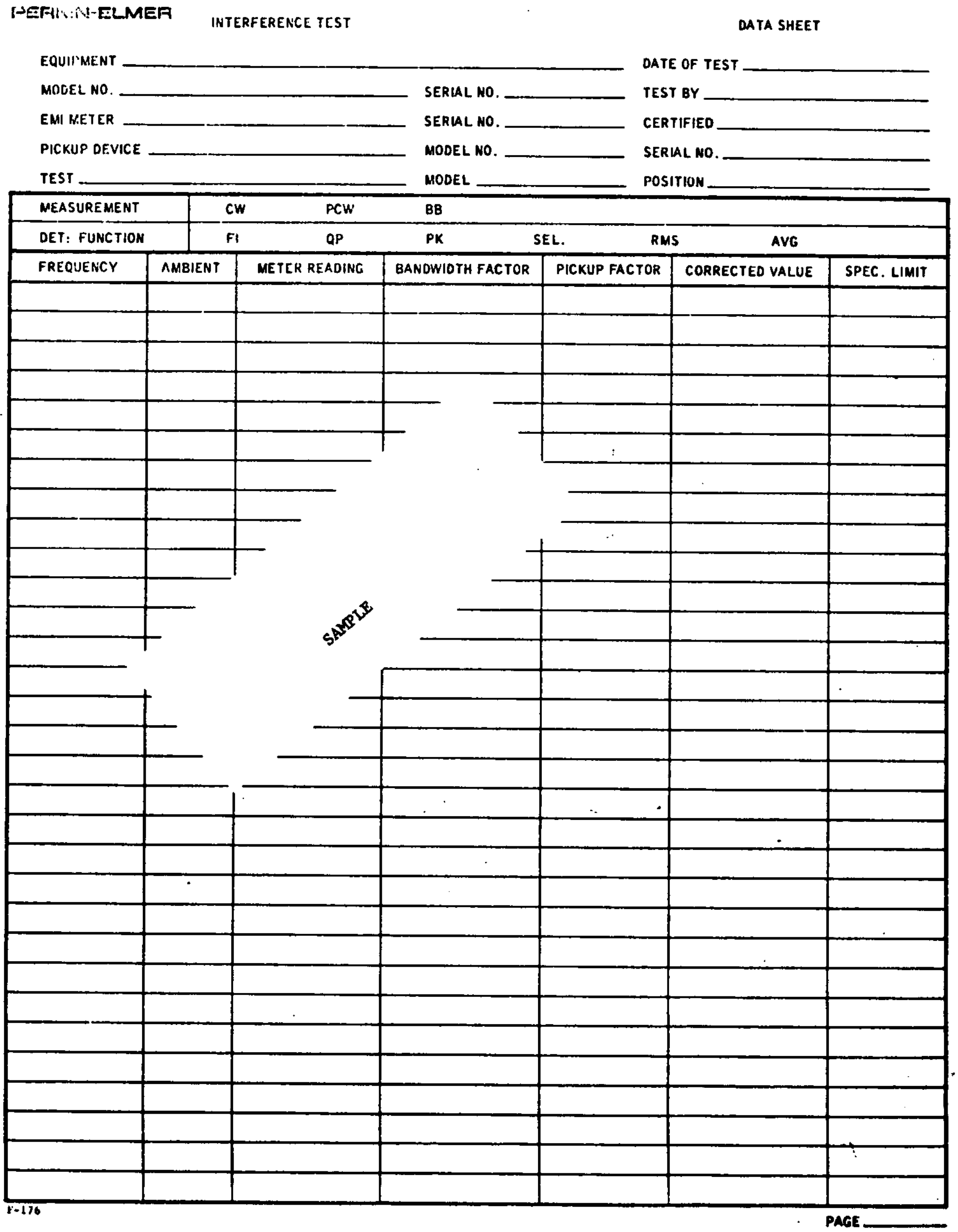
Test Condition: ________________ Receiver: SES NM-22A, band I Scan Speed: ____



SAMPLE EMI GRAPH

ADDENDUM

TP 82-0023



PERKIN-ELMER INTERFERENCE TEST DATA SHEET

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

MEASUREMENT	CW PCW BB
DET: FUNCTION	FI QP PK SEL. RMS AVG

FREQUENCY	AMBIENT	METER READING	BANDWIDTH FACTOR	PICKUP FACTOR	CORRECTED VALUE	SPEC. LIMIT

SAMPLE

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SAMPLE INTERFERENCE TEST DATA SHEET

ADDENDUM TP 82-0023

6.4 <u>ELECTROMAGNETIC COMPATIBILITY TEST DATA SHEET</u> (Sheet 1 of 1)

<u>REFERENCE PARAGRAPH</u> SERIAL NUMBER__________ PE 115 DEC 20 1971 S NASA 187C
STAMP/DATE

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. PE 115 DEC 20 1971 S NASA 187C
STAMP/DATE

c. Limits not exceeded (✓) ✓
OK

Data Sheets attached PE 115 DEC 20 1971 S NASA 187C
STAMP/DATE

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

(c) Limits not exceeded (✓) ✓
OK

Data Sheets attached PE 115 DEC 20 1971 S NASA 187C
STAMP/DATE

5.17.2 Test Setup and Procedure

a. Test set up as shown in Figure 1. PE 115 DEC 20 1971 S NASA 187C
STAMP/DATE

c. Limits not exceeded (✓) ✓
OK

Data Sheets attached PE 115 DEC 20 1971 S NASA 187C
STAMP/DATE

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

(c) Limits not exceeded (✓) ✓
OK

Data Sheets attached PE 115 DEC 20 1971 S NASA 187C
STAMP/DATE

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 NM22A
SERIAL NO. 417-16
CERTIFIED Due 10 July 72
PICKUP DEVICE Current Probe
MODEL NO. 91550-1
SERIAL NO. BF486
TEST 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/ma/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	

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DEC 20 1971

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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 NM22A
SERIAL NO. 417-16
CERTIFIED Due July 72
PICKUP DEVICE Current Probe
MODEL NO. 91550-1
SERIAL NO. BF-486
TEST CONDUCTED EMI
MODEL
POSITION 115 V LOW

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		DB	DB>/M./MHz	
160		39	40	-5	74	
300		15	↓	-9	46	
600		-3	↓	-11	26	
800		-8	↓	-12	20	
1.00 MEG	HERTZ	-8	↓	-12	20	
2.1 "	"	-12	↓	-13	15	
4.0 "	"	0	↓	-14	26	
6.35 "	"	-5	↓	-14	21	
10.0MEG	HERTZ	-12	↓	-14	14	
13.0 "	"	-1	↓	-14	25	
15.0 "	"	-10	↓	-14	16	
26.5 "	"	0	↓	-14	26	
24.5 "	"	+6	40	-14	32	
50.0 "	"	+6	40	-14	32	
			PE 17	DEC 20 1971		

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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 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	DB	DB	DB/μa/MHz	
20		30	60	+12	102	
27.5		28		+10	98	
32.5		30		+8	98	
39.2		32		+6	98	
41.75		31		+6	97	
72		19		+1	80	
82		23		0	83	
94		25		−1	84	
147		10	60	−4	66	

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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

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	DB 1 MICROVOLT	DB	DB >/μv/MHz	
18		47	60	+13	120	
20		37		+12	109	
39.2		20		+6	86	
52		22		+4	86	
71.5		24		+1	85	
86		30	↓	-1	89	
140		10	60	-4	66	
			DEC 20 1971 1870			

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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 NM40A

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

MEASUREMENT	[✓ CW]	PCW	[✓ BB]					
DET: FUNCTION	FI	QP	[✓ PK]	[✓ SEL.]	RMS	AVG		

FREQUENCY	AMBIENT	METER READING	BANDWIDTH FACTOR	PICKUP FACTOR	CORRECTED VALUE	SPEC. LIMIT
WIDE BAND	}	μv				
		33×10^2	NOMOGRAPH		51 DB/μa/mHz	
NARROW BAND			CORRECTION			
30 HERTZ		1.3×10^2	CHART		82	
300 HERTZ		2.5×10^3			88	
420 HERTZ		2.5×10^3			84	
780 HERTZ		1.4×10^3			71	
900 HERTZ		0.7×10^3			65	
1.05K HERTZ		0.4×10^3			64	
3.65K HERTZ		0.7×10^2		DEC 20 1971 187C	20	
4.1 K HERTZ		3.0×10^2			25	
9.5K HERTZ		3.0×10			15	
10.0K HERTZ		2.5×10			15	
12.0K HERTZ		2.5×10			15	
13.5K HERTZ		2.0×10			10	
14.5K HERTZ		2.5×10			10	
14.8K HERTZ		4×10			15	

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APPENDIX 2

Reproduced from best available copy.

PERKIN-ELMER

INTERFERENCE TEST

DATA SHEET

EQUIPMENT A[illegible] CONT S[illegible]

DATE OF TEST 12-20-71

MODEL NO.

SERIAL NO. 1

TEST BY F[illegible]

EMI METER NM-40A

SERIAL NO. 790-5

CERTIFIED Due July 72

PICKUP DEVICE C[illegible] P[illegible]

MODEL NO. 91550-1

SERIAL NO. 553-25

TEST C[illegible] EMI

MODEL

POSITION 115 V Hi

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 }		μv				
}		31×10^2	NOMOGRAPH		50 DB/μv/MHz	
Narrowband			CORRECTION			
30 HERTZ		1.2×10^2	CHART		80DB/μamp	
300 HERTZ		2.4×10^3			87	
420 HERTZ		2.5×10^3			84	
540 HERTZ		0.7×10^3			70	
660 HERTZ		0.6×10^3			65	
780 HERTZ		1.2×10^3			70	
900 HERTZ		0.7×10^3			65	
1.05 KHERTZ		0.7×10^3			65	
3.9K HERTZ		4.5×10			30	
4.0K HERTZ		4.5×10			30	
4.1K HERTZ		3×10			25	
4.4K HERTZ		5×10			30	
4.8K HERTZ		5×10			30	
5.2K HERTZ		5×10	PE 17	DEC 20 1971	25	
5.5K HERTZ		7×10			32	
5.7K HERTZ		6×10			28	
5.9K HERTZ		7×10			30	
6.8K HERTZ		2×10			15	
8.3K HERTZ		2.5×10			15	
10.5K HERTZ		2.25×10			15	
12.7K HERTZ		2×10			15	
14.3K HERTZ		1×10			10	
14.7K HERTZ		2×10			10	
15.0K HERTZ		1.4×10			5	

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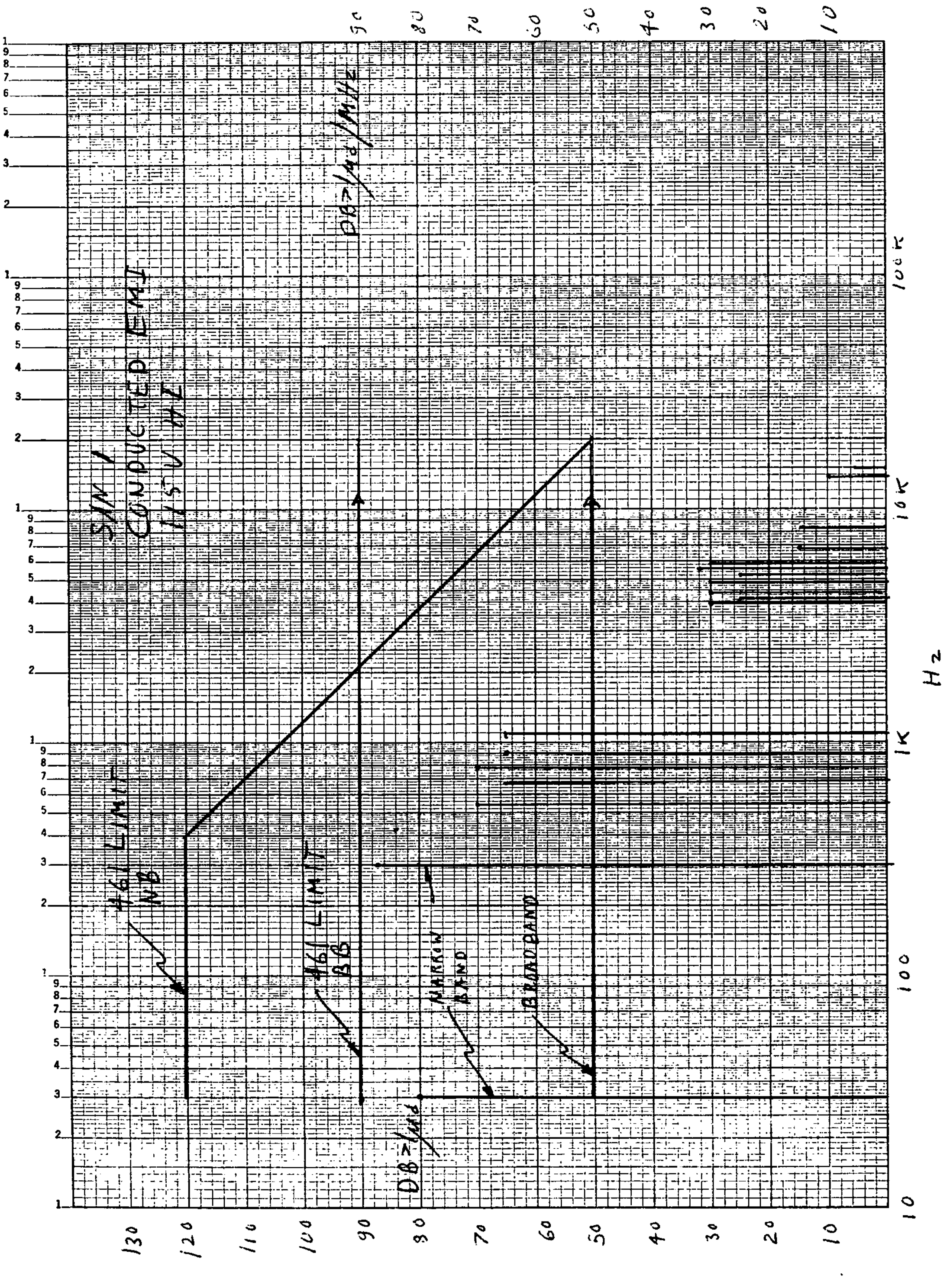
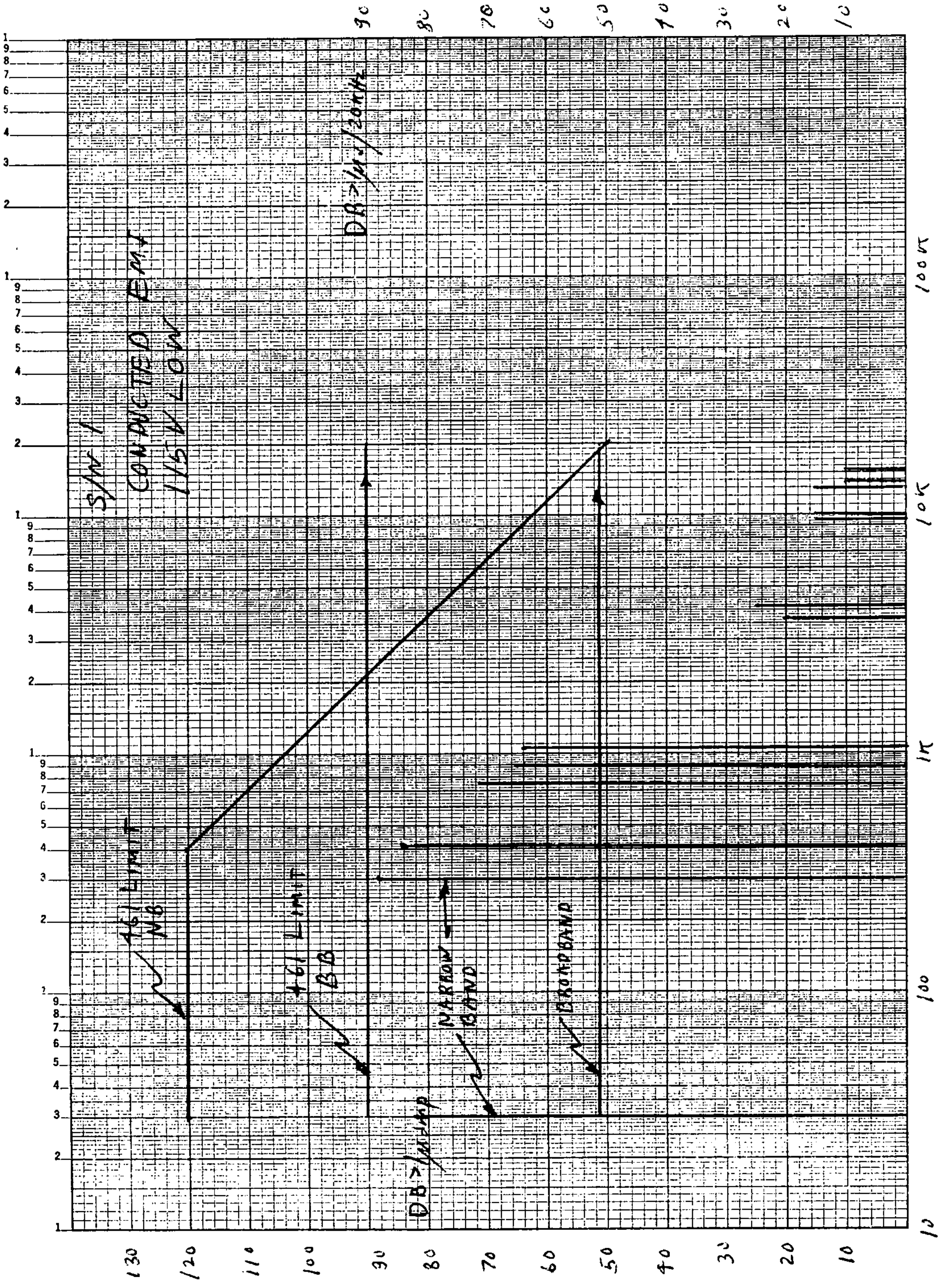
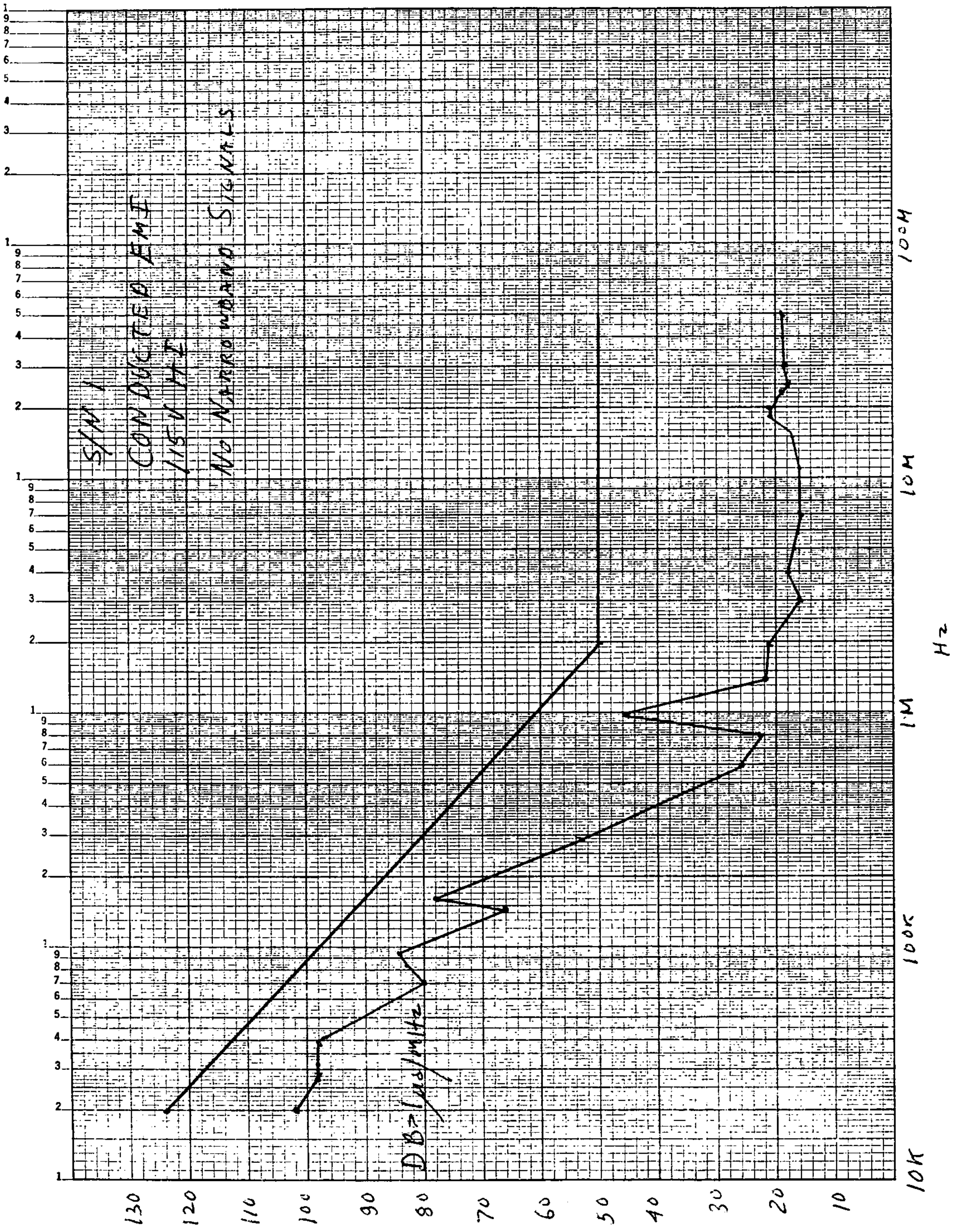
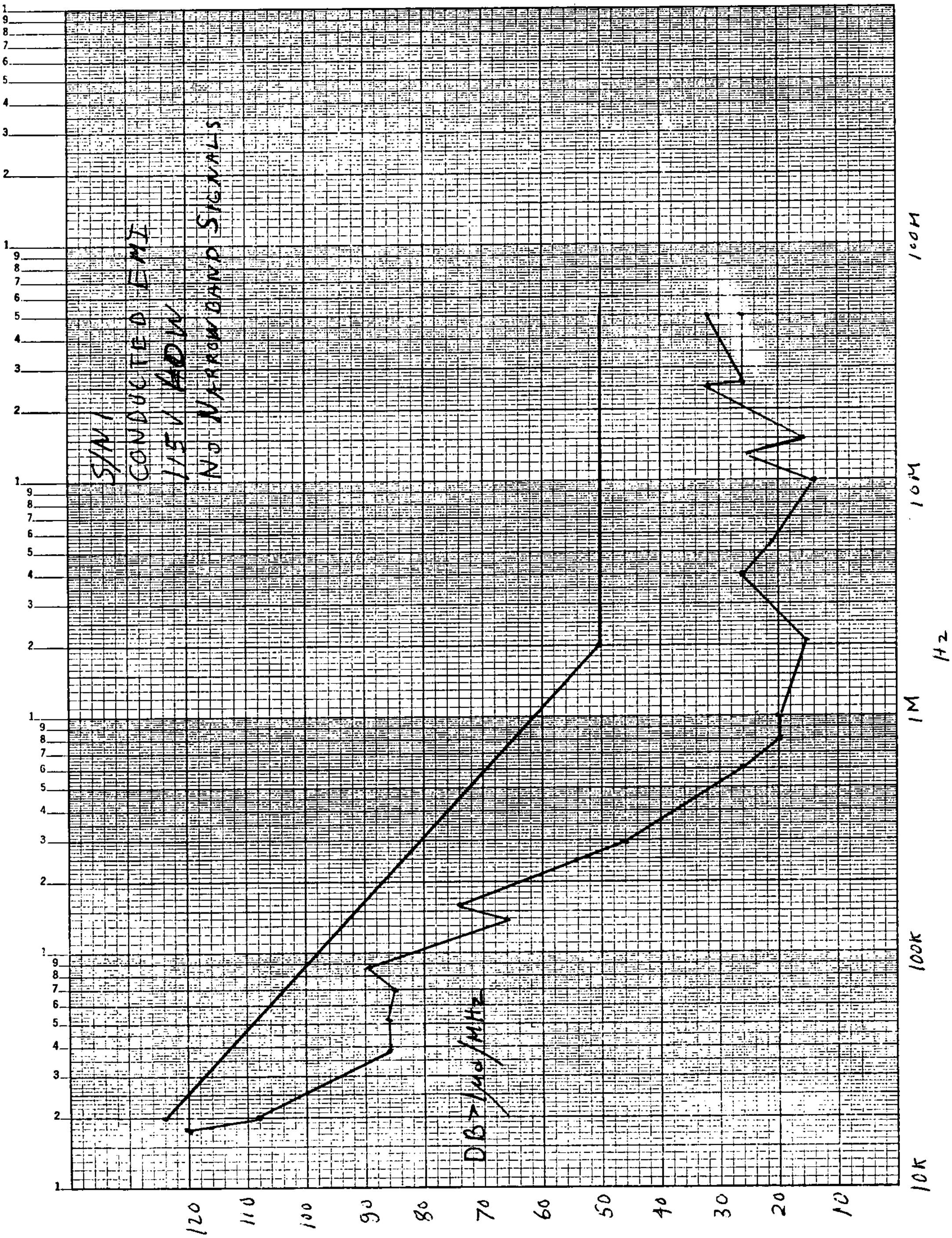

S/N 1
CONDUCTED EMI
115V HI
461 LIMIT NB
461 LIMIT BB
NARROW BAND
BROADBAND
DB>1μV
DB>1μV/MHz
Hz
10
100
1K
10K
100K
130
120
110
100
90
80
70
60
50
40
30
20
10


S/N 1
CONDUCTED EMI
115V LOW
461 LIMIT NB
461 LIMIT BB
NARROW BAND
BROADBAND
DB>μA/20kHz
DB>μAmp
130
120
110
100
90
80
70
60
50
40
30
20
10
10
100
1K
10K
100K

APPENDIX 2


S/N 1
CONDUCTED EMI
115V HI
No NARROWBAND SIGNALS
DB>1uV/MHz
Hz
10K
100K
1M
10M
100M
130
120
110
100
90
80
70
60
50
40
30
20
10

APPENDIX 2


S/N 1
CONDUCTED EMI
115V 40W
NO NARROWBAND SIGNALS
DB > 1uv/MHz
120
110
100
90
80
70
60
50
40
30
20
10
10K
100K
1M
10M
100M
Hz

APPENDIX 2

ATMOSPHERE CONTAMINANT SENSOR

PART NO. 344800   SERIAL NO. 002

ACCEPTANCE TEST DATA

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. Knedler Date 12-21-71

Test Verified 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. Knedler Date 12-21-71

Survey Verified by ____ Date 12-21-71

Survey Surveillance B. E. Shelton Date 12-21-71

____ Date ____

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 ___

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5.1.3 Variac setting shall be 115.0 ±1.0 V ac. 115 V ac

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5.2 NOMINAL CONDITIONS

H_2 ~~H_2O~~ shall be ≤ 2.0 torr. 1.3 torr

O_2 shall be ≤ 5.0 torr. 1.0 torr

CO_2 shall be ≤ 0.6 torr. 0.5 torr

F12 shall be ≤ 5 ppm$^+$ 000 ppm

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TP 82-0023

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 2 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

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3.2 TEST CONDITIONS

5.2 (Cont) ACTUAL

F114 shall be ≤ 5 ppm. 000 ppm

SAMPLE FLOW shall be ~~1~~0 SCFH. 0 MKR 0 SCFH

TC gauge shall be (TBD) 2 μA

I_p (200 μA scale) shall be ≤ 5 μA. 10 μA

I_{EA} shall be (TBD) 146

I_{AN} shall be 37.5 ±1.0 μA 37.5 μA

TS indicator shall be (TBD) 7.91 V

TV indicator shall be (TBD) 8.19

V_{ACC} shall be (TBD) 423

The pressure is slightly above the target value due to a high background. This does not affect the operation except in the case of Freon 11 as noted on page 24. MKR.

+5 shall be 5.00 ±0.05 4.90

-15 shall be 15.00 ±1.5 14.6

+15 shall be 15.00 ±1.5 14.8

+24 shall be 31.0 ±2.0 27.9-28.7

These voltage tolerances were established before system functional testing was complete. The actual values are in no way abnormal. MKR

N_2 output shall be ≤ 4 torr. 003 torr

H_2O output shall be ≤ 1 torr 0.8 torr

P.$_{AMB}$ shall be amb press ±2 torr AMB 737

P.$_{AMB}$ 737

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

1 (H_2 Elcmtr) shall be 0.01 or 0.02 .14

2 (H_2O Elcmtr) shall be 0.01 or 0.02 .03

Due to high backgrounds as stated above. MKR

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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 (N_2 Elcmtr) shall be 0.01 or 0.02 .02

4 (O_2 Elcmtr) shall be 0.01 or 0.02 .01

5 (CO_2 Elcmtr) shall be 0.01 or 0.02 Due to high → .04

6 (F12 Elcmtr) shall be 0.01 or 0.02 background .01

7 (F11/114 Elcmtr) shall be 0.01 or 0.02 as stated on page 14. → .05

MRK.

STAMP/DATE

5.3 ZERO CHECK

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

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b. Outputs indicated by OUTPUT DVM displays shall be:

H_2 ($\leq$ 2.0 torr) 0.1

O_2 ($\leq$ 5 torr) 0-1

CO_2 ($\leq$ 0.6 torr) 0.1

F12 ($\leq$ 5 ppm) 000

F114 ($\leq$ 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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STAMP/DATE

5. TEST PROCEDURES

5.3 (Cont)

c. DIGITAL TEST METER outputs shall be:

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

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5.4 FUNCTIONAL TEST

a. Standard Mixture composition

N_2	78.48 %
O_2	18.0 %
CO_2	1.02 %
A	1.01 %

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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)

ACTUAL

H_2 1.47 %

F12 104 ppm

F114 100 ppm

Cylinder Number 6347

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b. Flow rate shall be 0.05 ±0.01 SCFH

.05 SCFH

STAMP/DATE

c. Ambient Pressure 733 AMBIENT

740 torr

STAMP/DATE

d. Ion Pump current

150 μA

~~Nitrogen electrometer output (700 ±10)~~ ℓ

Not applicable. mer

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NASA 187C

e. Outputs

H_2 9.5 torr

O_2 134 torr

CO_2 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

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5. TEST PROCEDURES

5.4e. (Cont)

ACTUAL

F12 77 M torr

N_2 582 torr

H_2O mrr 1.0 torr

$P._{AMB}$ 740 torr

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f. Required values

REQUIRED

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

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

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

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

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

$$P_{N_2} = \frac{740}{(P._{AMB})} \times \frac{78.48}{(\%N_2)} \times \frac{1}{100} = 581 \text{ torr}$$

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

*No tolerance. Information only.

All readings within tolerance. (✓) ACPT ✓ REJ ___

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6.2 <u>FUNCTIONAL TEST DATA SHEET</u> (Sheet 7 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

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5. TEST PROCEDURES

5.5 INPUT VOLTAGE TEST

ACTUAL

a. High line Variac setting (126.5 ±1.0 V ac) 126.5 V ac

Outputs

H_2	9.9 torr
O_2	134 torr
CO_2	7.7 torr
F114	73 M torr
F12	73 M torr
N_2	581 torr
H_2O	1.4 torr
$P._{AMB}$	740 torr

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b. All readings within tolerance (✓) ACPT ✓ REJ ___

1971

STAMP/DATE

c. Low line Variac setting (103.5 ±1 V ac) ~~103.5~~ 104 V ac

Outputs

H_2	9.2 torr
O_2	134 torr
CO_2	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
N_2	583 torr
H_2O	0.9 torr
$P._{AMB}$	740-1 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

N_2	74.36 %
O_2	22.1 %
CO_2	2.03 %
A	1.02 %
H_2	.49 %

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 9 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

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5. TEST PROCEDURES

5.6b. (Cont) ACTUAL

F12 00 ppm

F114 00 ppm

Cylinder Number 5309

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Sample flow (0.05 ±0.01 SCFH) 05 SCFH

Sample pressure ($P_{ambient} \leq P_{sample} \leq P_{ambient}$ +10 torr) 740 torr

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c. Restabilize for minimum of 10 min. 10 min

Outputs

H_2 3.9 torr

O_2 163 torr

CO_2 15.3 torr

F114 001 M torr

F12 000 M torr

N_2 551 torr

H_2O 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

$$P_{H_2} = \underset{(P._{AMB})}{\underline{740}} \times \underset{(\%H_2)}{\underline{.49}} \times \frac{1}{100} = \underline{3.6} \pm 4 \text{ torr}$$

$$P_{O_2} = \underset{(P._{AMB})}{\underline{740}} \times \underset{(\%O_2)}{\underline{22.1}} \times \frac{1}{100} = \underline{164} \pm 10 \text{ torr}$$

$$P_{CO_2} = \underset{(P._{AMB})}{\underline{740}} \times \underset{(\%CO_2)}{\underline{2.03}} \times \frac{1}{100} = \underline{15.0} \pm 1.3 \text{ torr}$$

$$P_{F114} = \underset{(P._{AMB})}{\underline{740}} \times \underset{(\text{ppm F114})}{\underline{00}} \times \frac{1}{1000} = \underline{0} \pm 23 \text{ M torr}$$

$$P_{F12} = \underset{(P._{AMB})}{\underline{740}} \times \underset{(\text{ppm F12})}{\underline{00}} \times \frac{1}{1000} = \underline{0} \pm 23 \text{ M torr}$$

$$P_{N_2} = \underset{(P._{AMB})}{\underline{740}} \times \underset{(\%N_2)}{\underline{74.36}} \times \frac{1}{100} = \underline{550} \text{ torr}$$

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

*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 µA

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 11 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

STAMP/DATE

5. TEST PROCEDURES

ACTUAL

5.7b. Ion pump current increased by 10%. 165 μA

Outputs

H_2 3.8 torr

O_2 163 torr

CO_2 15.3 torr

N_2 551 torr

All readings within tolerance (✓) ACPT ✓ REJ ___

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c. Ion pump current decreased by 20%. 135 μA

Outputs

H_2 4.2 torr

O_2 163 torr

CO_2 15.3 torr

N_2 551 torr

All readings within tolerance (✓) ACPT ✓ REJ ___

STAMP/DATE

d. Ion pump current reset to value recorded in Step a above. 150 μA

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 12 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002 ______ DEC 21 1971
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5. TEST PROCEDURES

5.8 FREON 11 TEST ACTUAL

c. F11 background output ($\leq$ 4 M torr) This is due to a background partial pressure within the instrument. MKK 62 M torr
______ DEC 21 1971
STAMP/DATE

d. Freon 11/N_2 Composition 42 ppm

Cylinder Number 4549

______ DEC 21 1971
STAMP/DATE

e. Flow (0.05 ±0.01 SCFH .05 SCFH

Sample pressure ($P._{AMB} \leq P_{SAMPLE} \leq P._{AMB}$ +10 torr) 740 torr
______
STAMP/DATE

f. Outputs

F11 91 M torr

F12 0 M torr

$P._{AMB}$ 740 torr

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The correct F11 reading within tolerance is obtained by subtracting the background observed in step 5.8c. from the output recorded here, i.e. 91 - 62 = 29 mTorr.

g. Computed outputs

F11 = 740 $(P._{AMB})$ x 42 (ppm F11) x 1 = MPK 31 ±3.8 mtorr ±~~2.5 ppm~~ MPK

N_2 = 740 $(P._{AMB})$ 740 torr*

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 13 of 21)

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5. TEST PROCEDURES

5.8g. (Cont)	ACTUAL
F12 =	0 M torr*
*Information only	
All outputs are within tolerance.	(✓) ACPT ✓ REJ ___

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5.9 PRESSURE TEST

b. Flow rate (0.05 ±0.01 SCFH)	.05 SCFH
Inlet pressure (30 ±1 inHg)	30 inHg
Outputs	
H_2	9.9 torr
O_2	138 torr
CO_2	7.8 torr
F114	75 M torr
F12	76 M torr
N_2	599 torr
H_2O	2.8 torr
$P._{AMB}$	~~789~~ 762 torr

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 14 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

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5. TEST PROCEDURES

5.9 (Cont) Mixture #6347 mkr

Required values

ACTUAL REQUIRED

$P_{H_2} = \frac{762}{(P._{AMB})} \times \frac{1.47 \; \cancel{4.9}}{(\%H_2)} \times \frac{1}{100}$ = 11.2 ~~37~~ ±4 torr

$P_{O_2} = \frac{762}{(P._{AMB})} \times \frac{18 \; \cancel{22.1}}{(\%O_2)} \times \frac{1}{100}$ = 137 ~~168~~ ±10 torr

$P_{CO_2} = \frac{762}{(P._{AMB})} \times \frac{1.02 \; \cancel{2.03}}{(\%CO_2)} \times \frac{1}{100}$ = 7.77 ±1.3 torr

$P_{F114} = \frac{762}{(P._{AMB})} \times \frac{100}{(ppm\ F114)} \times \frac{1}{1000}$ = 76.2 ±23 M torr

$P_{F12} = \frac{762}{(P._{AMB})} \times \frac{104}{(ppm\ F12)} \times \frac{1}{1000}$ = 79 ±23 M torr

$P_{N_2} = \frac{762}{(P._{AMB})} \times \frac{78.48 \; \cancel{71.76}}{(\%N_2)} \times \frac{1}{100}$ mkr = 598 ~~567~~ torr mkr

P_{H_2O} = 0 torr*

*No tolerance. Information only.

All readings within tolerance. (√) ACPT ✓ REJ ___

~~$P._{AMB}$ (torr) ±2 torr = Inlet pressure (InHg) x 25.4~~ ~~(√) ACPT ___ REJ ___~~

Not applicable
mkr

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 15 of 21)

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REFERENCE PARAGRAPH SERIAL NUMBER CC 2 STAMP/DATE

5. TEST PROCEDURES

		ACTUAL
5.9c.	Flow rate (0.05 ±0.01 SCFH)	.04 SCFH
	Inlet pressure (20 ±1 inHg)	20 inHg
	Outputs	
	H_2	7.7 torr
	O_2	91 torr
	CO_2	5.3 torr
	F114	42 M torr
	F12	45 M torr
	N_2	398 torr
	H_2O	2.9 torr
	$P._{AMB}$	508 torr

Required Values REQUIRED

$$P_{H_2} = \frac{508}{(P._{AMB})} \times \frac{1.47}{(\%H_2)} \times \frac{1}{100} = 7.46 \pm 4 \text{ torr}$$

$$P_{O_2} = \frac{508}{(P._{AMB})} \times \frac{18}{(\%O_2)} \times \frac{1}{100} = 91 \pm 10 \text{ torr}$$

$$P_{CO_2} = \frac{508}{(P._{AMB})} \times \frac{1.02}{(\%CO_2)} \times \frac{1}{100} = 5.18 \pm 1.3 \text{ torr}$$

$$P_{F114} = \frac{508}{(P._{AMB})} \times \frac{100}{(\text{ppm F114})} \times \frac{1}{1000} = 50.8 \pm 23 \text{ M torr}$$

$$P_{F12} = \frac{508}{(P._{AMB})} \times \frac{104}{(\text{ppm F12})} \times \frac{1}{1000} = 53 \pm 23 \text{ M torr}$$

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 16 of 21)

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5.9c. (Cont)

REQUIRED

$P_{N_2} = \frac{508}{(P._{AMB})} \times \frac{\overset{78.48}{\cancel{74.36}}}{(\%N_2)} \times \frac{1}{100} =$ ~~378~~ 399 torr

$P_{H_2O} =$ 0 torr*

*No tolerance. Information only.

All readings within tolerance (✓) ACPT ✓ REJ ___

~~P_{AMB} (torr) ±2 torr = Inlet pressure (inHg) x 25.4~~ Not applicable MER ~~(✓) ACPT ___ REJ ___~~

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d. Flow rate (0.05 ±0.01 SCFH) .05 SCFH

Inlet pressure (40 ±1 inHg) 40 inHg

H_2 11.5 torr

O_2 184 torr

CO_2 10.7 torr

F114 119 M torr

F12 117 M torr

N_2 795 torr

H_2O 2.1 torr

$P._{AMB}$ 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

$$P_{H_2} = \underset{(P._{AMB})}{\underline{1016}} \times \underset{(\%H_2)}{\underline{1.47}} \times \frac{1}{100} = \underline{14.9} \pm 4 \text{ torr}$$

$$P_{O_2} = \underset{(P._{AMB})}{\underline{1016}} \times \underset{(\%O_2)}{\underline{18}} \times \frac{1}{100} = \underline{183} \pm 10 \text{ torr}$$

$$P_{CO_2} = \underset{(P._{AMB})}{\underline{1016}} \times \underset{(\%CO_2)}{\underline{1.02}} \times \frac{1}{100} = \underline{10.4} \pm 1.3 \text{ torr}$$

$$P_{F114} = \underset{(P._{AMB})}{\underline{1016}} \times \underset{(\text{ppm F114})}{\underline{100}} \times \frac{1}{1000} = \underline{\overset{102}{\cancel{10.16}}} \pm 23 \text{ M torr}$$

$$P_{F12} = \underset{(P._{AMB})}{\underline{1016}} \times \underset{(\text{ppm F12})}{\underline{104}} \times \frac{1}{1000} = \underline{106} \pm 23 \text{ M torr}$$

$$P_{N_2} = \underset{(P._{AMB})}{\underline{1016}} \times \underset{(\%N_2)}{\underline{\overset{78.48}{\cancel{74.36}}}} \times \frac{1}{100} = \underline{\overset{797}{\cancel{255}}} \text{ torr}$$

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

*No tolerance. Information only.

All readings within tolerance.　　(✓) ACPT ✓ REJ ___

~~$P._{AMB}$ (torr) ±2 torr = Inlet pressure (inHg) x 25.4~~ Not applicable MPR　　~~(✓) ACPT ___ REJ ___~~

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5.10 REDUNDANT FILAMENT TEST

ACTUAL

a. Outputs

	FIL #1	FIL #2	
H_2	.9	.9	torr
O_2	152	152	torr

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 18 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

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5. TEST PROCEDURES

5.10a. (Cont)

	ACTUAL FIL #1	ACTUAL FIL #2	
CO_2	1.4	1.5	torr
F114	002	001	M torr
F12	000	000	M torr
N_2	567	567	torr
H_2O	6.0	5.5	torr
$P._{AMB}$	734	733	torr

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b. Required Values — REQUIRED

P_{H_2} = 0 $\pm$4 torr

$P_{O_2} = \frac{725.4}{(P._{AMB} - P_{H_2O})} \times 20.99 \times \frac{1}{100}$ = 152 $\pm$10 torr

$P_{CO_2} = \frac{725.4}{(P._{AMB} - P_{H_2O})} \times 0.03 \times \frac{1}{100}$ = 0.2 $\pm$1.3 torr

$P_{N_2} = \frac{725.4}{(P._{AMB} - P_{H_2O})} \times 78.03 \times \frac{1}{100}$ = 566 torr

P_{H_2O} = Computed Value = 7.2 torr

F114 = 0 $\pm$11 M torr

F12 = 0 $\pm$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)

REQUIRED

All readings within tolerance. (✓) ACPT ✓ REJ ___

STAMP/DATE

5.11 DEGAS TEST

ACTUAL

b. Outputs rise (✓) ACPT ✓ REJ ___

STAMP/DATE

5.12 OVERPRESSURE PROTECTION TEST

a. Flow rate (0.05 ±0.01 SCFH) .05 SCFH

Ambient Pressure 737 ambient 756 torr

Ion pump current 100 μA

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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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c. Relay sound audible (✓) ACPT ✓ REJ ___

Filament off (✓) 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 ±0.01 SCFH) .05 SCFH

Ambient pressure ~~760~~ ambient 760 torr

Ion pump current 150 μA

NA

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6.2 FUNCTIONAL TEST DATA SHEET (Sheet 21 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

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5. TEST PROCEDURES

ACTUAL

5.13b. Power off at 1708 min

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c. Power on at 1738 min

Observe pump down (✓) ACPT ✓ REJ ___

DEC

STAMP/DATE

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

(Follow procedure of Paragraph 5.4.)

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 ±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

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)

ACTUAL

e. Outputs

N/A

H_2	________ torr
O_2	________ torr
CO_2	________ torr
F114	________ M torr
F12	________ M torr
N_2	________ torr
H_2O	________ torr
$P._{AMB}$	________ torr

STAMP/DATE

f. Required Values

REQUIRED

$P_{H_2} = \underset{(P._{AMB})}{\_\_\_\_\_\_} \times \underset{(\%H_2)}{\_\_\_\_\_\_} \times \frac{1}{100} =$ ______ ± 4 torr

$P_{O_2} = \underset{(P._{AMB})}{\_\_\_\_\_\_} \times \underset{(\%O_2)}{\_\_\_\_\_\_} \times \frac{1}{100} =$ ______ ± 10 torr

$P_{CO_2} = \underset{(P._{AMB})}{\_\_\_\_\_\_} \times \underset{(\%CO_2)}{\_\_\_\_\_\_} \times \frac{1}{100} =$ ______ ± 1.3 torr

$P_{F114} = \underset{(P._{AMB})}{\_\_\_\_\_\_} \times \underset{(ppm\ F114)}{\_\_\_\_\_\_} \times \frac{1}{1000} =$ ______ ± 23 M torr

$P_{F12} = \underset{(P._{AMB})}{\_\_\_\_\_\_} \times \underset{(ppm\ F12)}{\_\_\_\_\_\_} \times \frac{1}{1000} =$ ______ ± 23 M torr

STAMP/DATE

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} = ______ $(P._{AMB})$ x ______ $(\%N_2)$ x $\frac{1}{100}$ = ______ torr~~

~~P_{H_2O} = ______ torr*~~

~~*No tolerance. Information only.~~ ~~(✓) ACPT___ REJ___~~

~~______ STAMP/DATE~~

5.15 WORKMANSHIP

Workmanship verified (✓) ACPT___ REJ___

______ DEC 21 1971
STAMP/DATE

S NASA 187C

5.16 EXTERNAL DIMENSIONS

Dimensions verified (✓) ACPT___ REJ___

______ DEC 21 1971
STAMP/DATE

S NASA 187C

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 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.

ADDENDUM

TP 82-0023

STODDART
ELECTRO SYSTEMS

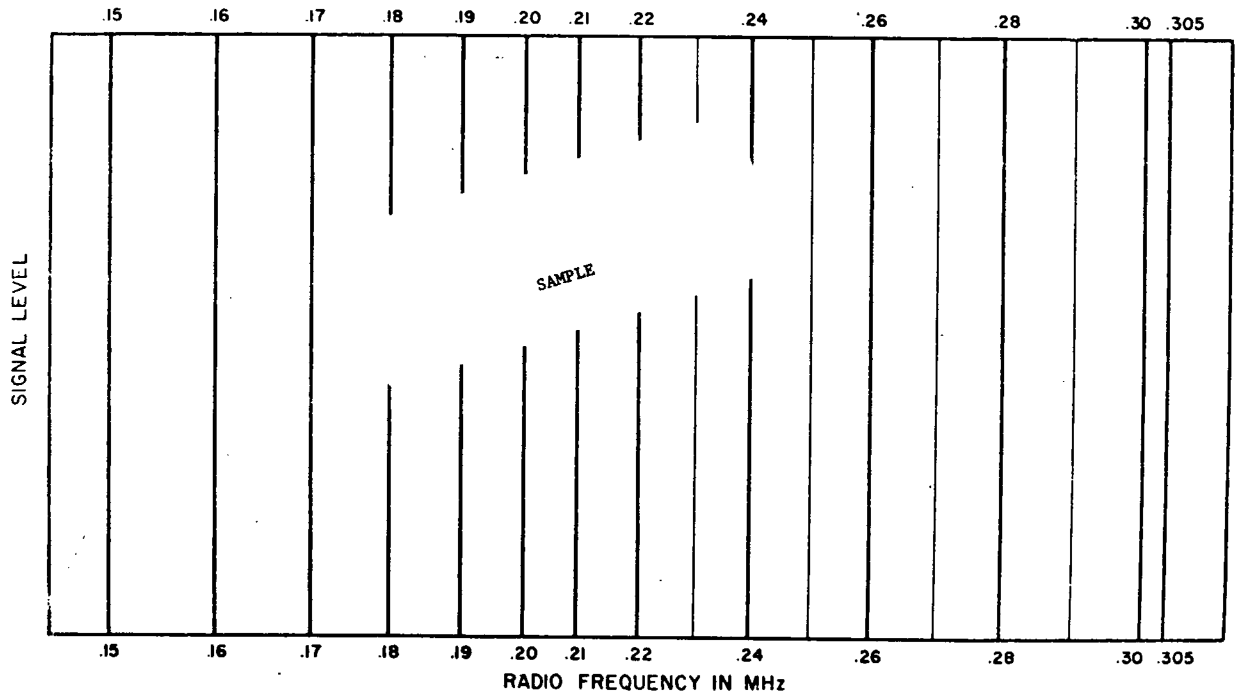
APC GRAPH PAPER

Company: __________

Test Specimen: __________ Technician: __________ Date: __________

Type of Interference: __________ Receiver Calibration Date: __________ Data Page No: __________

°Test Condition: __________ Receiver: SES NM-22A, band I Scan Speed: __________

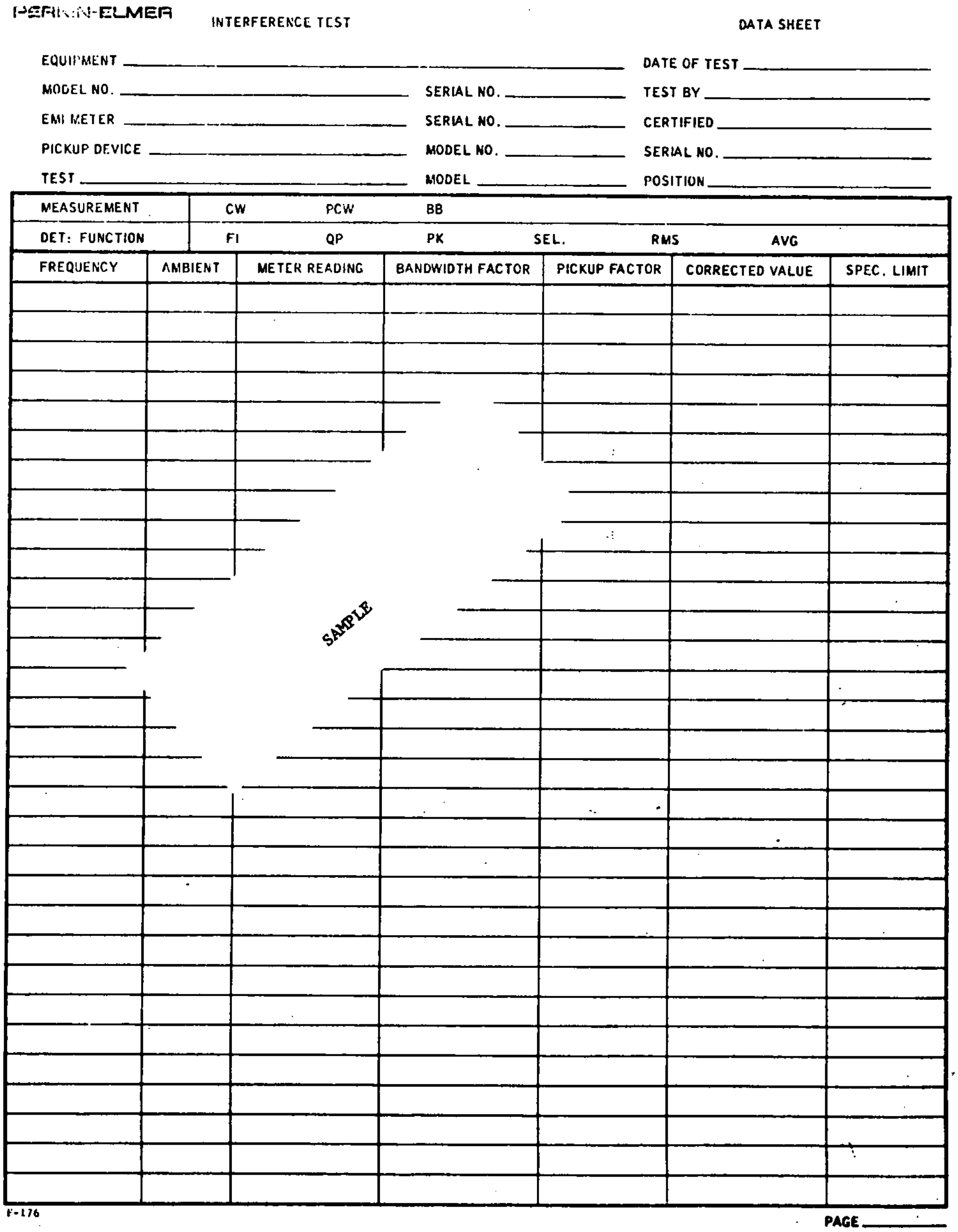


SAMPLE EMI GRAPH

APPENDIX 2

ADDENDUM

TP 82-0023



PERKIN-ELMER INTERFERENCE TEST DATA SHEET

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

MEASUREMENT: CW PCW BB
DET: FUNCTION: FI QP PK SEL. RMS AVG

FREQUENCY	AMBIENT	METER READING	BANDWIDTH FACTOR	PICKUP FACTOR	CORRECTED VALUE	SPEC. LIMIT

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PAGE ______

SAMPLE INTERFERENCE TEST DATA SHEET

ADDENDUM TP 82-0023

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

REFERENCE PARAGRAPH SERIAL NUMBER 002 C 17 12/22/71 STAMP/DATE

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. 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 12/22 DEC 22 1971 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

APPENDIX 2

PERKIN-ELMER INTERFERENCE TEST DATA SHEET

EQUIPMENT ATMOS CONT SENSOR
DATE OF TEST 12 22-71
MODEL NO.
SERIAL NO. 2
TEST BY F. DOIRON
EMI METER NM 43A
SERIAL NO. 740-5
CERTIFIED Oct 2-72
PICKUP DEVICE CURRENT PROBE
MODEL NO. 91550-1
SERIAL NO. 653 25
TEST CONDUCTED EMI
MODEL
POSITION 115 V 20

MEASUREMENT: [✓ CW] PCW [✓ BB]

DET: FUNCTION: FI QP [✓ PK] [✓ SEL.] RMS AVG

FREQUENCY	AMBIENT	METER READING	BANDWIDTH FACTOR	PICKUP FACTOR	CORRECTED VALUE	SPEC. LIMIT
Broadband		34×10^2 μv			50DB>/μv/20kHz	
			AMAC A			
			NOMOGRAPH			
Narrowband		μv			DB>/μv	
Hz						
30		1.3×10^2			80	
300		2×10^3			86	
900		$.8 \times 10^3$			66	
4.1K		1.1×10^2			15	
9K		3×10			15	
12K		1.0×10			10	
14K		6×10			20	

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APPENDIX 2

PERKIN-ELMER INTERFERENCE TEST DATA SHEET

EQUIPMENT A.M.S. CONE SENSOR

DATE OF TEST 12-22-71

MODEL NO. ______ SERIAL NO. 2

TEST BY J. DeMACK

EMI METER NM 40A SERIAL NO. 74[illegible] 5

CERTIFIED Dec [illegible] 72

PICKUP DEVICE CURRENT PROBE MODEL NO. 91550-1

SERIAL NO. 553 25

TEST CONDUCTED LMT MODEL ______

POSITION [illegible]

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		35x10 μA			50 DB μA/2KHz	
			NM 40A			
			AUTOGRAPH			
Narrowband						
Hz		μA			DB μA	
30		1.5×10^2			60	
300		2×10^3			86	
400		$.8 \times 10^3$			65	
1.75K		$.9 \times 10^2$			60	
4.3K		2×10			20	
6K		5×10			25	
10.5K		3×10			15	
14K		5×10			18	
			12/22/71			

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 DOIRON
EMI METER NM 22A
SERIAL NO. 117-16
CERTIFIED Dec 7-72
PICKUP DEVICE CURRENT PROBE
MODEL NO. 91550-1
SERIAL NO. BF 486
TEST CONDUCTED EMI
MODEL
POSITION 115V [illegible]

MEASUREMENT	CW PCW [✓ BB]
DET: FUNCTION	FI QP [✓ PK] SEL. RMS AVG

FREQUENCY	AMBIENT	METER READING	BANDWIDTH FACTOR	PICKUP FACTOR	CORRECTED VALUE	SPEC. LIMIT
KHz		DB>/uv	DB	DB	DB>/uv/MHz	
150		30	40	-5	65	
300		30		-8	62	
400		20		-10	50	
800		0		-12	28	
1.1M		0		-13	27	
3M		3		-14	29	
7M		-6		-14	20	
12M		-7		-14	19	
20M		-10			16	
30M		*Mtr BkGnd			11	
40M		Mtr BkGnd			11	
50M		Mtr BkGnd	40	-14	11	

* Meter Background (-15)

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APPENDIX 2

PERKIN-ELMER INTERFERENCE TEST DATA SHEET

EQUIPMENT ATMS CCKT [illegible]
DATE OF TEST 12/21/71
MODEL NO.
SERIAL NO. 2
TEST BY [illegible]
EMI METER NM 12T
SERIAL NO. AH 47
CERTIFIED Dec 7 72
PICKUP DEVICE CURRENT PROBE
MODEL NO. [illegible]
SERIAL NO. B1 486
TEST CONDUCTED EMI
MODEL
POSITION 120V 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
KHz		DB/μv	DB	DB	Db/μa/MHz	
15		29	60	+14	103	
20		33		+12	105	
33		20		+7	87	
40		20		+6	86	
61		15		+2	77	
75		17		+1	78	
94		25		−1	84	
120		10		−3	67	
140		0	60	−4	56	

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APPENDIX 2

PERKIN-ELMER INTERFERENCE TEST DATA SHEET

EQUIPMENT ATMOS CONT SENSOR
DATE OF TEST 12-22-71
MODEL NO.
SERIAL NO.
TEST BY F [illegible]
EMI METER NM 22A
SERIAL NO. #12-16
CERTIFIED Dec 7-72
PICKUP DEVICE CURRENT PROBE
MODEL NO. 91550-1
SERIAL NO. BF-486
TEST CONDUCTED EMI
MODEL
POSITION 115 V 60

MEASUREMENT	CW	PCW	[✓ BB]			
DET: FUNCTION	FI	QP	[✓ PK]	SEL.	RMS	AVG

FREQUENCY	AMBIENT	METER READING	BANDWIDTH FACTOR	PICKUP FACTOR	CORRECTED VALUE	SPEC. LIMIT
KHz		DB/μv	DB	DB	DB/μv/MHz	
150		35	40	-5	70	
280		25	↑	-8	57	
500		15		-11	44	
800		10		-12	38	
1.5M		5		-13	32	
3 M		0		-14	26	
8 M		-3		-14	23	
12 M		-2		↑	24	
20 M		-10			16	
30 M	*	Mtr Bkgnd			11	
40 M		Mtr BkGnd	↓	↓	11	
50 M		Mtr BkGnd	40	-14	11	

* Meter Background (−15)

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PERKIN-ELMER INTERFERENCE TEST DATA SHEET

EQUIPMENT AIMS CONT SENSOR
DATE OF TEST 12 22 71
MODEL NO.
SERIAL NO. 2
TEST BY F. DURKIN
EMI METER NM-12T
SERIAL NO. AH 41
CERTIFIED Dec 1 72
PICKUP DEVICE CURRENT PROBE
MODEL NO. 91550-1
SERIAL NO. BF 486
TEST CONDUCTED EMI
MODEL
POSITION 115V LO

MEASUREMENT	CW PCW [✓ BB]
DET: FUNCTION	FI QP [✓ PK] SEL. RMS AVG

FREQUENCY	AMBIENT	METER READING	BANDWIDTH FACTOR	PICKUP FACTOR	CORRECTED VALUE	SPEC. LIMIT
KHz		DB >/µa	DB	DB	DB >µa/MHz	
16		34	60	+14	108	
20		34	↑	+12	106	
33		22		+7	89	
45		23		+5	88	
62		18		+2	80	
72		18		+1	79	
94		27	↓	-1	86	
140		22	60	-4	78	

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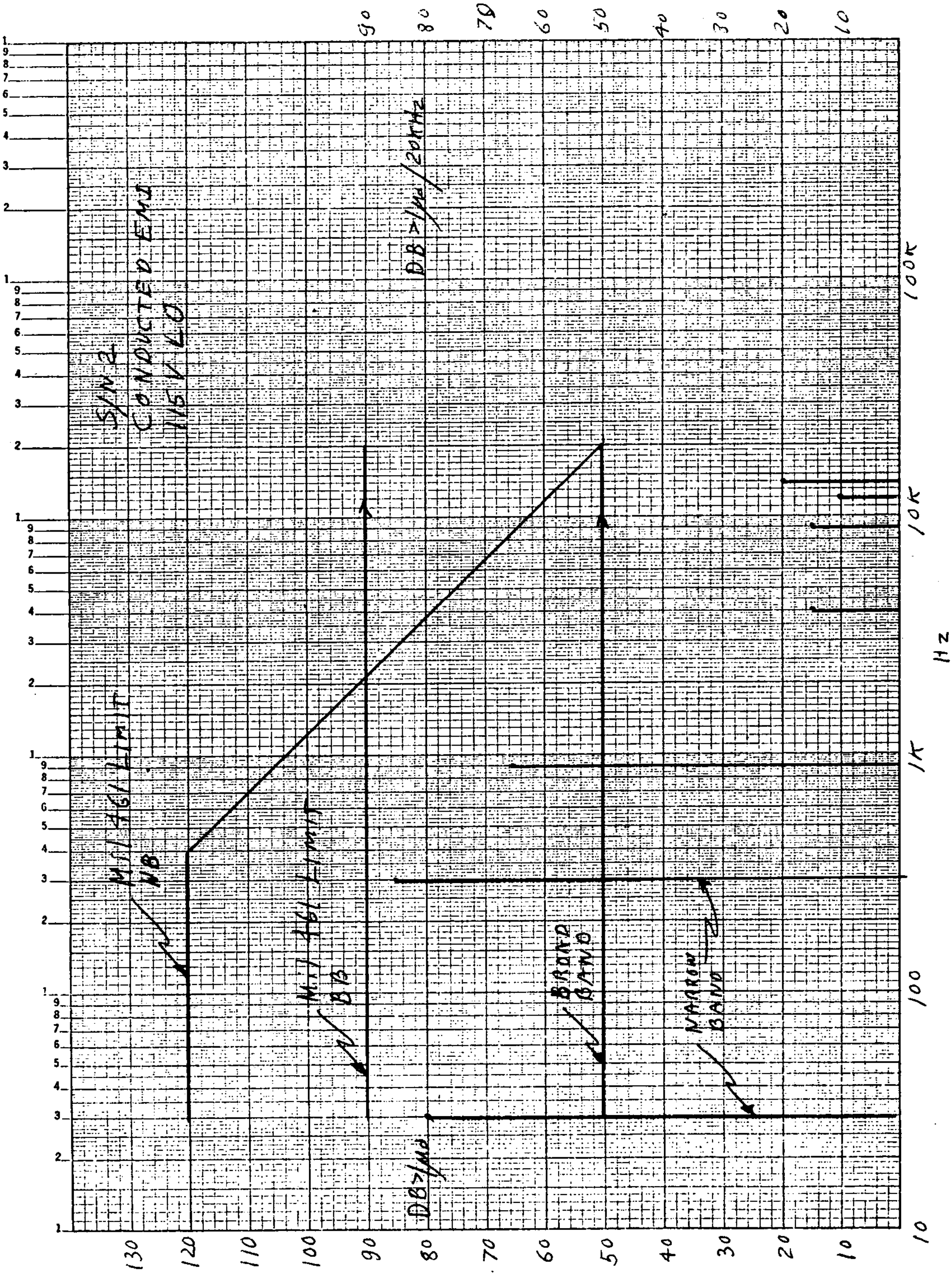
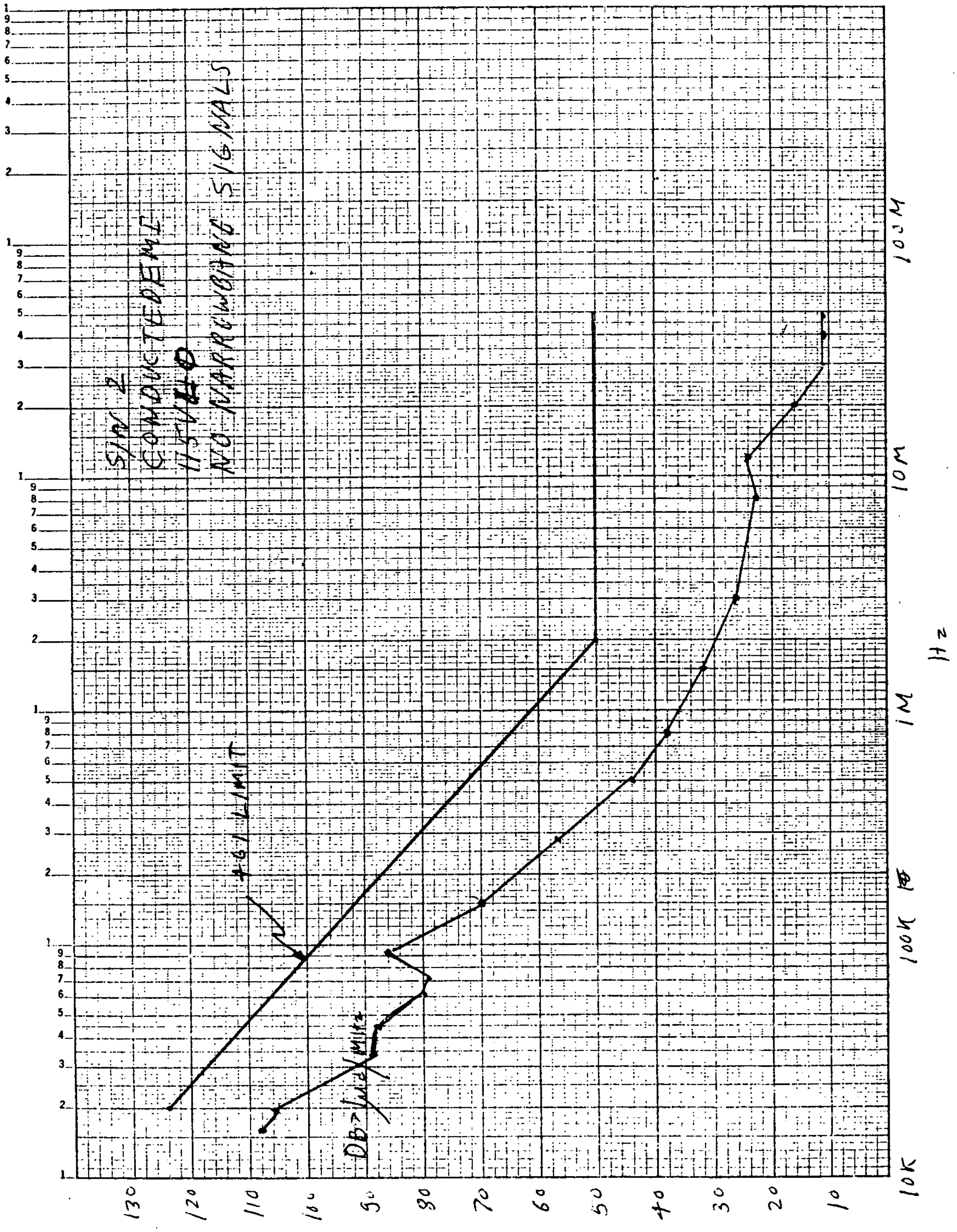
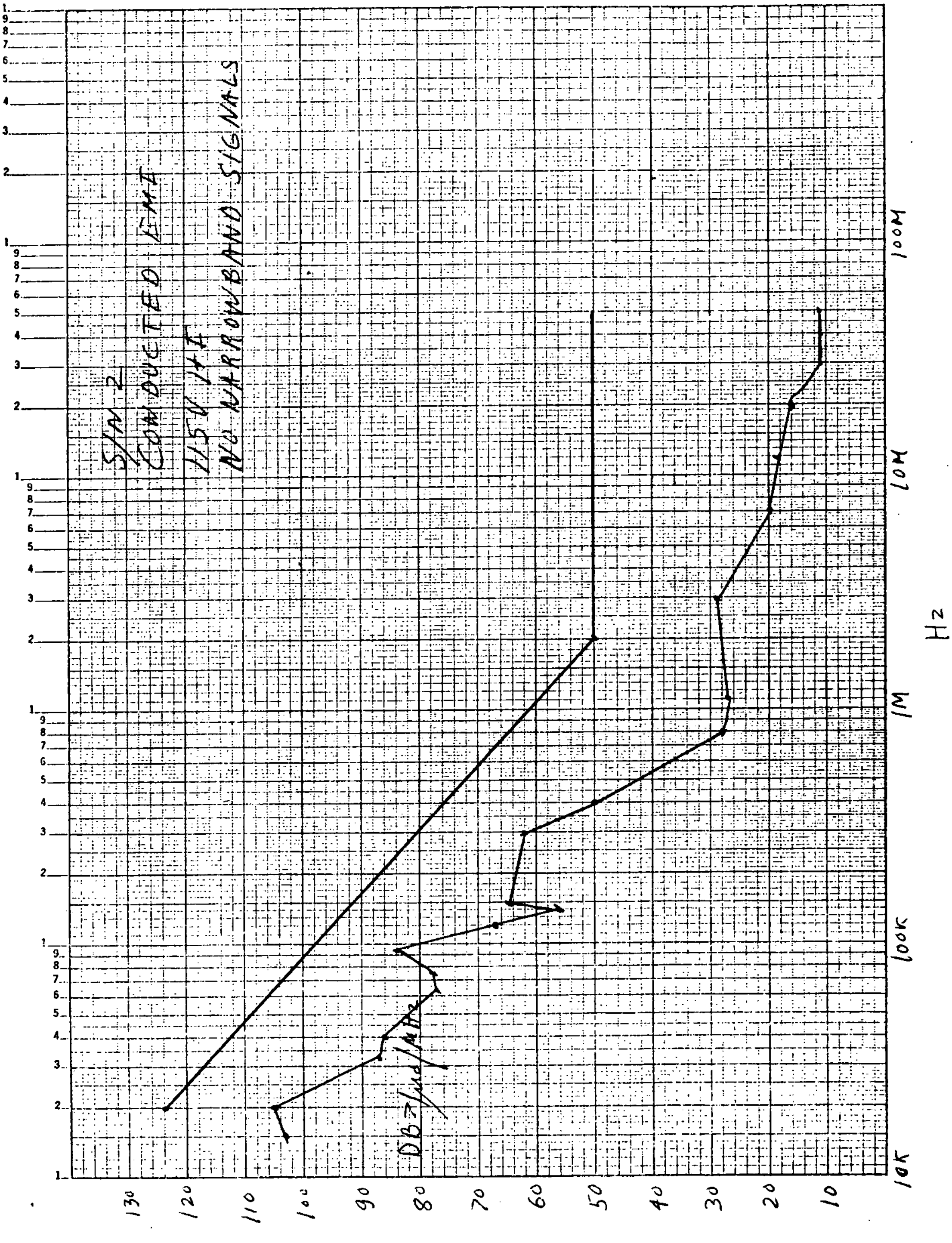

S/N 2
CONDUCTED EMI
115V LO
MIL 461 LIMIT NB
MIL 461 LIMIT BB
BROAD BAND
NARROW BAND
DB>/μv
DB>/μv/20kHz
Hz
10
100
1K
10K
100K
130
120
110
100
90
80
70
60
50
40
30
20
10

APPENDIX 2


S/N 2
CONDUCTED EMI
115 V 60
NO NARROWBAND SIGNALS
461 LIMIT
DB > Line Limit
130
120
110
100
90
80
70
60
50
40
30
20
10
10K
100K
1M
10M
100M
Hz

APPENDIX 2


S/N 2
CONDUCTED EMI
115V 1+I
NO NARROWBAND SIGNALS
DB>/uA/MHz
130
120
110
100
90
80
70
60
50
40
30
20
10
10K
100K
1M
10M
100M
Hz

APPENDIX 2

ATMOSPHERE CONTAMINANT SENSOR

PART NO. 344800   SERIAL NO. 002

SUPPLEMENTAL TEST DATA

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 JM Hagey Date 27 Jan 72
Test Verified by J W Stuart Date 27 Jan 72
Test Surveillance B. E. Shelton 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 W Stuart Date 27 Jan 72
Survey Surveillance B. E. Shelton Date 27 Jan 72
_______________ Date_______

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 1 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER__________

____
STAMP/DATE

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________

____
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___

____
STAMP/DATE

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

____
STAMP/DATE

5.2 NOMINAL CONDITIONS

H_2O shall be $\leq$ 2.0 torr. __________torr

O_2 shall be $\leq$ 5.0 torr. __________torr

CO_2 shall be $\leq$ 0.6 torr. __________torr

F12 shall be $\leq$ 5 ppm$^+$ __________ppm

____
STAMP/DATE

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 $\leq$ 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 μA.	__________μA
I_{EA} shall be (TBD)	__________
I_{AN} shall be 37.5 ±1.0 μA	__________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 $\leq$ 4 torr.	__________torr
H_2O output shall be $\leq$ 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

6.2 FUNCTIONAL TEST DATA SHEETS (Sheet 3 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER__________

__________ STAMP/DATE

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 __________

__________ STAMP/DATE

5.3 ZERO CHECK

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

__________ STAMP/DATE

b. Outputs indicated by OUTPUT DVM displays shall be:

H_2 ($\leq$ 2.0 torr) __________

O_2 ($\leq$ 5 torr) __________

CO_2 ($\leq$ 0.6 torr) __________

F12 ($\leq$ 5 ppm) __________

F114 ($\leq$ 5 ppm) __________

__________ STAMP/DATE

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 ($\leq$ 4 torr) __________

H_2O ($\leq$ 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 %

1/27/72

STAMP/DATE

APPENDIX 2

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 5 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

1/27/72 -
STAMP/DATE

5. TEST PROCEDURES

5.4a. (Cont)

ACTUAL

H_2 1.47 %

F12 104 ppm

F114 100 ppm

Cylinder Number 6347

1/27/72
STAMP/DATE

b. Flow rate shall be 0.05 ±0.01 SCFH 0.045 SCFH

1/27/72
STAMP/DATE

c. Ambient Pressure AMBIENT 736.5 torr

1/27/72
STAMP/DATE

d. Ion Pump current 100 µA

~~Nitrogen electrometer output (700 ±10)~~

Refer to 1st ATP.

1/27/72
STAMP/DATE

e. Outputs

H_2 9.7 torr

O_2 136 torr

CO_2 7.3 torr

F114 76 M torr

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 CC2

1/27/72
STAMP/DATE

5. TEST PROCEDURES

5.4e. (Cont)

ACTUAL

F12 80 M torr

N_2 581 torr

H_2O 2.8 torr

$P._{AMB}$ 741 torr

1/27/72
STAMP/DATE

f. Required values

REQUIRED

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

$P_{O_2} = \frac{741}{(P._{AMB})} \times \frac{18}{(\%O_2)} \times 1$ = 133.38 ±10 torr

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

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

$P_{F12} = \frac{741}{(P._{AMB})} \times \frac{\overset{104}{\cancel{800}}}{(ppm\ F12)} \times \frac{1}{1000}$ = 77.06 ~~5928~~ ±23 M torr

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

P_{H_2O} = 2.5 torr*

*No tolerance. Information only.

All readings within tolerance.

(✓) ACPT ✓ REJ ___

1/27/72
STAMP/DATE

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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 ±1.0 V ac) __________V ac

Outputs

H_2 __________torr

O_2 __________torr

CO_2 __________torr

F114 __________M torr

F12 __________M torr

N_2 __________torr

H_2O __________torr

$P._{AMB}$ __________torr

STAMP/DATE

b. All readings within tolerance (✓) ACPT___REJ___

STAMP/DATE

c. Low line Variac setting (103.5 ±1 V ac) __________V ac

Outputs

H_2 __________torr

O_2 __________torr

CO_2 __________torr

STAMP/DATE

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

N_2 __________torr

H_2O __________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

N_2 74.36 %

O_2 22.1 %

CO_2 2.03 %

A 1.02 %

H_2 0.49 %

1/27/72 STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 9 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

JMM 1/27/72
STAMP/DATE

5. TEST PROCEDURES

5.6b. (Cont)	ACTUAL
F12	00 ppm
F114	00 ppm
Cylinder Number 5309	JMM 1/27/72 STAMP/DATE
Sample flow (0.05 ±0.01 SCFH)	0.045 SCFH
Sample pressure ($P_{ambient} \le P_{sample} \le P_{ambient}$ +2 torr)	742 torr
	JMM 1/27/72 STAMP/DATE
c. Restabilize for minimum of 10 min.	10 min
Outputs	
H_2	3.6 torr
O_2	166 torr
CO_2	14.6 torr
F114	7 M torr
F12	0 M torr
N_2	551 torr
H_2O	1.6 torr
$P._{AMB}$	742 torr
	JMM 1/27/72 STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 10 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

1/27/72
STAMP/DATE

5. TEST PROCEDURES

5.6d. Required Values REQUIRED

$P_{H_2} = \frac{742}{(P._{AMB})} \times \frac{0.49}{(\%H_2)} \times \frac{1}{100}$ = 3.64 ±4 torr

$P_{O_2} = \frac{742}{(P._{AMB})} \times \frac{22.1}{(\%O_2)} \times \frac{1}{100}$ = 163.98 ±10 torr

$P_{CO_2} = \frac{742}{(P._{AMB})} \times \frac{\overset{2.03}{\cancel{1.46}}}{(\%CO_2)} \times \frac{1}{100}$ = 15.06 ±1.3 torr

$P_{F114} = \frac{742}{(P._{AMB})} \times \frac{\quad}{(ppm\ F114)} \times \frac{1}{1000}$ = 0 ±23 M torr

$P_{F12} = \frac{742}{(P._{AMB})} \times \frac{\quad}{(ppm\ F12)} \times \frac{1}{1000}$ = 0 ±23 M torr

$P_{N_2} = \frac{742}{(P._{AMB})} \times \frac{74.36}{(\%N_2)} \times \frac{1}{100}$ = 551.75 torr

P_{H_2O} = 2.0 torr*

*No tolerance. Information only.

All readings within tolerance. (✓) ACPT ✓ REJ __

1/27/72
STAMP/DATE

5.7 AUTOMATIC RATIO CIRCUIT TEST

a. Ion pump current ~~[illegible]~~ 100 μA

1/27/72
STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 11 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

1/27/72
STAMP/DATE

5. TEST PROCEDURES

ACTUAL

5.7b. Ion pump current increased by 10%. 110 μA

Outputs

H_2 3.6 torr

O_2 165 torr

CO_2 14.6 torr

N_2 551 torr

All readings within tolerance (✓) ACPT ✓ REJ ___

1/27/72
STAMP/DATE

c. Ion pump current decreased by 20%. 80 μA

Outputs

H_2 3.8 torr

O_2 166 torr

CO_2 14.5 torr

N_2 550 torr

All readings within tolerance (✓) ACPT ✓ REJ ___

1/27/72
STAMP/DATE

d. Ion pump current reset to value recorded in Step a above. 100 μA

1/27/72
STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 12 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

1/27/72
STAMP/DATE

5. TEST PROCEDURES

5.8 FREON 11 TEST

ACTUAL

c. F11 background output ($\leq$ 4 M torr)

9 M torr

1/27/72
STAMP/DATE

d. Freon 11/N_2 Composition

42 ppm

Cylinder Number 4549

1/27/72
STAMP/DATE

e. Flow (0.05 ±0.01 SCFH

0.045 SCFH

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

742 torr

1/27/72
STAMP/DATE

f. Outputs

F11 33 M torr

F12 2 M torr

$P._{AMB}$ 742 torr

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 ±2.5 ~~ppm~~ M torr

$$N_2 = \frac{742}{(P._{AMB})}$$

742 torr*

1/27/72
STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 13 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

1/27/72
STAMP/DATE

5. TEST PROCEDURES

5.8g. (Cont)

ACTUAL

F12 = 2 M torr*

*Information only

All outputs are within tolerance. (✓) ACPT ✓ REJ ___ X

1/27/72
STAMP/DATE

5.9 PRESSURE TEST

b. Flow rate (0.05 ±0.01 SCFH) ______ SCFH

Inlet pressure (30 ±1 inHg) ______ inHg

Outputs

H_2 ______ torr

O_2 ______ torr

CO_2 ______ torr

F114 ______ M torr

F12 ______ M torr

N_2 ______ torr

H_2O ______ torr

$P._{AMB}$ ______ torr

1/27/72
STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 14 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER__________

__________ STAMP/DATE

5. TEST PROCEDURES

5.9 (Cont)

ACTUAL

Required values REQUIRED

$P_{H_2} = \underset{(P._{AMB})}{\underline{\hspace{2cm}}} \text{ x } \underset{(\%H_2)}{\underline{\hspace{2cm}}} \text{ x } \frac{1}{100}$ = _______ ±4 torr

$P_{O_2} = \underset{(P._{AMB})}{\underline{\hspace{2cm}}} \text{ x } \underset{(\%O_2)}{\underline{\hspace{2cm}}} \text{ x } \frac{1}{100}$ = _______ ±10 torr

$P_{CO_2} = \underset{(P._{AMB})}{\underline{\hspace{2cm}}} \text{ x } \underset{(\%CO_2)}{\underline{\hspace{2cm}}} \text{ x } \frac{1}{100}$ = _______ ±1.3 torr

$P_{F114} = \underset{(P._{AMB})}{\underline{\hspace{2cm}}} \text{ x } \underset{(ppm\ F114)}{\underline{\hspace{2cm}}} \text{ x } \frac{1}{1000}$ = _______ ±23 M torr

$P_{F12} = \underset{(P._{AMB})}{\underline{\hspace{2cm}}} \text{ x } \underset{(ppm\ F12)}{\underline{\hspace{2cm}}} \text{ x } \frac{1}{1000}$ = _______ ±23 M torr

$P_{N_2} = \underset{(P._{AMB})}{\underline{\hspace{2cm}}} \text{ x } \underset{(\%N_2)}{\underline{\hspace{2cm}}} \text{ x } \frac{1}{100}$ = __________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

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 15 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER__________

____
STAMP/DATE

5. TEST PROCEDURES

ACTUAL

5.9c. Flow rate (0.05 ±0.01 SCFH) __________SCFH

Inlet pressure (20 ±1 inHg) __________inHg

Outputs

H_2 __________torr

O_2 __________torr

CO_2 __________torr

F114 __________M torr

F12 __________M torr

N_2 __________torr

H_2O __________torr

$P._{AMB}$ __________torr

Required Values

REQUIRED

$P_{H_2} = \underset{(P._{AMB})}{\underline{\hspace{2cm}}} \times \underset{(\%H_2)}{\underline{\hspace{2cm}}} \times \frac{1}{100}$ = ________ ±4 torr

$P_{O_2} = \underset{(P._{AMB})}{\underline{\hspace{2cm}}} \times \underset{(\%O_2)}{\underline{\hspace{2cm}}} \times \frac{1}{100}$ = ________ ±10 torr

$P_{CO_2} = \underset{(P._{AMB})}{\underline{\hspace{2cm}}} \times \underset{(\%CO_2)}{\underline{\hspace{2cm}}} \times \frac{1}{100}$ = ________ ±1.3 torr

$P_{F114} = \underset{(P._{AMB})}{\underline{\hspace{2cm}}} \times \underset{(\text{ppm F114})}{\underline{\hspace{2cm}}} \times \frac{1}{1000}$ = ________ ±23 M torr

$P_{F12} = \underset{(P._{AMB})}{\underline{\hspace{2cm}}} \times \underset{(\text{ppm F12})}{\underline{\hspace{2cm}}} \times \frac{1}{1000}$ = ________ ±23 M torr

____
STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 16 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER________

STAMP/DATE

5.9c. (Cont)

REQUIRED

P_{N_2} = $\underset{(P._{AMB})}{\_\_\_\_\_\_\_\_}$ x $\underset{(\%N_2)}{\_\_\_\_\_\_\_\_}$ x $\frac{1}{100}$ = ________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

d. Flow rate (0.05 ±0.01 SCFH) ________SCFH

Inlet pressure (40 ±1 inHg) ________inHg

H_2 ________torr

O_2 ________torr

CO_2 ________torr

F114 ________M torr

F12 ________M torr

N_2 ________torr

H_2O ________torr

$P._{AMB}$ ________torr

STAMP/DATE

6.2 <u>FUNCTIONAL TEST DATA SHEET</u> (Sheet 17 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER__________

____
STAMP/DATE

5. TEST PROCEDURES

5.9d (Cont)

REQUIRED

$P_{H_2} = \underset{(P._{AMB})}{\underline{\qquad\qquad}} \times \underset{(\%H_2)}{\underline{\qquad\qquad}} \times \frac{1}{100}$ = _______ ±4 torr

$P_{O_2} = \underset{(P._{AMB})}{\underline{\qquad\qquad}} \times \underset{(\%O_2)}{\underline{\qquad\qquad}} \times \frac{1}{100}$ = _______ ±10 torr

$P_{CO_2} = \underset{(P._{AMB})}{\underline{\qquad\qquad}} \times \underset{(\%CO_2)}{\underline{\qquad\qquad}} \times \frac{1}{100}$ = _______ ±1.3 torr

$P_{F114} = \underset{(P._{AMB})}{\underline{\qquad\qquad}} \times \underset{(ppm\ F114)}{\underline{\qquad\qquad}} \times \frac{1}{1000}$ = _______ ±23 M torr

$P_{F12} = \underset{(P._{AMB})}{\underline{\qquad\qquad}} \times \underset{(ppm\ F12)}{\underline{\qquad\qquad}} \times \frac{1}{1000}$ = _______ ±23 M torr

$P_{N_2} = \underset{(P._{AMB})}{\underline{\qquad\qquad}} \times \underset{(\%N_2)}{\underline{\qquad\qquad}} \times \frac{1}{100}$ = __________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

5.10 REDUNDANT FILAMENT TEST

ACTUAL

a. Outputs

	FIL #1	FIL #2	
H_2	0.4	0.5	torr
O_2	154	154	torr

JMH 1/21/72
STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 18 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002

1/27/72
STAMP/DATE

5. TEST PROCEDURES

5.10a. (Cont)

	ACTUAL FIL #1	ACTUAL FIL #2	
CO_2	0.9	1.6	torr
F114	9	11	M torr
F12	1	1	M torr
N_2	569	569	torr
H_2O	6.0	6.4	torr
$P._{AMB}$	736	736	torr

1/27/72
STAMP/DATE

b. Required Values

REQUIRED

P_{H_2} = 0 ±4 torr

$P_{O_2} = \frac{730}{(P._{AMB} - P_{H_2O})} \times 20.99 \times \frac{1}{100}$ = 153.23 ±10 torr

$P_{CO_2} = \frac{730}{(P._{AMB} - P_{H_2O})} \times 0.03 \times \frac{1}{100}$ = 0.22 ±1.3 torr

$P_{N_2} = \frac{730}{(P._{AMB} - P_{H_2O})} \times 78.03 \times \frac{1}{100}$ = 569.62 torr

P_{H_2O} = Computed Value = 6.57 torr

F114 = 0 ±11 M torr

F12 = 0 ±11 M torr

1/27/72
STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 19 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER__________

____
STAMP/DATE

5. TEST PROCEDURES

5.10b. (Cont)

REQUIRED

All readings within tolerance. (✓) ACPT___REJ___

____
STAMP/DATE

5.11 DEGAS TEST

ACTUAL

b. Outputs rise (✓) ACPT___REJ___

____
STAMP/DATE

5.12 OVERPRESSURE PROTECTION TEST

a. Flow rate (0.05 ±0.01 SCFH) __________SCFH

Ambient Pressure __________ambient __________torr

Ion pump current __________µA

____
STAMP/DATE

b. ON indicator lamp switched off. (✓) ACPT___REJ___

STANDBY indicator lamp off (✓) ACPT___REJ___

Ion pump current (approx 1 mA) (✓) ACPT___REJ___

____
STAMP/DATE

c. Relay sound audible (✓) ACPT___REJ___

Filament off (✓) ACPT___REJ___

____
STAMP/DATE

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 ±0.01 SCFH) 0.045 SCFH

Ambient pressure 737 ambient 737 torr

Ion pump current 125 μA

1/27/72
STAMP/DATE

6.2 FUNCTIONAL TEST DATA SHEET (Sheet 21 of 21)

REFERENCE PARAGRAPH SERIAL NUMBER 002-

JMH. 1/21/72
STAMP/DATE

5. TEST PROCEDURES

ACTUAL

5.13b. Power off at 1603 min

JMH. 1/21/72
STAMP/DATE

c. Power on at 1609 min

Observe pump down (✓) ACPT ✓ REJ ___

JMH - 1/21/72
STAMP/DATE

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

N_2 __________%

O_2 __________%

CO_2 __________%

A __________%

H_2 __________%

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

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

H_2	__________torr
O_2	__________torr
CO_2	__________torr
F114	__________M torr
F12	__________M torr
N_2	__________torr
H_2O	__________torr
$P._{AMB}$	__________torr

____
STAMP/DATE

f. Required Values

REQUIRED

$P_{H_2} = \frac{\_\_\_\_\_\_}{(P._{AMB})} \times \frac{\_\_\_\_\_\_}{(\%H_2)} \times \frac{1}{100}$ = _______ ± 4 torr

$P_{O_2} = \frac{\_\_\_\_\_\_}{(P._{AMB})} \times \frac{\_\_\_\_\_\_}{(\%O_2)} \times \frac{1}{100}$ = _______ ± 10 torr

$P_{CO_2} = \frac{\_\_\_\_\_\_}{(P._{AMB})} \times \frac{\_\_\_\_\_\_}{(\%CO_2)} \times \frac{1}{100}$ = _______ ± 1.3 torr

$P_{F114} = \frac{\_\_\_\_\_\_}{(P._{AMB})} \times \frac{\_\_\_\_\_\_}{(ppm\ F114)} \times \frac{1}{1000}$ = _______ ± 23 M torr

$P_{F12} = \frac{\_\_\_\_\_\_}{(P._{AMB})} \times \frac{\_\_\_\_\_\_}{(ppm\ F12)} \times \frac{1}{1000}$ = _______ ± 23 M torr

____
STAMP/DATE

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

REFERENCE PARAGRAPH SERIAL NUMBER__________

____
STAMP/DATE

5. TEST PROCEDURES

5.14 (Cont)

REQUIRED

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

P_{H_2O} = __________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

ADDENDUM TP 82-0023

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

REFERENCE PARAGRAPH SERIAL NUMBER__________

____
STAMP/DATE

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. __________ STAMP/DATE

c. Limits not exceeded (✓) __________ OK

Data Sheets attached __________ STAMP/DATE

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

(c) Limits not exceeded (✓) __________ OK

Data Sheets attached __________ STAMP/DATE

5.17.2 Test Setup and Procedure

a. Test set up as shown in Figure 1. __________ STAMP/DATE

c. Limits not exceeded (✓) __________ OK

Data Sheets attached __________ STAMP/DATE

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

(c) Limits not exceeded (✓) __________ OK

Data Sheets attached __________ STAMP/DATE