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February 11, 1971

Dr. Peter A. Morris, Director
Division of Reactor Licensing
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Dr. Morris:

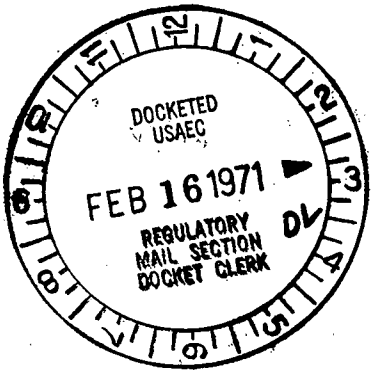
Enclosed are 60 copies of a Summary Technical Report describing the initial integrated leak rate test on Dresden Unit 3 primary containment.

This report is submitted in accordance with the requirements of Section 6.6.E of Appendix A of DPR-25.

Very truly yours,

Wayne L. Stiede

Wayne L. Stiede
Nuclear Licensing Administrator



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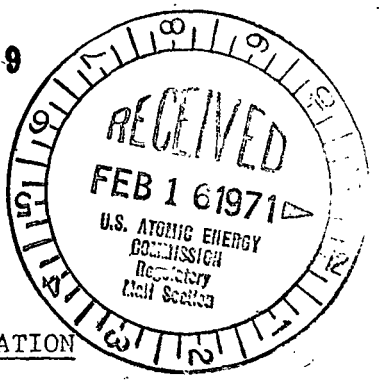


SUMMARY TECHNICAL REPORT OF DRESDEN NUCLEAR POWER STATION

UNIT 3 PRIMARY CONTAINMENT LEAK RATE TEST

This is a summary technical report describing the initial integrated leak rate test of the Dresden Unit #3 Primary Containment, which was conducted from August 22, 1970, through August 26, 1970.

The report is divided into three sections:

Section I Results of Integrated Leak Rate Tests at 25 and 48 psig
Section II Results of Local Leak Rate Tests
Section III Test Procedure, Instrumentation and Uncertainties

Reference: Dresden 3 Primary Containment Leak Rate Preoperational Test Report (A-1)

Section I: Unit #3 Primary Containment Leak Rate Test Results

On August 22 through August 26, 1970, the Unit #3 Primary Containment Leak Rate Test was conducted as required by Section 4.7.A of the Technical Specifications. The test was conducted in four parts:

a) A 24 hour pressure drop test at 48 psig
b) A 4 hour pressure drop test with a calibrated induced leakage at 48 psig
c) A 24 hour pressure drop test at 25 psig
d) A 4 hour pressure drop test with a calibrated induced leakage at 25 psig

Prior to all tests, in which pressurization or depressurization took place, sufficient time was alloted to allow all temperatures to stabilize at the new pressure. Calculation of leakage rate included correction for any changes in temperature and humidity throughout the test. Actual drywell pressure was converted to dry air pressure by subtracting the calculated vapor pressure, which was based on temperature and humidity measurements.

a) 24 hour test at 48 psig

This test was performed from 4:00 p.m. on August 23 through 4:00 p.m. on August 24. The total leakage L_m (48) out of the primary containment was calculated to be 0.232 weight percent of the contained air over the 24 hour test period, which is well within the Technical Specification limit of 1.6 weight percent of the contained air per 24 hours.

b) 4 hour test, with induced leakage, @ 48 psig

This test was performed from 5:00 p.m. to 9:00 p.m. on August 24, 1970. This test was performed to verify the adequacy of the test method and instrumentation to "see" a leakage rate equivalent to that of the Technical Specification limit. The induced leakage rate was 3.00 scfm, or 0.0153 weight percent per hour, making the total leakage rate 0.02495 weight percent per hour. The leakage measured during the test was 0.0259 weight percent per hour, giving a percent error between calculated and actual leakage rates of 10.7% error.

c) 24 hour test at 25 psig

This test was performed from 1:00 a.m. on August 25 to 1:00 a.m. on August 26, 1970. However, due to unstable temperature and humidity conditions during the first half of this test period, only the last 12 hours of the period was used for calculation of test results. The total leakage Lm (25) out of the primary containment was calculated to be 0.0175 weight percent of the contained air over the 12 hour test period.

d) 4 hour test, with induced leakage @ 25 psig

The induced leakage rate was 1.2 scfm, or 0.00968 weight percent per hour, for a total leakage of 0.01112 weight percent per hour. The measured leakage was 156 scfh or .021 weight percent per hour giving a 47 percent error between calculated and measured leakage rates.

Section II: Local Leak Rate Tests

Prior to the containment leak rate test, all testable containment penetrations were individually tested for leakage and all were recorded well within allowable limits specified in License DPR-19, Section 4.7.A.2. f of the Technical Specifications.

Proof leakage rate testing was conducted after the completion of construction of all testable welded seal joints, penetrations, and mechanical closures. The method established for acquiring data for the determination of penetration leakage rates was standardized so as to be repeatable during periodic retests. Data obtained from the change in pressure from the initial test pressure of 50 psig were used to compute a leakage rate.

The test procedure used to obtain a leak rate for the main steam isolation valves varied somewhat from that used in the other penetrations. The results were obtained by establishing a boundary upstream from the inboard valves, pressurizing the enclosed volume, and measuring the leakage through the inboard valves. Once the inboard valves were tested the test volume was expanded to include the outboard valves. Using the

results of the inboard tests and the system makeup rates, a leak rate was computed for the outboard valves.

The maximum permissible leakage rates for each type of penetration and the values obtained as a result of the local leak rate tests are shown in Table 1. The total leakage for all penetrations is summarized in standard cubic feet per hour and represents the final results of the local leak rate testing prior to the integrated test.

Section III. Integrated Leak Rate Test Procedure, Instrumentation and Uncertainties

The test method employed for the Unit #3 Drywell and Pressure Suppression Containment Leak Rate Test was the absolute pressure-temperature method. This method is in agreement with the "AEC Technical Safety Guide, Reactor Containment Leakage Testing and Surveillance Requirements", dated December, 1966, which permits either the absolute pressure-temperature method or the reference vessel system method in accordance with ANS-7.6 standards.

The leak rate test was conducted at two pressure levels: one, at the calculated maximum peak accident pressure of 48 psig, and the other at a pressure of 25 psig.

Closure of containment isolation valves for the test was accomplished by normal means.

The leak rates were calculated using the following formula:

$$L,\% = 100\left[1-\left(\frac{T_1P_2}{T_2P_1}\right)\right]$$

where: $L,\%$ = Primary Containment Leak Rate, %/Test Period
T_1 = Average Containment Air Temp. at start of test, ^oR
T_2 = Average Containment Air Temp. at end of test, ^oR
P_1 = Dry Air Pressure in Containment at start of test, mm of Hg
P_2 = Dry Air Pressure in Containment at end of test, mm of Hg

T_1 and T_2 were calculated using a weighted average of 28 copper constantan thermocouples located inside the containment.

P_1 and P_2 were calculated from the difference of the total absolute pressure in the containment as measured on a mercury manometer, and the water vapor pressure in the containment is calculated based on six dew point cells located in the containment.

Figures 1 and 2 show the locations in the containment of the thermocouples and dew point cells used in the temperature and water vapor pressure calculations.

Appendix "A" contains a copy of the instructions provided to the data takers and copies of the completed data sheets for both the 48 and 25 psig tests.

As indicated by calculations in appendix "B", the calculated measurement uncertainty of leak rate was + .016%/day for both 48 and 25 psig tests.

TABLE 1

LOCAL LEAK RATE TEST RESULTS

	Total Measured	Total Allowed	% of Allowable
Double Gasketed Seals 10% L_{t_o}	0.126 SCFH	58.7 SCFH	0.215
Testable penetrations and isolation valves excluding main steam line isolation valves. 30% L_{t_o} (48)	24.30 SCFH	176.03 SCFH	13.80
Any one penetration or isolation valve except main steam line isolation valves. 5% L_{t_o} (48)	6.07 SCFH*	29.34SCFH	20.69
Main Steam Isolation Valves	4.0 SCFH*	11.55SCFH/Valve	34.63

*Max. Measured leakage on an individual penetration/valve.

APPENDIX A

INSTRUCTIONS FOR RECORDING AND CALCULATING DATA

1) Record the following data hourly:
   a: ambient temperature.
   b: barometric pressure
   c: drywell * pressure suppression chamber pressure from gauge
   d: scale reading of right and left legs of Hg. manometer.
   e: temperature of Hg. manometer.
   f: air temperatures inside drywell and pressure suppression chamber.

2) The following plots are to be made in the field at the time of the test.

   a: Ambient temperature versus time.
   b: Average temperature of the contained air versus time.
   c: Absolute dry air pressure (corrected to a base temperature) versus time.

3) A table of reduced data, having columns No. 1 thru 18, are given below and is to be updated every hour during the leakage rate test.

Column [1] day

Column [2] hour

Column [3] ambient temperature=temperature of barometer (^{o}F)

Column [4] temperature of Hg. manometer (^{o}F)

Column [5] correction factor for mercury barometer:
= 0.000100452 x [4] x 1.003224621(figure No.A1)

Column [6] barometric pressure as read from barometer (mm of Hg.)

Column [7] barometric pressure (mm of Hg. at zero ^{o}C)=[5]x[6]

Column [8] difference in mercury elevations in Hg. manometer at ambient temperature (mm) (See figure A2)

Column [9] correction factor for Hg. manometer = - 0.000100452 x [4] x 1.003224621 (Fig. A1)

Column [10] total absolute pressure in vessel including water vapor pressure (mm of Hg at zero ^{o}C) =[8]x[9]

Column [11] average temperature of suppression chamber (^{o}F)
$=\frac{1}{2} \times \sum$(readings from Tc)

Column [12] average temperature of drywell (^{o}F)
1/26 x $\sum$(readings from Tc)

Column [13] average temperature of containment volume (^{o}F)
= .574 x [12] = .426 x [11]

for derivation of .574 and .426 factors see figure A4.

Column [14] water vapor pressure in suppression chamber (mm of Hg.)

Read from the table of temperatures and pressures at saturation shown on figure A3. Temperature T_1 defined below is to be used to enter the table.

$$T_1 = [11] - \left[\frac{(TE27\text{-}DPE4) + (TE28\text{-}DPE3)}{2}\right]$$

Column [15] water vapor pressure in drywell (mm of Hg.)

Read from the table of temperatures and pressures at saturation shown on figure A3. Temperature T_2 defined below is to be used to enter the table.

$$T2 = [12] - \left[\frac{(TE9\text{-}DPE1) + (TE3\text{-}DPE2) + (TE18\text{-}DPE6) + (TE11\text{-}DPE5)}{4}\right]$$

Column [16] average water vapor pressure in the total containment volume (mm of Hg) = .574 x [15] + .426 x [14]

Column [17] dry air pressure (absolute) in the total containment volume at temperature [13] (mm of Hg at 0°C)

Column [18] hourly indication of leakage rate(percent)

$$= 1 - \left[\frac{([13] \text{ @ previous hour} + R^{\circ})\ ([17] \text{ @ current hour})}{([13] \text{ @ current hour} + R^{\circ})\ ([17] \text{ @ previous hour})}\right] \times 100$$

where: $R^{\circ} = 459.67$ (converts °F to absolute)

APPENDIX B

UNCERTAINTY IN MEASUREMENT OF DRESDEN 3

PRIMARY CONTAINMENT LEAK RATE

Computation of Leak Rate

$$L, \% = 100\left[1 - \frac{T_1}{T_2}\frac{P_2}{P_1}\right],$$

where:
- $L, \%$ = Primary containment leak rate, %/hr.
- T_1 = Avg. air temp in primary containment at last hourly reading, °R
- T_2 = " " " " " " current " " , °R
- P_1 = Dry air pressure in primary containment at last hourly reading
- P_2 = " " " " " " current " "

The uncertainty, or standard deviation $\sigma(L)$, in the calculated value of leak rate is determined from the variance:

$$\sigma^2(L) = \left(\frac{\partial L}{\partial P_1}\right)^2\sigma^2(P_1) + \left(\frac{\partial L}{\partial P_2}\right)^2\sigma^2(P_2) + \left(\frac{\partial L}{\partial T_1}\right)^2\sigma^2(T_1) + \left(\frac{\partial L}{\partial T_2}\right)^2\sigma^2(T_2)$$

$$\frac{\partial L}{\partial P_1} = \frac{T_1}{T_2}\frac{P_2}{P_1^2}\,; \quad \frac{\partial L}{\partial P_2} = -\frac{T_1}{T_2 P_1}\,; \quad \frac{\partial L}{\partial T_1} = -\frac{P_2}{T_2 P_1}\,; \quad \frac{\partial L}{\partial T_2} = \frac{T_1 P_2}{T_2^2 P_1}$$

1. Uncertainty in dry air pressure:

$$P_{\text{Dry Air}} = P_{\text{barometric}} \times \text{C.F.} - P_{H_2O \text{ vapor}}$$

Manometers JM50G120BV2B, S/N 2-079A and JM50G130BV2B, S/N 11-199A (page 26 and 27, Pre-Op A-1) have range 0-3302 mm and certified accuracy of ±0.1 mm. Assume readability is ±2mm. Then

$$\sigma(P_{\text{Dry Air}}) = \left[(0.1/3302)^2 + (2/3302)^2\right]^{1/2}$$

$$= 0.06\%$$

2. Uncertainty in Avg. air temperature in primary containment

Accuracy of thermocouples ± 1% Assume ±1% accuracy of readout. Thus σ(temp) = ± 1.4%

Avg. air temperature in primary containment, T, is calculated:

$T = 0.574\ \bar{T}_{Drywell} + 0.426\bar{T}_{torus}$

$\sigma(\bar{T}_{Drywell}) = \frac{1.4}{\sqrt{20}} = 0.31\%$

$\sigma(\bar{T}_{Torus}) = \frac{1.4}{\sqrt{6}} = 0.57\%$

Thus $\sigma^2(T) = (0.574)^2\ (0.31)^2 + (0.426)^2\ (0.57)^2$

$\sigma(T) = 0.091\%$

3. Evaluation of uncertainty in primary containment leak rate:

$$\sigma^2(L) = \left(\frac{\partial L}{\partial P_1}\right)^2 \sigma^2(P_1) + \left(\frac{\partial L}{\partial P_2}\right)^2 \sigma^2(P_2) + \left(\frac{\partial L}{\partial T_1}\right)^2 \sigma^2(T_1) + \left(\frac{\partial L}{\partial T_2}\right)^2 \sigma^2(T_2)$$

For small leak rates:

$$\frac{\partial L}{\partial P_1} = \frac{T_1}{T_2}\frac{P_2}{P_1} \sim \frac{1}{P_1}\ ;\ \frac{\partial L}{\partial P_2} = \frac{-T_1}{T_2 P_1} \sim \frac{-1}{P_1}\ ;\ \frac{\partial L}{\partial T_1} = \frac{-P_2}{T_2 P_1} \sim \frac{-1}{T_2}$$

$$\frac{\partial L}{\partial T_2} = \frac{T_1}{T_2}\frac{P_2}{P_1^2} \sim \frac{1}{T_2}$$

$\therefore$ $\sigma^2(L) = (1/P_1)^2 \times (0.06\%)^2 + (-1/P_1)^2 \times (0.06\%)^2 + (-1/T_2)^2 \times (0.091)^2 + (1/T_2)^2 \times (0.091)^2 = (2/P_1^2) \times (0.06\%)^2 + (2/T_2^2) \times (0.091)^2$

For 48 psig test: $P_1 \cong 3200$ mm, $T_2 \cong 535^\circ R$

$\sigma^2(L) = \left[2/(3200)^2\right] (0.06\%)^2 + \left[2/(535)^2\right](0.091)^2$

$= \left[2/(3200)^2\right] (1.92\text{mm})^2 + \left[2/(535)^2\right] (1.48^\circ R)^2$

$= \left[20 \times 10^{-8} \times 3.7\right] + \left[6.98 \times 10^{-6} \times 0.23\right]$

$= 72 \times 10^{-8} + 161 \times 10^{-8}$

$= 233 \times 10^{-8}$

$\sigma(L)_{48} = 15.3 \times 10^{-4} = 0.0015\%$

$\therefore$ L = 0.232% ± 0.003% or

$=_b$ 2726 scf/day ± 35 scf/day

For 25 psig Test $P_1 \cong$ 2000 mm, $T_2 \cong 530^{\circ}R$

$$\sigma^2(L) = \left[2/(2000)^2\right](0.06\%)^2 + \left[2/(530)^2\right](0.091)^2$$

$$= \left[2/(2000)^2\right](1.2\text{mm})^2 + \left[2/(530)^2\right](.48^{\circ}R)^2$$

$$= \left[0.5 \times 10^{-6} \times 1.44\right] + \left[7.1 \times 10^{-6} \times 0.23\right]$$

$$= 72 \times 10^{-8} + 164 \times 10^{-8}$$

$$= 236 \times 10^{-8}$$

$$(L_{25}) = 15.3 \times 10^{-4} = 0.0015\%$$

$$\therefore L = 0.0350\% \pm 0.003\% \text{ or}$$

$$= 260 \text{ scf/day} \pm 22.3 \text{ scf/day}$$

Figure No.(1)

LOCATION OF THERMOCOUPLES, RESISTANCE THERMOMETERS AND DEW POINT INDICATORS

UNIT #3

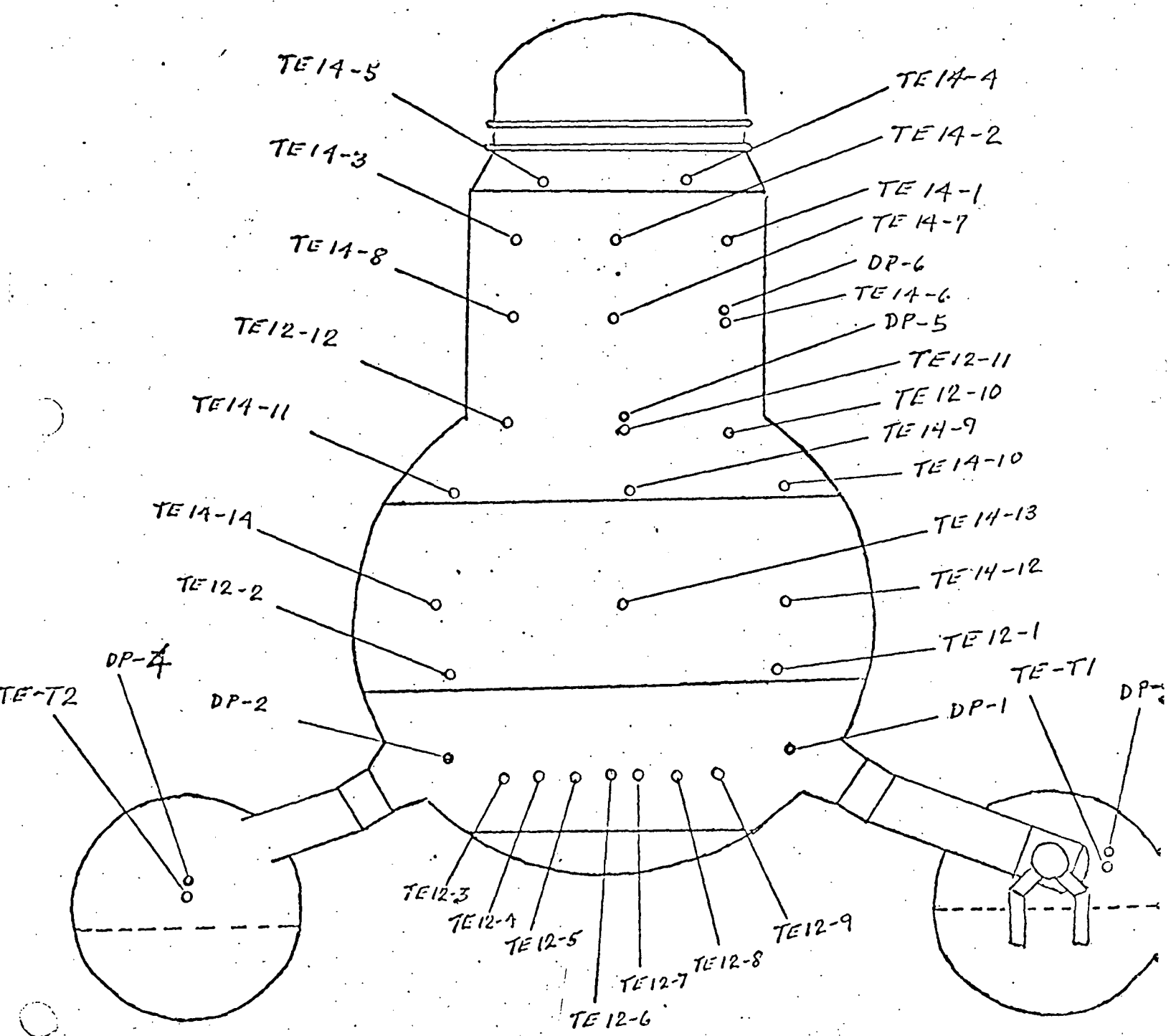
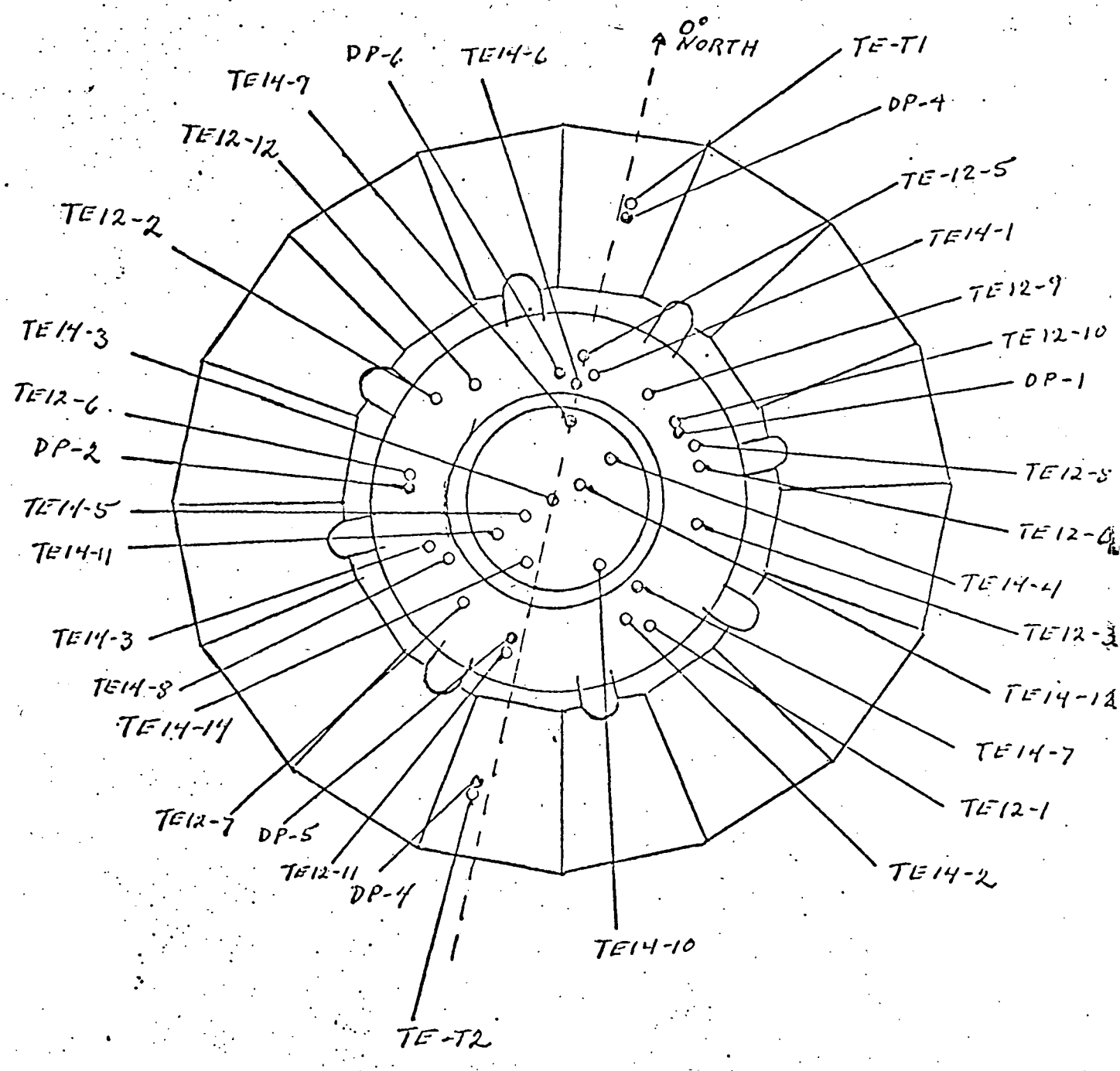


Figure No.(2)

LOCATION OF THERMOCOUPLES, RESISTANCE THERMOMETERS AND DEW POINT INDICATORS

UNIT #3



PRESSURE RELATED INSTRUMENTATION AND PIPING REQUIRED FOR PRESSURE TESTS

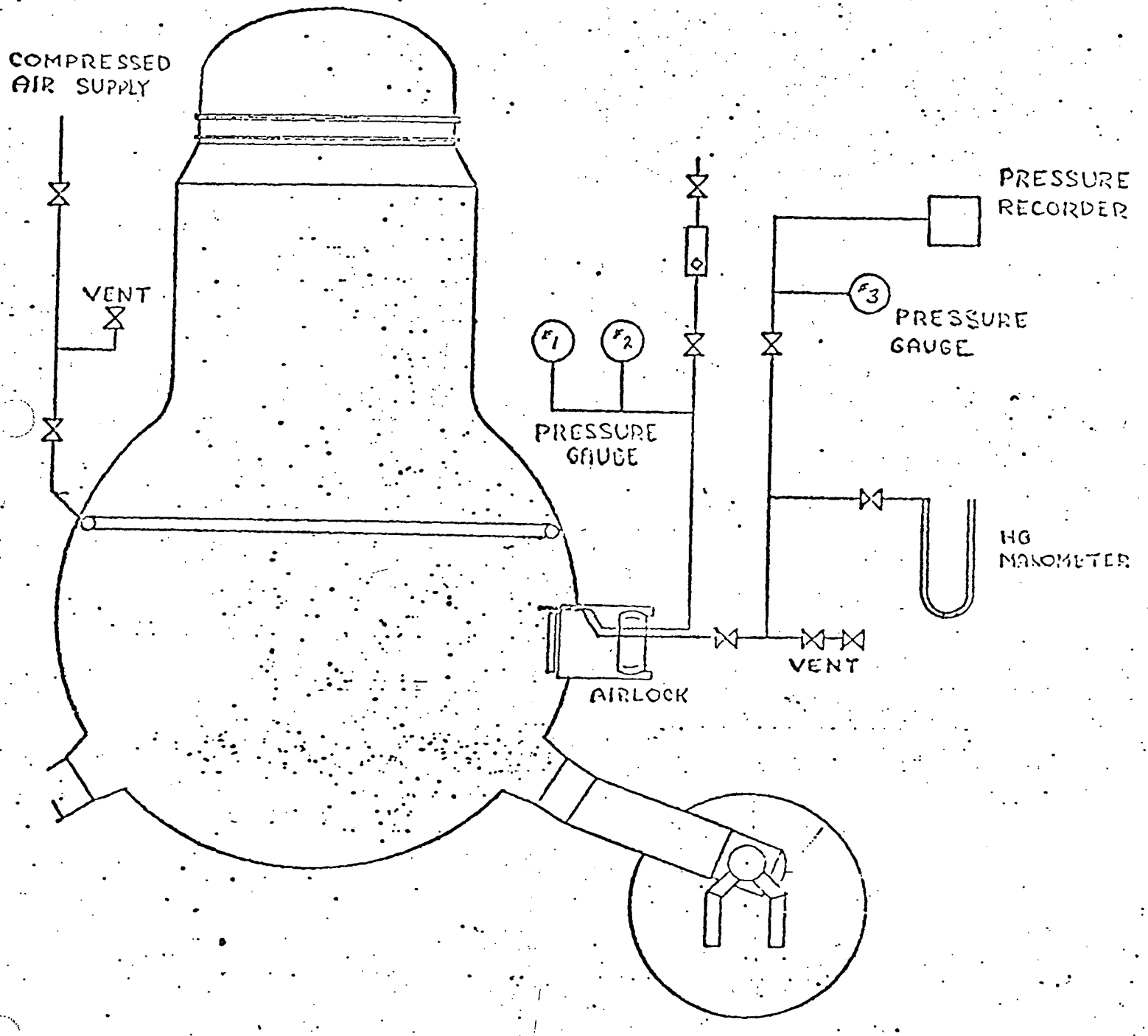


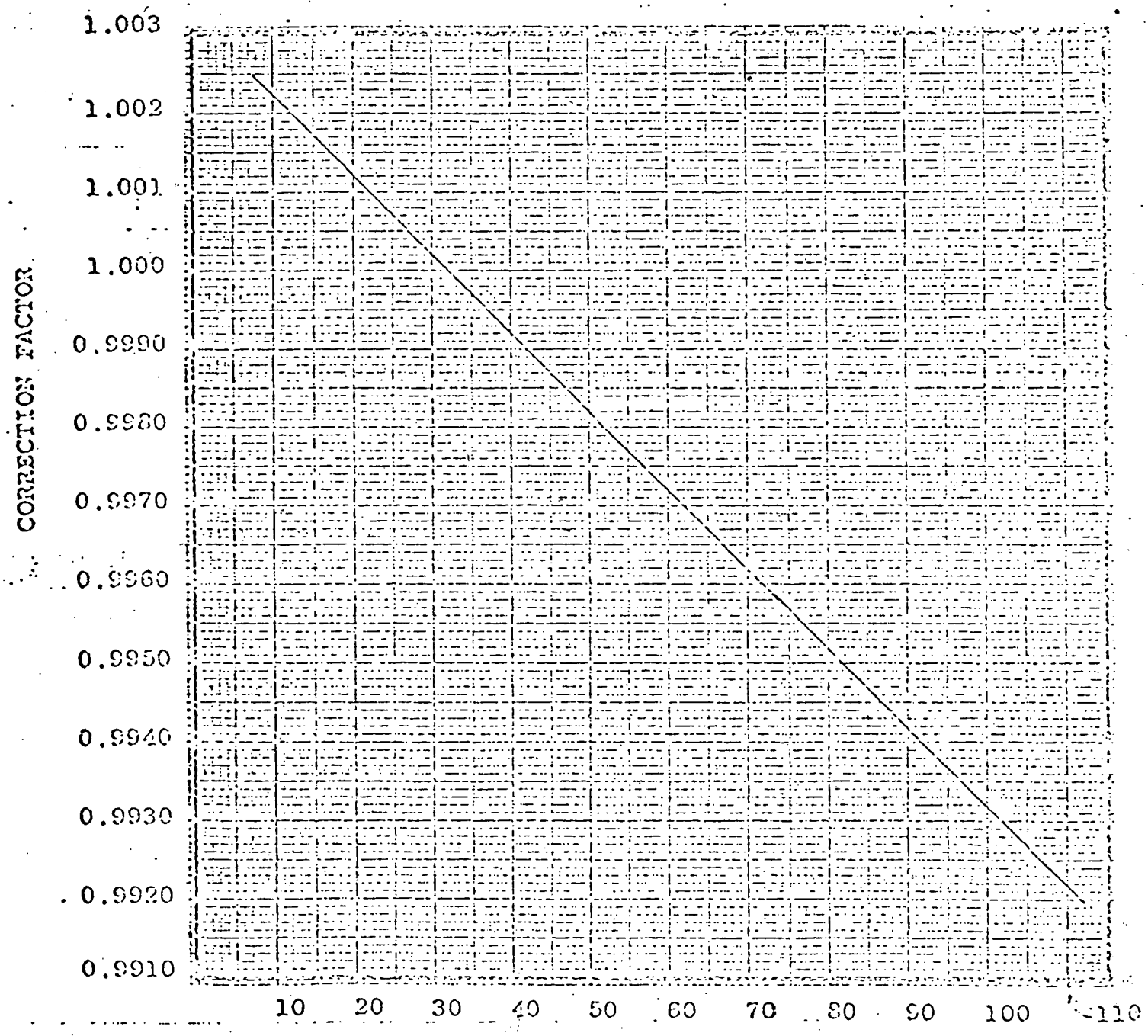
Figure A1

MERCURY MANOMETER CORRECTION FACTOR VS TEMPERATURE

Δmm = difference in mercury level in manometer legs (mm)

CF = correction factor as determined below

Pressure (psig) = 0.019338 x Δmm x C.F.



The above plot is approximately a straight line with the equation: CF = -0.000100452 x T + 1.003224321

Figure A2

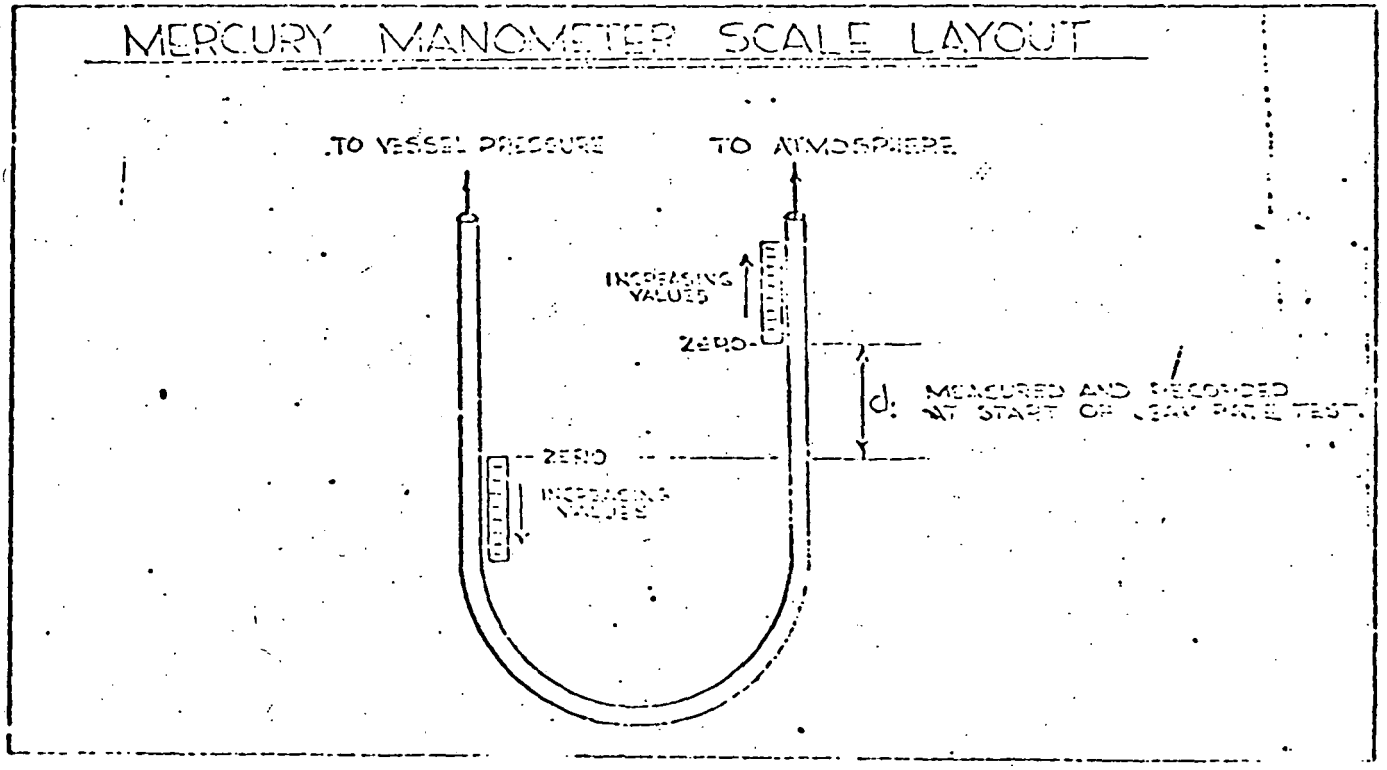

MERCURY MANOMETER SCALE LAYOUT
TO VESSEL PRESSURE
TO ATMOSPHERE
INCREASING VALUES
ZERO
d: MEASURED AND RECORDED AT START OF LEAK RATE TEST.
ZERO
INCREASING VALUES

Figure A3

SATURATION TEMPERATURES AND PRESSURES

Temp. °F	Pressure mm Hg.	Temp. °F	Pressure mm Hg	Temp. °F	Pressure mm Hg	Temp. °F	Pressure mm Hg
1	1.0074	26	3.4696	51	9.5532	76	22.9799
2	1.0612	27	3.6347	52	9.9131	77	23.7551
3	1.1176	28	3.8100	53	10.2821	78	24.5532
4	1.1768	29	3.9903	54	10.6608	79	25.3746
5	1.2390	30	4.1783	55	11.0653	80	26.2204
6	1.3040	31	4.3764	56	11.4747	81	27.0891
7	1.3721	32	4.5796	57	11.8974	82	27.9832
8	1.4435	33	4.7696	58	12.3337	83	28.9052
9	1.5182	34	4.9647	59	12.7838	84	29.8501
10	1.5966	35	5.1669	60	13.2496	85	30.8254
11	1.6784	36	5.3762	61	13.7279	86	31.8262
12	1.7643	37	5.5931	62	14.2225	87	32.8549
13	1.8542	38	5.8176	63	14.7328	88	33.9115
14	1.9479	39	6.0500	64	15.2585	89	34.9987
15	2.0462	40	6.2908	65	15.8011	90	36.1163
16	2.1491	41	6.5400	66	16.3604	91	37.2643
17	2.2565	42	6.7978	67	16.9370	92	38.4454
18	2.3689	43	7.0645	68	17.5313	93	39.6570
19	2.4864	44	7.3403	69	18.1437	94	40.9016
20	2.6086	45	7.6258	70	18.7747	95	42.1808
21	2.7361	46	7.9210	71	19.4249	96	43.4950
22	2.8702	47	8.2263	72	20.0947	97	44.8437
23	3.0124	48	8.5418	73	20.7846	98	46.2290
24	3.1572	49	8.8679	74	21.4950	99	47.6479
25	3.3096	50	9.2050	75	22.2265	100	49.1034

Figure A4

Deviation of factors used in weighted averages

[A] : Total volume of drywell

-Misc. steel volume
-Concrete slug volume

158, 236 ft^3

[B] : Total volume of suppression chamber

-Misc. steel volume
-Volume of water 112, 203

117,245 ft^3

[C] : Volume of vent lines between drywell and suppression chamber included in [B]

[D] : Total volume [A] + [B] + [C] 275481 ft^3

Percent total free volume drywell for total containment

% = [A] / [D] 57.4%

Percent total free volume suppression chamber and vent lines for total containment

$$\% = \frac{[B] + [C]}{[D]}$$ 42.6%

2 HOUR	3 AMBIENT TEMP (°F)	4 TEMP OF HG MANOMETER (°F)	5 CORRECTION FACTOR FOR HG MANOMETER	6 BAROMETRIC PRESSURE AS READ FROM BAROMETER (MM of HG)	7 BAROMETRIC PRESSURE (MM of HG @ 0°C)	8 [illegible] HG MANOMETER (MM)	9 CORRECTION FACTOR FOR HG MANOMETER	10 TOTAL ABS. PRESS. IN VESSEL IN WATER VAPOR [illegible] (@ 0°C)	11 AVE. TEMP OF SUPPRESSION CHAMBER (°F)	12 AVE. TEMP OF DRYWELL (°F)	13 AVE. TEMP OF CONTAINMENT VOLUME (°F)	14 WATER VAPOR PRESS. IN SUPPRESSION CHAMBER (MM of HG)	15 WATER VAPOR PRESSURE IN DRYWELL (MM of HG)	16 AVE. WATER VAPOR PRESSURE IN CONTAINMENT VOLUME (MM of HG)	17 DRY AIR PRESS. (ABS) IN CONTAINMENT VOL. @ TEMP [5] (MM of HG @ 0°C)	18 HOURLY INTEGRATED OF LEAKAGE RATE (%)
0000																
0100																
0200																
0300																
0400																
0500																
0600																
0700																
0800																
0900																
1000																
1100																
1200																
1300																
1400																
1500																
1600	79.0	78.2	.99538	748.6	745.1	3225.5	.99538	3210.66	79.00	84.52	82.16	22.98	29.06	26.47	3184.13	
1700	79.0	78.0	.99539	747.3	743.9	3222.1	.99539	3207.25	79.00	84.50	82.16	24.15	28.65	26.73	3180.52	+.1130
1800	78.0	77.5	.99544	747.5	744.1	3220.5	.99544	3205.81	78.50	84.38	81.88	23.61	28.63	26.50	3179.32	-.0140
1900	77.0	77.5	.99544	747.5	744.1	3220.0	.99544	3205.32	78.50	84.12	81.73	23.48	28.63	26.44	3178.88	-.0130
2000	78.0	77.0	.99549	747.8	744.4	3219.0	.99549	3204.48	78.20	83.98	81.52	23.33	28.44	26.26	3178.22	-.0180
2100	78.0	77.0	.99549	747.3	743.9	3218.0	.99549	3203.49	78.15	83.84	81.40	23.20	28.12	26.02	3177.47	+.0020
2200	78.0	77.0	.99549	748.1	744.2	3216.6	.99549	3202.09	78.65	83.76	81.33	23.20	28.24	26.09	3176.00	+.0330
2300	76.0	77.0	.99549	748.2	744.8	3216.0	.99549	3201.50	78.65	83.68	81.28	24.15	29.02	26.95	3174.55	+.0364
2400	76.0	77.0	.99549	748.1	744.7	3215.3	.99549	3200.80	77.95	83.48	81.16	22.81	29.21	26.57	3174.29	-.0130

48# TEST 8/23 – 8/24/25 68 PAGE # 3

2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Hour	Ambient Temp (°F)	Temp of HG ... (°F)	Correction Factor for HG [illegible]	Barometric Pressure as Read [illegible] (MM of HG)	Barometric Pressure (... @ 0°C)	[illegible] in HG Manometer (MM)	Correction Factor for HG [illegible]	Corrected [illegible] Water Manometer (... @ 0°C)	Avg. Temp of Suppression Chamber (°F)	Avg. Temp of Drywell (°F)	Avg. Temp of Containment Volume (°F)	Water Vapor Press. in Suppression Chamber (MM of HG)	Water Vapor Pressure in Drywell (MM of HG)	Avg. Water Vapor Pressure in Containment Volume (MM of HG)	Dry Air Press. (Abs) in Containment Vol. @ [illegible] (MM HG @ 0°C)	Hourly Increment of Leakage Rate (%)
0000																
0100	77.5	76.5	.99554	749.1	745.8	3214.3	.99554	3199.96	77.95	83.39	81.07	22.57	28.14	25.77	3174.05	−.0089
0200	77.5	76.5	.99554	748.7	745.4	3213.2	.99554	3198.87	77.70	83.26	80.86	23.10	27.93	25.87	3173.00	−.0063
0300	77.5	76.5	.99554	749.0	745.7	3212.6	.99554	3198.27	77.65	83.21	80.84	23.21	27.90	25.40	3172.37	+.0160
0400	77.0	76.0	.99559	749.1	745.8	3211.5	.99559	3197.34	77.65	83.14	80.80	22.44	27.87	25.77	3171.57	+.01[illegible]
0500	76.5	75.5	.99564	749.2	745.9	3211.0	.99564	3197.00	77.38	83.12	80.76	22.98	27.43	25.82	3171.18	−.0060
0600	76.5	75.5	.99564	749.5	746.2	3210.0	.99564	3196.00	77.30	83.08	80.62	22.57	27.83	25.54	3170.41	+.0090
0700	76.5	75.5	.99564	750.0	746.7	3209.3	.99564	3195.31	77.25	83.02	80.56	22.45	27.66	25.44	3169.87	+.0060
0800	77.0	75.5	.99564	750.1	746.8	3208.7	.99564	3194.71	77.15	83.02	80.52	22.57	26.93	25.07	3169.64	−.0001
0900	77.0	76.0	.99559	750.2	746.9	3208.4	.99559	3194.25	77.05	82.88	80.38	23.13	27.60	25.70	3168.55	+.0080
1000	78.0	77.0	.99549	750.5	747.1	3208.2	.99549	3193.73	77.05	82.88	80.40	22.64	27.63	25.50	3168.23	+.0140
1100	78.0	77.0	.99549	750.1	746.7	3208.1	.99549	3193.63	77.15	82.86	80.43	22.57	27.64	25.51	3168.12	+.0090
1200	78.0	77.0	.99549	750.1	746.7	3207.6	.99549	3193.13	77.10	82.84	80.39	22.49	27.68	25.47	3167.66	+.0080
1300	78.5	77.5	.99544	750.0	746.6	3207.4	.99544	3192.77	77.10	82.77	80.35	22.38	27.09	25.08	3167.69	−.0054
1400	78.5	77.5	.99544	750.5	747.1	3207.3	.99544	3192.61	77.25	82.78	80.42	22.75	27.87	25.69	3166.58	+.0360
1500	79.0	78.0	.99539	750.5	747.1	3207.2	.99539	3192.41	77.35	82.79	80.47	22.75	27.67	25.57	3167.04	+.00[illegible]
1600	79.0	78.0	.99539	749.0	745.5	3207.1	.99539	3192.32	77.35	82.78	80.47	22.75	27.62	25.55	3166.96	+.0025
1700																
1800																
1900													Total / 24 hrs.			+.2317
2000																
2100																
2200																
2300																
2400																

48# TEST 8/24/70 UNIT #3

045 lb. TEST PRESSURE

2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
HOUR	TC 28 AMBIENT TEMP (°F)	TC 27 TEMP OF HG MANOM-ETER (°F)	CORRECTION FACTOR FOR HG BAROMETER	BAROMETRIC PRESSURE AS READ FROM BAROMETER (MM OF HG)	BAROMETRIC PRESSURE (MM OF HG @ 0°C)	DIFF. IN HG. LEV. IN HG MANOM-ETER @ AMB. TEMP (MM)	CORRECTION FACTOR FOR HG MANOM-ETER	TOTAL ABS. PRESS. IN VESSEL INCL WATER VAPOR PRES. (MM OF HG @ 0°C)	AVE. TEMP OF SUPPRESSION CHAMBER (°F)	AVE. TEMP OF DRYWELL (°F)	AVE. TEMP OF CONTAIN-MENT VOLUME (°F)	WATER VAPOR PRESS. IN SUPP-RESSION CHAMBER (MM OF HG)	WATER VAPOR PRESSURE IN DRYWELL (MM OF HG)	AVE. WATER VAPOR PRESSURE IN CON-TAINMENT VOLUME (MM OF HG)	DRY AIR PRESS. (ABS) IN CON-TAINMENT VOL. @ TEMP 73 (MM OF HG @ 0°C)	HOURLY INDICATED OF LEAKAGE RATE (%)
0000																
0100																
0200																
0300																
0400																
0500																
0600																
0700																
0800																
0900																
1000																
1100																
1200																
1300																
1400																
1500																
1600																
1700	79.0	78.0		749.3		3227.0	.99545	3192.41	72.65	82.87	80.66	22.83	27.74	25.65	3166.76	
1800	78.5	78.0		748.6		3206.8	.99545	3192.41	72.6	82.87	80.64	23.02	27.48	25.58	3166.63	+.00071
1900	79.0	78.0		749.1		3206.2	.99545	3191.61	72.55	82.95	80.65	22.57	27.58	25.45	3166.16	+.01720
2000	78.5	78.0		748.9		3205.3	.99545	3190.12	72.75	82.97	80.75	22.60	27.54	25.44	3165.26	+.04683
2100	78.5	78.0		742.2		3204.1	.99545	3189.52	72.75	82.99	80.76	22.38	27.70	25.43	3164.09	+.04060
2200																
2300													TOTAL/24HRS			+.10371
2400																

@ 25 lb. TEST PRESSURE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
DY	HOUR	AMBIENT TEMP (°F)	TEMP OF HG MANOMETER (°F)	CORRECTION FACTOR FOR HG BAROMETER	BAROMETRIC PRESSURE AS READ FROM MANOMETER (MM of HG)	BAROMETRIC PRESSURE (MM of HG @ 0°C)	ELEV. IN HG MANOMETER @ 0°C (MM)	CORRECTION FACTOR FOR HG MANOMETER	TOTAL ABS. PRESS. IN VESSEL INC. WATER VAPOR PRESS. (MM of HG @ 0°C)	AVG. TEMP OF SUPPRESSION CHAMBER (°F)	AVG. TEMP OF DRYWELL (°F)	AVG. TEMP OF CONTAINMENT VOLUME (°F)	WATER VAPOR PRESS. IN SUPPRESSION CHAMBER (MM of HG)	WATER VAPOR PRESSURE IN DRYWELL (MM of HG)	AVG. WATER VAPOR PRESSURE IN CONTAINMENT VOLUME (MM of HG)	DRY AIR PRESS. (ABS) IN CONTAINMENT VOLUME [13] (MM of HG @ 0°C)	HOURLY INCREASE OF LEAKAGE RATE (%)
	0000																
	0100	78.0	77.0	.99549	750.0	746.6	2053.2	.99549	2048.91	76.20	81.90	79.47	22.26	26.29	24.58	2025.34	—
	0200	78.0	77.0	.99549	750.0	746.6	2061.5	.99549	2052.20	76.35	81.95	79.56	22.04	26.48	24.54	2027.61	-.095
	0300	78.0	77.0	.99549	749.8	746.4	2062.3	.99549	2053.00	76.50	82.05	79.68	22.26	26.70	24.81	2028.19	-.006
	0400	78.0	77.0	.99549	749.9	746.5	2062.0	.99549	2052.70	76.60	82.07	79.74	22.26	26.80	24.87	2027.85	+.024
	0500	77.5	76.5	.99554	749.1	745.8	2063.0	.99554	2053.50	76.70	82.10	79.81	22.26	27.07	25.02	2028.29	-.033
	0600	77.5	76.5	.99554	750.2	746.9	2062.9	.99554	2053.70	76.70	82.20	79.84	22.26	27.16	25.07	2028.63	+.010
	0700	77.5	76.5	.99554	750.3	747.0	2062.5	.99554	2053.50	76.70	82.14	79.82	22.26	27.16	25.07	2028.23	+.016
	0800	78.0	77.0	.99549	750.6	747.2	2062.7	.99549	2053.40	76.70	82.15	79.85	22.19	27.13	25.03	2028.37	-.005
	0900	78.0	77.0	.99549	751.0	747.6	2063.2	.99549	2053.90	76.75	82.05	79.79	22.19	27.22	25.08	2028.83	-.030
	1000	78.5	77.5	.99544	751.1	747.7	2063.6	.99544	2054.19	76.75	82.10	79.82	22.12	27.24	25.06	2029.13	-.009
	1100	79.0	78.0	.99539	751.2	747.7	2063.6	.99539	2054.09	76.75	82.05	79.79	22.30	27.34	25.19	2028.90	+.006
	1200	79.5	79.0	.99532	750.4	746.9	2063.5	.99532	2053.84	76.75	82.10	79.82	22.26	27.30	25.15	2028.69	+.016
	1300	79.0	78.0	.99539	750.8	747.3	2063.1	.99539	2054.19	76.90	82.12	79.90	22.45	27.12	25.13	2029.06	-.0034
	1400	79.0	78.0	.99539	751.8	747.3	2064.0	.99539	2054.98	76.90	82.15	79.91	22.45	27.17	25.16	2029.32	-.010
	1500	79.0	78.0	.99539	750.0	746.5	2064.2	.99539	2054.68	76.90	82.19	79.94	22.19	27.33	25.14	2028.54	-.005
	1600	79.0	78.0	.99539	750.0	746.5	2064.0	.99539	2054.49	77.00	82.20	79.98	22.45	27.32	25.25	2029.23	+.0227
	1700	79.5	78.5	.99534	750.0	746.5	2064.3	.99534	2054.68	77.00	82.23	80.00	22.45	27.35	25.26	2029.42	-.005
	1800	79.5	78.5	.99534	750.0	746.5	2064.3	.99534	2054.69	77.00	82.17	79.97	22.12	27.40	25.15	2029.53	-.011
	1900	80.0	78.5	.99534	749.9	746.9	2064.1	.99534	2054.98	77.10	82.20	80.03	22.19	27.32	25.13	2029.35	+.020
	2000	80.0	79.0	.99532	749.6	746.1	2064.9	.99532	2054.74	77.10	82.20	80.05	22.12	27.32	25.10	2029.64	-.0142
	2100	80.0	79.0	.99532	749.9	745.9	2064.3	.99532	2054.64	77.10	82.22	80.04	22.34	27.38	25.23	2029.41	+.014
	2200	79.5	78.5	.99534	750.3	746.8	2064.3	.99534	2054.69	77.10	82.22	80.04	22.34	27.38	25.23	2029.45	-.002
	2300	79.5	78.5	.99534	750.3	746.9	2064.0	.99534	2054.38	77.00	82.21	79.99	22.45	27.37	25.27	2029.11	+.008
	2400																

@25 lb. TEST PRESSURE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
DAY	HOUR	Te 26 AMBIENT TEMP (°F)	Te 27 TEMP OF HG MANOMETER (°F)	CORRECTION FACTOR FOR HG BAROMETER	BAROMETRIC PRESSURE AS READ FROM CONTAINMENT (MM of HG)	BAROMETRIC PRESSURE (MM of HG @ 0°C)	DIFF IN HG. ELEV. IN HG MANOMETER & BAROMETER (MM)	CORRECTION FACTOR FOR HG MANOMETER	TOTAL ABS PRESS. IN VESSEL INC WATER VAPOR PRESS (MM of HG @ 0°C)	AVE. TEMP OF SUPPRESSION CHAMBER (°F)	AVE. TEMP OF DRYWELL (°F)	AVE. TEMP OF CONTAINMENT VOLUME (°F)	WATER VAPOR PRESS. IN SUPPRESSION CHAMBER (MM of HG)	WATER VAPOR PRESSURE IN DRYWELL (MM of HG)	AVE. VAPOR PRESSURE IN CONTAINMENT VOLUME (MM of HG)	DRY AIR PRESS. (ABS) IN CONTAINMENT VOL @ TOTAL PS (MM of HG @ 0°C)	HOURLY INDICATED OR LEAKAGE RATE (%)
	0000	79.5	77.0	.99549	750.5	747.1	2064.2	.99549	2054.89	77.2	82.3	86.13	22.64	27.38	25.36	2029.54	+.005
	0100	79.0	77.6	.99559	738.4	747.1	2064.1	.99559	2,1700	77.2	82.3	82.13	22.64	27.38	25.36	2029.64	-.005
	0200																
	0300																
	0400												TOTAL FOR LAST				+.0175
	0500												12 HRS of TEST				
	0600																
	0700												SEE DATA PLOT				
	0800												FOR STEADY STATE				
	0900												hourly LEAKAGE				
	1000																
	1100																
	1200																
	1300																
	1400																
	1500																
	1600																
	1700																
	1800																
	1900																
	2000																
	2100																
	2200																
	2300																
	2400																

25 # TEST 65 8/26/70 SHEET #2

@ 15. TEST PRESSURE

2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
HOUR	Te 20 AMBIENT TEMP (°F)	Te 27 TEMP OF HG MANOMETER (°F)	CORRECTION FACTOR FOR HG BAROMETER	BAROMETRIC PRESSURE AS READ FROM BAROMETER (MM of HG)	BAROMETRIC PRESSURE (MM of HG @ 0°C)	DIFF IN HG. FROM MANOMETER (MM)	CORRECTION FACTOR FOR HG MANOMETER	TOTAL ABSOL. PRESS. IN VESSEL INCL. WATER VAPOR PRESS. (MM of HG @ 0°C)	AVE. TEMP. OF SUPPLY CHAMBER (°F)	AVE. TEMP. OF CAPTIVELL (°F)	AVE. TEMP. OF CONTAINMENT VOLUME (°F)	VAPOR PRESS. OF WATER VAPOR AT AVE. IN SUSPENSION CHAMBER (MM of HG)	VAPOR PRESS. OF WATER VAPOR IN CONTAINMENT VOLUME (MM of HG)	AVE. WATER VAPOR PRESSURE IN CONTAINMENT VOLUME (MM of HG)	TOTAL ABSOL. PRESS. IN CONTAINMENT VOLUME (MM of HG @ 0°C)	HOURLY LEAKAGE OF TEST GAS RATE (%)
0000																
0100	79	76		756.4		2064.1	.99553	2055.00	77.2	82.3	80.13	22.64	27.38	25.36	2029.69	-
0200	79	76		756.4		2064.0	.99554	2054.90	77.2	82.34	80.15	22.64	27.46	25.63	2029.27	T.022
0300	78	77		756.0		2063.4	.99549	2054.09	77.2	82.26	80.10	22.64	27.35	25.34	2028.75	T.016
0400	78.5	78		756.4		2063.2	.99539	2053.69	77.2	82.30	80.13	22.23	27.30	25.14	2028.55	T.016
0500	78.5	77.5		756.0		2062.8	.99544	2053.39	77.2	82.34	80.15	22.64	27.42	25.38	2028.01	T.030
0600																
0700																
0800													TOTAL FOR			
0900													4 hours			.024 %
1000																
1100																
1200																
1300																
1400																
1500																
1600																
1700																
1800																
1900																
2000																
2100																
2200																
2300																
2400																

25# TEST 8/26/70 -65- 4 HRS INDUCED LEAKAGE