Dr 4.

FEB 2 1 1996 (2) ENGINEERING DATA TRANSMITTAL

Page 1 of 1

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2. To: (Receiving Organization)	3. From: (Originating Organization)	4. Related EDT No.:
Distribution	Analytical Services, #5A620	n/a
5. Proj./Prog./Dept./Div.:	6. Cog. Engr.:	7. Purchase Order No.:
241-AW Vent Upgrades/TWRS	D. J. Minteer	n/a
8. Originator Remarks:		9. Equip./Component No.:
#ETN-95-0031		n/a
Acceptance test procedure performed per 2E-96-00103/M		10. System/Bldg./Facility: 200-G/241-AW
11. Receiver Remarks:		12. Major Assm. Dwg. No.: H-2-85608
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15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	WHC-SD-WM-ATR-169	-	0	Acceptance Test Report, 241-AW Air Inlet Filter Station Pressure Decay Test	Q			1

16. KEY

Approval Designator (F)	Reason for Transmittal (G)	Disposition (H) & (I)
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 4. Review 2. Release 5. Post-Review 3. Information 6. Dist. (Receipt Acknow. Required)	1. Approved 4. Reviewed no/comment 2. Approved w/comment 5. Reviewed w/comment 3. Disapproved w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name (K) Signature (L) Date (M) MSIN	(J) Name (K) Signature (L) Date (M) MSIN	(G) Reason	(H) Disp.
1	1	Cog.Eng. DJ Minteer DJ Minteer 2/20/96 S2-24			
1	1	Cog. Mgr. WW Jenkins WW Jenkins 2/20/96 S2-24			
1	1	QA CA Sams C.A. Sams 2/20/96 ~~S1-57~~ S5-13			
		Safety			
		Env.			
1	1	JA Tuck JAMES A Tuck 20 Feb 1996 S2-03			

18.	19.	20.	21. DOE APPROVAL (if required) Ctrl. No.
JAMES A Tuck 20 Feb 96	W.W. Jenkins 2/20/96	W.W. Jenkins 2/20/96	[ ] Approved [ ] Approved w/comments [ ] Disapproved w/comments
Signature of EDT Originator, JA Tuck Date	Authorized Representative for Receiving Organization Date	Cognizant Manager WW Jenkins Date	

BD-7400-172-2 (04/94) GEF097

BD-7400-172-1

Acceptance Test Report, 241-AW Air Inlet Filter Station Pressure Decay Test

James A. Tuck
WHC, Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-87RL10930

EDT/ECN: EDT 614412 UC: 506
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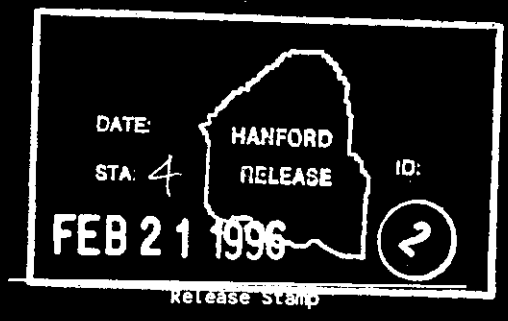
Key Words: Ventilation, Confinement, Nuclear Air Treatment, Leak Testing, ASME N509

Abstract: This is the acceptance test report for pressure decay tests performed on newly-installed 241-AW Tank Farm primary ventilation system air inlet filter stations.



Release Stamp

Release Approval 2/21/96 Date

Approved for Public Release

CONTENTS

ACCEPTANCE TEST REPORT, 241-AW AIR INLET FILTER STATION PRESSURE DECAY TEST

1.0 INTRODUCTION

Six primary ventilation system air inlet filter station assemblies were fabricated and installed as part of a ventilation upgrade in the 241-AW Tank Farm (WHC 1995; Vitro 1977). A pressure decay test was performed as part of acceptance testing on each of the completed installations, in accordance with a work package procedure (WHC 1996a). The procedure is attached as an appendix to this document, for reference.

The pressure decay test was performed 15-16 February 1996, in the 241-AW Tank Farm. The Cognizant Engineer was Daniel J. Minteer of TWRS Mitigation Systems Integration, Westinghouse Hanford Company. The Test Director was Robert L. Beireis of TWRS Operations Support, Westinghouse Hanford Company. Assistance was provided in the field by Jack F. Thompson, Engineer, and personnel from the 200 West Area Sheet Metal Fabrication Shop, ICF-Kaiser Hanford Company. Additional support was provided by the Vent and Balance organization and TWRS East Tank Farms Operations, both of Westinghouse Hanford Company.

The decay test procedure includes a description of the test and a list of equipment required, as well as specifying an allowable leak rate and documenting its basis in ASME N509 (ASME 1989a). Briefly, the test consisted of the following elements:

- Isolate/seal off the air station from the tank and the atmosphere;
- Perform visual inspections of ductwork, housings, filters, connections, and gaskets, and seals for signs of damage or improper installation;
- Pressurize the air station, allow to stabilize at a specified test pressure, and record pressure and temperature readings (as well as elapsed time) while pressure decays;
- Calculate a leak rate per ASME N510 (ASME 1989b) based on data, and compare with specified acceptance criterion of 0.14 standard ft^3/min (SCFM);
- If unit exceeds acceptance criterion (fails), locate and repair leaks and retest as often as necessary;
- Document results.

2.0 RESULTS AND DISCUSSION

The results of testing the Air Stations are tabulated below. The test pressure, specified in the procedure, was +7.5 in. w.g. The use of a bubble solution provided visual evidence that virtually all the measured leakage occurred on the inlet side of the assembly, i. e. the side of the filters opposite the tank. No leakage was detected using the bubble solution on any tank side connections (see App. A, procedure Sec. 4.1 and Fig. 1 for explanation of "tank side"). Therefore, a leak factor of 10% applied to the total leak rate, being the estimated proportion of total leakage occurring on the tank side of the HEPA filter, is conservative. The leak factor is included in the tabulated data.

SUMMARY OF TEST RESULTS	
TEST NUMBER	AVERAGE TANK SIDE HOUSING LEAKAGE RATE, SCFM
241-AW-101	0.025
241-AW-102	0.071
241-AW-103	0.051
241-AW-104	0.060
241-AW-105	0.016
241-AW-106	0.012

No test exceptions were found during the course of testing.

3.0 CONCLUSIONS

All six assemblies tested at less than the allowable leak rate of 0.14 SCFM, and are therefore acceptable for use. In addition, in each case the observed leakage occurred outside the confinement boundary or clean side of the HEPA filter, where it is not critical to the safety function of the equipment.

The Flow Controller and Vacuum Breaker subassemblies of the air inlet stations were extensively tested prior to installation, with results reported elsewhere (WHC 1996b & 1996c).

4.0 REFERENCES

ASME, 1989a, *Nuclear Power Plant Air-Cleaning Units and Components*, ASME N509-1989, American Society of Mechanical Engineers, New York.

ASME, 1989b, *Testing of Nuclear Air Treatment Systems*, ASME N510-1989, American Society of Mechanical Engineers, New York.

Vitro, 1977, *HVAC/Piping Vent Plan, 241-AW Tank Farm*, H-2-70337, Vitro Engineering Corporation, Richland, Washington.

WHC, 1995, *HEPA Filtered Inlet*, H-2-85614, Westinghouse Hanford Company, Richland, Washington.

WHC, 1996a, "Pressure Decay Test - AW Air Inlet Station Housing/Duct Assemblies", TWRS East Tank Farms Job Control System Work Package #2E-96-00103/M, Westinghouse Hanford Company, Richland, Washington.

WHC, 1996b, *Test Report, Constant Air Flow Control Device for 241-AW Tank Farm*, WHC-SD-WM-TRP-247, Westinghouse Hanford Company, Richland, Washington.

WHC, 1996c, Appendix A of: *Acceptance Test Report, Flow Controller and Vacuum Breaker Assemblies*, WHC-SD-WM-ATP-154, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A:

PRESSURE DECAY TEST PROCEDURE FROM WORK PACKAGE 2E-96-00103/M (WHC 1996) AND SUPPLEMENTAL INFORMATION, INCLUDING FLOW, SURFACE AREA, AND VOLUME CALCULATIONS

PRESSURE DECAY TEST
AW AIR INLET STATION HOUSING/DUCT ASSEMBLIES

1.0 SCOPE

This procedure shall be used to perform an in-place pressure test on each of the six AW tank air inlet filter housing/duct assemblies after field installation (see drawing H-2-85614). The boundary being verified includes all connections and access doors/ports between the 12" isolation butterfly valve and the HEPA filter seal. The connections on the inlet side (opposite tank) of the HEPA filter seal are non-critical. This procedure is designed to address the requirements specified in ASME N510-1989, *Testing of Nuclear Air Treatment Systems*, Section 6.5.3, "Pressure Decay Method." A general visual inspection of the new equipment will also be performed prior to pressure testing to detect obvious signs of damage, component mis-alignment, or other functional problems.

2.0 RESPONSIBILITIES

The cognizant engineering organization will appoint a Test Director to be responsible for scheduling resources, overseeing this test, and approving test exceptions. The Test Director, or a designee appointed by the Test Director, will be responsible for completing the associated data sheets (Data Sheets 1 and 2, and Record of Test Exception sheets) for each tested housing/duct assembly. Operations and Sheet Metal personnel will be required to support this test. Quality Control is responsible for verifying completion of this test by review of the data sheets.

3.0 ALLOWABLE HOUSING/DUCT LEAK RATE

The allowable leak rate (L_a) for the housing/duct assembly ("tank side" connections only, see Section 4.1) is based on using the most conservative application of ASME N509-1989 Nonmandatory Appendix B, Table B-3 for $L_a = (a/A)(PQ)/100 = 0.14$ scfm, where:

P = allowable percent leakage = 0.10 (Leakage Class I, Housing)
Q = system rated flow = 400 scfm (see attached calculations)
a = surface area of the housing/duct assembly (tank side) = 32.3 ft^2 (see attached calculations)
A = surface area of total system ductwork (tank side) = 92 ft^2 (see attached calculations)

4.0 GENERAL PRESSURE DECAY TEST DESCRIPTION

4.1 For this test, all of the openings on the housing/duct assembly will first be sealed off by a safe, suitable means. Connections and access openings on the "tank side" of the HEPA filter (includes HEPA filter door and all ports/openings and joints/connections between the HEPA filter seal and the 12" butterfly valve) will be closed off in the normal manner (i.e., gaskets, door seals, plugs, etc.). Connections and access openings on the "clean side" (inlet, opposite tank) of the HEPA filter seal will be sealed as necessary using temporary blankoffs, duct tape, sealants and/or other temporary means.

4.2 The assembly will then be instrumented and pressurized with air to

the specified test pressure, inspected for obvious leaks (which may be sealed as necessary), and allowed to stabilize.

4.3 After the pressurized air within the assembly has stabilized, the air supply will be isolated from the assembly, and the pressure decay test performed for a specified period of time or until the specified decay pressure is reached. The leak rate (from the "tank side" confines) will be calculated.

4.4 Equipment determined to be nonconforming is further evaluated to locate the areas where leakage exists. The leak paths are then repaired/adjusted. The location of leak paths will be determined by using the bubble leak location method and/or the audible leak location method (ASME N510 Section 6).

4.5 Once the leak path is located and repaired/adjusted the equipment is then retested to the same criteria as originally required to determine if the leak paths have been repaired.

5.0 TEST EQUIPMENT

5.1 Calibrated pressure measurement device, accurate to +/- 0.1" WG. Approximate range of 0 to 10" WG.

5.2 Calibrated barometer, accurate to +/- 0.01" Hg or use Hanford weather station data.

5.3 Calibrated temperature indicator, accurate to +/- 1 deg F.

5.4 Compressed air source (or blower), pressure reducer (may be a damper if a blower is used), isolation valve, and safety/relief mechanism to protect housing assembly from pressures in excess of test pressure.

5.5 Miscellaneous fittings to connect instruments and equipment to filter housing. There are two 1" female NPT ports and one 3/4" male NPT port to connect instruments and the air source (see Figure 1 for recommended instrument/equipment locations).

5.6 Temporary blankoffs, duct tape, sealants and/or other temporary materials necessary to seal connections and access openings on the "clean side" (pre-filter side) of the HEPA filter.

6.0 TEST PROCEDURE

Record all test data and test exceptions on Data Sheets 1 and 2, and the Record of Test Exception sheets (attached).

NOTE: Steps 6.1 through 6.4 may be performed for all six filter housing/duct assemblies prior to continuing with the remaining steps for each assembly.

6.1 Verify that the 12" butterfly valve located between the filter housing and tank riser is in the closed position.

6.2 Visually inspect all equipment/pipe/duct and connections from the tank riser to the air flow controller for obvious signs of damage, mis-alignment, or functional problems. This is an external inspection only. Ensure that paint is not providing a seal on any connections between the filter housing and the expansion joint.

6.3 Remove the filter housing doors and inspect the HEPA filter, filter housing, and the filter housing doors and their seals for obvious signs of damage. Note that these components have been examined during the fabrication and final assembly process. This step is only meant as a final soundness check before further testing. Thus, the filters need not be removed for this inspection unless damage is suspected. Repair/replace components as necessary.

6.4 Ensure that the HEPA filter is properly locked against its sealing frame and that the filter housing doors (pre-filter and HEPA filter) are secured. General manufacturer instructions for installing the HEPA filter are to initially torque the clamping bolts to produce 50% gasket compression and then to retorque them one or two weeks later to a total compression of 80%. Door latches are hand tightened in a gradual, equal sequence.

6.5 Seal the openings on the vacuum breaker and flow controller (see drawing H-2-85614) and provide temporary sealing for other joints, as necessary, on "clean side" (pre-filter side) of HEPA filter.

6.6 Isolate differential pressure indicators VTP-PDI-212, -213, -214, and -215 from the tested volume.

6.7 Install and seal temperature measuring instrument into one of the ports on the filter housing assembly (see Figure 1 for recommended location). Record equipment information on Data Sheet 1.

6.8 Install and seal pressure measuring instrument into one of the ports on the filter housing assembly (see Figure 1 for recommended location). Record equipment information on Data Sheet 1.

6.9 Install air supply line (with safety/relief mechanism, isolation valve, and pressure reducer) into one of the ports on the filter housing assembly (see Figure 1 for recommended location).

6.10 Positive Pressure Decay Test

6.10.1 Pressurize test housing/duct assembly to +7.5" wg +/- 0.5" wg. Locate (using a suitable bubble solution) and seal (see Section 4.1) all leaks as best as practical. Note any remaining leakage from the HEPA filter door and all ports/openings and

joints/connections between the HEPA filter seal and the 12" butterfly valve (i.e., "tank side" connections).

6.10.2 Maintain constant pressure until temperature remains constant within +/- 0.5 degrees F for a minimum of 10 minutes.

6.10.3 Isolate the air supply from the filter housing while starting the clock. Record initial pressure and temperature on Data Sheet 1.

6.10.4 Record pressure and temperature readings a minimum of once a minute until pressure decays to 5.25" wg or for a maximum of 15 minutes, which ever comes first, on Data Sheet 1.

6.10.5 Record final time, pressure, and temperature on Data Sheet 1.

6.10.6 Perform the housing/duct assembly leakage rate calculations per Data Sheet 2. If $Q_a < L_a$ then record "PASS" on Data Sheet 1. Otherwise, record "RETEST" on Data Sheet 1.

NOTE: If a retest is needed, determine the leak path(s) using the bubble leak location and/or audible leak location method. Repair leaks and perform steps 6.10.1 through 6.10.6, using new data sheets.

6.11 Remove test equipment and temporary blankoff/sealing materials and re-install test port plugs. Restore PDI gages to read housing pressures.

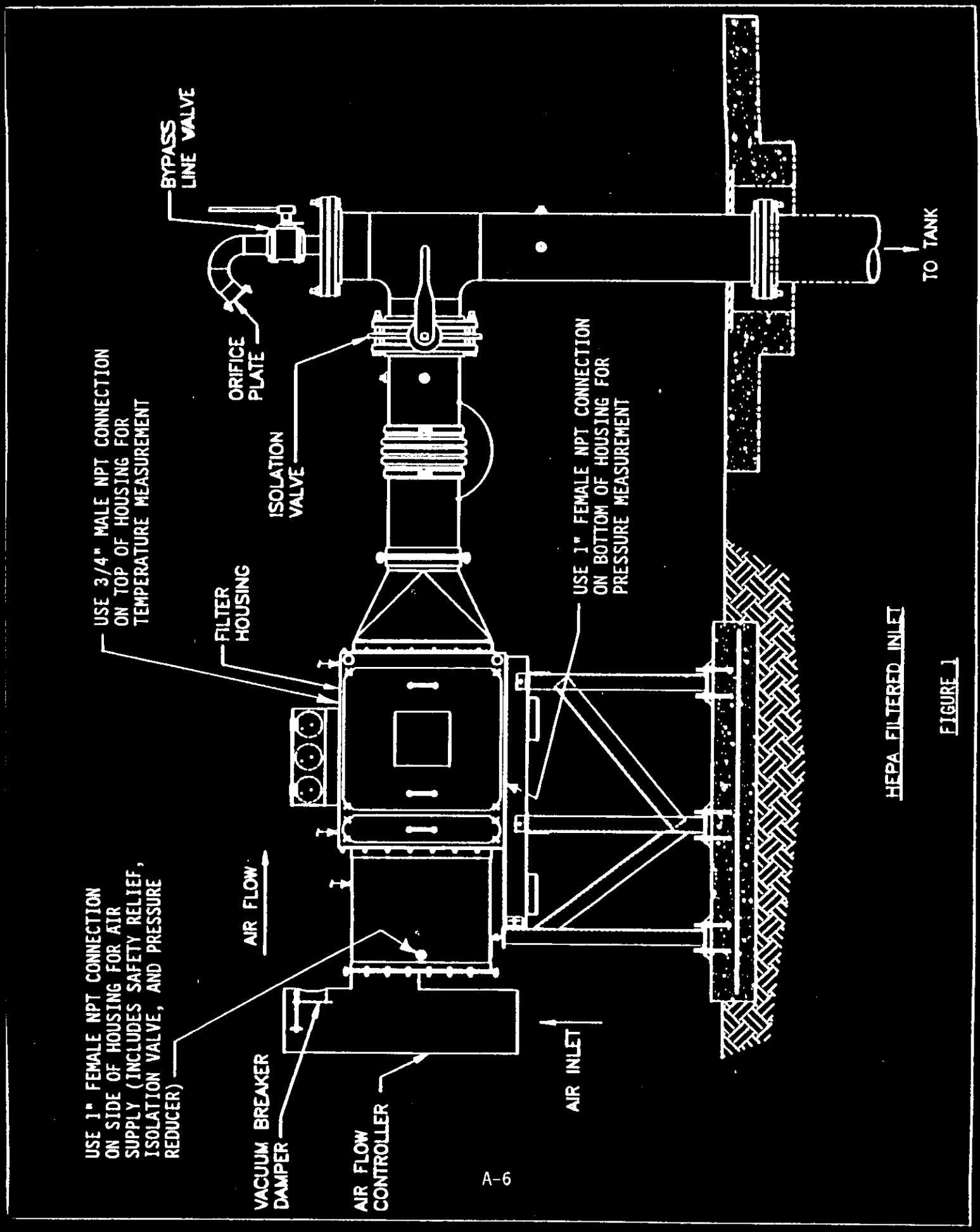

BYPASS LINE VALVE
TO TANK
ORIFICE PLATE
ISOLATION VALVE
USE 3/4" MALE NPT CONNECTION ON TOP OF HOUSING FOR TEMPERATURE MEASUREMENT
FILTER HOUSING
USE 1" FEMALE NPT CONNECTION ON BOTTOM OF HOUSING FOR PRESSURE MEASUREMENT
HEPA FILTERED INLET
AIR FLOW
USE 1" FEMALE NPT CONNECTION ON SIDE OF HOUSING FOR AIR SUPPLY (INCLUDES SAFETY RELIEF, ISOLATION VALVE, AND PRESSURE REDUCER)
VACUUM BREAKER DAMPER
AIR FLOW CONTROLLER
AIR INLET

FIGURE 1

DATA SHEET 1 - POSITIVE PRESSURE DECAY TEST

DATE: **TANK: 241-AW-** **RETEST #:**

6.1				
6.2				
6.3				
6.4				
6.5				
6.6				
6.7	(Mfr/Model/ID#/Cal. Exp. Date)			
6.8	(Mfr/Model/ID#/Cal. Exp. Date)			
6.9				
6.10.1				
6.10.2				
6.10.3	time	initial pressure (IN WG)	initial temp (deg F)	
6.10.4	time	pressure (IN WG)	temp (deg F)	
6.10.5	final time	final pressure (IN WG)	final temp (deg F)	
6.10.6				
6.11				

TEST DIRECTOR (print name and sign):

OTHERS (title, print name and sign):

Work Package 2E-96-00103/M

DATA SHEET 2 - LEAKAGE RATE CALCULATION

DATE: **TANK: 241-AW-** **RETEST #:**

(A) Beginning pressure in inches WG:

(B) Beginning pressure in psig (A/27.7):

(C) Beginning barometric pressure in psi (IN Hg x 0.491):

(P1) Beginning duct pressure in psfa (B + C)144: _____

(D) Beginning temperature in deg F:

(T1) Beginning temperature in deg R (D + 460): _____

(E) Ending pressure in inches WG:

(F) Ending pressure in psig (E/27.7):

(G) Ending barometric pressure in psi (IN Hg x 0.491):

(P2) Ending duct pressure in psfa (F + G)144: _____

(H) Ending temperature in deg F:

(T2) Ending temperature in deg R (H + 460): _____

(V) Test Volume in cubic feet (entire assembly shown in H-2-85614, from flow controller to 12" butterfly valve): 24.7

(R) R, gas constant, in ft lb/(lb*degR): 53.35

(ΔT) Test Duration in minutes: _____

(Q) Average total housing leakage rate in standard cubic feet per minute (per ASME N510-1989, Section 6.5.3.9):

$Q = (P1/T1 - P2/T2)V/(R * \Delta T * .075)$

(LF) Leak Factor (based on an evaluation of individual leaks present using the bubble leak location method, the proportion of leakage on "tank side" of HEPA filter):

(Q_a) Average "tank side" housing leakage rate (connections and access doors/ports between 12" butterfly valve and HEPA filter seal) in scfm = (Q)(LF):

(L_a) Allowable Leak Rate in standard cubic feet per minute: 0.14

TEST DIRECTOR (print name and sign):

OTHERS (title, print name and sign):

RECORD OF TEST EXCEPTION

Exception Number:

Date:

Tank Number(s):

Procedure Step Number(s):

Exception

Description of Problem:

Action Taken:

TEST DIRECTOR (print name and sign):

OTHERS (title, print name and sign):

[MAKE ADDITIONAL COPIES AS REQUIRED; ONE EXCEPTION PER SHEET]

DESIGN CALCULATION

(1) Drawing: H-2-85614 (2) Document #: (3) Page 1 of 2
(4) Building: 241-AW (5) Rev: 0 (6) Job #: 2E-95-000765/M
(7) Subject: DETERMINATION OF SYSTEM FLOW AT TEST PRESSURE
(8) Originator: D.J. Hinteer D J Hinteer Date: 1-29-96
(9) Checker: Jim KRISKOVICH Jim Kriskovich Date: 1-30-96

(10)

PROBLEM: Determine the air flow rate through the air control station (see drawing H-2-85614) given a tank pressure of +7" WG (corresponds to the housing/duct assembly leak test pressure).

ASSUMPTIONS:
1. Assume that the most restrictive orifice plate (for the air flow controller) which would be used in the field is a 3" I.D. (rated for 95 scfm) and it is installed.
2. Assume relatively clean filters.
3. Assume standard air conditions.

CALCULATIONS: The total pressure loss through the air control station (pipe, fittings, filters, and orifice plate) is calculated at various flow rates until the pressure loss equals 7" WG. This occurs at 400 scfm. This set of calculations is shown below. All references are to the 1993 ASHRAE Fundamentals Handbook, I-P Edition, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA.

SYSTEM FLOW RATE (scfm)	400
TOTAL PRESSURE LOSSES (inches WG)	7.0

PIPE		
12" tank riser pipe		
pipe dia (d), inches	12	
duct area, ft^2	0.785	
duct length (L), feet	25	
Velocity (V), fpm, = flow rate/area	510	
Vel Press (Pv), IN WG = density(V/1096.5)^2	0.016	pg 13.14, eqn 15
Reynolds number (Re), std air, = 8.56dV	52341	pg 32.5, eqn 23
Roughness Factor (r), ft, med. smooth	0.0003	pg 32.6, Table 1
Friction Factor, f	0.022	pg 32.5, eqn 21
f' = 0.11((12r/d) + (68/Re))^.25 and f=f' if f'>/=	0.018	
Note: If f' < 0.018, then use f = 0.85f' + 0.0028	0.021	pg 32.5, eqn 21
Input friction factor used	0.022	
pipe pressure loss, IN WG, = f(12L/d)Pv	0.009	pg 32.4, eqn 19

DESIGN CALCULATION

(1) Drawing: H-2-85614 (2) Document #: (3) Page 2 of 2
(4) Building: 241-AW (5) Rev: 0 (6) Job #: 2E-95-000765/M
(7) Subject: DETERMINATION OF SYSTEM FLOW AT TEST PRESSURE
(8) Originator: D.J. Hinteer Date: 1-27-96
(9) Checker: Jim Krisovich Date: 1-30-96

(10)

FITTINGS

12" tees w/blanked branch (2x - at riser pipe and flow controller)
Co = 1 (assumed conservative)
12" butterfly valve, fully open
Co = 1 (assumed conservative)
transition, 12" round to 24" square
pressure loss assumed negligible at this flow
transition, housing to flow controller
Co = 1 conservative, p 32.29, t/D = 0, L/D = 0
entrance to flow controller port
Co = 2 (assumed conservative)
flow controller inlet screens (2x)
Co = 0.5 conservative, p 32.28, A1/Ao = 1, n = 0.75

total Co	7	
Vel Press, Pv, IN WG	0.016	(from above)
fitting pressure losses, IN WG, = (Co)(Pv)	0.113	pg 32.6, eqn 30

FILTERS

HEPA filter, rated 1 IN WG loss @ 500 cfm
pressure loss, assume linear 0.8

other filters, assume 0.25 IN WG total losses @ 500 cfm
pressure loss, assume linear 0.2

ORIFICE PLATE

3" Air Flow Controller Orifice Plate

Orifice Dia (in)	3	
Area (sq ft)	0.049	
Velocity (ft/min)	8153	
Vel Press (IN WG) = (V/4005)^2	4.14	p 13.14, eqn 15
DP (IN WG) = 1.42(Vel Press)	5.88	
(based on test data, WHC-SD-WM-TRP-247)		

DESIGN CALCULATION

H-2-85608

(1) Drawing H-2-85614 (2) Doc. No. JFT-01 (3) Page 1 of 10

(4) Building 241 AW (5) Rev. 0 (6) Job No.

(7) Subject HEPA FILTER HOUSING INTERIOR SURFACE AREA / VOLUME

(8) Originator J. F. THOMPSON JFT Date 1-29-96

(9) Checker DJ Mintzer DJ Mintzer Date 1-31-96

(10)

1) OBJECTIVE:

CALCULATE THE INTERIOR SURFACE AREA AND VOLUME OF THE INLET HEPA FILTER HOUSING, H-2-85614 AND THE FLOW CONTROL DEVICE, H-2-85608, TO THE 12" ISOLATION VALVE.

2) INPUTS:

DRAWINGS - H-2-85614 & H-2-85608

3) ASSUMPTIONS:

THE VOLUME OCCUPIED BY THE HEPA AND PRE-FILTER WERE NOT INCLUDED IN THE VOLUME CACULATIONS.
ALL DIMENSIONS ARE SHOWN IN INCHES.

4.) METHOD:

HAND CACULATION

5) REFERENCES:

MACHINERY'S HANDBOOK - 24TH EDITION
AREAS AND VOLUMES

6) CACULATIONS:

(SEE SHEET 2 THRU 9)

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. JFT-01 (3) Page 2 of 10

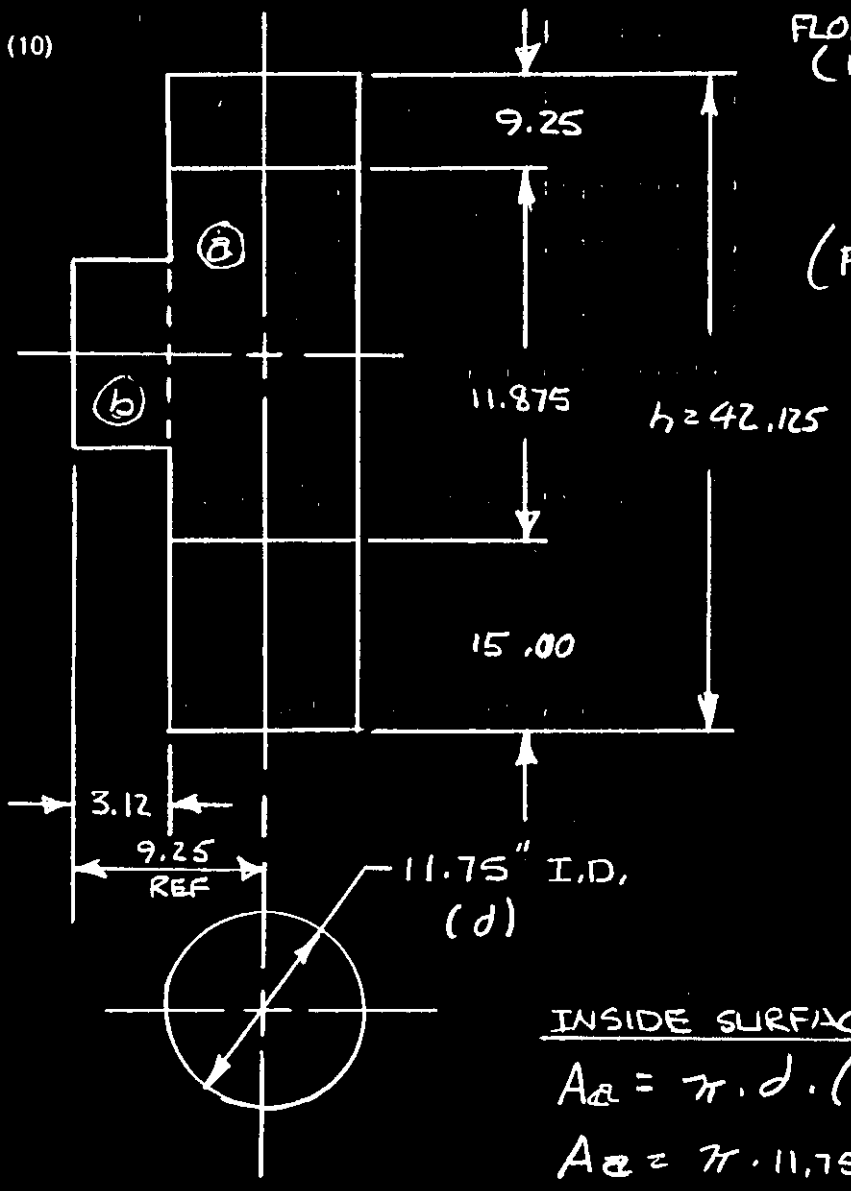
(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator J.F. THOMPSON JFT Date 1-29-96

(9) Checker D J Minteer DJM Date 1-31-96

(10)



FLOW CONTROLER
(H-2-85608)

(FIG #1)

INSIDE SURFACE AREA (FIG #1)

$A_a = \pi \cdot d \cdot \left(\frac{d}{2} + h\right)$

$A_a = \pi \cdot 11.75 \cdot \left(\frac{11.75}{2} + 42.125\right)$

$A_a = \pi \cdot 11.75 \cdot 48.00$

$A_a = \frac{1771.86 \text{ IN}^2}{144}$

$A_a = 12.3 \text{ Ft}^2$

SEE PAGE 3

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. JFT-01 (3) Page 3 of 10

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator J.F. THOMPSON JFT Date 1-30-96

(9) Checker D J Minteer DJM Date 1-31-96

(10) $A_b = \pi \cdot d \cdot h = \pi \cdot 11.75 \cdot 3.125$

$A_b = 115.36\ IN^2 = 0.8\ ft^2$

$A_2 + A_b = \underline{13.1\ ft^2}$

VOLUME: $V = 0.7854 \cdot d^2 \cdot h$ (FIG #1)

$V_2 = 0.7854 \cdot 11.875^2 \cdot 42.125$

$V_2 = 0.7854 \cdot 138.06 \cdot 42.125$

$V_2 = \frac{4,567.7\ IN^3}{1728} = 2.64\ ft^3$

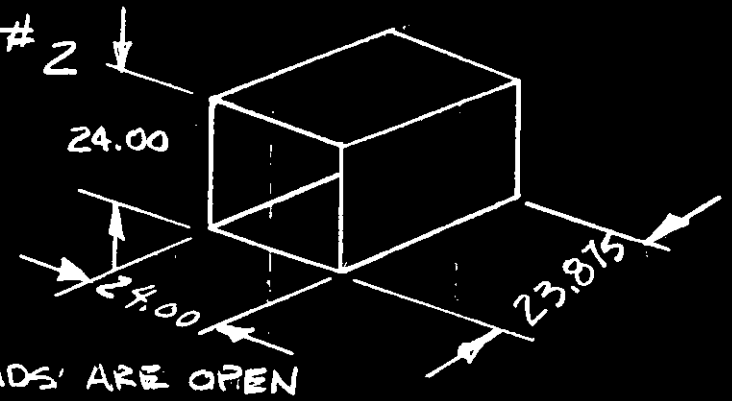
$V_b = 0.7854 \cdot 11.875^2 \cdot 3.125$

$V_b = 0.7854 \cdot 138.06 \cdot 3.125$

$V_b = 338.85\ IN^3 = .196\ ft^3$

$V_2 + V_b = 4906.55\ IN^3 = \underline{2.84\ ft^3}$

FIG # 2



* ENDS ARE OPEN

(SEE PAGE 4)

(1) Drawing _____ (2) Doc. No. JFT-01 (3) Page 4 of 10
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator J.F. THOMPSON JFT Date 1-30-96
(9) Checker DJ Minteer DJ Minteer Date 1-31-96

(10) INSIDE SURFACE AREA FIG. 2

$$A = 24.00 \cdot 23.875 \cdot 4 = \frac{2292.0}{144} \text{ IN}^2 = 15.92 \text{ FT}^2$$

VOLUME: FIG. 2

$$V = 24.00^2 \cdot 23.875 = \frac{13,752}{1728} \text{ IN}^3 = 7.958 \text{ FT}^3 = 8 \text{ FT}^3$$

FIG 3

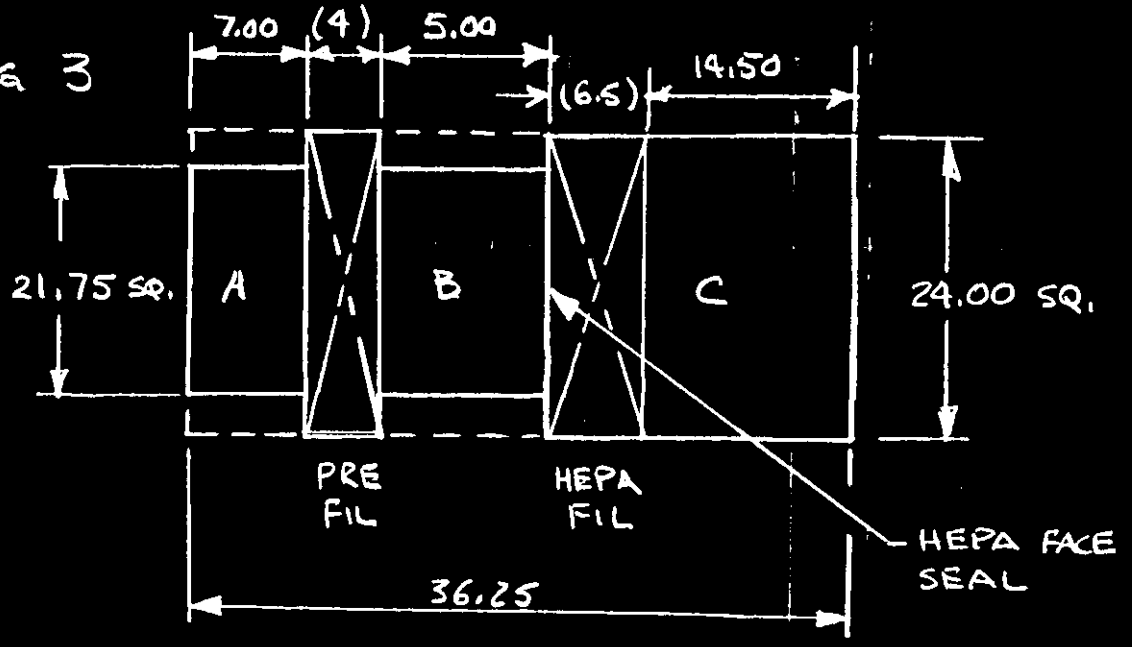


FIG. 3, SECTION A

$$V = 21.75^2 \cdot 7.00 = \frac{3311.43}{1728} \text{ IN}^3 = 1.92 \text{ FT}^3$$

$$A = 21.75 \cdot 7.00 \cdot 4 = \frac{609}{144} \text{ IN}^2 = 4.23 \text{ FT}^2$$

(SEE PAGE 5)

(1) Drawing _____ (2) Doc. No. JET-01 (3) Page 5 of 10
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(8) Originator J.F. THOMPSON JFT Date 1-30-96
(9) Checker D J Minteer DJM Date 1-31-96

(10) FIG. 3, SECTION B

$V = 21.75^2 \cdot 5.00 = \frac{2365.3}{1728} IN^3 = 1.37 ft^3$

$A = 21.75 \cdot 5.00 \cdot 4 = \frac{435}{144} IN^2 = 3.02 ft^2$

FIG. 3, SECTION C

$V = 24.00^2 \cdot 14.50 = \frac{8352}{1728} IN^3 = 4.83 ft^3$

$A = 24.00 \cdot 14.50 \cdot 4 = \frac{1392}{144} IN^2 = 9.66 ft^2$

FIG. 3

$A_{total} = 4.23 + 3.02 + 9.66 = 16.91 ft^2$

$V_{total} = 1.92 + 1.37 + 4.83 = 8.12 ft^3$

(SEE PAGE 6)

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. JFT-01 (3) Page 6 of 10

(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject _____

(8) Originator J.F. THOMPSON JFT Date 1-30-96

(9) Checker DJ Mintzer DJM Date 1-31-96

(10)

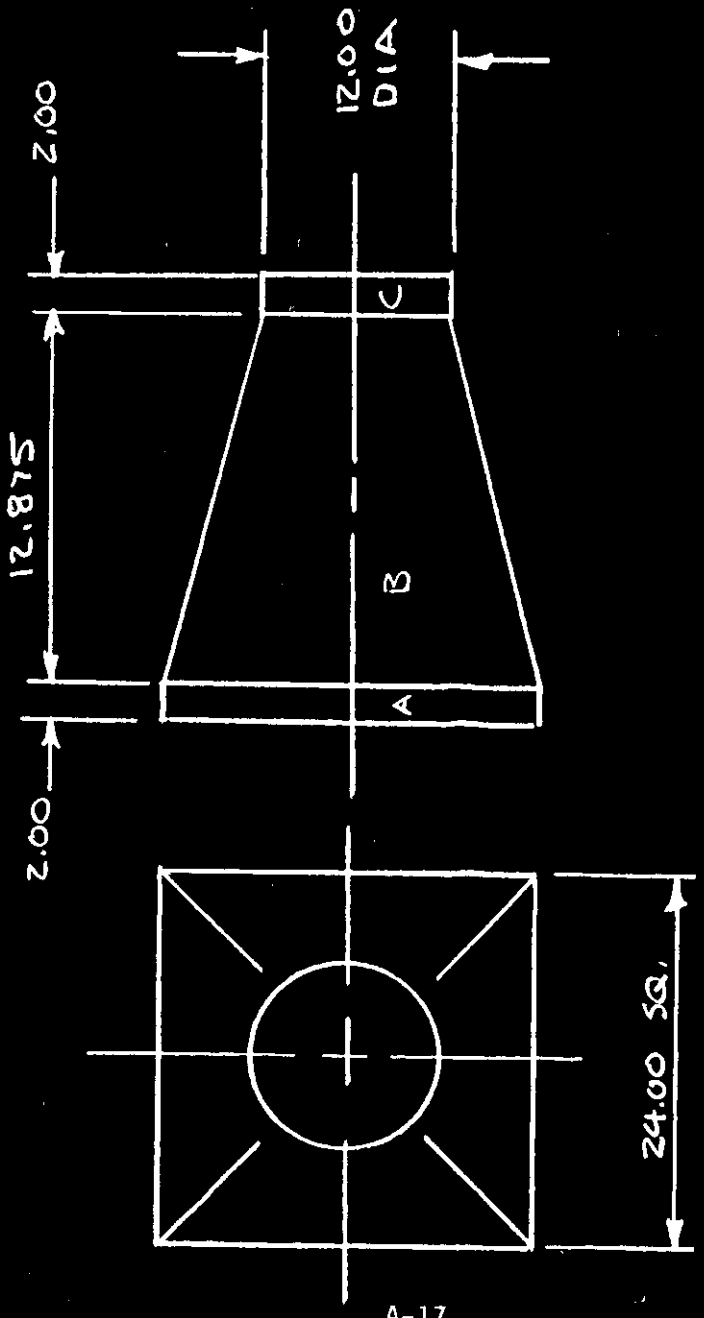


Fig. 4 (SEE PAGE 7)

(1) Drawing _____ (2) Doc. No. JFT-01 (3) Page 7 of 10
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator J.F. THOMPSON JFT Date 1-30-96
(9) Checker D J Minteer DJM Date 1-31-96

(10) FIG. 4, SECTION A

$$V = 0.7854 \cdot 12.00^2 \cdot 2.00 = \frac{226.2 \text{ IN}^3}{1728} = .13 \text{ ft}^3$$

$$A = 3.1416 \cdot 12.00 \cdot 2.00 = \frac{75.4 \text{ IN}^2}{144} = .52 \text{ ft}^2$$

FIG. 4, SECTION B (FUSTRUM OF PYRAMID)

$$V = \frac{12.875}{3}\left(576 + 144 + \sqrt{576 \cdot 144}\right)$$

$$V = 4.3\left(720 + 288\right) = \frac{4334.4 \text{ IN}^3}{1728} = 2.5 \text{ ft}^3$$

$$A = \frac{(12.00 + 24.00)\, 12.875}{2}$$

$$A = \left(\frac{36 \cdot 12.875}{2}\right) 4 = \frac{927. \text{ IN}^2}{144} = 6.43 \text{ ft}^2$$

FIG. 4, SECTION C

$$V = 24.00^2 \cdot 2 = \frac{1152 \text{ IN}^3}{1728} = .66 \text{ ft}^3$$

$$A = (24.00 \cdot 2)\, 4 = \frac{192 \text{ IN}^2}{144} = 1.33 \text{ ft}^2$$

(SEE PAGE 8)

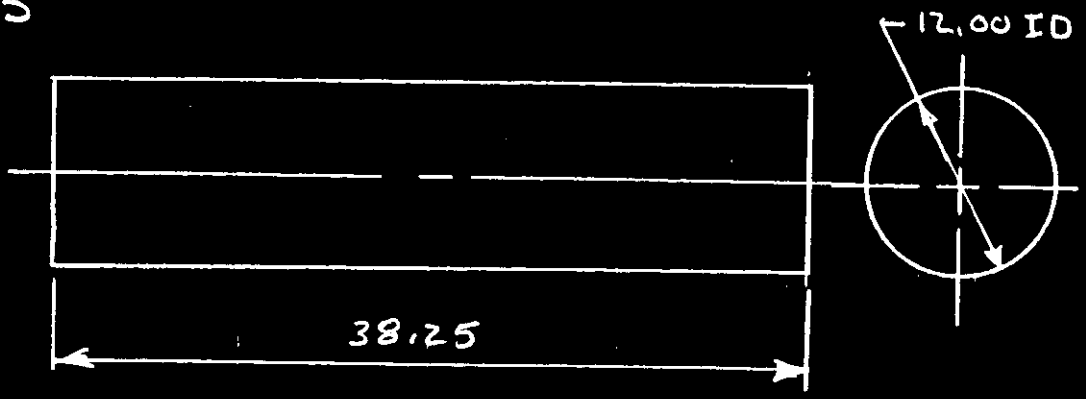
(1) Drawing _____ (2) Doc. No. JFT-01 (3) Page 8 of 10
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject _____
(8) Originator J.F. THOMPSON JFT Date 1-30-96
(9) Checker D I Minteer DIM Date 1-31-96

(10) FIG. 4

$V_{total} = .13 + 2.5 + .66 = 3.29\ ft^3$

$A_{total} = .52 + 6.43 + 1.33 = 8.28\ ft^2$

FIG. 5



$V = 0.7854 \cdot 12.00^2 \cdot 38.25 = \frac{4325.98\ IN^3}{1728} = 2.5\ ft^3$

$A = 3.1416 \cdot 12.00 \cdot 38.25 = \frac{1442\ IN^2}{144} = 10\ ft^2$

7) CONCLUSION

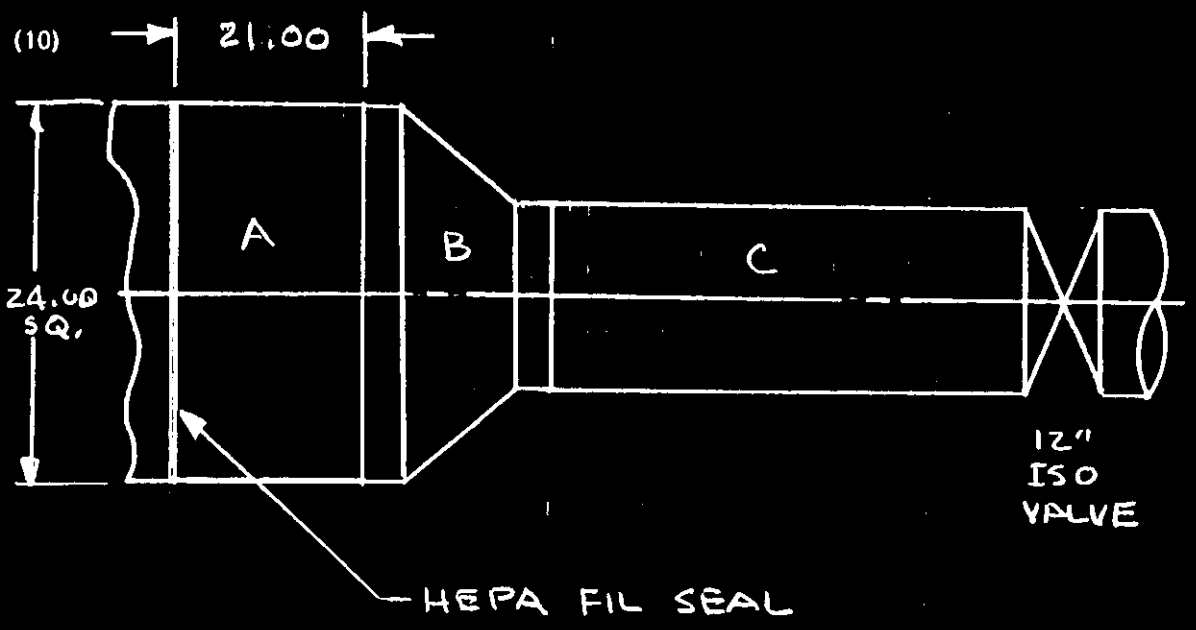
SYSTEM $V = 2.84 + 8.0 + 8.12 + 3.29 + 2.5 = 24.75\ ft^3$

SYSTEM $A = 13.1 + 15.92 + 16.91 + 8.28 + 10 = 64.21\ ft^2$

FOR CALCULATION OF HEPA FIL SEAL TO 12" ISO VALVE SEE PAGE 9.

(1) Drawing _____ (2) Doc. No. JFT-01 (3) Page 9 of 10
(4) Building _____ (5) Rev. _____ (6) Job No. _____
(7) Subject INTERIOR SURFACE AREA OF HEPA SEAL TO 12" ISO VALVE,
(8) Originator J.F. THOMPSON JFT Date 1-30-96
(9) Checker DJ Minter DJM Date 1-31-96

(10)



$A_A = 24.00 \cdot 21.00 \cdot 4 = \frac{2016}{144} IN^2 = 14.0\ ft^2$

$A_B = 8.28\ ft^2$ (SEE FIG. 4)

$A_C = 10.0\ ft^2$ (SEE FIG. 5)

$A_{total} = 14.0 + 8.28 + 10.0 = \underline{\underline{32.28\ ft^2}}$

$V_A = 24.00^2 \cdot 21.00 = \frac{12096}{1728} IN^3 = 7.0\ ft^3$

$V_B = 3.29\ ft^3$ (SEE FIG. 4)

$V_C = 2.5\ ft^3$ (SEE FIG 5)

$V_{total} = 7.0 + 3.29 + 2.5 = \underline{\underline{12.79\ ft^3}}$

DESIGN CALCULATION

(1) Drawing _____ (2) Doc. No. JFT-01 (3) Page 10 of 10

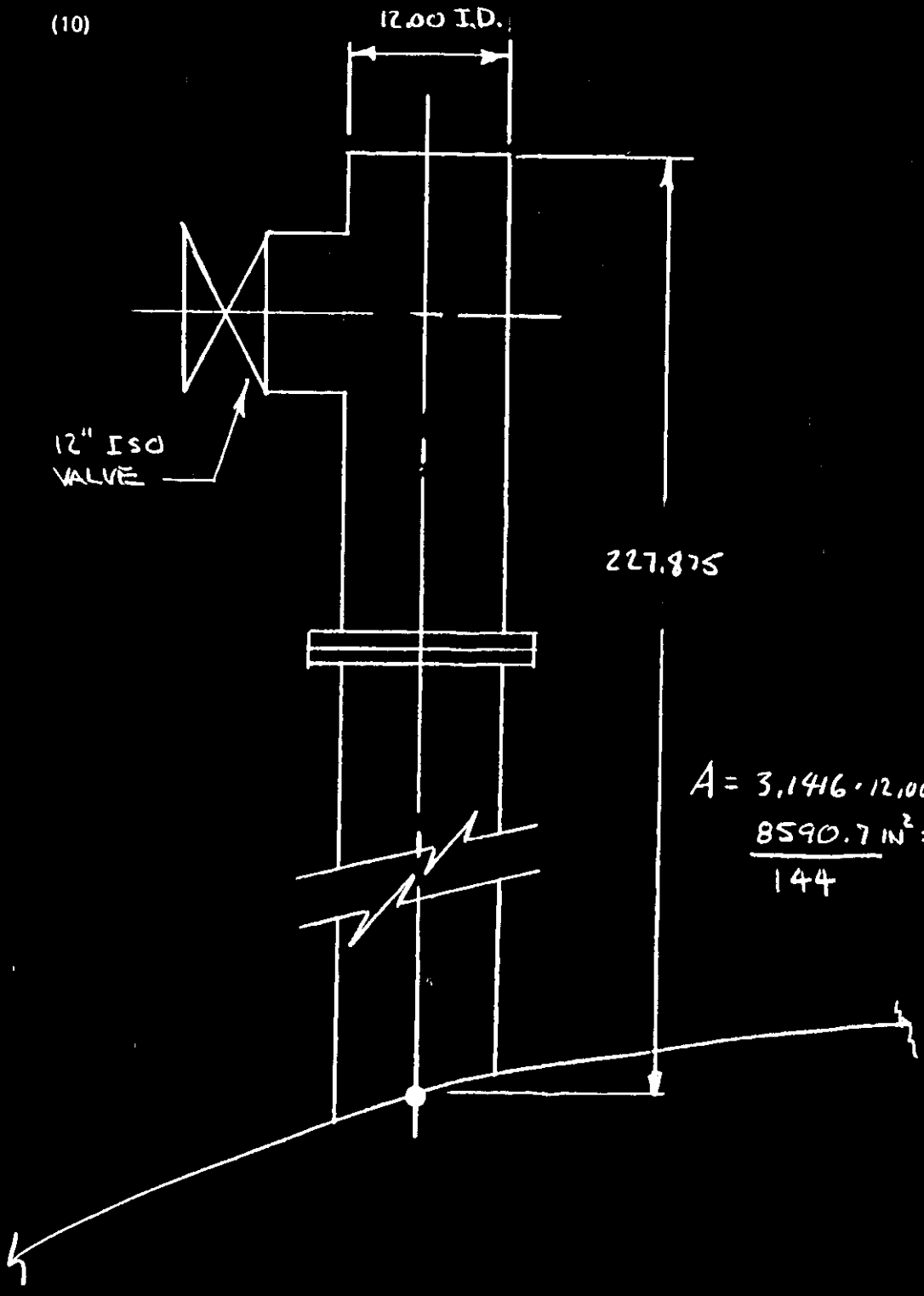
(4) Building _____ (5) Rev. _____ (6) Job No. _____

(7) Subject SURFACE AREA OF 12" PIPE - FROM 12" ISO VALVE TO TANK

(8) Originator J.F. THOMPSON JFT Date 1-30-96

(9) Checker D J Hunter D J H Date 1-31-96

(10)



$A = 3.1416 \cdot 12.00 \cdot 227.875 =$

$\frac{8590.7\ IN^2}{144} = 59.7\ FT^2$

APPENDIX B:

TEST DATA SHEETS

DATA SHEET 1 - POSITIVE PRESSURE DECAY TEST

DATE: 2-15-96 **TANK:** 241-AW-101 **RETEST #:** NA

STEP	DATA/COMMENTS	TEST DIRECTOR OR DESIGNEE INITIALS
6.1	valve UTP-V-254A closed	DJM
6.2	no sign of damage	DJM
6.3	no sign of damage	DJM
6.4	filter locked, doors installed	DJM
6.5	seals/blanks in place	DJM
6.6	gages isolated	DJM
6.7	(Mfr/Model/ID#/Cal. Exp. Date) Electronic Development Labs, Inc., Acu-Probe, -30 to 1800°F Type K, ID#710-58-02-008, Cal. Exp. 3-24-96	DJM
6.8	(Mfr/Model/ID#/Cal. Exp. Date) Dwyer, Model 400, ID#604-28-09-014, Cal. Exp. 12-6-96	DJM
6.9	equip. installed	DJM
6.10.1	no detectable leakage, using bubble solution (Snoop), on "tank side" connections	DJM
6.10.2	71°F maintained for 10 min. at 7.5" wg	DJM
6.10.3	time: 0 — initial pressure (IN WG): 7.5 — initial temp (deg F): 71	DJM
6.10.4	time: 31 sec — pressure (IN WG): 5.2 — temp (deg F): 71	DJM
6.10.5	final time: 31 sec — final pressure (IN WG): 5.2 — final temp (deg F): 71	DJM
6.10.6	PASS, see Data Sheet 2	DJM
6.11	system restored	DJM

TEST DIRECTOR (print name and sign): RL Beireis

OTHERS (title, print name and sign): Cog Engr DJ Minteer DJ Minteer

DATA SHEET 2 - LEAKAGE RATE CALCULATION

DATE: 2-15-96 **TANK:** 241-AW-101 **RETEST #:** NA

(A) Beginning pressure in inches WG: 7.5

(B) Beginning pressure in psig (A/27.7): 0.27

(C) Beginning barometric pressure in psi (IN Hg x 0.491): 14.46
Hanford Weather 29.46 "Hg

(P1) Beginning duct pressure in psfa (B + C)144: 2121

(D) Beginning temperature in deg F: 71

(T1) Beginning temperature in deg R (D + 460): 531

(E) Ending pressure in inches WG: 5.2

(F) Ending pressure in psig (E/27.7): 0.19

(G) Ending barometric pressure in psi (IN Hg x 0.491): 14.46
Hanford Weather 29.46" Hg

(P2) Ending duct pressure in psfa (F + G)144: 2110

(H) Ending temperature in deg F: 71

(T2) Ending temperature in deg R (H + 460): 531

(V) Test Volume in cubic feet (entire assembly shown in H-2-85614, from flow controller to 12" butterfly valve): 24.7

(R) R, gas constant, in ft lb/(lb*degR): 53.35

(ΔT) Test Duration in minutes: 31 sec/60 = 0.517

(Q) Average total housing leakage rate in standard cubic feet per minute (per ASME N510-1989, Section 6.5.3.9):

$Q = (P1/T1 - P2/T2)V/(R * \Delta T * .075)$

$= \left(\frac{2121-2110}{531}\right)\frac{24.7}{(53.35)(.517)(.075)}$

$= 0.25$

(LF) Leak Factor (based on an evaluation of individual leaks present using the bubble leak location method, the proportion of leakage on "tank side" of HEPA filter): 0.1
Considered conservative since no leakage was detected in tank side connections, Step 6.10.1

(Q_a) Average "tank side" housing leakage rate (connections and access doors/ports between 12" butterfly valve and HEPA filter seal) in scfm = (Q)(LF): (.25)(.1) = 0.025

(L_a) Allowable Leak Rate in standard cubic feet per minute: 0.14

TEST DIRECTOR (print name and sign): RL Beireis RL Beireis

OTHERS (title, print name and sign): Cog Engr DJ Minteer DJ Minteer

DATA SHEET 1 - POSITIVE PRESSURE DECAY TEST

DATE: 2-15-96 **TANK:** 241-AW-102 **RETEST #:** NA

STEP	DATA/COMMENTS	TEST DIRECTOR OR DESIGNEE INITIALS
6.1	valve VTP-V-254B closed	DJM
6.2	no sign of damage	DJM
6.3	no sign of damage	DJM
6.4	filter locked, doors installed	DJM
6.5	seals/blanks in place	DJM
6.6	gages isolated	DJM
6.7	(Mfr/Model/ID#/Cal. Exp. Date) same as for tank 101	DJM
6.8	(Mfr/Model/ID#/Cal. Exp. Date) same as for tank 101	DJM
6.9	equip. installed	DJM
6.10.1	no detectable leakage, using bubble solution, in "tank side" connections.	DJM
6.10.2	59°F maintained for 10 min at 7.2" wg	DJM
6.10.3	time: 0 — initial pressure (IN WG): 7.2 — initial temp (deg F): 59	DJM
6.10.4	time: 10 sec — pressure (IN WG): 5.2 — temp (deg F): 59	DJM
6.10.5	final time: 10 sec — final pressure (IN WG): 5.2 — final temp (deg F): 59	DJM
6.10.6	PASS, see Data sheet 2	DJM
6.11	system restored	DJM

TEST DIRECTOR (print name and sign): R L Beireis

OTHERS (title, print name and sign): Cog Engr D J Mintzer DJ Mintzer

DATA SHEET 2 - LEAKAGE RATE CALCULATION

DATE: 2-15-96 **TANK:** 241-AW-102 **RETEST #:** NA

(A) Beginning pressure in inches WG: 7.2

(B) Beginning pressure in psig (A/27.7): 0.26

(C) Beginning barometric pressure in psi (IN Hg x 0.491): 14.51
Hanford Weather 29.555" Hg

(P1) Beginning duct pressure in psfa (B + C)144: 2127

(D) Beginning temperature in deg F: 59

(T1) Beginning temperature in deg R (D + 460): 519

(E) Ending pressure in inches WG: 5.2

(F) Ending pressure in psig (E/27.7): 0.19

(G) Ending barometric pressure in psi (IN Hg x 0.491): 14.51
Hanford Weather 29.555" Hg

(P2) Ending duct pressure in psfa (F + G)144: 2117

(H) Ending temperature in deg F: 59

(T2) Ending temperature in deg R (H + 460): 519

(V) Test Volume in cubic feet (entire assembly shown in H-2-85614, from flow controller to 12" butterfly valve): 24.7

(R) R, gas constant, in ft lb/(lb*degR): 53.35

($\triangle$T) Test Duration in minutes: 10sec/60 = 0.167

(Q) Average total housing leakage rate in standard cubic feet per minute (per ASME N510-1989, Section 6.5.3.9):

$Q = (P1/T1 - P2/T2)V/(R * \triangle T * .075)$

$= \left(\frac{2127-2117}{519}\right)\frac{24.7}{(53.35)(.167)(.075)}$

$= 0.71$

(LF) Leak Factor (based on an evaluation of individual leaks present using the bubble leak location method, the proportion of leakage on "tank side" of HEPA filter): 0.1
considered conservative since no leakage was detected in tank side connections, Step 6.10.1

(Q_u) **Average "tank side" housing leakage rate (connections and access doors/ports between 12" butterfly valve and HEPA filter seal) in scfm = (Q)(LF):** (.71)(.1) = 0.071

(L_a) Allowable Leak Rate in standard cubic feet per minute: 0.14

TEST DIRECTOR (print name and sign): RL Beireis RL Beireis

OTHERS (title, print name and sign): Cog Engr DJ Minteer DJ Minteer

DATA SHEET 1 - POSITIVE PRESSURE DECAY TEST

DATE: 2-15-96 **TANK:** 241-AW-103 **RETEST #:** NA

STEP	DATA/COMMENTS	TEST DIRECTOR OR DESIGNEE INITIALS
6.1	valve VTP-V-254C closed	DJM
6.2	no sign of damage	DJM
6.3	no sign of damage	DJM
6.4	filter locked, doors installed	DJM
6.5	seals/blanks in place	DJM
6.6	gages isolated	DJM
6.7	(Mfr/Model/ID#/Cal. Exp. Date) same as for tank 101	DJM
6.8	(Mfr/Model/ID#/Cal. Exp. Date) same as for tank 101	DJM
6.9	equip. installed	DJM
6.10.1	no detectable leakage, using bubble solution, in "tank side" connections	DJM
6.10.2	72°F maintained for 10 min at 7.0" wg	DJM
6.10.3	time: 0 initial pressure (IN WG): 7.0 initial temp (deg F): 72	DJM
6.10.4	time: 11 sec pressure (IN WG): 5.2 temp (deg F): 72	DJM
6.10.5	final time: 11 sec final pressure (IN WG): 5.2 final temp (deg F): 72	DJM
6.10.6	PASS, see Data Sheet 2	DJM
6.11	system restored	DJM

TEST DIRECTOR (print name and sign): RL Beireis

OTHERS (title, print name and sign): Cog Engr DJ Minteer DJ Minteer

Work Package 2E-96-00103/M

DATA SHEET 2 - LEAKAGE RATE CALCULATION

DATE: 2-15-96 **TANK:** 241-AW-103 **RETEST #:** NA

(A) Beginning pressure in inches WG: 7.0

(B) Beginning pressure in psig (A/27.7): 0.25

(C) Beginning barometric pressure in psi (IN Hg x 0.491): 14.46
Hanford Weather 29.45" Hg

(P1) Beginning duct pressure in psfa (B + C)144: 2118

(D) Beginning temperature in deg F: 72

(T1) Beginning temperature in deg R (D + 460): 532

(E) Ending pressure in inches WG: 5.2

(F) Ending pressure in psig (E/27.7): 0.19

(G) Ending barometric pressure in psi (IN Hg x 0.491): 14.46
Hanford Weather 29.45" Hg

(P2) Ending duct pressure in psfa (F + G)144: 2110

(H) Ending temperature in deg F: 72

(T2) Ending temperature in deg R (H + 460): 532

(V) Test Volume in cubic feet (entire assembly shown in H-2-85614, from flow controller to 12" butterfly valve): 24.7

(R) R, gas constant, in ft lb/(lb*degR): 53.35

(ΔT) Test Duration in minutes: 11 sec/60 = 0.183

(Q) Average total housing leakage rate in standard cubic feet per minute (per ASME N510-1989, Section 6.5.3.9):

$Q = (P1/T1 - P2/T2)V/(R * \Delta T * .075)$

$= \left(\frac{2118-2110}{532}\right)\frac{24.7}{(53.35)(.183)(.075)}$

$= 0.51$

(LF) Leak Factor (based on an evaluation of individual leaks present using the bubble leak location method, the proportion of leakage on "tank side" of HEPA filter): 0.1
considered conservative since no leakage was detected in tank side connections, Step 6.10.1

(Q_u) Average "tank side" housing leakage rate (connections and access doors/ports between 12" butterfly valve and HEPA filter seal) in scfm = (Q)(LF): (.51)(.1) = 0.051

(L_a) Allowable Leak Rate in standard cubic feet per minute: 0.14

TEST DIRECTOR (print name and sign): RL Beireis

OTHERS (title, print name and sign): Cog Engr DJ Minteer DJ Minteer

Work Package 2E-96-00103/M

DATA SHEET 1 - POSITIVE PRESSURE DECAY TEST

DATE: 2-16-96 **TANK:** 241-AW-104 **RETEST #:** NA

STEP	DATA/COMMENTS	TEST DIRECTOR OR DESIGNEE INITIALS
6.1	valve VTP-V-254D closed	DJM
6.2	no sign of damage	DJM
6.3	no sign of damage	DJM
6.4	filter leaked, doors installed	DJM
6.5	seals/blanks in place	DJM
6.6	gages isolated	DJM
6.7	(Mfr/Model/ID#/Cal. Exp. Date) Same as for tank 101	DJM
6.8	(Mfr/Model/ID#/Cal. Exp. Date) Same as for tank 101	DJM
6.9	equip. installed	DJM
6.10.1	no detectable leakage, using bubble solution, in "tank side" connections	DJM
6.10.2	35°F maintained for 10 min at 7.4 "wg	DJM
6.10.3	time: 0 / initial pressure (IN WG): 7.4 / initial temp (deg F): 35	DJM
6.10.4	time: 15 sec / pressure (IN WG): 5.2 / temp (deg F): 35	DJM
6.10.5	final time: 15 sec / final pressure (IN WG): 5.2 / final temp (deg F): 35	DJM
6.10.6	PASS, see Data Sheet 2	DJM
6.11	system restored	DJM

TEST DIRECTOR (print name and sign): RL Beireis

OTHERS (title, print name and sign): Cog Engr DJ Minter DJ Minter

DATA SHEET 2 - LEAKAGE RATE CALCULATION

DATE: 2-16-96 **TANK:** 241-AW-104 **RETEST #:** NA

(A) Beginning pressure in inches WG: 7.4

(B) Beginning pressure in psig (A/27.7): 0.27

(C) Beginning barometric pressure in psi (IN Hg x 0.491): 14.41
Hanford Weather 29.343 "Hg

(P1) Beginning duct pressure in psfa (B + C)144: 2114

(D) Beginning temperature in deg F: 35

(T1) Beginning temperature in deg R (D + 460): 495

(E) Ending pressure in inches WG: 5.2

(F) Ending pressure in psig (E/27.7): 0.19

(G) Ending barometric pressure in psi (IN Hg x 0.491): 14.41
Hanford Weather 29.343 "Hg

(P2) Ending duct pressure in psfa (F + G)144: 2102

(H) Ending temperature in deg F: 35

(T2) Ending temperature in deg R (H + 460): 495

(V) Test Volume in cubic feet (entire assembly shown in H-2-85614, from flow controller to 12" butterfly valve): 24.7

(R) R, gas constant, in ft lb/(lb*degR): 53.35

(ΔT) Test Duration in minutes: 15sec/60 = 0.25

(Q) Average total housing leakage rate in standard cubic feet per minute (per ASME N510-1989, Section 6.5.3.9):

$Q = (P1/T1 - P2/T2)V/(R * \Delta T * .075)$

$= \left(\frac{2114 - 2102}{495}\right) \frac{24.7}{(53.35)(.25)(.075)}$

$= 0.60$

(LF) Leak Factor (based on an evaluation of individual leaks present using the bubble leak location method, the proportion of leakage on "tank side" of HEPA filter): 0.1
Considered conservative since no leakage was detected in tank side connections, Step 6.10.1

(Q_u) Average "tank side" housing leakage rate (connections and access doors/ports between 12" butterfly valve and HEPA filter seal) in scfm = (Q)(LF): (.6)(.1) = 0.06

(L_t) Allowable Leak Rate in standard cubic feet per minute: 0.14

TEST DIRECTOR (print name and sign): RL Beireis

OTHERS (title, print name and sign): Cog Engr DJ Minteer DJ Minteer

Work Package 2E-96-00103/M

DATA SHEET 1 - POSITIVE PRESSURE DECAY TEST

DATE: 2-16-96 **TANK:** 241-AW-105 **RETEST #:** NA

STEP	DATA/COMMENTS	TEST DIRECTOR OR DESIGNEE INITIALS
6.1	valve VTP-V-254E closed	DJM
6.2	no sign of damage	DJM
6.3	no sign of damage	DJM
6.4	filter locked, doors installed	DJM
6.5	seals/blanks in place	DJM
6.6	gages isolated	DJM
6.7	(Mfr/Model/ID#/Cal. Exp. Date) Same as for tank 101	DJM
6.8	(Mfr/Model/ID#/Cal. Exp. Date) same as for tank 101	DJM
6.9	equip. installed	DJM
6.10.1	no detectable leakage, using bubble solution, in "tank side" connections	DJM
6.10.2	50°F maintained for 10 min at 7.4" wg	DJM
6.10.3	time: 0 initial pressure (IN WG): 7.4 initial temp (deg F): 50	DJM
6.10.4	time: 54sec pressure (IN WG): 5.2 temp (deg F): 50	DJM
6.10.5	final time: 54 sec final pressure (IN WG): 5.2 final temp (deg F): 50	DJM
6.10.6	PASS, see Data Sheet 2	DJM
6.11	system restored	DJM

TEST DIRECTOR (print name and sign): RL Beireis

OTHERS (title, print name and sign): Cog Engr DJ Minteer DJ Minteer

DATA SHEET 2 - LEAKAGE RATE CALCULATION

DATE: 2-16-96 **TANK: 241-AW-** 105 **RETEST #:** NA

(A) Beginning pressure in inches WG: 7.4

(B) Beginning pressure in psig (A/27.7): 0.27

(C) Beginning barometric pressure in psi (IN Hg x 0.491): 14.41
Hanford Weather 29.353 "Hg

(P1) Beginning duct pressure in psfa (B + C)144: 2114

(D) Beginning temperature in deg F: 50

(T1) Beginning temperature in deg R (D + 460): 510

(E) Ending pressure in inches WG: 5.2

(F) Ending pressure in psig (E/27.7): 0.19

(G) Ending barometric pressure in psi (IN Hg x 0.491): 14.41
Hanford Weather 29.353 "Hg

(P2) Ending duct pressure in psfa (F + G)144: 2102

(H) Ending temperature in deg F: 50

(T2) Ending temperature in deg R (H + 460): 510

(V) Test Volume in cubic feet (entire assembly shown in H-2-85614, from flow controller to 12" butterfly valve): 24.7

(R) R, gas constant, in ft lb/(lb*degR): 53.35

(▲T) Test Duration in minutes: 54sec/60 = 0.9

(Q) Average total housing leakage rate in standard cubic feet per minute (per ASME N510-1989, Section 6.5.3.9):

$Q = (P1/T1 - P2/T2)V/(R * \blacktriangle T * .075)$

$= \left(\frac{2114-2102}{510}\right)\frac{24.7}{(53.35)(.9)(.075)}$

$= 0.16$

(LF) Leak Factor (based on an evaluation of individual leaks present using the bubble leak location method, the proportion of leakage on "tank side" of HEPA filter): 0.1
considered conservative since no leakage was detected in "tank side" connections, Step 6.10.1

(Q_a) Average "tank side" housing leakage rate (connections and access doors/ports between 12" butterfly valve and HEPA filter seal) in scfm = (Q)(LF): (.16)(.1) = 0.016

(L_a) Allowable Leak Rate in standard cubic feet per minute: 0.14

TEST DIRECTOR (print name and sign): RL Beireis

OTHERS (title, print name and sign): Cog Engr D J Minteer DJ Minteer

Work Package 2E-96-00103/M

DATA SHEET 1 - POSITIVE PRESSURE DECAY TEST

DATE: 2-16-96 **TANK:** 241-AW-106 **RETEST #:** NA

STEP	DATA/COMMENTS	TEST DIRECTOR (OR DESIGNEE) INITIALS
6.1	valve VTP-V-254F closed	DJM
6.2	no sign of damage	DJM
6.3	no sign of damage	DJM
6.4	filter locked, doors installed	DJM
6.5	seals/blanks in place	DJM
6.6	gages isolated	DJM
6.7	(Mfr/Model/ID#/Cal. Exp. Date) same as for tank 101	DJM
6.8	(Mfr/Model/ID#/Cal. Exp. Date) same as for tank 101	DJM
6.9	equip. installed	DJM
6.10.1	no detectable leakage, using bubble solution, in "tank side" connections	DJM
6.10.2	70°F maintained for 10 min at 7.6 "wg	DJM
6.10.3	time: 0 — initial pressure (IN WG): 7.6 — initial temp (deg F): 70	DJM
6.10.4	time: 64 sec — pressure (IN WG): 5.2 — temp (deg F): 70	DJM
6.10.5	final time: 64 sec — final pressure (IN WG): 5.2 — final temp (deg F): 70	DJM
6.10.6	PASS, see Data Sheet 2	DJM
6.11	system restored	DJM

TEST DIRECTOR (print name and sign): RL Beireis

OTHERS (title, print name and sign): Cog Engr DJ Minteer DJ Minteer

Work Package 2E-96-00103/M

DATA SHEET 2 - LEAKAGE RATE CALCULATION

DATE: 2-16-96 **TANK:** 241-AW-106 **RETEST #:** NA

(A) Beginning pressure in inches WG: 7.6

(B) Beginning pressure in psig (A/27.7): 0.27

(C) Beginning barometric pressure in psi (IN Hg x 0.491): 14.42
Hanford Weather 29.36 "Hg

(P1) Beginning duct pressure in psfa (B + C)144: 2115

(D) Beginning temperature in deg F: 70

(T1) Beginning temperature in deg R (D + 460): 530

(E) Ending pressure in inches WG: 5.2

(F) Ending pressure in psig (E/27.7): 0.19

(G) Ending barometric pressure in psi (IN Hg x 0.491): 14.42
Hanford Weather 29.36 "Hg

(P2) Ending duct pressure in psfa (F + G)144: 2104

(H) Ending temperature in deg F: 70

(T2) Ending temperature in deg R (H + 460): 530

(V) Test Volume in cubic feet (entire assembly shown in H-2-85614, from flow controller to 12" butterfly valve): 24.7

(R) R, gas constant, in ft lb/(lb*degR): 53.35

(▲T) Test Duration in minutes: 64sec/60 = 1.07

(Q) Average total housing leakage rate in standard cubic feet per minute (per ASME N510-1989, Section 6.5.3.9):

$Q = (P1/T1 - P2/T2)V/(R * \blacktriangle T * .075)$

$= \left(\frac{2115-2104}{530}\right)\frac{24.7}{(53.35)(1.07)(.075)}$

$= 0.12$

(LF) Leak Factor (based on an evaluation of individual leaks present using the bubble leak location method, the proportion of leakage on "tank side" of HEPA filter): 0.1
considered conservative since no leakage was detected in tank side connections, Step 6.10.1

(Q_u) **Average "tank side" housing leakage rate (connections and access doors/ports between 12" butterfly valve and HEPA filter seal) in scfm = (Q)(LF):** (.12)(.1) = 0.012

(L_a) **Allowable Leak Rate in standard cubic feet per minute: 0.14**

TEST DIRECTOR (print name and sign): RL Beirels

OTHERS (title, print name and sign): Cog Engr DJ Minteer DJ Minteer

DISTRIBUTION SHEET

To	From	Page 1 of 1
Distribution	DJ Minteer	Date February 21, 1996
Project Title/Work Order		EDT No. 614412
241-AW Ventilation Upgrades		ECN No. n/a

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
WW Jenkins	S2-24	X			
DJ Minteer	S2-24	X			
LD Rakestraw	S5-05	X			
KA White	S5-13	X			
CA Sams	S5-13				X
JA Tuck	S2-03	X			
SK Farnworth	H5-57				X
Central Files	A3-88 ~~L8-04~~	X			