ENGINEERING CHANGE NOTICE				1. ECN 710588
Page 1 of <u>2</u>				Proj. ECN
2. ECN Category (mark one) Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersedure ☐ Cancel/Void ☐	3. Originator's Name, Organization, MSIN, and Telephone No. <i>Dan Johnston, PFP Engr, N202, 6-1412</i>	4. USQ Required? ☒ Yes ☐ No	5. Date <i>8/22/00</i>	
6. Project Title/No./Work Order No. <i>A-Labs - Rm 157 LOI furnace</i>		7. Bldg./Sys./Fac. No. <i>23A-5/25A</i>		8. Approval Designator <i>SQ</i>
9. Document Numbers Changed by this ECN (includes sheet no. and rev.) <i>HNF-6390, Rev. 0</i>		10. Related ECN No(s). <i>N/A</i>		11. Related PO No. <i>N/A</i>
12a. Modification Work ☐ Yes (fill out Blk. 12b) ☒ No (NA Blks. 12b, 12c, 12d)	12b. Work Package No. <i>22-00-00359</i>	12c. Modification Work Completed <i>N/A</i> Design Authority/Cog. Engineer Signature & Date		12d. Restored to Original Condition (Temp. or Standby ECNs only) <i>N/A</i> Design Authority/Cog. Engineer Signature & Date
<div style="display: flex; justify-content: space-between;"> <div style="width: 40%;"> 13a. Description of Change <p style="font-size: 1.2em;">Typos corrected on pg 1 of 8, 5 of 8, Appendix A pg 5 of 16, 6 of 16 typo & corrected step sequence, 7 of 16 - deleted 4.8, typo on 8 of 16, removed background check from data sh# 3.</p> </div> <div style="width: 55%;"> 13b. Design Baseline Document? ☐ Yes ☒ No </div> </div>				
14a. Justification (mark one) Criteria Change ☐ Design Improvement ☒ Environmental ☐ Facility Deactivation ☐ As-Found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐	14b. Justification Details <p style="font-size: 1.2em;">Correct typo and clarify test sequence</p> <p style="font-size: 1.2em;">USQ see ECN 657677</p>			
15. Distribution (include name, MSIN, and no. of copies)				
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <i>J.D. Dick T5-11</i> <i>DC Johnston N2-02</i> <i>RA Burk T4-20</i> <i>DR Groth T4-15</i> <i>SE Nunn T5-51</i> </div> <div style="width: 45%;"> <i>D.R. Speer T5-50</i> <i>E.W. Curfman T5-05</i> <i>S.T. Hurlbut T5-06</i> <i>Central Files B1-07</i> </div> </div>				
RELEASE STAMP				
<div style="border: 2px solid black; padding: 10px; display: inline-block;"> <p style="font-size: 1.5em; margin: 0;">AUG 23 2000</p> <p>DATE: _____</p> <p>STA: <i>5</i></p> <div style="border: 1px solid black; padding: 5px; display: inline-block; text-align: center;"> <p style="margin: 0;">HANFORD RELEASE</p> </div> <div style="border: 1px solid black; border-radius: 50%; width: 40px; height: 40px; display: flex; align-items: center; justify-content: center; margin: 5px auto;"> <p style="font-size: 1.5em; margin: 0;">12</p> </div> <p>ID: _____</p> </div>				

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16. Design Verification Required	17. Cost Impact		18. Schedule Impact (days)	
	<div>ENGINEERING</div> <div>Additional ☐ \$ _____</div> <div>Savings ☐ \$ _____</div>		<div>CONSTRUCTION</div> <div>Additional ☐ \$ _____</div> <div>Savings ☐ \$ _____</div>	
☐ Yes ☒ No			<div>Improvement ☐ _____</div> <div>Delay ☐ _____</div>	

SDD/DD	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specification	☐	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐
Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐
Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
FSAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐
Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐	Tickler File	☐
Environmental Report	☐	Inspection Plan	☐	<u>NONE</u>	☒
Environmental Permit	☐	Inventory Adjustment Request	☐		☐

Document Number/Revision

NONE

Signature

Date _____

Signature

Date _____

Design Authority

A-Lab LOI

Cog. Eng.

Cog. Mgr.

QA

Safety

Environ.

Other

Design Agent

PE

QA

Safety

Design

Environ.

Other

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

LOSS ON IGNITION FURNACE ACCEPTANCE/ OPERABILITY TEST PROCEDURE

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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Richland, Washington

LOSS ON IGNITION FURNACE ACCEPTANCE/ OPERABILITY TEST PROCEDURE

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ACCEPTANCE/ OPERABILITY TEST PROCEDURE	LOSS ON IGNITION FURNACE, ROOM 157, GLOVEBOX 157-3&4	HNF-6390 REV. 1 Pg 1 of 8
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1.0 TEST PLAN

1.1 Purpose

The purpose of this Acceptance Test Procedure and Operability Test Procedure (ATP/OTP) is to verify the operability of newly installed LOI equipment, including a model 1608FL CM™ Furnace, a dessicator, and balance.

1.2 Scope

The operability of the furnace will be verified. The arrangement of the equipment placed in Glovebox 157-3/4 to perform Loss on Ignition (LOI) testing on samples supplied from the Thermal Stabilization line will be verified. In addition to verifying proper operation of the furnace, this ATP/OTP will also verify the air flow through the filters, verify a damper setting to establish and maintain the required differential pressure between the glovebox and the room pressure, and test the integrity of the newly installed HEPA filter.

In order to provide objective evidence of proper performance of the furnace, the furnace must heat 15 crucibles, mounted on a crucible rack, to 1000° C, according to a program entered into the furnace controller located outside the glovebox. The glovebox differential pressure will be set to provide the 0.5 to 2.0 inches of water (gauge) negative pressure inside the glovebox with an expected airflow of 100 to 125 cubic feet per minute (cfm) through the inlet filter. The glovebox inlet G1 filter will be flow tested to ensure the integrity of the filter connections and the efficiency of the filter medium. The newly installed windows and glovebox extension, as well as all disturbed joints, will be sonically tested via ultra probe to verify no leaks are present. The procedure for DOS testing of the filter is found in Appendix A.

1.3 System Description

The Loss on Ignition Furnace and support equipment installed in glovebox 157-3/4 will be used to analyze samples supplied from the metals and oxides stabilization process. Samples of approximately 11 grams will be transported to the Analytical Laboratory, where the samples will be further subsampled into approximately 4 to 6 gram aliquots. The weight of the samples will be determined prior to heating. The subsamples will then be placed in the LOI furnace and heated at approximately 1000°C for about 2 hours. The samples will then be weighed after cooling. Any loss of weight is assumed to be due to loss of

ACCEPTANCE/ OPERABILITY TEST PROCEDURE	LOSS ON IGNITION FURNACE, ROOM 157, GLOVEBOX 157-3&4	HNF-6390 REV. 1 Pg 2 of 8
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water. The LOI process serves as a check on the ability of the metals and oxides stabilization process to completely remove water from the material.

The LOI equipment consists of the furnace, associated controller, analytical balance, dessicator, sample holder, tools for handling material and sample containers, and a table to hold samples while loading or unloading the furnace. Samples will be placed into the glovebox using a sphincter port located on the east, or left, side of the glovebox. Samples and waste will be removed from the glovebox using a seal-out port, most likely a gloveport converted for that purpose.

1.4 Objectives

The objectives of this ATP/OTP are to ensure that all equipment is operational, to establish ventilation flow requirements through the glovebox, and to verify that the HEPA filter will function per the requirements of ASMEN5101989.

1.5 Responsibilities

Test Director

The Test Director for the test of the furnace and associated equipment will be selected from the Analytical Laboratory Group. The Test Director for the test of the glovebox ventilation and for the test of the HEPA filter will be selected from the Ventilation Engineering Group. The Test Director(s) shall:

- Coordinate and direct operational testing of equipment of which they are cognizant
- Confirm that all prestart requirements have been met before allowing the test to begin
- Ensure that the system is left in a safe mode if the test is to be suspended for a period of time
- Reverify test prerequisites before restarting a suspended test
- Initial each step in the test procedure as it is performed
- Evaluate the need to make changes to the test and initiate ECNs to document those changes
- Review and approve test data sheets and exceptions
- Approve resolution to test exceptions

Witnesses

A test witness shall be provided by Quality Assurance. Test witnesses shall:

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- Witness portions of the test as identified by the Quality Engineer or Test Director
- Review and approve test data sheets and exceptions for the sections of the test that they witness
- Approve resolution to test exceptions for the sections of the test that they witness

Test Performer

The person performing the test shall be designated by Analytical Laboratory management or Ventilation Engineering as applicable. The test performer shall:

- Perform the test under the direction of the test director
- Record required information on the test data sheets as well as initial and date the form

2.0 SAFETY

PreJob Briefings shall be conducted per the requirements of Plutonium Finishing Plant Conduct of Operations FSPFP0821 Chapter 12. Configuration Control shall be maintained per Chapter 8. In the event that electrical equipment must be deenergized for work or adjustment during the performance of the procedure, perform lockout/tagout operations per, Chapter 9. This procedure shall be read and understood by all personnel involved in its performance. All personnel shall conform to the requirements of the Radiological Work Permit in accordance with the Hanford Site Radiological Control Manual DOE/RL96109.

The recommendations of the manufacturer shall be followed during equipment set-up and operation.

An operator shall monitor glovebox temperatures periodically during initial energization of the furnace. Gloves near the furnace shall be pulled out of the glovebox and tied or otherwise immobilized prior to energizing the furnace to avoid damaging the gloves.

3.0 TOOLS, EQUIPMENT, AND SUPPLIES

- Ultra Probe 2000
- Miscellaneous hand tools
- Required data forms and tables. Writing utensil

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- Equipment as required by Appendix A to establish differential pressure in the glovebox and to perform DOS test of the inlet filter
- Other tools or equipment as needed per the direction of the Test Director or Test Performer.

4.0 INITIAL CONDITIONS

Installation of the furnace and associated equipment is per applicable drawings and Engineering Change Notices. All work procedures are complete and signed off, with the exception of Task 4 of Work Package 2Z-00-0359. The manufacturer's technical manual is available for use during this procedure. Electrical power is available to the furnace controller. The building ventilation system is operable and in a normal configuration.

5.0 PROCEDURE

Each step in the procedure shall be initialed by the Test Director or designee when completed. Use the blanks in the margin to the left of each step.

If equipment is faulty or requires repair during the procedure, the procedure can be continued per the direction of the Test Director. The discrepancy shall be noted in Section 6.0.

At the Test Director's discretion, Pen and Ink changes may be made to the procedure in the field as the test progresses. Pen and Ink changes shall be made as follows:

- Each change must be signed by the cognizant engineer and the responsible manager. Additional signatures may be specified by the Test Director as required by ZAP-000-004. Change authorizations per telephone conversation shall be noted as such.
- The Test Director or designee shall ensure that the Pen and Ink changes remain within the scope of the ATP/OTP and any limits specified therein. The Test Director may authorize the continuation of the procedure prior to obtaining Exception or authorization signatures if determined to have a non-safety impact.
- Discrepancies shall be noted on the Exceptions list (Section 6.0).

ACCEPTANCE/ OPERABILITY TEST PROCEDURE	LOSS ON IGNITION FURNACE, ROOM 157, GLOVEBOX 157-3&4	HNF-6390 REV. 1 Pg 5 of 8
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- Existing data sheets or applicable test sections may be copied and added to this test plan if needed to repeat a section of the test. The page number of the page added shall be appended with an alphabetical suffix.

The following steps shall be performed in the order listed.

5.1 Ultra Probe Leak Test and Airflow Adjustment

5.1.1 Perform Ultra Probe testing of all new and disturbed mechanical joints. Perform Ultra Probe testing with the glovebox inlet damper shut and the exhaust damper fully open to provide the maximum differential pressure in the glovebox.

Quality Control Inspector: Verify zero leakage through all newly installed or disturbed joints.

Accept _____ Reject _____

Quality Control Inspector _____ / _____ / _____
Name Signature Date

5.1.2 Establish airflow through the inlet filter such that the airflow is a minimum of 50 cfm and the differential pressure of glovebox 157-3&4 and Room 157 is 0.5 to 2.0 inches of water (gauge). (Take single point measurement (Cog.) 8/22/00)

Record airflow _____ cfm

Record differential pressure _____ inches of water (gauge)

Ventilation Engineer: Verify airflow through the inlet filter is a minimum of 50 cfm and the differential pressure of glovebox 157-3&4 is 0.5 to 2.0 inches of water (gauge).

Ventilation Engineer _____ / _____ / _____
Name Signature Date

5.2 Performance of DOS Test of Inlet Filter

5.2.1 Perform DOS test of the inlet filter in accordance with Appendix A.

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Ventilation Engineer: Verify performance of DOS test of inlet filter in accordance with Appendix A. Verify that all data and signatures have been recorded as required in Appendix A

Ventilation Engineer _____ / _____ / _____
Name Signature Date

5.3 Operational Test of the Furnace

_____ 5.3.1 Arrange the sample rack, dessicator, scale, and other auxiliary equipment to receive and process samples. Ensure that spacing and arrangement allow safe manipulation of the samples and safe operation of the furnace. Place two thermometers in the glovebox: one above the furnace, near a fire suppression sprinkler head; and one next to the gloves which are nearest to the furnace

5.3.2 Energize and operate the furnace in accordance with the procedure in the manufacturer's technical manual.

Thermometer Number _____ Calibration due Date _____

Thermometer Number _____ Calibration due Date _____

5.3.3 Verify that the furnace and controls operate per the specifications in the manufacturer's technical manuals. Verify that the thermocouple in the furnace has been calibrated.

Quality Control Inspector _____ / _____ / _____

5.3.4 After the furnace has been energized for a sufficient time to allow the temperature of the glovebox to come to equilibrium (indicated by no change for 5 minutes), read and record the glovebox temperature as indicated by the thermometres positione din step 5.3.1

Top of glovebox (near sprinkler head) _____
Next to gloves (nearest the furnace) _____

5.3.5 Verify that the furnace and controls operate the specification in the manufacturer's technical manuals

Name Signature Date
Test Director (or designee) _____ / _____ / _____
Name Signature Date

ACCEPTANCE/ OPERABILITY TEST PROCEDURE	LOSS ON IGNITION FURNACE, ROOM 157, GLOVEBOX 157-3&4	HNF-6390 REV. 1 Pg 7 of 8
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6.0 EXCEPTIONS LIST

TABLE 6-1. EXCEPTIONS LIST

No.	EXCEPTION	RESOLUTION	SIGNATURE/DATE
			<hr/> Test Director <hr/> Quality Assurance
			<hr/> Test Director <hr/> Quality Assurance
			<hr/> Test Director <hr/> Quality Assurance
			<hr/> Test Director <hr/> Quality Assurance
			<hr/> Test Director <hr/> Quality Assurance

ACCEPTANCE/ OPERABILITY TEST PROCEDURE	LOSS ON IGNITION FURNACE, ROOM 157, GLOVEBOX 157-3&4	HNF-6390 REV. 1 Pg 8 of 8
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7.0 REFERENCES

- Manufacturer's Technical Manuals for the furnace and controller
- Drawings

H2-80209 sht. 1 Rev. 1, and sht. 2 Rev. 1 Rm 157 Glovebox Assembly
H2-302575 Spatula, Crucible Rack
H2-302573 Crucible Rack
H2-302577 Adjustable Table

- Engineering Change Notices

659366 New Filter and Support
656205 Adds Amphenol Connectors
651318 Install 480V Single Phase Power
657492 Gloveport Replacement and Equipment Arrangement
654445 Glovebox Extension
659358 Change Weld Callout and Connector Location
659626 Changes to ECN 659366
657677 FSAR Changes

8.0 ATP ACCEPTANCE

Any equipment non-conformance or anomalies will be listed on the Exceptions List. Upon test completion and acceptance, the Cognizant Engineer will prepare an Operational Test Report (OTR) from the original OTP (Appendix A) with field entries and transmit it to Central Files via Engineering Data Transmittal (EDT).

The undersigned concur that the OTP was completed successfully.

Quality Inspector _____ / _____ / _____
Name Signature Date

Cognizant Engineer _____ / _____ / _____
Name Signature Date

Lead Laboratory Scientist _____ / _____ / _____
Name Signature Date

Laboratory Manager _____ / _____ / _____
Name Signature Date

PFP Plant Manager _____ / _____ / _____
Name Signature Date

Aerosol Test of Filter F-157-2 In Room 157 of Building 234-5Z - System 25A**Page 1 of 16**

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Aerosol Test of Filter F-157-2 In Room 157 of Building 234-5Z - System 25A**Page 2 of 16**

1.0 INTRODUCTION**1.1 Purpose**

- 1.1.1 This procedure is used for visual inspection, operational acceptance and surveillance leak testing of installed High Efficiency Particulate Air (HEPA) filters. The basis for this procedure is ASME-N510-1989.

1.2 Scope

- 1.2.1 In accordance with ASME-N510-1989, a U.S. Department of Energy approved aerosol is injected into the air stream upstream of the tested filter bank. A representative aerosol concentration is determined for both upstream and downstream locations. Percent penetration through or around filter units is determined from ratio of downstream to upstream concentrations.

1.3 Applicability

- 1.3.1 This procedure is applicable to Filter F-157-2 in Room 157 of Building 234-5Z.

2.0 PRECAUTIONS AND LIMITATIONS**2.1 Caution Statements**

none

2.2 Limitations

- 2.2.1 Scheduling requirements are such that personnel performing this procedure complete the filter test trial within the duration of a single shift and with support of a single crew.
- 2.2.2 Minimum photometer warm-up time is 15 minutes.
- 2.2.3 Photometers and aerosol generators may be exchanged only at completion of test trial, NOT during test trial.

Aerosol Test of Filter F-157-2 In Room 157 of Building 234-5Z - System 25A**Page 3 of 16**

3.0 PREREQUISITES**3.1 Planning and Coordination**

- 3.1.1 ENSURE Air Balance SOEs are trained in accordance with Training Course No. 060048, "Ventilation System Testing and Adjusting."

3.2 Special Tools and Equipment**NOTE**

Measuring and Test Equipment (M&TE) used to collect data during performance of this procedure is required to be within the current calibration cycle as evidenced by an affixed calibration label and be capable of desired range.

- 3.2.1 M&TE as follows:

- Aerosol generator capable of producing a suitable challenge aerosol as verified by a specification check. (Aerosol generators may be air-generated or thermal-[nitrogen-] generated as long as adequate aerosol is generated to conduct valid test.)
- Linear, readout-forward, light-scattering, photometer or percent-penetration meter having threshold sensitivity of at least 10^{-3} micrograms per liter of air for 0.2 to 3.0 micron particles. (Instrument should have sampling rate of at least 1 cfm. Photometer should be capable of measuring concentration of 10^5 times the threshold sensitivity.)
- Backup instrumentation when required by step 4.3.2.

- 3.2.2 Aerosol: Emery 3004.

3.3 Field Preparations

- 3.3.1 ENSURE Filter to be tested (F-157-2) is in service.

3.4 Approvals and Notifications

Facility PIC shall notify Quality Control (QC) for potential surveillance, enter name of QC Inspector notified, sign and date below.

QC Inspector _____ (Printed Name)

PIC Signature _____ / _____ / _____
Printed Name Signature Date

Aerosol Test of Filter F-157-2 In Room 157 of Building 234-5Z - System 25A**3.5 Personnel Requirements**

Person in Charge (PIC).

Air Balance Stationary Operating Engineers (SOEs).

Chemical Technician

Radiological Control Technicians (RCTs), continuous coverage.

3.6 Performance Documents

This section intentionally blank.

Aerosol Test of Filter F-157-2 In Room 157 of Building 234-5Z - System 25A**Page 5 of 16**

4.0 PERFORMANCE**4.1 Preliminary Instructions**

- 4.1.1 COMPLETE Data Sheet as steps are performed,
THEN ENTER initial and date.

NOTE

Steps 4.1.2 and 4.1.3 may be performed and repeated at any time.

- 4.1.2 APPLY tape over open ports when temporary system closure is desired.

- 4.1.3 REMOVE tape from ports when required AND DISCARD as radiological waste.

NOTE

Minimum photometer warm-up time is 15 minutes.

- 4.1.4 START photometer.

NOTE

The purpose of visual inspection is to alert Surveillance to potential problems in ventilation system. The inspection is intended to be only a brief check of the system based on the expertise of the Vent and Balance SOEs. There are no pass/fail criteria to be used in the inspection.

4.2 Visual Inspection of Filter System

- 4.2.1 COMPLETE Visual Inspection Checklist (Attachment 1).

- 4.2.2 WRITE brief description of any indicated problem in Comments section of checklist.

4.3 Recording Calibration Data

- 4.3.1 RECORD calibration data for Vent and Balance instrumentation to be used on Data Sheet 1 (Attachment 4).

- 4.3.2 IF during performance of test additional or replacement instrumentation is required to complete test,
THEN RECORD calibration data for additional instrument(s) on Data Sheet 1.

- 4.3.3 IF additional instrumentation was used per step 4.3.2,
THEN EXPLAIN in Comments section of Data Sheet 1 why additional instrumentation was needed AND DESCRIBE in detail when (test trial number) and where (procedure step number) additional instrumentation was needed.

Aerosol Test of Filter F-157-2 In Room 157 of Building 234-5Z - System 25A

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4.4 Determining System Airflow

4.4.1 MARK pitot tube as specified on Data Sheet 2 (Attachments 5).

NOTE

Figures 1 through 3 show location of test ports for filter testing.

- REMOVE cap/plug from port **TP-500-C**.

4.4.2 MEASURE Velocity Pressure (VP) at specified traverse intervals
THEN RECORD VP measurement on Data Sheet 2.

4.4.3 REMOVE test equipment from test ports.

4.4.4 CALCULATE velocity (in feet per minute [fpm]) at each traverse interval from corresponding VP measurement using the following equation:

$$fpm = 4005\sqrt{VP}$$

- RECORD results rounded to nearest whole number on Data Sheet 2.

4.4.5 CALCULATE total of fpm columns AND RECORD results on Data Sheet 2.

4.4.6 DIVIDE sum of fpm entries by number of entries to find average AND RECORD results on Data Sheet 2.

4.4.7 CALCULATE total airflow rate (in cfm) using the following equation:

$$cfm = Average\ fpm \times 0.0873\ sq.\ ft.$$

- RECORD result rounded to nearest whole number on Data Sheet 2.

4.5 Measuring Differential Pressure (DP)

4.5.1 MEASURE DP across filter using calibrated instrumentation
AND RECORD result on appropriate Data Sheet 3.

4.6 Establishing Base Percent

NOTE

The minimum photometer warm-up time is 15 minutes.

4.6.1 PREPARE photometer.

- REMOVE cap/plug from port **TP-500-B**.

4.6.2 INSERT photometer probe into port **TP-500-B**.

4.6.3 START aerosol generator AND INJECT aerosol into injection port **TP-500-B** (see sketch) to establish BP.

A. 100 8/22/00

Aerosol Test of Filter F-157-2 In Room 157 of Building 234-5Z - System 25A**Page 7 of 16**

4.7 Determining Base Percent

- 4.7.1 RECORD range switch setting (scale) and meter reading for BP on appropriate Data Sheet 3.
- 4.7.2 STOP aerosol generator.

4.8 Not Used**4.9 Determining Total Penetration for Filter**

- 4.9.1 REMOVE cap/plug from port **TP-500-A**.
- 4.9.2 START aerosol generator AND INJECT aerosol into port **TP-500-A**.
- 4.9.3 MEASURE total penetration (P1) through filter at port **TP-500-C**
AND RECORD scale and meter readings on appropriate Data Sheet 3.
- 4.9.4 STOP aerosol generator.

4.10 Final Steps

- 4.10.1 REPEAT steps 4.6.3 through 4.9.4 for a total of 3 trials except for cap/plug removal.
- 4.10.2 REMOVE equipment from test ports
- 4.10.3 STOP photometer.
- 4.10.4 INSTALL cap/plugs on test ports.

4.11 Calculations

- 4.11.1 CALCULATE equation inputs BP, and P1 using the following equation:

$$Input = (Scale Reading) \times (Meter Reading)$$

- RECORD results on Data Sheet 3.

- 4.11.2 CALCULATE percent penetration for all 3 trials using the following equation:

$$calculated \% penetration = 100 \times \frac{(P1)}{(BP)}$$

- RECORD results on appropriate Data Sheet 3.

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- 4.11.3 IF Calculated Percent Penetrations (CP1, CP2 and CP3) are less than 0.025%,
THEN WRITE N/A for step 4.11.4 on Data Sheet 3 AND GO TO step 4.11.7.

NOTE

Only the equation for percent difference on Trial 1 is shown. Data Sheet 3 has remaining calculations.

- 4.11.4 CALCULATE percent difference for Calculated Percent Penetrations using the following equation:

$$\% \text{ Diff.} = 100 \times \frac{(CP1 - CP2)}{CP2}$$

- RECORD results on appropriate Data Sheet 3.

- 4.11.5 IF 2 or more percent difference calculations are between -5% and +5%,
THEN GO TO step 4.11.8.

- 4.11.6 IF NO percent difference calculations are between -5% and +5%,
THEN NOTIFY HVAC Cognizant Engineer.

NOTE

Test failure occurs when Calculated Percent Penetration is equal to or greater than 0.05%.

- 4.11.7 RECORD largest Calculated Percent Penetration on Data Sheet 4 (Attachment 11)
AND GO TO step 4.11.9.
- 4.11.8 RECORD largest Calculated Percent Penetration with percent difference between -5% and +5% on Data Sheet 4.

NOTE

System performance is acceptable when the filter bank efficiency is greater than 99.95%. Failure occurs when the penetration (i.e., the final recorded value) is greater than or equal to 0.05%

- 4.11.9 IF Calculated Percent Penetration (final recorded value) is greater than or equal to 0.05%,
THEN NOTIFY (immediately) Building Emergency Director (BED) (Shift Manager/BED certified individual) that Filter box has failed penetration test.
- 4.11.10 UPDATE test sticker OR INSTALL new sticker.

Aerosol Test of Filter F-157-2 In Room 157 of Building 234-5Z - System 25A**5.0 POST PERFORMANCE ACTIVITIES****5.1 Results**

- 5.1.1 System performance is acceptable when the filter efficiency is greater than 99.95%. Failure occurs when the penetration (i.e., the final recorded value) is greater than or equal to 0.05%.

5.2 Disposition

- 5.2.1 VERIFY data sheets complete AND DOCUMENT any deficiencies or component failures observed during performance of procedure, THEN RECORD comments on Data Sheet 4.
- 5.2.2 REVIEW procedure Data Sheets for completeness, legibility, and correct calculations.
- 5.2.3 RECORD any deficiencies noted on OTP/ATP exception sheet.

6.0 SOURCE REQUIREMENTS

- *American Society of Mechanical Engineers*, ASME-N510-1989
- *ERDA 76-21*, Chapter 8, "Energy Research and Development Administration"
- Training Course No. 060048, "Ventilation System Testing and Adjusting."
- Material Safety Data Sheet (MSDS) No. 24335, "Emery 3004 Synthetic Hydrocarbon."

7.0 APPENDIX**FIGURE 1 – Location Of Ports For Testing – F-157-2**

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ATTACHMENT 1 - VISUAL INSPECTION CHECKLIST

F-157-2

Step 4.2.1	VISUAL INSPECTION CHECKLIST	YES	NO
*	Is there adequate access to the filter housing?		
*	Is the housekeeping in and around the housing adequate for testing?		
*	Is the lighting adequate to perform the test and inspection?		
*	Is there any evidence of physical damage to the housing or connected ductwork adjacent to the housing?		
*	Are the sample ports identified in the sketch available for use?		
*	Are sample ports labeled?		
*	Is there any evidence of leakage or damage to the seal between the door and filter housing?		
*	Do installed pressure gauges have component labels?		
*	Is there any unacceptable damage (e.g., broken gauges, disconnected lines, and so forth) to the local instrumentation?		

COMMENTS: _____

Initials/Date _____

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ATTACHMENT 4 - DATA SHEET 1

Step 4.3.1	INSTRUMENT CALIBRATION DATA	
	Air Flow Instrument	Photometer
	Flow Instrument Type	Equipment Number
	Code Number	Code Number
	Calibration Due Date	Instrument Calibration Due Date
		Functional Calibration Due Date
	Aerosol Generator	
	Model Number	
	Equipment Number	
	Aerosol Type	
	Functional Verification Due Date	
Step 4.3.2	ADDITIONAL INSTRUMENT CALIBRATION DATA *See Footnote	

Step 4.3.3 COMMENTS: _____

Initials/Date _____

* Calibration Data should be entered into this portion of Data Sheet in the same format as shown in step 4.3.1.

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ATTACHMENT 5 - DATA SHEET 2

F-157-2

System Air Flow Readings			
Step	Pitot tube Traverse Points (in.)	VP (in. w.g.)	Velocity (fpm)
4.4.1	1/8		
4.4.2	5/8		
4.4.4	1 1/8		
	2 7/8		
	3 3/8		
	3 7/8		
4.4.5	Total fpm		
4.4.6	Average fpm = Total fpm ÷ 6		
4.4.7	Cfm = (Average fpm) X (0.0873 sq. ft.)		

Initials/Date _____

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ATTACHMENT 8 - DATA SHEET 3 (F-157-2)

Step	System ID No.	Gauge ID No.	Limit	DP (in. WG)	Initial/Date
4.5.1	F-157-2	DPI 4-157	<2 in. WG	in. WG	
Step	TRIAL 1	TRIAL 2	TRIAL 3		
4.7.1, 4.11.1	SCALE x READING = INPUT X = (BP)	SCALE x READING = INPUT X = (BP)	SCALE x READING = INPUT X = (BP)	SCALE x READING = INPUT X = (BP)	
4.11.1	X = (P1)	X = (P1)	X = (P1)	X = (P1)	
4.9.3, 4.11.1	X = (P1)	X = (P1)	X = (P1)	X = (P1)	
4.11.2	Calculated Penetration 1 $CP1 = 100 \times \frac{(P1)}{(BP)}$ $CP1 = 100 \times \frac{(\quad)}{(\quad)}$ $CP1 = \frac{\quad}{\quad} \%$	Calculated Penetration 2 $CP2 = 100 \times \frac{(P1)}{(BP)}$ $CP2 = 100 \times \frac{(\quad)}{(\quad)}$ $CP2 = \frac{\quad}{\quad} \%$	Calculated Penetration 3 $CP3 = 100 \times \frac{(P1)}{(BP)}$ $CP3 = 100 \times \frac{(\quad)}{(\quad)}$ $CP3 = \frac{\quad}{\quad} \%$	Percent Difference 1 - 2 $\% DIFF. = 100 \times \frac{(CP1 - CP2)}{CP2}$ $\% DIFF. = 100 \times \frac{(\quad - \quad)}{(\quad)}$ $\% Diff. = \frac{\quad}{\quad}$	Percent Difference 1 - 3 $\% DIFF. = 100 \times \frac{(CP1 - CP3)}{CP3}$ $\% DIFF. = 100 \times \frac{(\quad - \quad)}{(\quad)}$ $\% Diff. = \frac{\quad}{\quad}$
4.11.4	Percent Difference 1 - 2 $\% DIFF. = 100 \times \frac{(CP1 - CP2)}{CP2}$ $\% DIFF. = 100 \times \frac{(\quad - \quad)}{(\quad)}$ $\% Diff. = \frac{\quad}{\quad}$	Percent Difference 2 - 3 $\% DIFF. = 100 \times \frac{(CP2 - CP3)}{CP3}$ $\% DIFF. = 100 \times \frac{(\quad - \quad)}{(\quad)}$ $\% Diff. = \frac{\quad}{\quad}$	Percent Difference 1 - 3 $\% DIFF. = 100 \times \frac{(CP1 - CP3)}{CP3}$ $\% DIFF. = 100 \times \frac{(\quad - \quad)}{(\quad)}$ $\% Diff. = \frac{\quad}{\quad}$		

Initials/Date

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ATTACHMENT 11 - DATA SHEET 4

JCS Work Package No. _____

Step 4.11.7 or 4.11.8

F-157-2 PENETRATION TEST RESULTS _____ % Initials/date _____ / _____

Step 4.11.9

Does filter pass the aerosol test? F-157-2 YES _____ NO _____

(Acceptable penetration is less than 0.05%)

If NO, circle in RED and record time when BED was notified _____

Step 5.2.1 Comments: _____

Work Performed By: _____ / _____ / _____

Vent and Balance (Lead) Initials Printed Name Signature Date

Step 5.2.2 REVIEW procedure data sheets for completeness and legibility.

Work Reviewed By: _____ / _____ / _____

Facility or V&B PIC Initials Printed Name Signature Date

REQUIRED ACTION: IF HEPA filter is found to be inoperable (NO on step 4.11.9),
IMMEDIATELY notify BED.