

# OAK RIDGE NATIONAL LABORATORY

MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

P.O. Box 2008  
Mail Stop 6052  
Oak Ridge, TN 37831-6052  
Phone: (865) 574-0368  
Fax: (865) 241-4644  
Email: wcy@ornl.gov

October 30, 2002

Mr. Ben Franklin  
American Air Filter International  
Nuclear Environmental Systems  
10300 Ormsby Park Place, Suite 600  
Louisville, Kentucky 40223

Dear Mr. Franklin,

We are pleased to reinstate American Air Filter (AAF) as an "Approved" or "Evaluated" manufacturer and supplier of nuclear-grade HEPA filters to the Oak Ridge National Laboratory (ORNL). This approval is recommended for a period not to exceed three years and is based on the satisfaction of all outstanding audit findings and corrective actions in order to meet requirements set forth in ANSI/ASME NQA-1 and P-AAA 10CFR830, Subpart A.

From a technical perspective, we appreciate an improved reliability at AAF resulting from the corrective actions. Using monodispersed polymer microspheres, traceable to the National Institute of Standards and Technology to calibrate the test equipment using laser measurement methods, and further production testing with microspheres as a replacement for DOP (Dioctylphthalate) smoke will eliminate concerns for particle size variation coincident with changes in temperature.

This letter and supporting objective evidence will be placed in the ORNL Procurement Quality Services data base for internal review by ORNL employees.

Congratulations on a job well done.



Wayne A. Camp  
Procurement Quality Services  
Oak Ridge National Laboratory

Cc: W. G. Askew  
L. K. Brown  
J. G. Burr  
M. H. Carpenter  
G. E. Chitwood  
M. L. Gildner  
M. J. Harris  
G. A. Harvey

S. A. Hinton  
K. R. Houbre  
J. S. Ivey  
K. S. Joy  
G. Q. Kirk  
J. E. Lee  
G. N. Norman  
G. F. Payne

D. C. Rice  
C. A. Schrof  
J. W. Sinclair  
W. K. Thomas  
L. J. Turner  
M. C. Vance  
J. L. Wagner  
D. M. Walls



10300 ORMSBY PARK PL STE 600  
LOUISVILLE KY 40223-6169  
P O BOX 35690  
LOUISVILLE KY 40232-5690  
502.637.0011  
www.aafintl.com

September 3, 2002

Mr. Wayne Camp, MS 6052  
Procurement Quality Services  
Oak Ridge National Laboratory  
UT-Battelle for DOE  
P.O. Box 2008  
Oak Ridge, TN 37831

References: (1) Report PQS-2002-003 (May 22, 2002)  
Q A Audit of AAF International  
(2) ORNL Letter May 31, 2002  
(3) ORNL Letter August 26, 2002

Subject: AAF Response

Dear Mr. Camp:

The enclosed AAF CAR 02-003, together with its attachments, is our response to your audit finding and your letter of August 26, 2003. It has been accepted internally by Mr. Jim Thomas, our Nuclear QA Manager.

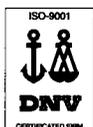
It is also in agreement with your August 26, 2002 letter except that for items 2 and 3 it substitutes PSL (Polystyrene Latex) spheres for DOP, which is allowed by the DOE HEPA Specification DOE 3020-97. AAF's Equipment using DOP cannot yet be calibrated as requested. The reference PSL used to calibrate the Laser equipment is calibrated to NIST. The actual test PSL will be of a range slightly smaller than .3 microns, which will insure conservative test results. The AAF laser testing has been in use at AAF for many years.

Please accept this response. Should additional information or explanation be required, please do not hesitate to contact me.

AAF appreciates the patience and understanding shown by UT-Battelle.

Sincerely,

Ben Franklin, Director  
Nuclear Environmental Systems  
AAF International



**CORRECTIVE ACTION REQUEST FORM (C.A.R.)**

C.A.R. # 02-003

REPLY BY: 9-29-02

(Instructions on Reverse Side)

(A)	<b>FORWARD TO: (Respondent &amp; Department)</b> AF Columbia Plant c/o Andrew McLeland, Plant Manager		
	<b>PRODUCT (PN) / PROCESS / PROCEDURE INVOLVED:</b> Hot DOP Testing		
	<b>DESCRIPTION OF NONCOMPLIANCE:</b> REFERENCE: UT Battelle, LLC, Oak Ridge National Laboratory, Oak Ridge, Tennessee Final External Assessment Report: Supplier Re-Qualification Evaluation of AAF International and AAF International Manufacturing Plant, Columbia, Missouri. Report Date: May 22, 2002 by Evaluator: W.A. Camp Paragraph 5.8 Criterion 8, Performance/Inspection and Acceptance Testing. FINDING: Unacceptable Noncompliance Actual wording of the finding - Page 7 thru 9 of the report - is attached.		
	GENERIC CAUSE (Circle One) TIME	SYSTEM (Procedural) DISCIPLINE	RESOURCES MANAGEMENT SUPPORT
			TRAINING OTHER: See attachment
	ORIGINATED BY: <i>[Signature]</i>		DATE: <u>8/29/02</u>
(B)	Q.I. PERSONNEL: <i>[Signature]</i>	DATE: <u>8/29/02</u>	C.A.R. APPROPRIATE: <input checked="" type="radio"/> YES <input type="radio"/> NO
(C)	ROOT CAUSE OR PROBLEM  SEE ATTACHED LETTER DATED <u>8/30/02</u>		
	CORRECTIVE ACTION TAKEN (See Instructions):  SEE ATTACHED LETTER DATED <u>8/30/02</u>		
	SIGNATURE: <i>[Signature]</i> TITLE: PLANT MANAGER REPLY DATE: <u>8-30-02</u>	DATE CORRECTIVE ACTION WILL BE IMPLEMENTED: <u>9/20/02</u>	
(D)	C.A.R. REVIEW <input checked="" type="checkbox"/> ACCEPTABLE <input type="checkbox"/> NOT ACCEPTABLE	REVIEWER: <i>[Signature]</i> <u>9/3/02</u>	
	VERIFICATION <input type="checkbox"/> ACCEPTABLE <input type="checkbox"/> NOT ACCEPTABLE <input type="checkbox"/> CLOSED DATE: _____	DIST. _____ _____ _____	
	REVIEWER: _____		



2100 Nelwood Drive  
Columbia, MO 65203  
Phone: (573) 886-3100  
Fax: (573) 886-3103  
email: amcleland@aafintl.com

August 30, 2002

Mr. Ben Franklin  
10300 Ormsby Park Place, Suite 600  
Louisville, KY 40223-6169

Mr. Ben Franklin:

This letter is written in response to the corrective action finding on AAF Columbia (CAR 02-003) as a result of the UT Battelle supplier re-qualification report dated May 22, 2002. The report of non-conformance references section 5.8, Criterion 8 – Performance/Inspection and Acceptance Testing. It is specifically referring to the inability to verify particle size on the Q107 filter efficiency tester.

Following a fire in April of 2001, the Q107 thermal aerosol generator was replaced with an ATI TDA-5B closed-loop hot DOP generator. The 5B generator has no adjustment to operating parameters that can change particle size; therefore, required no ongoing monitoring. Based on our understanding of this from the manufacturer, AAF discontinued the use of the owl as verification of particle size.

Following notification from the Oak Ridge National Laboratory audit that there was question concerning the validation of the particle size, AAF reinstated the practice of randomly auditing the testing system with the use of a calibrated OWL. The OWL readings were not consistent with our understanding of what the 5B generator was producing. AAF therefore contracted the assistance of Dan Milholland to determine true mean particle size. The conclusion of the study was:

“The AAF data does not match the OWL calibration curve. Due to the polydispersity of the aerosol, the CMD is considerably smaller than the OWL reading indicates. As a result of factory testing filters with an aerosol closer to the MPPS, the filter efficiency ratings are understated, i.e., the filters are more efficient than at 0.3  $\mu\text{m}$  than AAF claims”

Dan Milholland and AAF acknowledge and recognize the research of First and Hinds as the basis for the above conclusion: Hinds, First et al; *Size Distribution of "Hot DOP" Aerosol Produced by ATI Q-127 Aerosol Generator*, 15<sup>th</sup> DOE Nuclear Air Cleaning Conference, 1978.

The results of data comparing AAF's efficiency readings to those of Oak Ridge readings support the above conclusion, as well. Thus, AAF is confident that filters provided to Oak Ridge National Laboratory meet or exceed the requirements for filter efficiency.



The continuing concern, however, is AAF's inability to consistently measure a DOP filter challenge aerosol of known size and concentration to determine filter efficiency. Therefore, AAF proposes to use Polystyrene latex spheres (PSL) as our test challenge and measure filter efficiency with a calibrated particle counter. PSL is the calibration standard for optical particle counting equipment. The PSL particle size is very uniform and NIST certified in 0.001 um resolution.

To validate our test method, AAF will

1. Procure a known sphere size of less than 0.3 um to use as a filter challenge. AAF's purchase order will specify requirement of sphere size.
2. Encapsulate and challenge a group of filters with approximately 25 million (2.5 e7) PSL particles per cubic foot of upstream air at the rated flow.
3. Using a calibrated particle-measuring device, AAF will record upstream and downstream results, thus developing filter efficiency.
4. A sample of filters no less than 15 will be submitted to Oak Ridge Testing Laboratory for validation of our test results. Upon successful completion of the validation of our test method, AAF will maintain calibration schedules of the particle-measuring device for future orders and testing.
5. Copy of the test procedure and C of C will be submitted to Oak Ridge Test Laboratories.

By this method as referred to by DOE standards, specifically IEST RP-7 method modified to use 0.3 um particles, AAF will be able to quantitatively verify particle size and filter efficiency.

Sincerely,

A handwritten signature in black ink, appearing to read 'Andrew McLeland'. The signature is stylized and includes a circled 'M' and a circled 'L'.

Andrew McLeland  
Plant Manager at AAF - Columbia

**Attachments:**

- Equipment Operating Procedure MM2-10.0504 (3 pages)
- Certificate of Calibration for the PMS Lasiar 110-B particle counter in service (1 page)
- Certificate of Calibration for the Emerson flow meter (traceable to NIST) used to calibrate flow of above Lasiar counter (1 page)
- Certificate of Calibration for the Duke Scientific PSL (traceable to NIST) used to calibrate particle size of above Lasiar counter (2 pages)
- Picture of Laser Test Duct-Micro LPC-110 (1 page)

Title: LASER TEST DUCT-MICRO LPC-110

**1.0 SCOPE**

This procedure defines the methods to be used for operating the Laser Test Duct with a Micro LPC-110 laser particle counter.

**2.0 RESPONSIBILITY**

Quality Assurance/Quality Control Technicians or designees are responsible through the Quality Assurance Supervisor for performing test in accordance with this instruction.

**3.0 PROCEDURE****3.1 EQUIPMENT START-UP**

3.1.1 Turn on the Micro LPC-110 and remove the warning by pressing the button next to the warning.

3.1.1.1 If the warning is due to an LPC power interrupt, press enter to exit.

\* 3.1.1.2 If the warning is due to a low voltage, the machine should remain powered. Remove the warning repeatedly until the warning does not return.

3.1.1.3 If the warning remains on the machine, replace the machine with another Micro LPC-110.

3.1.2 Turn on the computer.

3.1.3 Input the required information.

**3.2 EFFICIENCY AND RESISTANCE TEST**

3.2.1 Place filter in test duct and push "Close Filter Clamp" to rapidly move the plenum. Use the switch located on the plenum for slow movement.

3.2.2 With filter clamped in place, push "Fan On". The damper controlling airflow should be set such that the airflow is not initially too high.

3.2.3 Push "Smoke to Filter".

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**Title: LASER TEST DUCT-MICRO LPC-110**

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- 3.2.4 Set airflow according to order specifications.
- 3.2.4.1 Adjust the damper by visual inspection of the appropriate manometer until the required orifice pressure drop is reached. Continue to monitor the orifice pressure drop during each filter test.
- 3.2.5 Switch the Micro LPC-110 to take an upstream sample every fifth filter tested. *note 10/21/92*
- 3.2.5.1 Allow the Micro LPC-110 to count for the amount of time set in the machine.
- \* 3.2.5.2 The counts are to give 2 million particles on the required particle size band, unless otherwise specified.
- \* 3.2.5.3 If the counts are not within the required range, adjust the test interval in the setup of the Micro LPC-110 until the counts are consistently in the required range.
- \* 3.2.6 Take an upstream count with one set of upstream data collected for every fifth filter tested.
- 3.2.7 Switch the Micro LPC-110 to take a downstream sample.
- \* 3.2.8 Take a downstream count for every filter tested.
- 3.2.9 By visual inspection of the appropriate manometer, note and record filter resistance to airflow.
- 3.3 COMPLETE THE TEST
- 3.3.1 Analyze the data and generate a test report in the computer.
- 3.3.2 Push "Divert Smoke".
- 3.3.3 Push "Open Filter Clamp".
- 3.3.4 Remove filter.

**AAF International**

SECTION MM2-10.0504

**EQUIPMENT OPERATING PROCEDURE**

PAGE NO. 3 OF 3  
DATE: 30 NOVEMBER 1998

Title: LASER TEST DUCT-MICRO LPC-110

PREPARED BY:

Bonnie S. Carnes

11-30-98

Date

REVIEWED BY:

Trace Siebenick

11/30/98

Date



Fix CC: Wayne Camp  
 10/18/02 UT-Battelle

Retest 10/24/02  
 -BF

I've added the FTF penetration results  
 above the AAF results  
 -BF



2100 Nelwood Drive  
 Columbia, MO 65202

**B-LEVEL PSL TEST REPORT**

RATED FLOW: 1000

CFM 10-24-02  
 AAF } 0.26 + 0.02 MICRON PSL  
 SPHERES USED IN TESTS

DATE TESTED: OCT 01 2002

ACCEPTANCE LEVELS:

PEN. %

RESISTANCE IN. W.G.

AAF  
 45

AT RATED FLOW:

≤ .030

≤ 1.0

INSPECTION NO.:

AT 20% OF RATED FLOW:

≤ .030

N/A

PENETROMETER S/N: 32543-0994-101/a

	MEDIA LOT NO.	ROLL NO.	FILTER SERIAL NO.	RATED FLOW		20% FLOW		OVERALL DIMENSIONS ✓=ACC.
				PEN % OR FTF / AAF	RES. IN. W.G.	PEN % OR FTF / AAF		
1	2098	1621-6	42 316010	.007	.9	.013	✓	
2	"	"	42 316011	.012	.9	.016	✓	
3	"	"	42 316012	.013	.9	.014	✓	
4	"	"	42 316013	.010	.9	.014	✓	
5	"	"	42 316014	.009	.9	.014	✓	
6	"	"	42 316015	.008	.9	.012	✓	
7	"	"	42 316009	.009	.9	.013	✓	
8	"	"	42 316008	.008	.9	.012	✓	
9	"	"	42 316007	.010	.9	.012	✓	
10	"	"	42 316006	.008	.9	.011	✓	
11				.	.	.		
12				.	.	.		
13				.	.	.		
14				.	.	.		
15				.	.	.		
16				.	.	.		
17				.	.	.		
18				.	.	.		
19				.	.	.		
20				.	.	.		

This will certify that the filters described herein have been inspected and tested in accordance with AAF International's standard inspection and testing procedures which are intended to comply with I.E.S. recommended practices.

C/N 846824-1 ORDER NO. 907573 4000 a 18084 FILTER P/N 105-1352345-505 (ECO 83180) (907-198-201)  
 From UT-Battelle PO  
 OK Amto 10/2/02

Reviewed by Bonnie S. Conroy Title QA TECHNICIAN Date 10-2-02  
 NO. 4426 P. 1  
 AAF OCT. 24. 2002 2:02PM

**Air - Air Techniques International**  
**OAK RIDGE FILTER TEST FACILITY**  
**FILTER TEST REPORT**

<b>CUSTOMER</b> UT Battelle/ORNL	<b>TEST CRITERIA</b>		NUMBER ORDERED 10	DATE RECEIVED 03 OCT 02
PURCHASE ORDER NO. 4000018084	DOP PENETRATION .03 % @ RATED FLOW    .03 % @ 20%		NUMBER RECEIVED 10	DATE TESTED 04 OCT 02
	RESISTANCE 1.0			
FILTER MODEL NUMBER 105-1332-345-505	SPECIFICATION NON-NUCLEAR DOE STD 3020-97/Spec # 15885		NUMBER ACCEPTED 10	DATE SHIPPED 08 OCT 02
MANUFACTURER American Air Filter		<b>TEST CONDITIONS</b>		
FILTER DESCRIPTION 24x24x11 1/2" Wood Seps 2X Gast		TEMPERATURE 57 F	TEST FLOW (ACFM) 1000/200	PENETRATION
PO reviewed by DWC	RATED FLOW (ACFM) 1000	BAROMETRIC PRESS. 29.35 IN. HG.	Humidity in % RH 73%	RESISTANCE
		<b>REJECTS</b>		
		DAMAGE	OTHER	

ITEM No.	FILTER SERIAL NUMBER	INSPECTION RESULTS	TEST RESULTS		
			RESISTANCE	% PENETRATION	
				@ 100% FLOW	@ 20% FLOW
1	42316009	<b>Accepted</b>	<b>0.9</b>	<b>.005</b>	<b>.004</b>
2	42316013	"	<b>0.9</b>	<b>.006</b>	<b>.005</b>
3	42316010	"	<b>0.9</b>	<b>.004</b>	<b>.002</b>
4	42316012	"	<b>0.9</b>	<b>.002</b>	<b>.002</b>
5	42316011	"	<b>0.9</b>	<b>.005</b>	<b>.004</b>
6	42316007	"	<b>0.9</b>	<b>.007</b>	<b>.004</b>
7	42316015	"	<b>0.9</b>	<b>.004</b>	<b>.003</b>
8	42316014	"	<b>0.9</b>	<b>.004</b>	<b>.002</b>
9	42316006	"	<b>0.9</b>	<b>.005</b>	<b>.003</b>
10	42316008	"	<b>0.9</b>	<b>.003</b>	<b>.002</b>
11					
12					
13					
14					
15					
16					
17					
18					

DISTRIBUTION  <p style="text-align: center;">Steve Hinton</p>	TESTED BY: <div style="text-align: center;"><i>Justin A. Davis</i></div> <hr/> APPROVED BY: <div style="text-align: center;"><i>David W. Crosby</i></div>
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**OXFORD RIDGE FILTER TEST FACILITY  
- FILTER VISUAL INSPECTION CHECK LIST -**

Customer UT Battelle/ORNL

P.O.#: 4000018084

Date: 04OCT 02

Specific Reference for Acceptance Criteria: DOE STD 3020-1997

**RECEIVING INSPECTION**

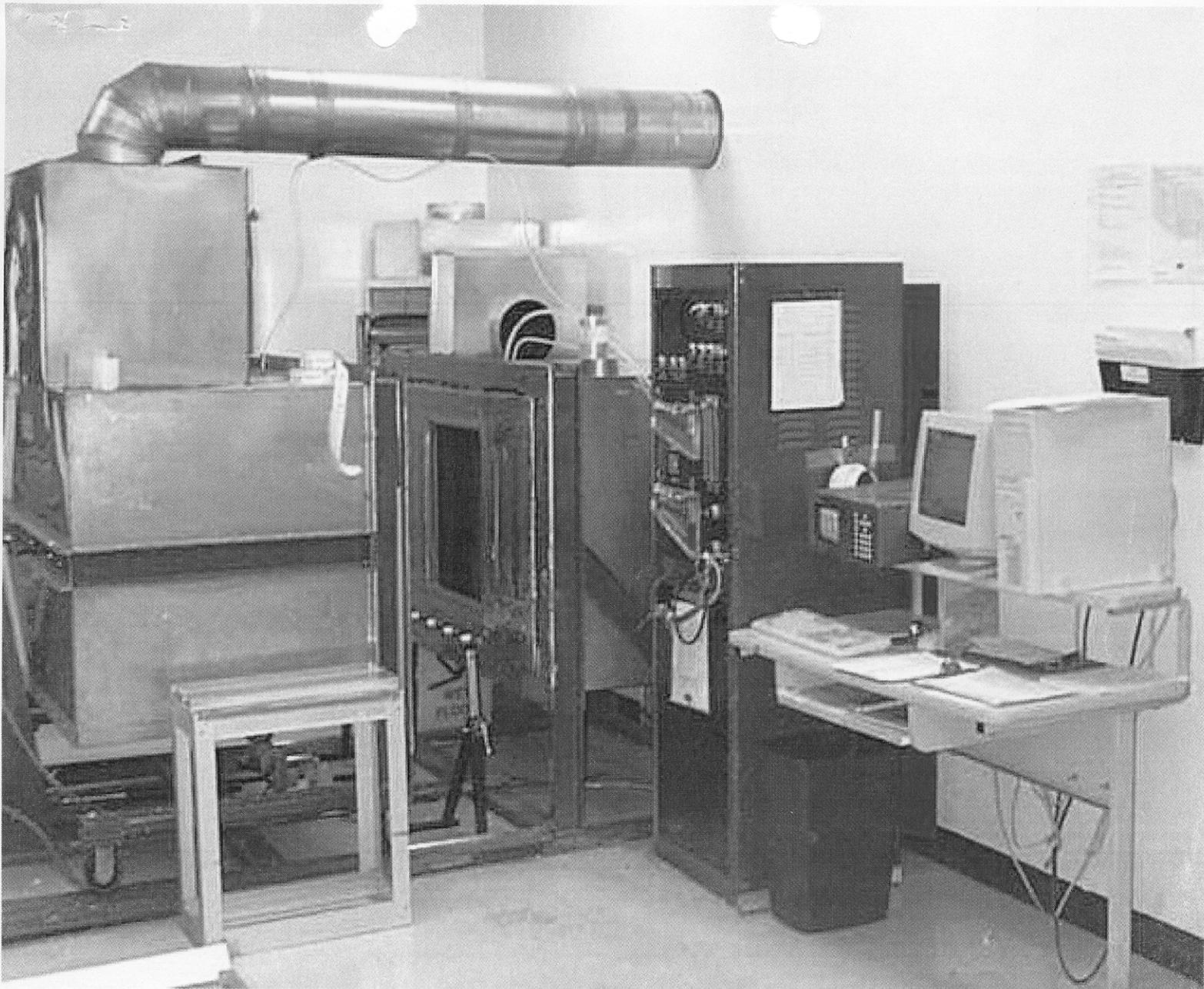
	Satisfactory	Unsatisfactory	N/A
<b>Number of Filters as Shown on Shipping Papers</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Filters Received in Upright Orientation (pleats vertical)</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Cartons/Filters Undamaged</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*Characteristics As Specified In Customer Purchase Order or Specifications:*

	Satisfactory	Unsatisfactory	N/A
<b>Number of Filters</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Frame Material</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Frame Construction</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Gaskets:</b>			
<b>Type</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Location</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Size &amp; Construction</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Capacity</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>UL-586 Label</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Faceguards</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Separators</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Required</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Labels/Marking/Identification</b>			
<b>Exposed Edges of Frame Sealed</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Frame Edges/Faces Free of Splinters/Rough Edges</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Gaskets Secure and Undamaged</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Fluid Seal Gasket Undamaged</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<b>No Damage to Filter Media</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Filter Dimensions</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Squareness of Frame</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Hidden Shipping Damage</b>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Other:</b>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

*Comments: The filters arrived not on a pallet or skid. No apparent damaged could be seen.*

*Inspected by: Julie A. Davis*



~~PMS- LASIA~~

PMS- LASIAR 110

S/N 34692  
Penetrometer 32543

This is the replacement  
Penetrometer to be used  
for the old DOP. Q107



**PARTICLE  
MEASURING  
SYSTEMS**

5475 Airport Blvd., Boulder, CO 80301  
303-449-7100 1-800-298-1901 FAX: 303-449-6870  
Customer Response Center: 1-877-475-3317  
Instrument Service & Support: 1-800-657-6363  
www.pmeasuring.com

## Certificate of Calibration

Customer: PMS/SERVICE

Field Office: BOULDER, CO

Instrument: LASIAR-110-(8)

Temperature: 75.2 °F

Serial Number: 34692/6-1095-28

Humidity: 43.2 %RH

Job Number: N/A

Customer Recommended Calibration

Calibration Due: 28-Feb-03

PMS Recommended Calibration

Customer Asset Number:

*PMS certifies that the instrument listed above meets or exceeds all published specifications and has been calibrated using equipment and standards whose accuracies are traceable to the USA National Institute of Standards and Technology (NIST). The test uncertainty ratio is  $\pm 4:1$ . Our calibration processes satisfy BS EN ISO9001:1994 requirements. This instrument was calibrated in accordance with the PMS quality system documentation listed below. This certificate may not be reproduced, except in full, without the written consent of PMS.*

PMS Procedure: 3002

**Instrument Condition Received:**

In Tolerance

Operational Failure

New

Out of Tolerance

Physical Damage

**Out of Tolerance Description:** Replaced APD due to zero-count failure.

**Instrument Condition Shipped:**

Meets PMS Specifications

Other (description attached)

**Standards Used:**

Manufacturer	Particle Size	Standard Deviation	Lot No.	Expiration Date
DUKE	.503 $\mu\text{m}$	.0063 $\mu\text{m}$	24265	Jan 04
DUKE	.993 $\mu\text{m}$	.010 $\mu\text{m}$	24139	Dec 03
	$\mu\text{m}$	$\mu\text{m}$		

Type	Manufacturer	Serial Number	Calibration Date	Calibration Due
AIR	Brooks (accuracy +/-5%)	A 1-1	22-Apr-98	22-Apr-03

Type	Manufacturer	Serial Number	Calibration Date	Calibration Due
HSLAS	PMS	35851/3-1195-155	1-Mar-02	1-Sep-02

Certified by:

Calibration Technician

Calibration Date: 28-Aug-02

**EMERSON**  
Process Management

April 8, 2002

PARTICLE MEASURING SYSTEMS  
5475 AIRPORT BLVD.  
BOULDER, CO 80301-2339

Brooks Instrument  
407 West Vine Street  
P.O. Box 903  
Hatfield, PA 19440-0903  
USA

T (215) 362 3500  
F (215) 362 3745

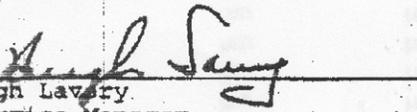
**CERTIFICATE OF CALIBRATION**

This certifies that this unit has been calibrated on equipment traceable to the National Institute of Standards and Technology. This unit was calibrated in accordance with ANSI/NCSL Z540-1-1994 (supersedes MIL-STD-45662A).

This certificate shall not be reproduced except in full, without the express written approval of Brooks Instrument, Hatfield, PA.

BROOKS S/N: 8712HC014063/3 P.O. NO.: 110373  
BROOKS P/N: 1307EJ21CE2AA ORING FULLVIEW REF.S/N: 0102030204819001  
RANGE: .32 - 3.17 SCFM AIR ACCURACY: +/-2% FSA  
CUSTOMER CONDITIONS: 70 DEG F 14.7 PSIA SP GR: 1.0 VISC: .0182 CP  
CALIBRATION PROCEDURE: CAL-036 REV.1 CAL-037 REV.1 C-651,E-926A, 37B, C-261

  
D.J. Beach  
Supervisor

  
Hugh Lavery  
Service Manager

mjl

*Calibrator's  
air flow into  
machine*

Brooks Instrument

SVC



**Duke Scientific Corporation**

2483 Faber Place  
P.O. Box 50005  
Palo Alto, California 94302  
1-800-334-3553  
1-650-424-1177  
Fax 1-650-424-1158  
www.dukescientific.com  
e-mail: info@dukescl.com

May 1, 1998

**PARTICLE COUNTER SIZE STANDARDS  
NIST Traceable Mean Diameter**

**1. DESCRIPTION.** These particle size standards provide accurate and traceable size calibration for particle counters. They are part of a series of monodisperse polymer microspheres, which were calibrated with methodology traceable to the National Institute of Standards and Technology (NIST). Diameters from 0.08 to 100µm (micrometer) are available as aqueous suspensions in dropper-tipped vials, calibrated by transmission electron microscopy (TEM) or optical microscopy. The approximate particle concentration in number per milliliter is given to facilitate sample preparation for particle counters. The aqueous medium has been prepared to promote dispersion and reduce clumping of the particles. The certified diameter is traceable to NIST. Other physical data is for information only and should not be used as calibration values.

<b>2. PHYSICAL DATA.</b>	Catalog Number: 3K-300, Nominal 0.3µm
Certified Mean Diameter:	0.300µm ± 0.005µm
Standard Deviation:	0.0043µm
Coefficient of Variation:	1.4%
Microsphere Composition:	Polystyrene
Polymer Density:	1.05g/ml
Index of Refraction:	1.59 @ 589nm
Approximate Concentration:	10 <sup>9</sup> particles per milliliter

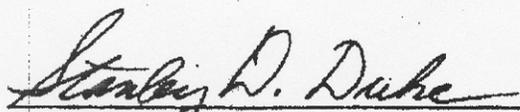
- Continued on page 2

**VALUABLE CERTIFICATE - KEEP ON FILE**

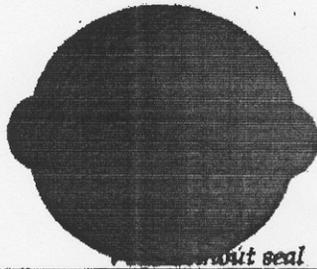
**CERTIFICATE OF CALIBRATION AND TRACEABILITY**

This certifies that the calibrated mean diameter of this product was transferred by electron microscopy (TEM) from National Institute of Standards and Technology (NIST) certified microspheres (NIST SRM # 1963, 1691, or 1690.)

Catalog Number: 3K-300, Particle Counter Size Standards	
Certified Mean Diameter: 0.300µm	Material Batch: 3K-300-002
Uncertainty: ± 0.005µm	Certification Date: April 30, 1998



Stanley D. Duke, Laboratory Director  
Duke Scientific Corporation



Seal

Packaging Lot # 23679

Expiration Date: JUL '03

- Over for more data

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**3. MEASUREMENT METHODOLOGY.** The certified diameter of this product was transferred by transmission electron microscopy from NIST certified microsphere size standards. The uncertainty is the sum of the calibration transfer uncertainty and the random error of the measurements. The size distribution (standard deviation) was obtained by electron microscopy. The Coefficient of Variation is the standard deviation as a percentage of the mean diameter.

**4. OPERATING INSTRUCTIONS.** For ease of use, these standards are packaged in an aqueous suspension. They must be thoroughly dispersed in the bottle to assure statistically consistent samples. To disperse the particles, gently invert the bottle several times, then immerse in a low power ultrasonic bath (30 seconds). Do not shake the bottle, as the small bubbles formed may introduce statistical artifacts. Before using, clear the tip of residue by dispensing 2-3 drops into a waste container. Using the dropper tip, dispense immediately after dispersion.

**5. SAFETY AND HANDLING PRECAUTIONS.** Avoid aerosol production in the workplace while handling these products, or wear a suitable filter respirator when necessary. Although there are no known ill effects, avoid inhalation or ingestion of the particles. These products should only be used by trained scientific personnel. A Material Safety Data Sheet is included with each package.

**6. STORAGE AND DISPOSAL.** Keep the bottle tightly sealed to avoid contamination, and store it upright to prevent clogging the tip with particles. Refrigeration is not required for storage. Do not freeze the particles. In case of spills, wash or wipe the area thoroughly. Dispose of as normal laboratory waste. Each bottle has a specified shelf life and should not be used after its expiration date.

**7. LIMITED WARRANTY.** These products are intended for general laboratory use by trained scientific personnel. Determination of their suitability for specific end-uses is the responsibility of the user, who assumes liability for loss or damage arising out of the use of the product. *Rebottling or relabeling invalidates the certification and traceability of these products.* Except for the purposes of record keeping, this certificate may not be reproduced. Duke Scientific Corporation's warranty is limited to replacement of defective products if returned with our authorization prior to the expiration date on the package.

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**RESEARCH AND TEST**

**Latex Microsphere Suspension**

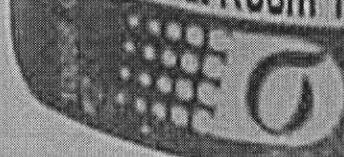
Catalog Number: 5026B

Size Distribution:  $\leq 3\%CV$

Contents: Polymer Microspheres in Water

Solids: 10% w/w

Store at Room Temperature. Do not Refrigerate



Duke Scientific Corporation

# AND TEST PARTICLES

Suspensions

100mL

Mean Diameter:

**0.26 $\mu$ m**

Spheres in Water

Expiration: SEP'05

Do not Refrigerate.

Lot No: 24499

[www.dukescientific.com](http://www.dukescientific.com)  
Palo Alto, CA 94303

FAX TO: 865-241-4644  
WAYNE CAMP -AAF-  
574-0368

Franklin, Ben

From: Franklin, Ben  
Sent: Thursday, October 24, 2002 2:10 PM  
To: 'Wayne Camp'  
Cc: McCluskey, Greg; Cavness, Bonnie; Thomas, Jim; Massie, Ron  
Subject: UT-Battelle PSL C of C (10-24-02)

Wayne:

I have, and will fax to you:

1. The Calibration of the Penetrometer: MLPC-110 Serial No. 32453-0994-101/D6, which is the instrument used to measure the penetration of the (10) HEPA filters which were later check tested at Oak Ridge FTF. The calibration was done by PMS (Particle Measuring Systems) on 8 JUL 02.
2. The calibration medium was 0.3 micron PSL spheres. Also enclosed is the Duke Scientific Calibration Certificate 1 MAY 98 (to NIST) of these PSL spheres, Lot 23679.
3. To calibrate the AAF penetrometer, 1. above, PMS used their own LASAIR-110 penetrometer, serial no. 34692/6-1095-281. Enclosed is PMS' Certificate of 28 AUG 02 of this instrument. This is the most recent calibration. It took place after the 8 July 02 test of the AAF unit. When PMS calibrated AAF's unit, their LASAIR was in calibration. It had been calibrated in FEB 02. However, after our calibration, PMS found a need to recalibrate, which occurred in Aug. 02. We received PMS' latest calibration for this instrument.
4. PMS also used a Brooks flowmeter, which Calibration Certificate by Brooks (Emerson Process Management) dated 8 APR 02 is also included.
5. The PSL spheres used in the day-to-day production testing of the HEPAs are purchased as 0.26 +/-0.02 microns, but not calibrated, nor certified. The AAF calibrated penetrometer measures particles between 0.2 and 0.3 microns. Any PSL spheres outside of this range will not be measured. Therefore, there is no need to calibrate the production test spheres. Test results, as shown by the Oak Ridge check tests, indicate that the AAF particles are less than 0.3 microns.

We trust these documents are adequate.

Should additional information or explanation be required, please do not hesitate to contact me.

Ben Franklin (10-24-02)



-----Original Message-----

From: Wayne Camp [mailto:wcy@ornl.gov]  
Sent: Thursday, October 24, 2002 12:53 PM  
To: bfranklin@aafintl.com  
Subject: PSL C of C

Hello Ben,

I have not received the Certificate of Conformance for the PSL spheres for the test medium (~.26 um) by fax.

Can you send again please?

Thanks,

Wayne Camp