NATIONAL BUREAU OF STANDARDS REPORT

7396

PERFORMANCE TEST OF A FOLDING AEROSOLVE
MODEL 3H-85 AIR FILTER

Manufactured by
Cambridge Filter Corporation
Syracuse, New York

by

C. W. Coblentz and P. R. Achenbach

Report to

Public Buildings Service
General Services Administration
Washington 25, D. C.

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

THE NATIONAL BUREAU OF STANDARDS

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NBS PROJECT
1003-30-10630

January 5, 1962

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Mechanical Systems Section
Building Research Division

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1. INTRODUCTION

At the request of the Public Buildings Service, General Services Administration, the performance characteristics of the Aerosolve Model 3H-85 air filter were determined. The scope of this examination included the determination of the arrestance of particulate matter in the laboratory air, the pressure drop and the dust-holding capacity of the filter at the rated air flow rate of 1,000 cfm.

2. DESCRIPTION OF TEST SPECIMEN

The test specimen was manufactured and supplied for test purposes by the Cambridge Filter Corporation of Syracuse, New York.

The filter medium was a mat, approximately one quarter inch thick, made of glass fibers. A microscopic examination indicated a rather uniform fiber diameter of somewhat below one micron and an average fiber length on the order of two mm. The dry filter medium was supported by a smooth, thin sheet of glass fibers on the downstream side. The filter mat with its backing was formed into twelve one foot deep pleats and was cemented into a collapsible frame 24 inches square and 12 inches deep. Two opposite sides of the frame were rigid and the others were made of flexible plastic sheet. The filter cartridge was shipped in a folded or collapsed condition. The cartridge was expanded to its normal shape and size by pulling apart the two rigid sides. It could then be easily installed into the supporting steel wire frame, model 4H-1000. The total area of the medium was approximately 44 sq ft.

3. TEST METHOD AND PROCEDURE

The filter was tested at the rated air flow rate of 1,000 cfm corresponding to a face velocity of 250 ft/min. The arrestance determinations were made with the NBS Dust Spot Method described in a paper by R. S. Dill entitled "A Test Method for Air Filters" (ASHVE Transactions, Vol. 44, p. 379, 1938). The filter under test was installed in the test apparatus and carefully sealed to prevent any by-pass of air or inward leakage into the test apparatus, except through the measuring orifice. After establishing the correct air flow rate through the filter, samples of air were drawn from the center points of the test duct 2 feet upstream and 8 feet downstream of the test specimen at equal rates and passed through known areas of Whatman No. 41 filter paper. The arrestance determinations were made with the particulate matter in the laboratory air as the aerosol.

The light transmission of the sampling papers was measured on the same area of each paper before and after the test and the two sampling papers used for any one arrestance determination were selected to have the same light transmission when clean.

For determining the arrestance of the particulate matter in the laboratory air, equal sampling areas were used in the upstream and downstream samplers. A similar increase of the opacity of the two sampling papers was obtained by passing the sampling air only part of the time through the upstream paper while operating the downstream sampler continuously. This was accomplished by installing one solenoid valve in the upstream sampling line and another one in a bleed line by-passing the sampler. The solenoid valves were operated by an electric timer and a relay so that one was open while the other one was closed during any desired percentage of the 5-minute timer cycle, reversing the position of the two valves during the remainder of the cycle. The arrestance, A (in percent), was then determined with the formula:

$$A = 100 - T \times \frac{\Delta D}{\Delta U}$$

where T is the percentage of time during which air was drawn through the upstream sampler, and ΔU and ΔD are the observed changes in the opacity of the upstream and downstream sampling paper, respectively.

Arrestance determinations were made at the beginning and at the end of the test and at several intermediate loading conditions. The filter was loaded with Cottrell precipitate to which cotton linters were added in a ratio of 4 parts to every 96 parts of Cottrell precipitate. The Cottrell precipitate had been previously sifted through a 100-mesh screen and the lint was prepared by grinding No. 7 cotton linters through a Wiley mill with a 4-millimeter screen.

The pressure drop across the filter under test was recorded at the beginning of the test, after each arrestance determination, and after every 20-gram increment of Cottrell precipitate that was introduced into the test duct. The tests were terminated when the pressure drop across the test specimen reached 0.8 in. W.G.

4. TEST RESULTS

A summary of the test results is presented in Table 1.

Table 1

Performance of Cambridge Model 3H-85

Dust Load g	Pressure Drop in. W.G.	Arrestance %
0	0.254	76.8
161	0.283	--
363	0.329	89.8
564	0.428	90.3
765	0.630	89.8
846	0.757	91.2
886	0.833	---

The "Dust Load" shown in this table is the amount of Cottrell precipitate and lint received by the filter. It is the weight of dust introduced into the test apparatus diminished by the amount of dust fallout upstream of the filter. The percentage of dust fallout was determined from the ratio of the weight of the dust that was swept out of the front section of the test duct at the conclusion of the test to the total amount of dust introduced.

It will be noted that the arrestance of the filter increased from an initial value of 76.8 percent with a pressure drop of 0.254 in. W.G. to a value of 91.2 percent after 846 grams of dust had been received by the filter and the pressure drop had increased to 0.757 in. W.G.

Figure 1 presents a graph of the values shown in Table 1 with smooth curves approximating the line of the least mean square distances from the points of observation.

A filter of this type is usually operated until its pressure drop has increased by 0.5 in. W.G. The dust-holding capacity, then, is the amount of the dust that has produced this pressure drop. With an initial pressure drop of 0.254 in. W.G. approximately 840 grams of dust had been received by the test specimen when the pressure drop reached 0.754 in. W.G. The average arrestance of approximately 88 percent is, then, indicated as an imaginary horizontal line which encloses equal areas below and above the arrestance curve in figure 1.

Cambridge Model 3H-85

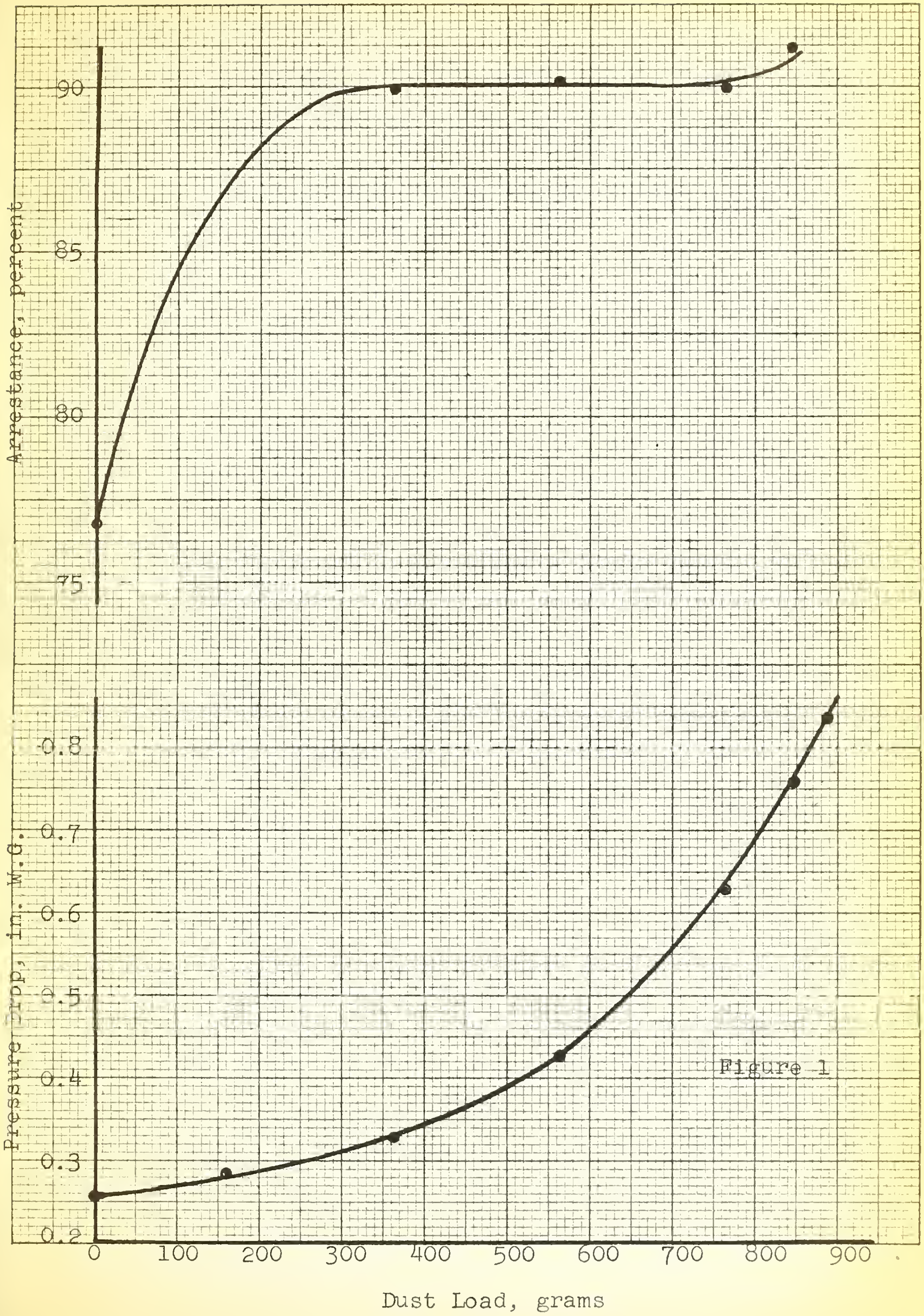

Figure 1

U. S. DEPARTMENT OF COMMERCE
Luther H. Hodges, *Secretary*

NATIONAL BUREAU OF STANDARDS
A. V. Astin, *Director*

THE NATIONAL BUREAU OF STANDARDS

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WASHINGTON, D.C.

Electricity. Resistance and Reactance. Electrochemistry. Electrical Instruments. Magnetic Measurements. Dielectrics.

Metrology. Photometry and Colorimetry. Refractometry. Photographic Research. Length. Engineering Metrology. Mass and Scale. Volumetry and Densimetry.

Heat. Temperature Physics. Heat Measurements. Cryogenic Physics. Equation of State. Statistical Physics.

Radiation Physics. X-ray. Radioactivity. Radiation Theory. High Energy Radiation. Radiological Equipment. Nucleonic Instrumentation. Neutron Physics.

Analytical and Inorganic Chemistry. Pure Substances. Spectrochemistry. Solution Chemistry. Standard Reference Materials. Applied Analytical Research.

Mechanics. Sound. Pressure and Vacuum. Fluid Mechanics. Engineering Mechanics. Rheology. Combustion Controls.

Organic and Fibrous Materials. Rubber. Textiles. Paper. Leather. Testing and Specifications. Polymer Structure. Plastics. Dental Research.

Metallurgy. Thermal Metallurgy. Chemical Metallurgy. Mechanical Metallurgy. Corrosion. Metal Physics. Electrolysis and Metal Deposition.

Mineral Products. Engineering Ceramics. Glass. Refractories. Enameled Metals. Crystal Growth. Physical Properties. Constitution and Microstructure.

Building Research. Structural Engineering. Fire Research. Mechanical Systems. Organic Building Materials. Codes and Safety Standards. Heat Transfer. Inorganic Building Materials.

Applied Mathematics. Numerical Analysis. Computation. Statistical Engineering. Mathematical Physics. Operations Research.

Data Processing Systems. Components and Techniques. Digital Circuitry. Digital Systems. Analog Systems. Applications Engineering.

Atomic Physics. Spectroscopy. Infrared Spectroscopy. Solid State Physics. Electron Physics. Atomic Physics.

Instrumentation. Engineering Electronics. Electron Devices. Electronic Instrumentation. Mechanical Instruments. Basic Instrumentation.

Physical Chemistry. Thermochemistry. Surface Chemistry. Organic Chemistry. Molecular Spectroscopy. Molecular Kinetics. Mass Spectrometry.

Office of Weights and Measures.

BOULDER, COLO.

Cryogenic Engineering. Cryogenic Equipment. Cryogenic Processes. Properties of Materials. Cryogenic Technical Services.

Ionosphere Research and Propagation. Low Frequency and Very Low Frequency Research. Ionosphere Research. Prediction Services. Sun-Earth Relationships. Field Engineering. Radio Warning Services.

Radio Propagation Engineering. Data Reduction Instrumentation. Radio Noise. Tropospheric Measurements. Tropospheric Analysis. Propagation-Terrain Effects. Radio-Meteorology. Lower Atmosphere Physics.

Radio Standards. High Frequency Electrical Standards. Radio Broadcast Service. Radio and Microwave Materials. Atomic Frequency and Time Interval Standards. Electronic Calibration Center. Millimeter-Wave Research. Microwave Circuit Standards.

Radio Systems. High Frequency and Very High Frequency Research. Modulation Research. Antenna Research. Navigation Systems.

Upper Atmosphere and Space Physics. Upper Atmosphere and Plasma Physics. Ionosphere and Exosphere Scatter. Airglow and Aurora. Ionospheric Radio Astronomy.

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