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NATIONAL BUREAU OF STANDARDS REPORT

6408

PERFORMANCE TESTS OF
TWO THROW-AWAY TYPE "DUSTGARD" AIR FILTERS

MANUFACTURED BY
AMERICAN ROCK WOOL CORPORATION
WABASH, INDIANA

by

Carl W. Coblentz and Paul R. Achenbach

Report to

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

NBS

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

THE NATIONAL BUREAU OF STANDARDS

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Carl W. Coblentz and Paul R. Achenbach
Air Conditioning, Heating, and Refrigeration Section
Building Technology Division

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1. INTRODUCTION

At the request of the Public Buildings Service, General Services Administration, the performance characteristics of two specimens of the same model of throw-away type "Dustgard" air filters were determined. The scope of this investigation included the determination of the arrestance of Cottrell precipitate and atmospheric dust, the dust holding capacity and the pressure drop at an air flow rate of 800 cfm.

2. DESCRIPTION OF THE TEST SPECIMENS

The test specimens were manufactured and supplied for test purposes by the American Rock Wool Corporation of Wabash, Indiana, and were identified by their trade name, "Dustgard." The filter media were 2-in. thick pads of light gray colored noncombustible fibers and were treated with an oily adhesive. The cardboard frames measured 20 x 20 x 2 in. on the outside; they consisted of a U-shaped channel, leaving a 17 5/8 in. square opening, i.e., 2.16 sq ft net face area. The weights of the two test specimens were 435 grams and 438 grams, respectively (approximately 15 1/2 oz).

3. TEST METHOD AND PROCEDURE

The performance of the filters was determined at 370 ft/min face velocity, i.e., at an air flow rate of 800 cfm. The arrestance measurements were conducted in accordance with the NBS "Dust Spot Method" as described in the paper, "A Test Method for Air Filters" by R. S. Dill (ASHVE Transactions, Vol. 44, p. 379, 1938).

The aerosol used for the arrestance determination was Cottrell precipitate which had been sifted through a 100-mesh wire screen. In order to simulate actual operating conditions when loading the filters, four percent by weight of cotton linters, previously ground in a Wiley mill with a four-millimeter screen,

was introduced simultaneously with the Cottrell precipitate. The pressure drop of the filters was recorded after each increment of 20 grams of dust had been introduced into the test apparatus. Whereas the arrestance determinations were made with 100 percent Cottrell precipitate, cotton linters were added to retain a ratio of four parts by weight to every 96 parts of Cottrell precipitate, including that amount used for arrestance measurements. Arrestance determinations were made at the beginning and at the end of the loading of each filter and also at several intermediate load conditions.

Before introducing dust, the pressure drop of the first test specimen was determined at five different air flow rates from 420 cfm to 1200 cfm, corresponding to face velocities of 194 ft/min to 555 ft/min. Two arrestance determinations were made on the second test specimen using the laboratory air as the aerosol without addition of further particulate matter, before arrestance determinations were made with Cottrell precipitate.

The filters were loaded with a dust concentration of approximately 1 gram of dust in 1000 cu ft of air until the pressure drop exceeded 0.5 in. W.G., at which point the test was discontinued.

4. TEST RESULTS

Table 1 shows the pressure drops of the first filter before the loading test at air flow rates from 420 cfm to 1200 cfm, i.e., face velocities of 194 ft/min to 555 ft/min. The pressure drop of the filter increased from 0.030 in. W.G. at the lowest flow rate to 0.168 in. W.G. at the highest flow rate and was 0.088 in. W.G. at the rated face velocity of 370 ft/min.

Table 1

Pressure Drop of Clean Filter, Specimen 1

Air Flow Rate, cfm	Face Velocity, ft/min	Pressure Drop, in. W.G.
420	194	0.030
600	278	0.055
800	370	0.088
1000	463	0.125
1200	555	0.168

Table 2

Performance of Filter Specimen 1 at 800 cfm
(370 ft/min Face Velocity)

Dust Load g/sq ft	Pressure Drop in. W.G.	Arrestance %
0	0.088	-
7	0.097	48*
54	0.180	54
118	0.300	63*
142	0.367	64*
190	0.516	65

* Average of two tests

Table 3

Performance of Filter Specimen 2 at 800 cfm
(370 ft/min Face Velocity)

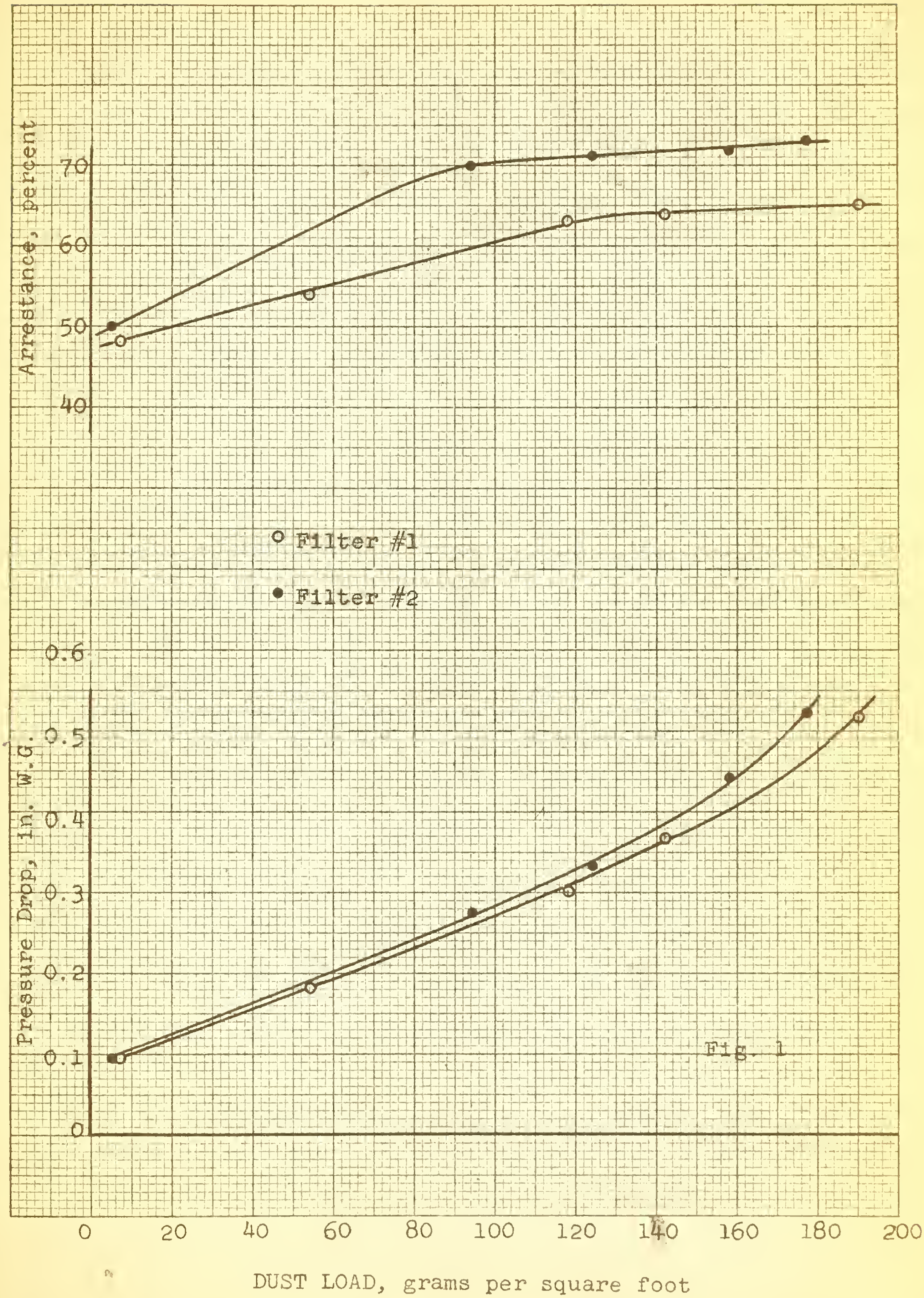
Dust Load g/sq ft	Pressure Drop in. W.G.	Arrestance %
0	0.089	6.4(Note A)
5	0.097	50*
94	0.272	70*
124	0.336	71*
158	0.442	72*
177	0.521	73

Note A: This value presents the average of two tests in which the laboratory air with its suspended particulate matter was the aerosol.

* Average of two tests

Tables 2 and 3 show the pressure drops and arrestance values determined during the loading of the two test specimens. These data are presented graphically in Fig. 1 as four smooth curves drawn to approximately fit the individual points of observation. It will be noted that the arrestance determined with the second filter using the particulate matter of the laboratory air as an aerosol is not shown on this graph.

American Rock Wool Corporation, DUSTGARD



The dust load values shown in Tables 2 and 3 are the amount of dust introduced into the test apparatus divided by the net face area of the filter and diminished by the percentage of dust fallout upstream of the filter. This fallout was determined at the conclusion of each test by sweeping out the test apparatus and calculating the ratio of fallout to the total dust introduced into the system.

The dust loads accumulated on the two test specimens when the pressure drop had increased to 0.5 in. W.G. were taken from the lower curves of Fig. 1 and are shown in Table 4 as the "Dust Holding Capacity." Also indicated in this table are the "Mean Arrestance" values, which represent the average arrestance during the period in which the capacity dust load was accumulated, taken from the arrestance curves of Fig. 1.

Table 4

Dust Holding Capacity and Mean Arrestance
(Determined from Fig. 1)

Filter Specimen No.	1	2
Dust Holding Capacity, grams/sq ft	186	173
Mean Arrestance, percent	59	65

Although no difference had been noticed in the appearance of the two filters before or after the tests, the observed arrestances were significantly different. No definite reason for ~~the cause of~~ this difference can be ~~made~~ OFFERED

The differences in the results obtained on the two specimens probably represent variations in the density or uniformity of the media or variations in the amount of adhesive on the media at the start of the test. However, the operation of the second specimen with laboratory air as the aerosol for about two hours prior to the first test with Cottrell precipitate may have had a small effect on the results. During the two hours' operation with atmospheric air as the aerosol, the pressure drop across specimen No. 2 increased from 0.089 in. W.G. to 0.094 in. W.G. indicating that the dust deposit had a measurable effect on the density of the media. It is probable that this deposit consisted principally of fine particles which penetrated into the media and some lint on the upstream surface.

Since the two specimens were tested one after the other by the same personnel, it seems unlikely that the manipulations of the operator were responsible for the observed differences in test results.

U. S. DEPARTMENT OF COMMERCE
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THE NATIONAL BUREAU OF STANDARDS

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

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BOULDER, COLORADO

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Radio Propagation Engineering. Data Reduction Instrumentation. Modulation Systems. Navigation Systems. Radio Noise. Tropospheric Measurements. Tropospheric Analysis. Radio Systems Application Engineering. Radio-Meteorology.

Radio Standards. High Frequency Electrical Standards. Radio Broadcast Service. High Frequency Impedance Standards. Electronic Calibration Center. Microwave Physics. Microwave Circuit Standards.

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