NATIONAL BUREAU OF STANDARDS REPORT

8383

PERFORMANCE TEST OF THE FILTREX GLASS FIBER
AUTOMATIC RENEWABLE FILTER MEDIA, TYPE 63 DGC

manufactured by
Drico Industrial Corporation
Passaic, New Jersey

by

Joseph C. Davis and Paul R. Achenbach

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

NBS

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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NBS PROJECT **NBS REPORT**

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1. Introduction

At the request of the Public Buildings Service, General Services Administration, the performance characteristics of the "Filtrex" glass fiber roll-type filter media, Type 63 DGC, manufactured by the Drico Industrial Corporation of Passaic, New Jersey, were determined. The scope of the investigations included the determination of the arrestances of Cottrell precipitate diffused into the laboratory air and the dust-holding capacity when the face velocity was maintained at 500 ft/min. and while the media was intermittently advanced under the control of a pressure switch with a maximum setting for the pressure drop across the media of 0.5 in. W.G.

2. Description of Test Specimen

The roll of filter media was manufactured and supplied for test purposes by the Drico Industrial Corporation of Passaic, New Jersey. It was identified as "Filtrex", Type 63 DGC. The media was approximately 34 inches wide and 2-1/2 inches thick, laminated with blue color on one face and white color on the other face. The white fibers of the downstream face were closer spun than the blue fibers on the upstream face. The media was composed of spun glass fibers bonded with an organic bonding agent. It was coated with a fire-retardant oil. Microscopic examination of the fibers indicated that they were between 30 and 50 microns in diameter. The length of the fibers in the white face ranged from about 1 to about 3 inches; the length of the fibers in the blue face ranged from about 2 to 5 inches. The approximate unit weight of mat was 40 gram/ft^2.

3. Test Method and Procedure

The medium was tested at a net face velocity of 500 ft/min. The arrestance determinations were made with the"NBS

Dust Spot Method For Air Filters" (ASHVE Transactions, Vol. 44, p. 379, 1938). For the test, the roll of media was installed in a roll-filter frame constructed to fit the NBS test apparatus. This apparatus provided an air-tight enclosure and adapters to fit the upstream and down-stream sections of the test duct. This roll-filter frame has been used previously for testing various media of this type.

The frame had two openings, 2 ft x 2 ft, one upstream and the other downstream from the filter. The roll of filter media was placed at the top of the frame on a spool and arranged so the media passed immediately behind the downstream opening as it unrolled. The expended media was rolled up in a similar spool at the bottom of the frame. The bottom spool was driven by a motor actuated by an adjustable pneumatic switch which sensed the pressure drop across the media. Nine vertical bars in the downstream opening served to prevent appreciable deflection of the media under the influence of the air pressure difference. The edges of the media were enclosed in metal groove-type tracks to restrict by-pass of air between the media and frame.

The frame and Drico media were installed in the dust spot test apparatus and carefully sealed to prevent any by-pass of air or inward flow 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 two feet upstream and eight feet downstream of the test specimen at equal rates and passed through known area of Whatman No. 41 filter paper. The arrestance determinations were made with Cottrell precipitate injected into the air stream at a ratio of one gram per 1,000 cu. ft. of air.

The light transmission of the sampling papers was measured before and after the test on the same area of each paper, 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 filter, different size areas of sampling paper were exposed upstream and downstream of the filter in order to obtain a similar increase of opacity on the two sampling papers. The arrestance was calculated by the formula:

$$A = \left(1 - \frac{S_D}{S_U} \times \frac{\Delta D}{\Delta U}\right) \times 100$$

where the symbols S_U and S_D are the upstream and downstream sampling areas and ΔU and ΔD are the observed changes in the opacity of the upstream and downstream sampling papers, respectively.

Arrestance determinations were made when the media was clean at the beginning of the test, and at selected intervals of loading until the intermittent advance of the media under the control of the pneumatic switch became representative of a steady state operation. The arrestance determinations were made with Cottrell precipitate only, while cotton linters were added during the loading process in a ratio of 4 parts to every 96 parts of Cottrell precipitate, including the Cottrell precipitate used for arrestance measurements. 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 advance of the filter media was observed through a window in the test apparatus by determining the position of a marker, attached to the mat, relative to a yardstick mounted in the filter housing, adjacent to the mat. A pilot light connected in parallel with the electric motor enabled the operator to note the position of the media and to record the pressure drop across the medium at the beginning and at the end of each advance cycle. The pressure switch was adjusted to commence the advance cycle when the pressure drop reached approximately 0.50 in. W. G. and to stop when the drop was about 0.45 in. W. G.

The position of the media at the beginning of each advance cycle was recorded as well as the corresponding cumulative dust load at the time of advance. From this information a plot was made of the advance of the media vs. dust load, and when the relation between the two parameters became very nearly linear, ten more determinations of advance as related to load were made, from which it was possible to draw a straight line from which the dust-holding capacity in grams/ft^2 was determined.

The pressure drop across the media was recorded at the beginning of the test, after each arrestance determination, after introduction of each 20-gram increment of Cottrell precipitate and lint into the test duct, and at the beginning and end of each advance cycle.

4. Test Results

The test results obtained on the specimen Filtrex media at the design air flow rate of 2000 cfm are summarized in Tables 1 and 2.

Table 1

Performance of the "Filtrex" Roll Filter Media, Type 63 DGC at an Air Flow Rate of 2000 CFM

Cumulative Dust Load Grams	Total Advance of Media Inches	Pressure Drop In. W.G.	Arrestance* Per Cent
0	0	.130	70.5
1726	34	.456	83.5
1892	38	.494	83.8
2059	41 1/2	.480	84.1
2225	45	.506	84.2
2267	45	.468	83.0
2330	47	.442	84.5

*Cottrell precipitate in the laboratory air

It will be noted that the arrestance of the clean filter medium was 70.5 percent and the average arrestance under steady-state conditions was 83.9% using Cottrell precipitate in the laboratory air as the aerosol.

Table 2

Dust Load, Mat Travel, and Pressure Drop
Of "Filtrex" Glass Fiber Media, Type 63 DGC

Dust Load Grams	Mat Travel Inches Advance	Total	Pressure Drop, In. W.G. Before Advance	After Advance
0	-	-	0.130	-
1465	2	28	0.495	0.460
1570	2	30	0.495	0.435
1664	2	32	0.510	0.455
1726	2	34	0.515	0.455
1809	2	36	0.515	0.460
1892	2	38	0.520	0.465
2017	2	40	0.525	0.480
2142	1 1/2	43	0.505	0.460
2225	2	45	0.505	0.450
2330	2	47	0.505	0.445

The first movement of the media was approximately 3 inches and occurred with a dust load of 542 grams and at a pressure drop of 0.390 in. W.G. The pneumatic control was adjusted to the desired cut-in pressure as the first 28 inches of the roll of media were advanced into the air stream. The pressure drop at the beginning of the advance cycles after steady-state conditions had been reached (at 1465 grams) ranged from 0.495 to 0.525 in. W.G. The average was 0.509 in. W.G. At the end of the advance cycles under these conditions, the pressure drops ranged from 0.435 to 0.480 in. W.G. with an average of 0.457 in. W.G.

The graph of Fig. 1 shows the performance of the media for the 10 observations taken after steady state conditions were established. It will be noted that some of the individual points of observation do not lie in the straight line. These deviations occurred partly because the advance distance could only be observed on the scale to the nearest half-inch mark, and because the pressure control switch did not always open and close at exactly the same pressure levels. Based on the best-fitted straight line through the observed data in Figure 1, it is shown that after 28 in. of mat travel the dust was 1460 grams and after 47 in. travel, the dust load was 2310 grams Thus a mat travel of 19 inches was caused by the introduction of 850 grams of dust The dust-holding capacity of the media was calculated by dividing the dust load increment by the incremental length of advance in feet and by the width of the media.

$$\text{Dust-holding capacity} = \frac{850}{2} \times \frac{12}{19} = 268 \text{ grams/sq. ft.}$$

The performance values determined for the test specimen were 83.9 percent average arrestance and 268 grams/sq. ft. dust-holding capacity. The current requirements specified for the type E media are 75 percent average arrestance and 200 grams/sq.ft.dust holding capacity using Cottrell precipitate as the test dust.

MAT TRAVEL VERSUS DUST LOAD
FILTREX MEDIA, TYPE 63 DGC

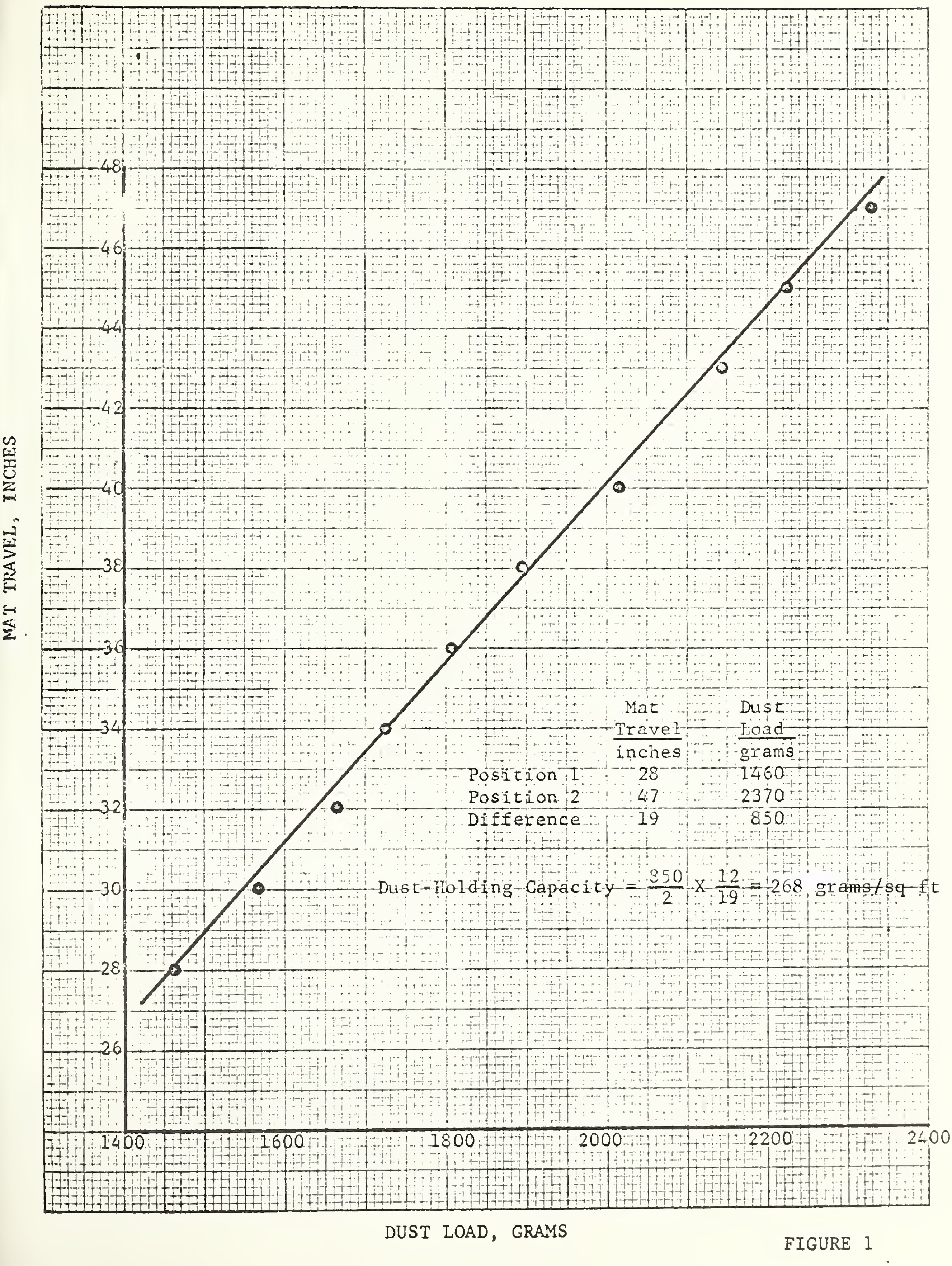

FIGURE 1

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