NATIONAL BUREAU OF STANDARDS REPORT

8522

PERFORMANCE CHARACTERISTICS OF A "ULOK",
MODEL 87 BT, DISPOSABLE, VISCOUS TYPE,
SYNTHETIC FIBER AIR FILTER

manufactured by
Linde Division, Union Carbide Corporation
New York, New York

by

Joseph C. Davis and Paul R. Achenbach

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

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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* NBS Group, Joint Institute for Laboratory Astrophysics at the University of Colorado.
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NBS PROJECT		NBS REPORT
421.03-30-4210630	August 6, 1964	8522

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Mechanical Systems Section
Building Research Division

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Performance Characteristics of a "Ulok", Model 87 BT, Disposable, Viscous Type, Synthetic Fiber Air Filter

manufactured by
Linde Division
Union Carbide Corporation
New York, N. Y.

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Joseph C. Davis and Paul R. Achenbach

1. INTRODUCTION

At the request of the Public Buildings Service, the performance characteristics of a "Ulok" Model 87 BT, disposable synthetic fiber filter manufactured by the Union Carbide Corporation (Linde Division), New York, New York were determined. The filter was a viscous type and was treated with an air filter oil. The scope of the investigations included the determination of the arrestance of the particulate matter of the laboratory air by the filter and the pressure drop of the filter at the rated air-flow rate of 940 cfm as the dust load was gradually increased from zero to a final value corresponding to a pressure drop of 0.5 in. W.G.

2. DESCRIPTION OF TEST SPECIMEN

The filter was manufactured and supplied for test purposes by the Union Carbide Corporation (Linde Division) New York, New York. The outside dimensions of the filter unit were 20 3/4" x 20 3/4" x 2" deep. The filter media extended 1/2 inch beyond the edge of a metal supporting ring The filter media area was approximately 3 ft^2 and consisted of an oil treated batt of Dynel Modacrylic* fiber, a synthetic material made from natural gas. The media was attached to a stiff 1/4-inch mesh resin reinforcing scrim and fastened to the metal supporting ring. The cross sectional area of the Dynel fibers was irregular because of pertuberance on their surfaces. The diameter of the fibers was approximately 5 microns; their average length was about 1 1/2-inches. The net face dimensions after installation in the test apparatus was 19" by 19" equivalent to 2.51 ft^2.

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* The name "Dynel Modacrylic" is a trade name.

At an air flow rate of 940 cfm, the net face velocity was 370 ft/min. the weight of the clean filter was about 323 grams or 11.4 oz.

3. TEST METHOD AND PROCEDURE

The filter was tested at the air flow rate of 940 cfm. 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 or inward flow of air 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. Each sample of air was passed through Whatman No. 41 filter paper. The arrestance determinations were made with the particulate matter in the laboratory air as the aerosol. The filter was loaded with a mixture of Cottrell precipitate and lint injected into the air stream at a ratio of 1 gram per 1,000 cu. ft. of air.

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 filter papers. A similar increase of the opacity of the two sampling papers was obtained by passing the sampling air through the upstream paper only part of the time while operating the downstream sampler continuously. This time proportioning was accomplished by the use of one solenoid valve in the upstream sampling line and another in a 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 a 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, ΔU and ΔD are the observed changes in the opacity of the upstream and downstream sampling papers, respectively.

Arrestance determinations were made at the beginning and at the end of the test and at several intermediate loading conditions as indicated in Table 1. The loading was done incrementally, each increment consisting of 96 parts Cottrell precipitate and 4 parts cotton linters, by weight. The Cottrell precipitate had previously been 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 each increment of Cottrell precipitate and lint that was introduced into the test duct. The test was terminated when the pressure drop across the filter reached 0.5 in. W.G.

4. TEST RESULTS

The test results obtained on the air filter specimens at the air flow rate of 940 cfm or 370 fpm net face velocity are summarized in Table 1.

TABLE 1

Performance of a Union Carbide Corporation "Ulok" Disposable Air Filter 87 BT at a Face Velocity of 370 fpm

Cumulative Load			Arrestance of Atmospheric Aerosol	Pressure Drop
Cottrell Precipitate	Lint	Total		
Grams	Grams	Grams	Percent	In. W.G.
0	0	0	57.5	0.160
60	2.5	62.5	67.4	0.204
160	6.6	166.6	74.8	0.280
260	10.8	270.8	80.9	0.350
360	14.9	374.9	81.4	0.432
460	19.1	479.1	80.2	0.520

It will be noted that pressure drop increased from 0.160 in. W.G. with a clean filter to 0.520 after a dust load of 479 grams had been reached for the filter. The increase in pressure drop was almost proportional to the dust load.

The arrestance of the dust in the atmospheric air increased from 57.5 percent to 80.2 percent during the loading period and averaged approximately 75.5 percent. The dust load of Cottrell precipitate and lint corresponding to a pressure drop of 0.50 in. W.G. was 180 grams/sq ft. of net face area.

The values show in Table 1 are graphically presented in Figure 1. In this figure the arrestance of the particulate matter in the laboratory air and the pressure drop are both plotted against the dust load.

UNION CARBIDE (LINDE DIVISION)
"ULOK" MODEL 87 BT

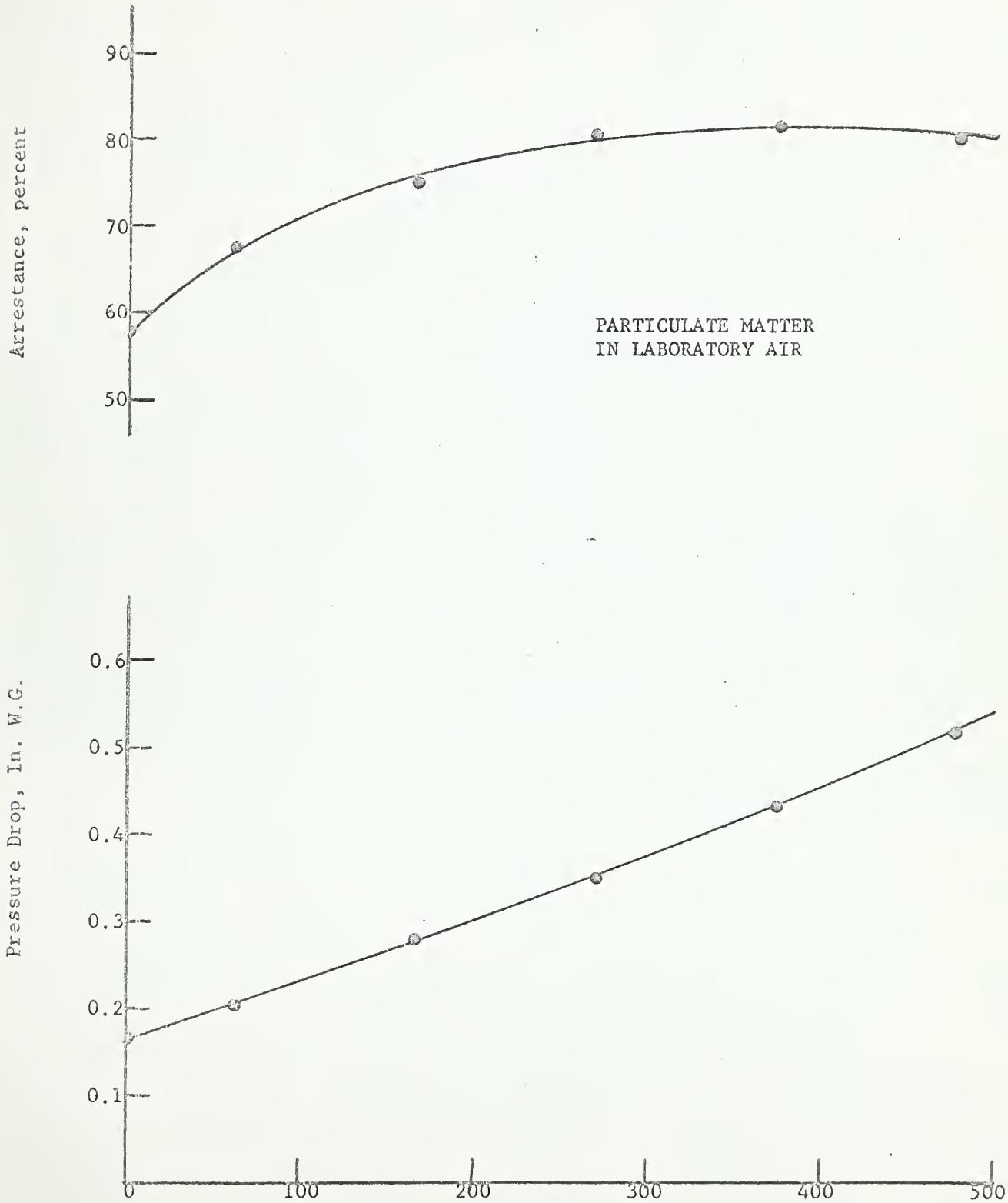

Fig. 1