A COMPARATIVE EVALUATION OF HIGH-TEMPERATURE PULSE-JET BAGHOUSE FILTER FABRICS

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ABSTRACT

Comparative testing of a range of filter fabrics is described. Fabrics tested included various grades of woven fiberglass, fiberglass felts, aramid felts, polyphenylene sulfide felts, polyimide felt and polyflurocarbon membrane laminated to woven fiberglass. Testing was conducted under various conditions of temperature, acidity and alkalinity. The test procedures and results are discussed within the framework of environmental regulations.

INTRODUCTION

There is an emerging consensus of opinion that a spray dryer/baghouse combination is preferable to other forms of air pollution control equipment when used to control emissions from stationary sources such as waste-to-energy facilities. This is primarily due to the significantly improved utilization of spray dryer reagent, which is trapped as filter cake on the fabric filter bags [1]. Also, when equipped with suitable filter bags, a baghouse is relatively insensitive to dramatic changes in flue-gas conditions that can occur in the combustion of solid waste.

There are three fundamentally different types of baghouse available, and they are characterized by their bag-cleaning method. They are shake/deflate, reverse air and pulse-jet.

A pulse-jet system's bags are fitted to cylindrical cages, and collect dust on the bags' outer surfaces. At regular intervals, a short pulse of compressed air is directed into each bag from the top. This causes a deflection wave to travel down the bag, dislodging the dust cake which falls off into the collection hopper below.

Because of the cleaning mechanism of pulse-jet baghouses, there is less dust cake build-up on the bag than in other types of baghouses and, consequently, lower pressure drop. Thus, the pulse-jet baghouse can operate at higher gas-to-cloth ratios than can other types of baghouses; that is, it can filter a greater quantity of gas per unit area of fabric at a given operating pressure drop.

REQUIRED CAPABILITIES OF PULSE-JET BAGHOUSE FABRICS

In order to be effective in pulse-jet baghouse applications, a filter fabric must be able to ensure good collection of particulates, long bag life, and low operating-pressure differentials. In order to provide such characteristics, a fabric must possess capabilities in each of the following categories:

Strength

Because a filter bag fabric has to withstand the stresses imposed by the complete weight of the dust cake, the stresses imposed by the operating pressure differential across the bag, and those imposed by the high-pressure cleaning, its strength is a fundamental requirement.

Fatigue Resistance

A pulse-jet baghouse filter bag is subjected to the baghouse cleaning mechanism's pressure pulses at regular intervals. These pressure pulses impose two fatigue loads on the bag: *(a)* a reversed pressure load across the bag material, and *(b)* an abrasion load between the support cage and the bag. Thus, the fabric's fatigue resistance is crucial to long bag life.

Filtering Efficiency

The purpose of the filter bag fabric is to separate solid particulate matter from its gaseous environment. The many mechanisms by which this occurs are beyond the scope of this paper. However, regardless of the filtering mechanism employed, a high level of filtering efficiency (i.e., particulate collection efficiency) is a characteristic vital to a filter fabric.

Dust-Release Characteristics

The stresses placed on a filter bag by operating pressure differential and dust load are reduced when the amount of dust cake resident on the bag is minimized. This means removing as much dust cake as desirable in each cleaning cycle, while using minimum cleaning pressure to do so. A fabric that easily releases dust requires low cleaning pressure to remove a large proportion of residual dust cake, and, therefore, operates at low pressure differentials and with a light cake load. This reduces the stresses in the bag material and extends bag life. Low pressure differential also reduces the horsepower needed by the fan that moves the flue-gas stream.

Corrosion Resistance

The chemical composition of a flue-gas being cleaned by a baghouse depends greatly on the fuel being burned, the degree to which the fuel is completely oxidized, the flue-gas temperature, and the type of post-combustion flue-gas treatment system used. For example, when a high sulfur coal is burned in an industrial boiler and no flue-gas scrubber is used, SO_2 and SO_3 gases pass through the baghouse. If for some operational reason the flue-gas temperature is allowed to fall below the acid dew-point, sulfuric acid is formed in the gas stream. This sulfuric acid attacks all the components with which it comes into contact. Even when such a combustion process is fitted with a scrubber of some sort, excursions in acidity of the flue-gas can, and do occur.

As another example, consider the case of a municipal incinerator employing a spray drier to neutralize the acidic flue-gases produced by the incineration process. A significant portion of the unreacted lime slurry from the spray drier is carried downstream and is captured on the bag surface in the form of lime dust. This corrosive alkaline product is in constant intimate contact with the fabric surface.

It is therefore readily apparent that good all-round corrosion resistance by the filter fabric is a prerequisite for long bag life—especially when the chemical composition of the fuel being burned varies greatly, as is the case in a waste-to-energy facility.

Temperature Resistance

An air-pollution-control system is designed to operate at a nominal design temperature. Excursions in the operation of the pollution source (e.g., combustion furnace), or in the flue-gas treatment system (e.g., scrubber), can result in significant changes in flue-gas temperature. A fabric possessing high strength at elevated temperatures will be relatively unaffected by these temperature surges.

AVAILABLE FABRIC TYPES AND THEIR FILTERING MECHANISMS

There are three types of fabric from which filter bags may be manufactured—woven fabrics, membranes and felts.

Woven Fabrics

Because they have relatively large spaces between their fibers, woven fabrics depend on dust particles to bridge these spaces and form a dust cake on the material surface. The spaces between the dust particles in the dust cake are relatively small, and it is primarily this dust cake which performs filtration. On initial start-up, and after each cleaning cycle, the reduced quantity of dust cake (or filter cake) on the fabric results in poor filtering efficiency, which persists until the cake has built up to an appreciable thickness. The dust cake results in a relatively high operating-pressure differential, and any attempt to reduce it by cleaning more frequently results in poor particle capture efficiency. The presence of a long-term filter cake results in high stresses on the bag fabric, and ultimately, relatively short bag life. Woven fabrics, therefore, do not take full advantage of pulse-jet cleaning technology.

Membranes

These fabrics consist of a woven or felted backing to which an extremely thin, porous membrane is bonded. It is the surface of this membrane which performs most of the filtration. Although membrane fabrics have very good particle capture efficiency, they are fragile and can be damaged easily during installation. When filtering fine, non-agglomerating dusts the membrane pores may become clogged by dust particles, resulting in very high operating-pressure differentials (or, ultimately, blinding).

Felts

These fabrics are composed of a relatively thick (up to around $\frac{3}{16}$ in.) matt of densely packed, randomly oriented, fine fibers—sometimes needled to a supporting open-woven-scrim fabric. Their filtration mechanism is through the extremely fine interstices between these fibers. Because felts do not depend primarily on a particulate dust cake for their filtration function, felts operate at very high collection efficiencies from start-up and continuously provide high collection efficiencies—even immediately after cleaning cycles. It has been pointed out that filtering efficiency greatly depends on fiber size; those felts employing fine fibers in their construction have higher filtering efficiencies than those employing coarser fibers [2].

DESCRIPTION OF FABRICS EVALUATED

The following filter fabrics were tested for performance.

Woven Fiberglass

Four different types of woven fiberglass having two different weights/unit area, and two different chemical resistant finishes were tested. The nominal weights were 22 oz/sq yd (750 g/m^2) and 16 oz/sq yd (540 g/m^2); each with a 10% Teflon® "B" finish, and with a commercially available acid-resistant finish. These fabrics are referred to as 16 oz Woven Glass Tef B, 22 oz Woven Glass Tef B, 16 oz Woven Glass AR, and 22 oz Woven Glass AR, respectively.

Expanded Polyfluorocarbon Membrane Laminated to 16.8 oz/sq yd (570 g/m^2), 10% Teflon "B"-Coated Woven Fiberglass Backing

For the sake of brevity, this fabric will be referred to by its commercial name, Gore-Tex/Glass®.

Fiberglass Felt

Two different weights of fiberglass felt: 27 oz/sq yd (915 g/m^2), and 16 oz/sq yd (540 g/m^2) were tested. Each of these felts is composed of a fiberglass batt needled to a supporting open-woven fiberglass scrim fabric. These fabrics are treated with a proprietary silicone-based resin protection system during their manufacture and are referred to as Huyglas® 1607-S and Huyglas 1701 respectively.

Aramid Felt

The most commonly used version of this fabric was tested. It has a nominal weight per unit area of 14 oz/sq yd (475 g/m^2) and is composed of an open-woven aramid scrim fabric needled between two aramid felts. The aramid fabric is referred to as Nomex®.

Polyphenylene Sulfide Felt

This fabric is made up of an open woven scrim needled between two polyphenylene sulfide felts. The scrim is woven from slitted polyflurocarbon membrane, and the total fabric nominal weight is 16 oz/sq yd (540 g/m^2). This composite fabric is referred to as Ryton®/Rastex®.

Polyimide Felt

This fabric was tested in a 16 oz/sq yd (540 g/m^2) weight and is made up of a woven-polyimide scrim needled between two polyimide felts. Since the fibers used in this fabric were proprietary in shape (cross-section), the felt is referred to by its commercial name of P-84.

DESCRIPTION OF TESTS AND TEST RESULTS

A battery of tests was run on all the fabrics to establish their relative performance characteristics. The filter fabrics were tested for retention of strength under acidic, alkaline, and high-temperature conditions. Fatigue strength was measured, and panel tests were run at a high gas-to-cloth ratio, using a fine dust. Collection efficiencies and pressure drops were also measured.

The tests and their results are discussed below.

TESTING UNDER ACIDIC CONDITIONS

In order to determine the fabrics' performances in acidic environments, samples (panels) of each fabric were conditioned at 425°F (218°C) for 1 hr to simulate a realistic baghouse thermal environment. [Nomex and Ryton had lower allowable temperatures and were conditioned at 400°F (205°C) and 375°F (190°C), respectively.] The samples were then immersed in solutions of 25% H_2SO_4 by volume. The acid baths containing the samples were placed in convection ovens at 300°F (150°C) for 75 min. They were then removed from the ovens and cooled for 18 hr at ambient temperature. After rinsing and drying at 200°F (93°C) for 1 hr, the samples were tested for tensile strength in both directions (weft and warp) to ASTM D1682, as well as for Mullen burst strength to ASTM D3786. Retained strengths were calculated as a percentage of strength in the conditioned state and are presented in Table 1 in order of decreasing retained strength. A minimum of five samples was used in each case, and the values presented are averages of the test results.

Of the ten fabrics tested, four had zero retained strength and one had only 5.4% average retained strength. These were three of the woven fiberglass fabrics, the Nomex felt, and the Gore-Tex/Glass membrane fabric. The heaviest woven fiberglass with acid-resistant finish had an average strength retention of just over 57%. The remaining four fabrics exhibited average strength retentions of more than 80%, with the heavy-weight Huyglas felt having an average strength retention of more than 93%.

TESTING UNDER ALKALINE CONDITIONS

In order to ascertain the fabrics' performances in alkaline environments, samples of each fabric were conditioned as for acidic conditions. The samples were then immersed in solutions of lime water having a pH of 11. The alkaline baths containing the samples were placed in convection ovens at 300°F (150°C) for 75 min. They were then removed from the ovens and cooled for 18 hr at ambient temperature. After rinsing, and drying at 200°F (93°C) for 1 hr, the samples were tested for tensile strength in both directions, as well as for Mullen burst strength. As in the acidic environment testing, retained strengths were calculated as a percentage of strength in the conditioned state and are presented in Table 2 in order of decreasing retained strength. A minimum of five samples was used in each case, and the values presented are averages of the test results. Note that the P-84 fabric was not tested since the fiber manufacturer does not recommend its use in high-temperature alkaline environments.

Of the nine fabrics tested, the two worst-performing fabrics had average retained strengths of between 70 and 80%. This performance appeared reasonable—however, in each case retained strengths in one of the three types of test was around 45%. These two fabrics were woven fiberglasses. Six of the remaining seven fabrics had average strength retention values in excess of 90%, and one fabric performed in the 80% range.

TABLE 1 RETAINED STRENGTHS AFTER EXPOSURE TO ACIDIC ENVIRONMENT

FABRIC	WEFT TENSILE (%)	WARP TENSILE (%)	MULLEN BURST (%)	AVERAGE (%)
Huyglas 1607-S	100.0	83.8	95.7	93.2
P-84	91.2	87.2	100.0	92.8
Ryton/Rastex	81.3	94.0	95.8	90.4
Huyglas 1701	86.5	81.1	84.8	84.1
22 oz. Woven Glass AR	77.4	60.5	34.1	57.3
16 oz. Woven Glass AR	0.0	0.0	16.3	5.4
Nomex	0.0	0.0	0.0	0.0
Gore-Tex/Glass	0.0	0.0	0.0	0.0
22 oz. Woven Glass Tef B	0.0	0.0	0.0	0.0
16 oz. Woven Glass Tef B	0.0	0.0	0.0	0.0

TABLE 2 RETAINED STRENGTHS AFTER EXPOSURE TO ALKALINE ENVIRONMENT

FABRIC	WEFT TENSILE (%)	WARP TENSILE (%)	MULLEN BURST (%)	AVERAGE (%)
Gore-Tex/Glass	100.0	100.0	96.5	98.8
Nomex	100.0	100.0	95.7	98.6
22 oz. Woven Glass Tef B	100.0	94.7	100.0	98.2
Huyglas 1607-S	100.0	100.0	92.8	97.6
Ryton/Rastex	84.2	98.3	100.0	94.2
Huyglas 1701	100.0	88.4	88.1	92.2
16 oz. Woven Glass AR	54.1	97.0	93.9	81.7
22 oz. Woven Glass AR	44.8	80.6	100.0	75.1
16 oz. Woven Glass Tef B	100.0	65.4	44.9	70.1
P-84*	-	-	-	-

* P-84 not tested

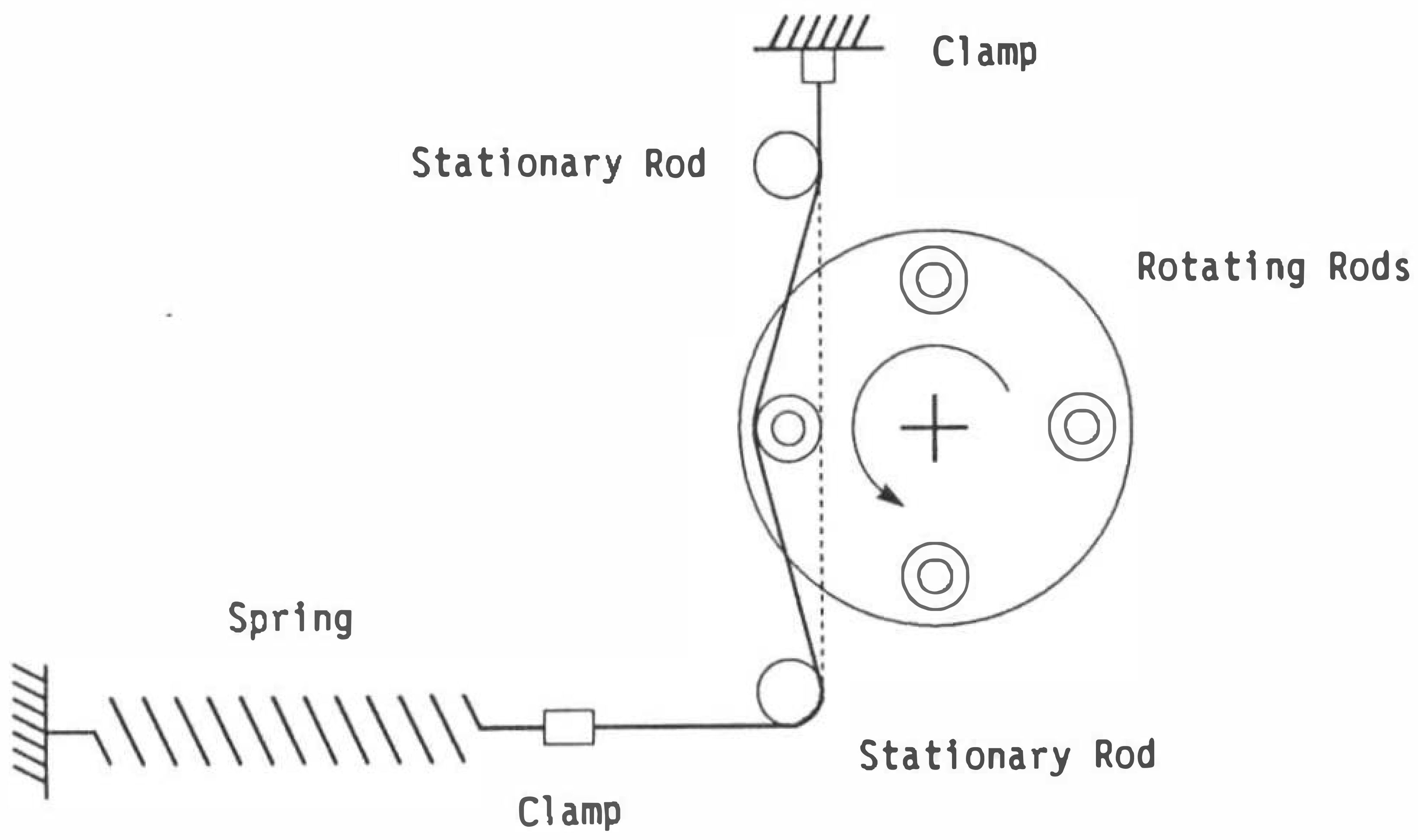

FIG. 1 SCHEMATIC OF FLEX-TESTING APPARATUS

Testing for Fatigue Strength

In order to determine the fatigue strength of fabrics, a test apparatus was used to simulate bag fatigue loading as closely as possible. A schematic diagram of the equipment is presented in Fig. 1. A set of samples was cut from each weave direction. The samples were then conditioned at 425°F (218°C) for 1 hr. A test sample was clamped at one end, passed between stationary rods and clamped to a spring at its other end. The spring was adjusted to apply a tension of 8 lb/in. (140 g/mm) to the sample in the unflexed position. Four rods (carried in bearings) sequentially deflected the sample by 0.125 in. (3 mm). The sample was subjected to 100,000 loading cycles, and then tested for tensile strength. Retained strengths were calculated as a percentage of strength in the conditioned state and are presented in Table 3 in order of decreasing retained strength. A minimum of five samples was used in each case, and the values presented are averages of the test results.

Most of the fabrics tested retained a significant portion of their original strength before flexing. The heavyweight acid-resistant woven fiberglass was the poorest performer, retaining a little under 55% average strength. The remaining nine fabrics retained more than 80% average strength; four of these appeared unaffected by the fatigue loading.

TESTING FOR FATIGUE STRENGTH UNDER ACIDIC CONDITIONS

It was expected that acidic environments would affect the fabrics' fatigue strength. In order to determine this effect, samples of fabric were exposed to the acidic environment described previously, and then subjected to 100,000 loading cycles on the Flex-Testing Apparatus. The samples were then tested for tensile strength. Retained strengths were calculated as a percentage of strength in the conditioned state and are presented in Table 4 in order of decreasing strength. A minimum of five samples was used in each case, and the values presented are averages of the test results.

Five fabrics had zero residual strength after post-acidic environment fatigue loading (note that these five are the same as those most affected by acidic environments in Table 1). The heaviest woven fiberglass with Acid-Resistant finish retained an average tensile strength of 39%. The four remaining fabrics exhibited average strength retentions of more than 70%.

TABLE 3 RETAINED STRENGTHS AFTER 100,000 CYCLES OF FLEXING

FABRIC	WEFT TENSILE (%)	WARP TENSILE (%)	AVERAGE TENSILE (%)
Nomex	100.0	100.0	100.0
16 oz. Woven Glass Tef B	100.0	100.0	100.0
Gore-Tex/Glass	100.0	100.0	100.0
P-84	100.0	100.0	100.0
16 oz. Woven Glass AR	98.5	100.0	99.3
22 oz. Woven Glass Tef B	100.0	92.7	96.4
Ryton/Rastex	83.1	97.4	90.3
Huyglas 1701	77.8	99.7	88.8
Huyglas 1607-S	95.1	80.1	87.6
22 oz. Woven Glass AR	58.2	51.3	54.8

TABLE 4 RETAINED STRENGTHS AFTER EXPOSURE TO ACIDIC ENVIRONMENTS AND 100,000 LOADING CYCLES

FABRIC	WEFT TENSILE (%)	WARP TENSILE (%)	AVERAGE TENSILE (%)
P-84	100.0	100.0	100.0
Ryton/Rastex	87.5	97.4	92.5
Huyglas 1701	100.0	67.4	83.7
Huyglas 1607-S	90.0	57.6	73.8
22 oz. Woven Glass AR	29.5	49.5	39.5
Nomex	0.0	0.0	0.0
Gore-Tex/Glass	0.0	0.0	0.0
22 oz. Woven Glass Tef B	0.0	0.0	0.0
16 oz. Woven Glass Tef B	0.0	0.0	0.0
16 oz. Woven Glass AR	0.0	0.0	0.0

TESTING FOR FATIGUE STRENGTH UNDER ALKALINE CONDITIONS

In order to determine the effect of alkaline environments on fatigue strength, samples of fabric were exposed to the alkaline environment described previously, and then subjected to 100,000 loading cycles on the Flex-Testing Apparatus. The samples were then tested for tensile strength. Retained strengths were calculated as a percentage of strength

TABLE 5 RETAINED STRENGTHS AFTER EXPOSURE TO ALKALINE ENVIRONMENTS AND 100,000 LOADING CYCLES

FABRIC	WEFT TENSILE (%)	WARP TENSILE (%)	AVERAGE TENSILE (%)
Nomex	100.0	100.0	100.0
Huyglas 1701	100.0	97.6	98.8
Gore-Tex/Glass	100.0	90.2	95.1
22 oz. Woven Glass TEF B	100.0	84.3	92.2
Ryton/Rastex	81.9	100.0	91.0
16 oz. Woven Glass TEF B	84.9	95.9	90.4
Huyglas 1607-S	96.7	71.9	84.3
22 oz. Woven Glass AR	35.4	72.0	53.7
16 oz. Woven Glass AR	45.9	46.4	46.2
P-84*	-	-	-

*P-84 not tested

TABLE 6 PANEL-TEST PARAMETERS

GAS/CLOTH RATIO	4.5 ft/min (1.4 m/min)
GRAIN LOADING	3.0 gr/dscf (6.9 g/m^3)
PULSE FREQUENCY	once every 30 minutes
PULSE DURATION	200 milliseconds

in the conditioned state and are presented in Table 5 in order of decreasing retained strength. A minimum of five samples was used in each case, and the values presented are averages of the test results. Note that P-84 fabric was not included in the alkaline testing for the reasons described previously.

Of the nine fabrics tested, two had average retained strengths of the order of 50%. The remaining fabrics had average retention values of more than 80%.

PRESSURE DROP AND FILTERING EFFICIENCY TESTS

In order to evaluate the fabrics' abilities to collect particulate, as well as to determine their operating pressure-drop characteristics, a series of tests was run on a panel-testing apparatus.

A schematic diagram of the apparatus is presented in Fig. 2. A gas stream containing a known quantity of dust was passed through a rectangular sample (panel) of the fabric being tested. Flyash obtained from a circulating fluidized-bed boiler burning anthracite culm was used in the panel tests. It had a large enough submicron proportion to enable collection efficiency of these extremely fine particles to be determined. Particulate matter that penetrated the fabric was captured on a preweighed absolute filter. This filter was replaced at regular intervals, and fabric filtering efficiency was calculated by comparing the weight of the dust on the filter with the total quantity of dust in the gas stream during the test period. Pulse-jet cleaning was simulated by periodically releasing a jet of compressed air onto the sample in the direction opposite to that of the gas stream. Operating pressure-drop across the sample was measured before and after pulsing, and an average was calculated.

The panel-test parameters are presented in Table 6, and a dust particle-size distribution summary is presented in Table 7.

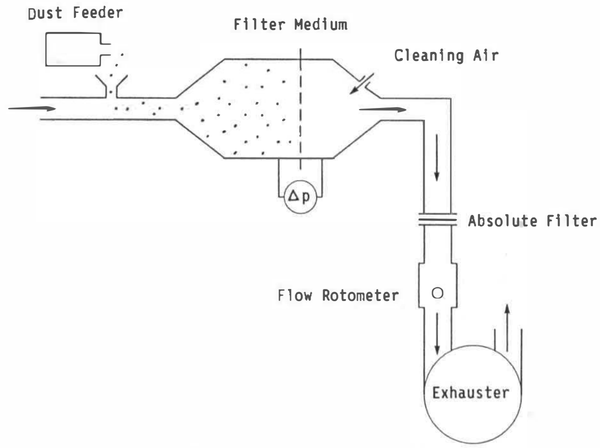

FIG. 2 SCHEMATIC OF PANEL TESTING APPARATUS

TABLE 7 DUST PARTICLE SIZE SUMMARY

BY VOLUME:

Reference Diameter (Microns)	% of Volume Below Reference Diameter
4.25	10%
6.70	20
9.11	30
11.83	40
15.03	50
18.96	60
24.56	70
33.63	80
45.00	90

BY POPULATION COUNT:

Reference Diameter (Microns)	% of Population Below Reference Diameter
0.30	10%
0.39	20
0.48	30
0.59	40
0.72	50
0.90	60
1.15	70
1.57	80
2.46	90

TABLE 8 COLLECTION EFFICIENCIES

Fabric	Collection Efficiency after 2 hours	100 hours
	%	%
Gore-Tex/Glass	99.989	99.997
Huyglas 1607-S	99.958	99.993
Huyglas 1701	99.927	99.993
P84	99.183	99.989
Nomex	99.421	99.972
Ryton/Rastex	99.378	99.959
22 oz. Woven Glass Tef 8	93.921	99.896
16 oz. Woven Glass Tef B	92.621	99.881

TABLE 9 EQUIVALENT EMISSION LEVELS

Fabric	Equivalent Emission Levels after 2 hours		100 hours	
	gr/dscf	mg/Nm^3	gr/dscf	mg/Nm^3
Gore-Tex/Glass	0.00033	0.76	0.00010	0.23
Huyglas 1607-S	0.00126	2.88	0.00020	0.45
Huyglas 1701	0.00219	5.01	0.00020	0.45
P84	0.02451	5.61	0.00032	0.73
Nomex	0.01737	39.76	0.00085	1.96
Ryton/Rastex	0.01866	42.71	0.00123	2.82
22 oz. Woven Glass Tef B	0.18237	417.44	0.00311	7.11
16 oz. Woven Glass Tef B	0.22137	506.72	0.00359	8.21

Collection Efficiency

Collection (filtering) efficiencies of the fabrics are presented in Table 8 in order of decreasing efficiency. They are presented as efficiency after 2 hr of testing and 100 hr of testing. Samples of acid-resistant woven fiberglass were not tested for collection efficiency. Equivalent emission levels were calculated using the inlet grain loading and collection efficiencies; these are presented in Table 9 in order of increasing emission level.

Of the eight fabrics tested, only three fabrics exhibited 2-hr collection efficiencies better than 99.90%. These were Gore-Tex/Glass and the two versions of Huyglas. These were also the only fabrics having 100-hr efficiencies in excess of 99.99%. The three remaining felts (P-84, Nomex, and Ryton) exhibited 2 hr efficiencies over 99.0%. Both weights of woven glass demonstrated 2 hr efficiencies in the 93–94% range. After 100 hr of testing, efficiencies for these fabrics improved as their dust cakes built up to a thickness which improved the filtration mechanism. As expected, equivalent emission levels followed similar trends.

The equivalent emission levels of the best-performing fabrics were of the order of 100 times better than current federal requirements. The worst-performing fabrics had emission levels that did not meet these federal requirements after 2 hr of testing. Note that these are emission levels for fabrics only—actual baghouse levels are expected to be higher due to tubesheet, bag attachment, and bypass damper leakage.

TABLE 10 PRESSURE DROP PERFORMANCE

Fabric	Pressure Drop after 2 hours in. water	mm water	100 hours in. water	mm water
Gore-Tex/Glass	1.9	48.3	2.4	61.0
Huyglas 1607-S	0.4	10.2	2.6	66.0
Huyglas 1701	0.3	7.6	2.7	68.6
P-84	0.3	7.6	3.1	78.7
Nomex	0.6	15.2	3.5	88.9
Ryton/Rastex	0.5	12.7	3.5	88.9
16 oz. Woven Glass Tef B	0.1	2.5	5.2	132.1
22 oz. Woven Glass Tef B	0.2	5.1	5.3	134.6

Pressure Drop Performance

Table 10 depicts the pressure drop results obtained from the panel tests.

Pressure-drop readings were taken every 30 min. All the felts and the membrane fabric reached a stable pressure-drop within 30 hr of test initiation, indicating that a state of equilibrium had been reached between dust cake build-up and dust cake release. However, the woven fabrics required approximately 80 hr for their pressure-drop to stabilize, indicating that their stable dust cake was much thicker than those of the other fabrics. For the sake of completeness the tests were run for 100 hr on each fabric.

Pressure drop levels are presented after 2 hr and 100 hr of testing, in order of increasing pressure drop.

The fabrics' filtration mechanisms were clearly reflected in their pressure drop performance. The membrane fabric's (Gore-Tex/Glass) 2 hr pressure drop was the highest of the group—due to the small pore size of the membrane. However, after 100 hr of testing, the Gore-Tex/Glass fabric exhibited the lowest pressure drop: 2.4 in. of water (61 mm).

The Huyglas felts both exhibited low pressure drop after 100 hr of testing: 2.6 and 2.7 in. of water (66 and 68.6 mm). Three organic felts (P-84, Nomex, and Ryton) followed, with pressure drops between 3.1 and 3.5 in. (78.7 and 88.9 mm). The woven glass fabrics' poor dust-release properties and use of dust cake for filtration contributed to their performance. At 2 hr, the woven glass fabrics had very low pressure drops because dust cakes had not yet fully formed on their surfaces. After 100 hr of testing, the woven glass fabrics exhibited the highest pressure drops—approximately double the pressure of the best-performing fabrics.

CONCLUSIONS

The results of the tests demonstrated the differences in the abilities of a range of fabrics to withstand corrosive, high-temperature environments, and to perform effectively as filtration media while operating at reasonably lowest pressure drops. Although some fabrics were only suited to particular environments (e.g., Nomex in alkaline), the Huyglas felts gave the best all-round performance in all environments, while providing excellent filtration efficiencies and low operating-pressure drop. The Gore-Tex/Glass fabric provided the best filtration efficiency and lowest pressure drop, while the woven fiberglass's efficiency and pressure drop were deemed unacceptable.

A baghouse's performance is primarily dependent on the performance of the fabric from which the bags are made. Care must be taken to ensure that the fabric chosen

(a) is suitable for all possible variations in flue-gas temperature and chemical composition;

(b) will operate at low pressure drop; and

(c) will provide the filtering efficiency necessary to meet the applicable emissions regulations.

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