FILTRATION OF RADIOACTIVE AEROSOLS BY GLASS FIBERS

PART TWO. APPENDICES

BY

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FILTRATION OF RADIOACTIVE AEROSOLS BY GLASS FIBERS

Part Two - Appendices

by

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April 16, 1951

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INTRODUCTION

For purposes of convenience, the report entitled "The Filtration of Radioactive Aerosols By Glass Fibers" has been published in two volumes. Part one (HW-20847, 4-16-51) contains the text of the report and describes the development program which led to the design of highly efficient, glass fiber filters. Part two (HW-20847, 4-16-51) is composed of five appendices each of which pertains to a separate phase of the program. Four of the appendices contain experimental data presented in graphical form. The remaining appendix consists of a series of nomographs summarizing the permeability and efficiency characteristics of three types of glass fibers.

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Figure A-1

SAMPLE CALCULATION OF THE PARTICLE SIZE
DISTRIBUTION DETERMINED BY THE
MODIFIED CASCADE IMPACTOR

Test Date: 1-10-50

Sample Flow Rate: 0.5 cfm.

<u>Stage No.</u>	<u>Stage Median Diameter Microns</u>	<u>Radioactivity Content dpm.</u>	<u>Stage Median Value</u>	<u>Cumulative Per Cent of Activity Less Than the Stage Median Value</u>
I	7.72	10,900	5,500	99.80
II	3.24	30,700	15,400	99.02
III	1.71	188,000	94,000	94.95
IV	1.14	444,000	222,000	83.17
V	0.68	2,010,000	1,005,000	37.45

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Figure A-3
PARTICLE SIZE DISTRIBUTION FOR THE PROCESS-CELL AIR
AS DETERMINED BY THE MODIFIED CASCADE IMPACTOR

Test Date: 1-16-50

Sample Flow Rate: 1.0 cfm.

Particle Diameter - Microns

20

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Figure A-5

PARTICLE SIZE DISTRIBUTION FOR THE PROCESS-CELL AIR
AS DETERMINED BY THE MODIFIED CASCADE IMPACTOR

Test Date: 4-12-50

Sample Flow Rate: 1.0 cfm.

Particle Diameter - Microns

0.1

1.0

Cumulative Per Cent of Activity Less Than the Stage Median Value

22

Particle Diameter - Microns

-22-

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Particle Diameter - Microns

24

-24-

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25

Figure A-9

PARTICLE SIZE DISTRIBUTION IN THE METHYLENE BLUE SMOKE
AS DETERMINED BY THE MODIFIED CASCADE IMPACTOR

Test Date: 5-31-50

Sample Flow Rate: 2.5 cfm.

Particle Diameter - Microns

-25-

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26

Figure A-10

PARTICLE SIZE DISTRIBUTION IN THE METHYLENE BLUE SMOKE
AS DETERMINED BY THE MODIFIED CASCADE IMPACTOR

Test Date: 7-28-50

Sample Flow Rate: 1.7 cfm.

Particle Diameter - Microns

Figure B-1
GRAPH OF PRESSURE DROP
VS. SUPERFICIAL VELOCITY

No. 55 Fiberglas, $\rho_p = 3.0$ pcf.

X - L = 12 inches

O - L = 24 inches

Figure B-2

GRAPH OF PRESSURE DROP
VS. SUPERFICIAL VELOCITY

No. 55 Fiberglas, $\rho_p = 6.0$ pcf.

- - L = 5 inches
- X - L = 6 inches
- △ - L = 9 inches
- - L = 48 inches

Figure B-3
GRAPH OF PRESSURE DROP
VS. SUPERFICIAL VELOCITY

No. 55 Fibreglas, $\rho_p = 9.0$ pof.
○ - L = 2 inches
△ - L = 4 inches
□ - L = 6 inches

Figure B-4
CROSS-PLOT OF PRESSURE DROP
VS. BED DEPTH

No. 55 Fibreglas

○ - V = 25 fpm; ρ_p = 3 pcf.
△ - V = 50 fpm; ρ_p = 3 pcf.
□ - V = 25 fpm; ρ_p = 6 pcf.
X - V = 50 fpm; ρ_p = 6 pcf.

⊗ - V = 10 fpm; ρ_p = 9 pcf.
⊠ - V = 30 fpm; ρ_p = 9 pcf.
▲ - V = 50 fpm; ρ_p = 9 pcf.

Figure B-5
CROSS-PLOT OF PRESSURE DROP
VS. PACKING DENSITY

No. 55 Fiberglas

○ - V = 25 fpm, L = 6 inches
△ - V = 50 fpm, L = 5 inches
X - V = 50 fpm, L = 10 inches

Figure B-6
GRAPH OF PRESSURE DROP
VS. SUPERFICIAL VELOCITY

No. 55 P Fiberglas
 O - L = 6 inches; $\rho_p = 2.0$ pcf.
 X - L = 6 inches; $\rho_p = 3.0$ pcf.

Figure B-7
GRAPH OF PRESSURE DROP
VS. SUPERFICIAL VELOCITY

AA Fibreglas, $\rho_p = 0.6$ pcf.

○ - L = 1.5 inches

X - L = 1.0 inch

△ - L = 0.5 inch

Figure B-8
GRAPH OF PRESSURE DROP
VS. SUPERFICIAL VELOCITY

AA Fiberglas, $\rho_p = 1.2$ pcf.

⊙ - L = 1.00 inch

X - L = 0.75 inch

◻ - L = 0.50 inch

△ - L = 0.25 inch

Figure B-9
GRAPH OF PRESSURE DROP
VS. SUPERFICIAL VELOCITY

AA Fiberglas, $\rho_p = 2.4$ pcf.

○ - L = 1.00 inch

X - L = 0.75 inch

□ - L = 0.50 inch

△ - L = 0.25 inch

Figure B-10
CROSS-PLOT OF PRESSURE DROP
VS. BED DEPTH

AA Fiberglas

- - V = 50 fpm; $\rho_p = 1.2$ pcf.
 △ - V = 10 fpm; $\rho_p = 1.2$ pcf.
 □ - V = 10 fpm; $\rho_p = 0.6$ pcf.

Figure B-11
CROSS-PLOT OF PRESSURE DROP
VS. PACKING DENSITY

AA Fiberglas

- ⊙ - L = 0.25 inch; V = 5 fpm.
- △ - L = 0.25 inch; V = 10 fpm.
- X - L = 0.50 inch; V = 10 fpm.
- ◻ - L = 0.50 inch; V = 20 fpm.

Figure B-12
GRAPH OF PRESSURE DROP
VS. SUPERFICIAL VELOCITY

B Fiberglas

⊙ - L = 1.0 inch, $\rho_p = 1.4$ pcf.

Δ - L = 1.0 inch, $\rho_p = 0.7$ pcf.

Figure B-13
GRAPH OF PRESSURE DROP
VS. SUPERFICIAL VELOCITY

B (L and R) Fiberglass
 $\rho_p = 3.5$ pcf.
 $L = 1.0$ inch

Figure B-14
GRAPH OF PRESSURE DROP
VS. SUPERFICIAL VELOCITY

No. 450 Fiberglas

$\rho = 5.7$ pcf.

$L = 8$ inches

Figure B-15
GRAPH OF PRESSURE DROP
VS. SUPERFICIAL VELOCITY

No. 600 Fiberglas
 $\rho_p = 5.1$ pcf.
 $L = 7$ inches

Figure B-16
GRAPH OF PRESSURE DROP
VS. SUPERFICIAL VELOCITY

No. 800 Fiberglas
 $\rho = 6.6$ pcf.
 $L = 8$ inches

Figure B-17
GRAPH OF PRESSURE DROP
VS. SUPERFICIAL VELOCITY

No. 115 Fiber, $C_p = 3.8$ pcf.

○ - L = 10 inches
 △ - L = 20 inches

Figure B-18
GRAPH OF PRESSURE DROP
VS. SUPERFICIAL VELOCITY
No. 115 K Fiberglass

□ - L = 6 inches, $\rho_p = 6.0$ pcf.	◇ - L = 6 inches, $\rho_p = 1.5$ pcf.	
○ - L = 12 inches, $\rho_p = 6.0$ pcf.	X - L = 12 inches, $\rho_p = 1.5$ pcf.	
△ - L = 24 inches, $\rho_p = 6.0$ pcf.	▽ - L = 18 inches, $\rho_p = 1.5$ pcf.

Figure B-19

GRAPH OF PRESSURE DROP VS. SUPERFICIAL VELOCITY
NO. 115K FIBERGLAS

□	L = 6 inches	$\rho_p = 9.0$ pcf.
○	L = 12 inches	$\rho_p = 9.0$ pcf.
△	L = 6 inches	$\rho_p = 3.0$ pcf.
◇	L = 12 inches	$\rho_p = 3.0$ pcf.
X	L = 24 inches	$\rho_p = 3.0$ pcf.

Figure B-20

GRAPH OF PRESSURE DROP VS. BED DEPTH
NO. 115K FIBERGLAS

Figure B-21

GRAPH OF PRESSURE DROP VS. PACKING DENSITY

NO. 115K FIBERGLAS

- L = 6 inches, V = 25 fpm.
- L = 12 inches, V = 10 fpm.
- △ L = 12 inches, V = 25 fpm.
- ◇ L = 12 inches, V = 50 fpm.

Figure C-2

GRAPH OF DECONTAMINATION FACTOR
VS. SUPERFICIAL VELOCITY

No. 55 Fiberglas, $\rho_p = 3.0$ pcf.

⊙ - L = 12 inches

X - L = 24 inches

Figure C-3

GRAPH OF DECONTAMINATION FACTOR
VS. SUPERFICIAL VELOCITY

No. 55 Fiberglas, $\rho_p = 4.5$ pcf.

L = 6 inches

Figure C-4

GRAPH OF DECONTAMINATION
FACTOR VS. SUPERFICIAL VELOCITY

No. 55 Fiberglas, $\rho_p = 6.0$ pcf.

⊙ - L = 5 inches

X - L = 9 inches

Figure C-5

GRAPH OF DECONTAMINATION FACTOR
VS. SUPERFICIAL VELOCITY

No. 55 Fiberglas, $\rho_p = 9.0$ pcf.

- - L = 2 inches
- X - L = 4 inches
- △ - L = 6 inches

Figure C-6

CROSS-PLOT OF DECONTAMINATION FACTOR

VS. BED DEPTH

No. 55 Fiberglas

Δ - ρ_p = 3.0 pcf., V = 20 fpm.	$\odot$ - ρ_p = 9.0 pcf., V = 5 fpm.
$\square$ - ρ_p = 3.0 pcf., V = 50 fpm.	∇ - ρ_p = 9.0 pcf., V = 30 fpm.
X - ρ_p = 6.0 pcf., V = 30 fpm.	

Figure C-7
CROSS-PLOT OF DECONTAMINATION FACTOR
VS. PACKING DENSITY

No. 55 Fiberglas

- ⊙ - L = 6 inches, V = 10 fpm.
- X - L = 6 inches, V = 50 fpm.
- Δ - L = 9 inches, V = 10 fpm.
- ◻ - L = 9 inches, V = 5 fpm.

Figure C-8

GRAPH OF DECONTAMINATION FACTOR
VS. SUPERFICIAL VELOCITY

No. 55P Fiberglas, $\rho_p = 3.0$ pcf.

○ - L = 6 inches
X - L = 12 inches

Figure C-9

GRAPH OF DECONTAMINATION FACTOR
VS. SUPERFICIAL VELOCITY

AA Fiberglas, $\rho_p = 0.6$ pcf.

○ - L = 0.5 inch

X - L = 1.0 inch

△ - L = 1.5 inches

Figure C-10

GRAPH OF DECONTAMINATION FACTOR
VS. SUPERFICIAL VELOCITY
AA FIBERGLAS

- Δ - $\rho_p = 1.2$ pcf.; $L = 0.25$ inch
 $\times$ - $\rho_p = 1.2$ pcf.; $L = 0.50$ inch
 $\circ$ - $\rho_p = 1.8$ pcf.; $L = 0.50$ inch

Figure C-11

CROSS-PLOT OF DECONTAMINATION FACTOR

VS. BED DEPTH

AA Fiberglas

- - $\rho_p = 0.6$ pcf., $V = 5$ fpm.
- X - $\rho_p = 0.6$ pcf., $V = 20$ fpm.
- △ - $\rho_p = 1.2$ pcf., $V = 5$ fpm.
- - $\rho_p = 1.2$ pcf., $V = 40$ fpm.

Figure C-12

CROSS-PLOT OF DECONTAMINATION
FACTOR VS. PACKING DENSITY

AA FIBERGLAS

L = 0.5 inch

○ - L = 10 fpm.

X - L = 20 fpm.

△ - L = 40 fpm.

Figure C-13

GRAPH OF DECONTAMINATION FACTOR

VS. SUPERFICIAL VELOCITY

B (L and R) Fiberglas, $\rho_p = 4.0$ pcf.

X - L = 0.50 inch

⊙ - L = 0.25 inch

Figure C-14

GRAPH OF DECONTAMINATION FACTOR

VS. SUPERFICIAL VELOCITY

B Fiberglas, $\rho_p = 0.7$ pcf.

$L = 1.0$ inch

Figure C-15

GRAPH OF DECONTAMINATION FACTOR
VS. SUPERFICIAL VELOCITY

No. 450 Fiberglas, $\rho_p = 5.7$ pcf.

L = 8 inches

Figure C-16

GRAPH OF DECONTAMINATION FACTOR
VS. SUPERFICIAL VELOCITY

No. 600 Fiberglas, $\rho_p = 5.1$ pcf.

L = 7 inches

Figure C-17

GRAPH OF DECONTAMINATION FACTOR
VS. SUPERFICIAL VELOCITY

No. 800 Fiberglas, $\rho_p = 6.6$ pcf.

L = 8 inches

Figure C-18

GRAPH OF DECONTAMINATION FACTOR
VS. SUPERFICIAL VELOCITY

No. 115 Fiber, $\rho_p = 3.8$ pcf.

○ - L = 10 inches
△ - L = 20 inches

Figure C-19

CROSS PLOT OF DECONTAMINATION FACTOR
VS. BED DEPTH

No. 115 Fiber $\rho = 3.8 \text{ pcf.}$
 X - V = 2 fpm.
 O - V = 10 fpm.
 Δ - V = 25 fpm.
 □ - V = 50 fpm.

Figure C-20

**GRAPH OF DECONTAMINATION FACTOR
VS. SUPERFICIAL VELOCITY**

No. 115K Fiberglas, $\rho_p = 1.5$ pcf.

○ - L = 6 inches

X - L = 12 inches

△ - L = 18 inches

Figure C-21

GRAPH OF DECONTAMINATION FACTOR
VS. SUPERFICIAL VELOCITY

No. 115K Fiberglas, $\rho_p = 3.0$ pcf.

○ - L = 6 inches
X - L = 12 inches
△ - L = 18 inches

Figure C-22

GRAPH OF DECONTAMINATION FACTOR

VS. SUPERFICIAL VELOCITY

No. 115K Fiberglas, $\rho_p = 6.0$ pcf.

- - L = 6 inches
- X - L = 12 inches
- △ - L = 18 inches

Figure C-23

GRAPH OF DECONTAMINATION FACTOR

VS. SUPERFICIAL VELOCITY

No. 115K Fiberglas, $\rho_p = 9.0$ pcf.

○ - L = 6 inches

X - L = 12 inches

Figure C-24

CROSS-PLOT OF DECONTAMINATION FACTOR

VS. BED DEPTH

No. 115K Fiberglass

X - $\rho_p = 1.5$ pcf., V = 15 fpm.

○ - $\rho_p = 3.0$ pcf., V = 25 fpm.

△ - $\rho_p = 6.0$ pcf., V = 15 fpm.

□ - $\rho_p = 6.0$ pcf., V = 50 fpm.

▽ - $\rho_p = 9.0$ pcf., V = 5 fpm.

Figure C-25

CROSS-PLOT OF DECONTAMINATION FACTOR
VS. PACKING DENSITY

No. 115K Fiberglas

X - L = 6 inches, V = 15 fpm.

Δ - L = 6 inches, V = 30 fpm.

□ - L = 12 inches, V = 5 fpm.

⊗ - L = 12 inches, V = 15 fpm.

⊙ - L = 12 inches, V = 40 fpm.

▽ - L = 18 inches, V = 5 fpm.

75

L - INCHES

Figure D-1

Nomograph of the
Permeability
Characteristics of
No. 55 Fiberglas

$$\Delta P = K_{55} L V \rho_p^{1.6}$$

Where

ΔP = Pressure Drop-
Inches of Water

K_{55} = Constant

L = Bed Depth, Inches

V = Superficial
Velocity, fpm.

ρ_p = Packing Density,
pcf.

76

ρ_p - pcf

A

ΔP

V - fpm

Figure D-3

Nomograph of the
Permeability
Characteristics of
No. 115K Fiberglas

$$\Delta P = K_{115K} L V \rho_p^{1.5}$$

Where

ΔP = Pressure Drop -
Inches of Water

K_{115K} = Constant

L = Bed Depth, inches

V = Superficial
Velocity, fpm

ρ_p = Packing Density,
pcf

L - INCHES

ρ_p - pcf

9
8
7
6
5
4
3
2
1.5

A

0
2
4
6
8
10
12
14
16
18
20
22

A

78

DF	%
4.00	99.99
3.00	99.9
2.30	99.5
2.00	99
1.39	96
1.17	93
1.00	90
.696	80
.522	70
.400	60
.300	50
.222	40
.156	30
.100	20
.048	10

V - fpm

1
2
3
4
5
6
7
8
9
10
15
20
25
30
40
50
60
75

Figure D-4

Nomograph of the Efficiency Characteristics of No. 55 Fiberglas

$$DF = \frac{C_{55} L^{0.9} \rho_p^{1.1}}{V^{0.4}}$$

Where

- DF = Decontamination Factor
- C_{55} = Constant
- L = Bed Depth, inches
- ρ_p = Packing Density pcf.
- V = Superficial Velocity, fpm.

L - INCHES

24
20
15
12
10
9
8
7
6
5
4
3
2

ρ_p - pcf.

A

DF	%
5.00	99.999
4.00	99.99
3.00	99.9
2.30	99.5
2.00	99.0
1.39	96
1.17	93
1.000	90
0.696	80
0.522	70
0.400	60
0.300	50

V - fpm

Figure D-5

Nomograph of the Efficiency
Characteristics of

AA Fiberglas

$$DF = \frac{C_{AA} L^{0.8} \rho_p^{1.0}}{V^{0.2}}$$

Where

DF = Decontamination Factor

C_{AA} = Constant

L = Bed Depth, inches

ρ_p = Packing Density, pcf.

V = Superficial Velocity, fpm.

L - INCHES

80

V - fpm

Figure D-6

L - INCHES

Nomograph of the Efficiency
Characteristics of
No. 115K Fiberglas

$$DF = \frac{C_{115K} L^{0.9} \rho_p^{0.9}}{V^{0.4}}$$

Where

DF = Decontamination Factor

C_{115K} = Constant

L = Bed Depth, inches

ρ_p = Packing Density, pcf

V = Superficial Velocity, fpm

DF	%
4.00	99.99
3.00	99.9
2.00	99.0
1.70	98
1.30	95
1.00	90
0.70	80
0.52	70
0.40	60
0.30	50
0.22	40
0.16	30
0.10	20
0.048	10

A 0
2
4
6
8
10
12
14
16
18
20
22
A

ρ_p - pcf
9
8
7
6
5
4
3
2
1.5

-79-

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81

82

84

Figure E-5

GRAPH OF PRESSURE DROP
VS. Σ - FUNCTION FOR THE FIRST SAND FILTER TEST UNIT

- - 2 inches of Type IV Sand
- △ - 12 inches of Type V Sand
- - 3 inches of Type VI Sand
- X - Entire filter unit

Figure E-6

GRAPH OF PRESSURE DROP

VS. Σ - FUNCTION

FOR THE SECOND SAND

FILTER TEST UNIT

- - 12 inches of Type II Sand
- - 12 inches of Type III Sand
- △ - 6 inches of Type IV Sand
- X - 12 inches of Type V Sand
- ▽ - 3 inches of Type VI Sand
- ⊙ - Entire filter unit.

Superficial Velocity - 5 fpm.

90

91

Figure E-8

GRAPH OF THE RADIOACTIVITY DISTRIBUTION
IN A PLANT SAND FILTER

O - Tube No. 1
X - Tube No. 2

Figure E-9
GRAPH OF PRESSURE DROP
VS. Σ - FUNCTION

⊙ - 5 inches of No. 55 Fiberglas at 9.0 pcf. Protecting

Δ - 0.25 inch of AA Fiberglas at 1.2 pcf.

Superficial Velocity - 50 fpm.

Figure E-10
GRAPH OF PRESSURE DROP
VS. Σ - FUNCTION

- - 11 inches of No. 55 Fiberglas at 6.0 pcf. Protecting
□ - 0.25 inch of AA Fiberglas at 1.2 pcf.
Superficial Velocity - 50 fpm.

Figure E-11
GRAPH OF PRESSURE DROP
VS. Σ - FUNCTION

- - 5 inches of No. 55 Fiberglas at 3.0 pcf. Protecting
□ - 11 inches of No. 55 Fiberglas at 6.0 pcf.
Superficial Velocity - 50 fpm.

Figure E-12
GRAPH OF PRESSURE DROP
VS. Σ - FUNCTION

□ - 12 inches of No. 450 Fiberglas at 5.7 pcf. Protecting
○ - 5 inches of No. 55 Fiberglas at 3.0 pcf.
Superficial Velocity - 50 fpm.

Figure E-13
GRAPH OF PRESSURE DROP
VS. Σ - FUNCTION

○ - 12 inches of No. 600 Fiberglas at 6.8 pcf. Protecting
□ - 12 inches of No. 450 Fiberglas at 5.7 pcf.
Superficial Velocity - 50 fpm.

Figure E-14
GRAPH OF PRESSURE DROP
VS. Σ - FUNCTION

□ - 12 inches of No. 800 Fiberglas at 6.6 pcf. Protecting
○ - 12 inches of No. 600 Fiberglas at 6.8 pcf.
Superficial Velocity - 50 fpm.

Figure E-15
GRAPH OF PRESSURE DROP
VS. Σ - FUNCTION

□ - 8 inches of No. 55 Fiberglas at 6.0 pcf. Protecting
○ - 0.25 inch of AA Fiberglas at 1.2 pcf.
Superficial Velocity - 25 fpm.

Figure E-16
GRAPH OF PRESSURE DROP
VS. Σ - FUNCTION

- - 5 inches of No. 55 Fiberglas at 3.0 pcf. Protecting
 ○ - 8 inches of No. 55 Fiberglas at 6.0 pcf.
 Superficial Velocity - 25 fpm.

100

Figure - E-17
GRAPH OF PRESSURE DROP
VS. Σ - FUNCTION

□ - 5 inches of No. 115 Fiber at 3.8 pcf. Protecting
 ○ - 5 inches of No. 55 Fiberglas at 3.0 pcf.
 Superficial Velocity - 25 fpm.

Figure E-18
GRAPH OF PRESSURE DROP
VS. Σ - FUNCTION

○ - 12 inches of No. 450 Fiberglas at 10 pcf. Protecting
□ - 5 inches of No. 115 Fiber at 3.8 pcf.
Superficial Velocity - 25 fpm.

102

103

-98-

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Figure E-19
GRAPH OF PRESSURE DROP
VS. Σ - FUNCTION

○ 14 inches No. 55 Fiberglas at 1.5 pcf. Protecting
△ 5 inches No. 55 Fiberglas at 3.0 pcf.
Superficial Velocity - 25 fpm.

Figure E-20
GRAPH OF PRESSURE DROP
VS. Σ - FUNCTION

○ - 12 inches of No. 450 Fiberglas at 10.0 pcf. Protecting
□ - 14 inches of No. 55 Fiberglas at 1.5 pcf.
Superficial Velocity - 25 fpm.

105

Figure E-21
GRAPH OF PRESSURE DROP
VS. Σ - FUNCTION

○-24 inches No. 450 Fiberglas at 5.0 pcf. Protecting
□-14 inches No. 55 Fiberglas at 1.5 pcf.
Superficial Velocity 25 fpm.

106

107

-101-

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Figure E-21
GRAPH OF PRESSURE DROP
VS. Σ - FUNCTION

○ 10 inches No. 55 Fiberglas at 1.5 pcf. Protecting
□ 5 inches No. 55 Fiberglas at 3.0 pcf.
Superficial Velocity - 25 fpm.

108

109

102

101

Figure E-23

GRAPH OF PRESSURE DROP VS. Σ FUNCTION

- - 24 inches of No. 450 Fiberglas at 2.0 pcf. protecting.
 - - 14 inches of No. 55 Fiberglas at 1.5 pcf.
- Superficial Velocity - 25 fpm.

Pressure Drop - Inches of Water

10
9
8
7
6
5
4
3
2
1.0
0.8
0.6
0.5
0.4
0.3
0.2
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01

Σ Function - Grains/ft.²

110

111

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Figure E-24

GRAPH OF PRESSURE DROP VS. Σ FUNCTION

⊙ - 24 inches of No. 800 Fiberglas at 5.0 pcf.
Protecting

□ - 14 inches of No. 55 Fiberglas at 1.5 pcf.

Superficial Velocity - 25 fpm.

Pressure Drop - Inches of Water

Figure E-25

GRAPH OF PRESSURE DROP VS. Σ FUNCTION FOR A
COMPOSITE UNIT OPERATED AT 50 fpm.

- 1 - 16 inches of No. 55 Fiberglas at 1.5 pcf.
- 2 - 6 inches of No. 55 Fiberglas at 3.0 pcf.
- 3 - 8 inches of No. 55 Fiberglas at 6.0 pcf.
- 4 - 1 inch of AA Fiberglas at 1.2 pcf.
- 5 - entire filter unit.

Pressure Drop - Inches of Water

114

115

-105- 109

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Figure E-26A

GRAPH OF PRESSURE DROP VS. Σ FUNCTION FOR A COMPOSITETEST UNIT OPERATED AT 25 fpm.

- 1 - 1st. inch of No. 55 Fiberglas at 1.5 pcf.
- 2 - 2nd and 3rd inches of No. 55 Fiberglas at 1.5 pcf.
- 3 - 1st inch of No. 55 Fiberglas at 3.0 pcf.

Pressure Drop - Inches of Water

Σ - Function - Grains/ft.²

116

117

-105-

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Figure E-26 B

GRAPH OF PRESSURE DROP VS. Σ FUNCTION FOR A COMPOSITETEST UNIT OPERATED AT 25 fpm

- 1 - 14 inches of No. 55 Fiberglas at 1.5 pcf.
- 2 - 6 inches of No. 55 Fiberglas at 3.0 pcf.
- 3 - 8 inches of No. 55 Fiberglas at 6.0 pcf.
- 4 - 0.75 inches of AA Fiberglas at 1.2 pcf.
- 5 - entire filter unit.

Pressure Drop - Inches of Water

118

Figure E-27GRAPH OF PRESSURE DROP VS. Σ FUNCTION

○-8 inches of No. 55P Fiberglas at 6.0 pcf protecting
■-0.75 inch of AA Fiberglas at 1.2 pcf.
Superficial Velocity - 25 fpm.

119

Figure E-28

GRAPH OF PRESSURE DROP VS. Σ FUNCTION

○ - 6 inches No. 55P Fiberglas at 3.0 pcf. protecting

□ - 8 inches No. 55P Fiberglas at 6.0 pcf.

Superficial Velocity - 25 fpm.

120

Figure E-29

GRAPH OF PRESSURE DROP VS. Σ FUNCTION

⊙ - 18 inches of No. 55P Fiberglas at 1.5 pfc.
protecting

⊠ - 8 inches of No. 55P Fiberglas at 3.0 pfc.

Superficial Velocity - 25 fpm.

121

Figure E-30

GRAPH OF PRESSURE DROP VS. Σ FUNCTION

○- 8 inches of No. 115K Fiberglas at 9.0 pcf.
protecting.

□- 3/4 inch AA Fiberglas at 1.2 pcf.

Superficial Velocity - 50 fpm.

122

Figure E-31

GRAPH OF PRESSURE DROP VS. Σ FUNCTION

□ - 6 inches of No. 115K Fiberglas at 6.0 pcf.
protecting.

▲ - 8 inches of No. 115K Fiberglas at 9.0 pcf.

○ - 1st inch of No. 115K Fiberglas at 6.0 pcf.

Superficial Velocity - 50 fpm.

Figure E-32

GRAPH OF PRESSURE DROP VS. Σ FUNCTION

○ - 6 inches of No. 115K Fiberglas at 3.0 pcf.
protecting.

□ - 8 inches of No. 115K Fiberglas at 6.0 pcf.

Superficial Velocity - 50 fpm.

Figure E-33

124

GRAPH OF PRESSURE DROP VS. Σ FUNCTION

○ - 12 inches No. 115K Fiberglas at 1.5 pcf.
protecting.

□ - 6 inches No. 115K Fiberglas at 3.0 pcf.

Superficial velocity - 50 fpm.

Figure E-34

125

GRAPH OF PRESSURE DROP VS. Σ FUNCTION

○ - 8 inches No. 115K Fiberglas at 9.0 pcf.
protecting.

□ - 3/4 inch AA Fiberglas at 1.2 pcf.

Superficial Velocity - 25 fpm.

Figure E-35

GRAPH OF PRESSURE DROP VS. Σ FUNCTION

○ - 6 inches No. 115K Fiberglas at 6.0 pcf.
protecting.

□ - 8 inches No. 115K Fiberglas at 9.0 pcf.
Superficial velocity - 25 fpm.

Figure E-36

GRAPH OF PRESSURE DROP VS. Σ FUNCTION

6 inches No. 115K Fiberglas at 6.0 pcf.

Superficial Velocity - 25 fpm.

Figure E-37

GRAPH OF PRESSURE DROP VS. Σ FUNCTION

⊙ - 6 inches No. 115K Fiberglas at 3.0 pcf.
protecting.

□ - 8 inches No. 115K Fiberglas at 6.0 pcf.

Superficial Velocity - 25 fpm.

Figure E-38

GRAPH OF PRESSURE DROP VS. Σ FUNCTION

○ - 6 inches No. 115K Fiberglas at 3.0 pcf.
protecting.

□ - 8 inches No. 115K Fiberglas at 6.0 pcf.
Superficial Velocity - 25 fpm.

130

Figure E-39

GRAPH OF PRESSURE DROP VS. Σ FUNCTION

○ - 3 inches No. 115K Fiberglas at 3.0 pcf.
protecting.

□ - 6 inches No. 115K Fiberglas at 6.0 pcf.

Superficial Velocity - 15 fpm.

131

132

-120-

5

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Pressure Drop - Inches of Water

Figure E-40
GRAPH OF PRESSURE DROP VS. Σ FUNCTION

- - First one inch increment of 12 inches No. 115K Fiberglas at 1.5 pcf.
 - - 12 inches of No. 115K Fiberglas at 1.5 pcf.
 - △ - 6 inches of No. 115K Fiberglas at 3.0 pcf.
- Superficial Velocity - 25 fpm.

Σ Function - Grains/ft.²