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TITLE

TESTS TO DETERMINE EFFECT OF HUMIDITY ON HIGH-EFFICIENCY FILTERS WHEN INSTALLED HORIZONTALLY

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TESTS TO DETERMINE EFFECT OF HUMIDITY ON HIGH-EFFICIENCY FILTERS WHEN INSTALLED HORIZONTALLY

by

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TESTS TO DETERMINE EFFECT OF HUMIDITY ON HIGH-EFFICIENCY FILTERS WHEN INSTALLED HORIZONTALLY

I. OBJECT OF TESTS

To determine effect of high-humidity air on the physical characteristics of filter media and separators when the filter is mounted in the horizontal position. Usual installation is with the filter mounted vertically.

II. BACKGROUND AND JUSITIFICATION

The fabricator of the mounting frames for the Reactor Confinement Project has experienced difficulty in maintaining the necessary tolerances required for the frames. These frames are sealed to frames cast in the building structure by means of inflated neoprene tubes. With this design even slight deviation from tolerance can not be permitted. The filter units are installed in the large frames at one site, and then transported to the point of use where they are installed in the vertical position. This method exposes the filters to numerous possibilities of damage. The filters are easily damaged, and extreme care is necessary in the handling, transportation, and installation. This being so, any reduction in handling or moving would be beneficial.

It has been proposed that a different mounting frame design be prepared for NPR. The proposed method of installation, coupled with the use of smaller frames, would permit greater dimensional tolerances and, consequently, easier fabrication, handling, and installation.

Before initiation of the proposed design, it was necessary to determine effect of high-humidity air on the filter unit when installed horizontally.

III. METHOD OF TESTING

An additional chamber was installed on the filter testing apparatus located in the fan room of the 234-5 Building. This chamber is designed for mounting the filter in the horizontal position. The air flow through the filter is directed either vertically upward or downward by repositioning guillotine type dampers.

Humidification is supplied by bleeding steam into the air duct upstream of the filter.

Two filters were obtained from those purchased for the IPD Confinement Project (CG1-791). A new filter was used in each test.

IV. TESTS

It was originally intended to conduct the tests with exposure of 48 hours at 80% R.H., 48 hours at 90% R.H., and 48 hours at 100% R.H. This was found impracticable, as it required close and continuous round-the-clock observance and manipulation of the steam supply. The man-hours involved would not be justified.

Instead of following the above method it was decided to perform combined R.H. tests, with shift personnel in the building checking the test periodically.

Test 1 FLOW UPWARD THROUGH FILTER

Time	1:30	3:30	5:00	7:00	9:00	12:00	2:30
Fan Suction WG	5.5	5.5	5.5	5.4	5.4	5.4	5.4
Filter Intake WG	4.8	4.8	4.4	3.6	2.6	2.1	1.6
Resistance WG	.7	.7	1.1	1.8	2.8	3.3	3.8
Wet Bulb °F	64	88	88	87.5	93	94.5	95.5
Dry Bulb °F	75	94	94	93	96	97	98
R.H. %	55	79	79	80	89	90	90
Flow	1050	1050	1000	900	800	700	590

	4:30	6:00	7:30	8:30	9:30	10:30*
Fan Suction WG	5.4	5.3	5.3	5.3	5.3	5.3
Filter Intake WG	1.2	.8	.4	.3	.3	.3
Resistance WG	4.2	4.5	4.9	5.0	5.0	5.0
West Bulb °F	97	101	103	103.5	104.5	105
Dry Bulb °F	100	103	104	104	105	105
R. H. %	90	92	97	98	98	100
Flow	480	320	275	180	80	60

*End of test. Note gradual decrease in flow during approximately 22 hours exposure at humidities ranging from 78% to 100%.

The filter core did not sag, break down, or lose formation under above conditions. However, upon drying out penetration had increased from .03% to 1.2%, by DOP test, or a decrease in efficiency from 99.97% to 98.80%. Further visual inspection revealed minute perforations scattered over the back face of the filter.

Weight of filter before test = 50.5 lbs; weight of filter on completion of R.H. test 72.5 lbs; filter absorbed 22 lbs. H_2O during test.

Test 2 FLOW DOWNWARD THROUGH FILTER

Time	9:30	11:30	2:30	4:30	6:30	8:00	10:30
Fan Suction WG	5.5	5.5	5.5	5.4	5.4	5.4	5.4
Filter Intake WG	4.8	4.8	4.5	4.0	3.8	3.4	3.0
Resistance WG	.7	.7	1.0	1.4	1.6	2.0	2.4
Wet Bulb °F	67	81	82	83	83	85	89
Dry Bulb °F	77	86	87	88	88	90	91
R. H_2O %	59	80	81	81	81	82	90
Flow	1099	1080	1000	900	700	550	340

	12:30	3:00	4:30	6:30	8:30	10:30	12:00
Fan Suction WG	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Filter Intake WG	2.8	2.0	1.5	1.0	1.5	2.0	2.5
Resistance WG	2.5	3.3	3.8	4.3	3.8*	3.3	2.8
Wet Bulb °F	89.5	90.5	93.5	98	100	102	103
Dry Bulb °F	92	93	96	100	101	103	103
R.H. %	90	90	90	93	96	97	100
Flow	250	200	120	80	150*	200	300

*Note reduction in filter resistance and increase in flow at this stage, indicating damage to filter core. Upon examination, found large area of perforations in media at direct center of filter and slight sagging in the core.

Weight of filter before test = 51 lbs; weight of filter on completion of R.H. test = 84 lbs; filter absorbed 33 lbs. H_2O during test.

END

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