NATIONAL BUREAU OF STANDARDS REPORT

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FIRE ENDURANCE TEST

of

TWO BULKHEAD ASSEMBLIES

by

J. V. Ryan and E. W. Bender

for

U. S. COAST GUARD

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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ABSTRACT

Two bulkhead assemblies were subjected to a standard fire test. The two differed only in the density of the asbestos marine boards used. Each served as an effective barrier to flame passage for the full 60 minutes of the test. Excessive temperature rise was reached on the unexposed surface of the 30 lb per cu ft board at 13.9 minutes and on the 36 lb per cu ft board at 14.5 min.

1. Introduction

At the request of Headquarters, U. S. Coast Guard (letter of 30 November 1961, MMT, JJ/164.008/48, JJ/164.008/49), two bulkhead specimens were subjected to fire test in compliance with Subpart 164.008-3(b) of Specification for Bulkhead Panels for Merchant Vessels.

2. Specimens

The specimens were submitted by Turners Asbestos Cement Co., Ltd., Manchester, England. The materials were delivered to the National Bureau of Standards where they were assembled under the supervision of a representative of the submittor. Each specimen, when assembled, consisted of two pieces of Turnall Asbestos Ships Board with a vertical joint between, a metal joint member, and metal channel on the four edges. The edges of the Turnall boards were sanded to a slight bevel before assembly to prevent binding in the metal members. The details of the assembly are shown in Figure 1 at the end of this report.

The two specimens differed only as to the densities of the asbestos marine boards. Enough pieces for two specimens of each density, 30 and 36 lb per cu ft, were received in good condition. Measurements made on each piece prior to assembly indicated the following:

Nominal Density lb/ft3	Weight lb	Length in.	Width in.	Mean Thickness in.	Actual Density lb/ft3
30	22	95	18	.768	28.9
	21.5	95	18.06	.769	28.2
	40	94.97	30.5	.768	31.1
	39	95	30.5	.764	30.4
36	27.5	95.03	18.06	.755	36.7
	26	95.06	18.06	.759	34.5
	44.5	94.88	30.5	.761	34.9
	43	95	30.56	.757	33.8

The pieces actually used in the test specimens were those having actual densities (underlined above) nearest the nominal density.

3. Test Method

The specimens were mounted in two openings of a test frame arranged to permit the simultaneous fire exposure of three bulkhead specimens in the wall test furnace. The third opening was closed with an insulated metal panel.

Care was taken that each specimen was restrained against vertical movement, so that the only relief from thermal expansion would be that provided for in the design and fabrication of the specimens' frame and joint details. The periphery between each specimen and the furnace test frame was sealed with a fillet of plaster. This plaster fillet covered all the metal on the fire exposed side except the vertical joint member between the two pieces of marine board.

Eight thermocouples were placed on the unexposed surface of each specimen, distributed as shown in Figure 1. Each thermocouple junction and several inches of its lead wires were covered by a 6- by 6- by 0.4-in. felted asbestos pad. Twelve thermocouples, encased in porcelain insulators and iron pipes, were distributed within the furnace chamber. The furnace fuel was gas from the local municipal supply. The fuel flow was adjusted as necessary to produce average furnace temperatures as close as feasible to those of the standard time-temperature curve of ASTM E-119, which include: 1000°F at 5 min, 1300°F at 10 min, 1550°F at 30 min, and 1700°F at 1 hr.

4. Results

The test was conducted on January 10, 1962 and was witnessed by the following:

W. L. Russon, LCDR, USCG
H. A. Pledger, Lt, USCG
Paul Gibson, USCG
Graham I. Sleeman, Turners Asbestos Co.
George J. Goll
Willard R. Seipt

No cracks developed through either specimen during the test, although a diagonal flexure line near the bottom of the unexposed surface of the 30-lb specimen observed at 52 min corresponded to a crack in the exposed surface. The joint members bowed slightly toward the fire in the first few minutes but, after about 12 min, the joint members and marine boards bowed away from the fire. The test was stopped at 1 hr.

Both specimens remained effective barriers to flame passage throughout the test, there being no cracks in the unexposed surface. The limiting 250°F temperature rise at one thermocouple on the unexposed surface of the asbestos marine board was reached at 13.9 minutes for the 30 lb per cu ft board specimen and at 14.5 minutes for the 36 lb per cu ft board specimen. The fire exposure severity for the 1 hr test was 99.3 percent. Additional temperature data are given in Figure 1; the condition of the specimens at the start and at the end of the test are shown in Figures 2, 3, and 4.

5. Summary

The results of the test indicated that both specimens served as effective barriers to flame passage for 1 hr, and that the limiting temperature rise was reached at 13.9 min for the particular samples of nominal 30 lb per cu ft Turnall board and at 14.5 min for the particular samples of nominal 36 lb per cu ft Turnall board used in the specimens.

Neither the contents of this report nor the fact that the test was made at the National Bureau of Standards shall be used for advertising or promotional purposes.

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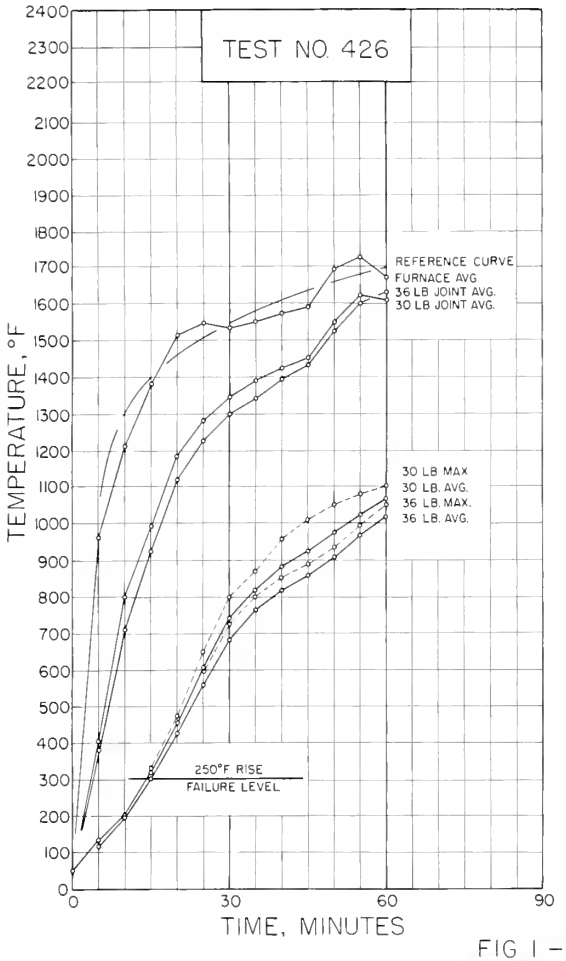

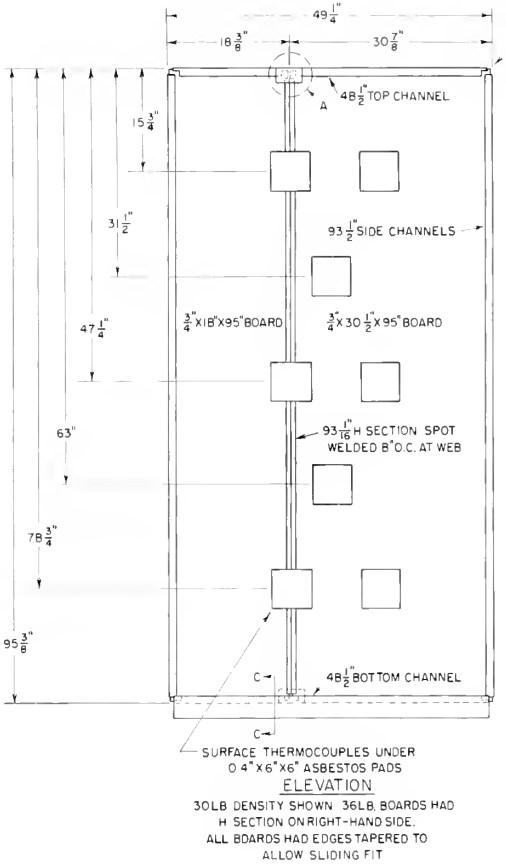

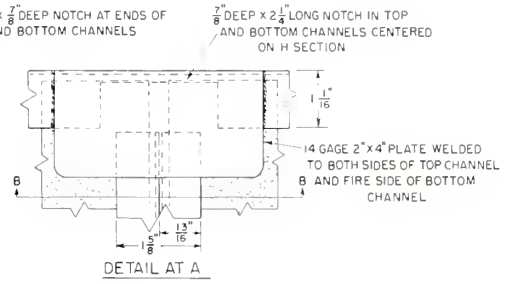

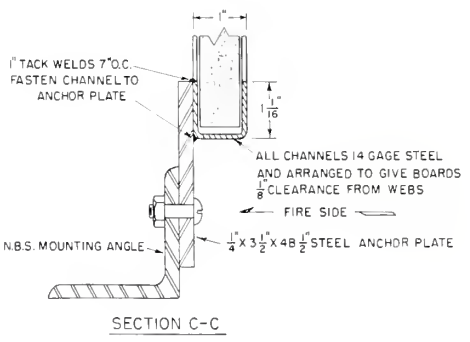

FIG 1 – TEMPERATURE DATA AND CONSTRUCTION DETAILS

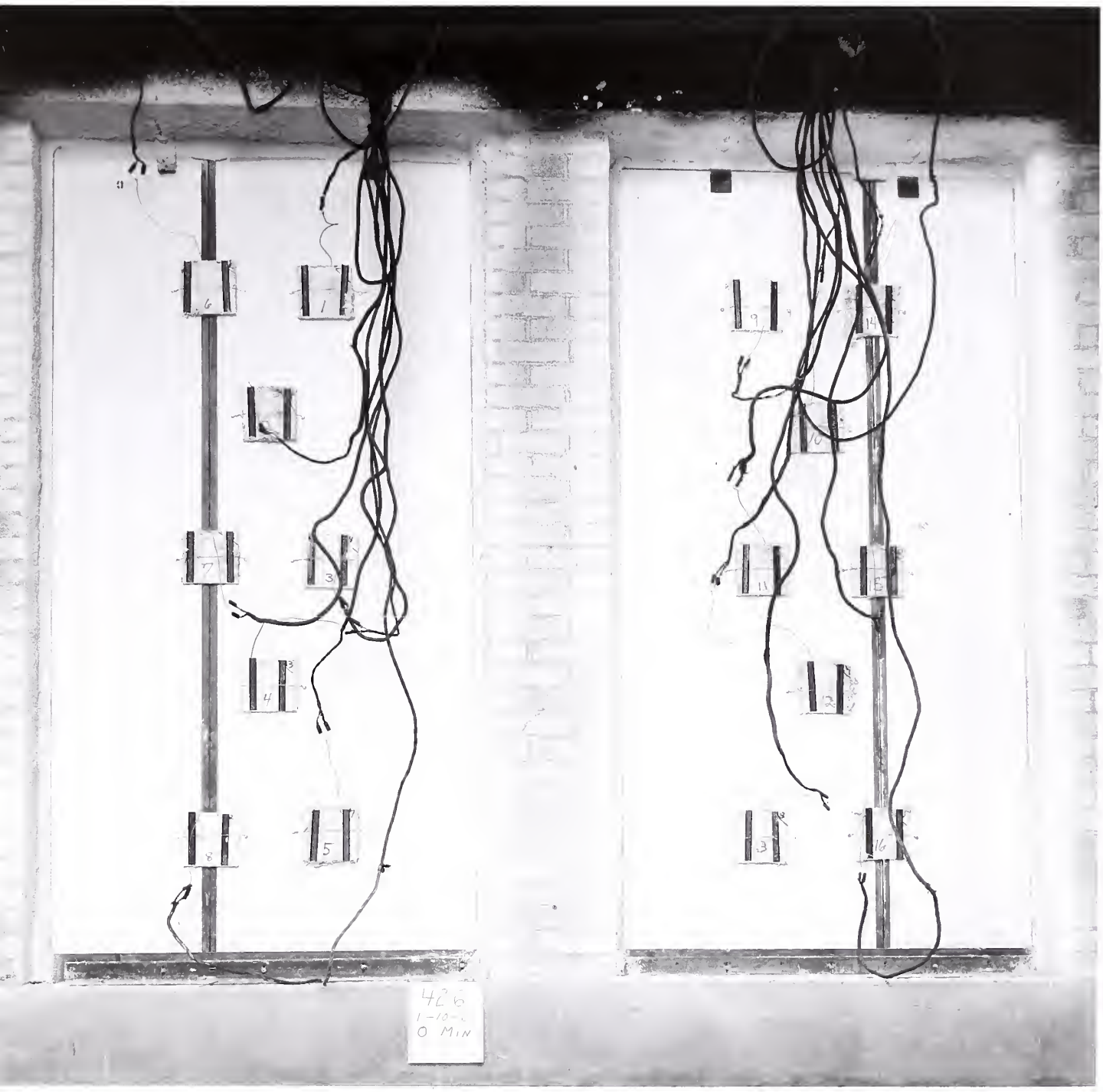

Figure 2. Unexposed surface at start of test.

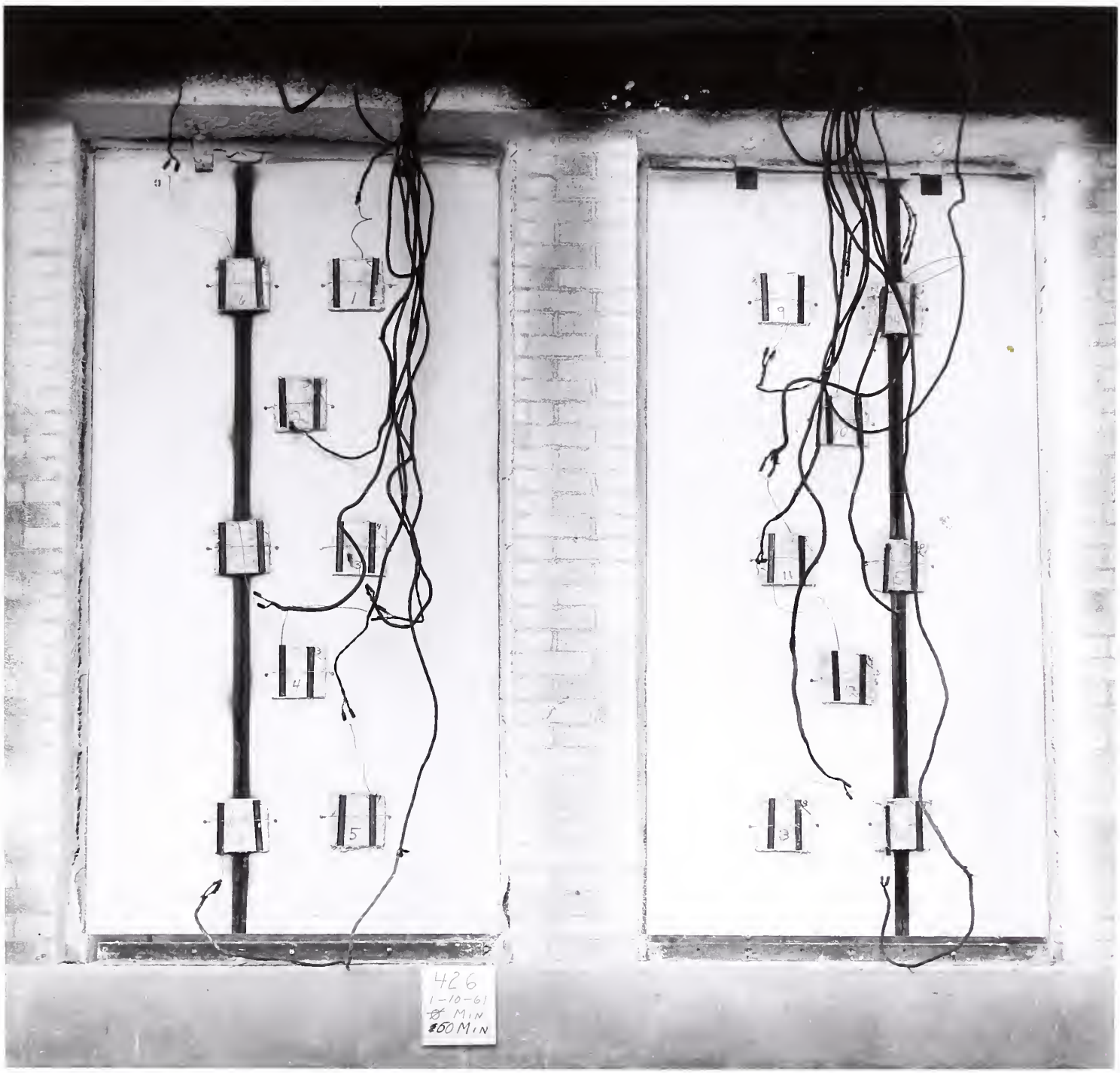

Figure 3. Unexposed surface at end of test.

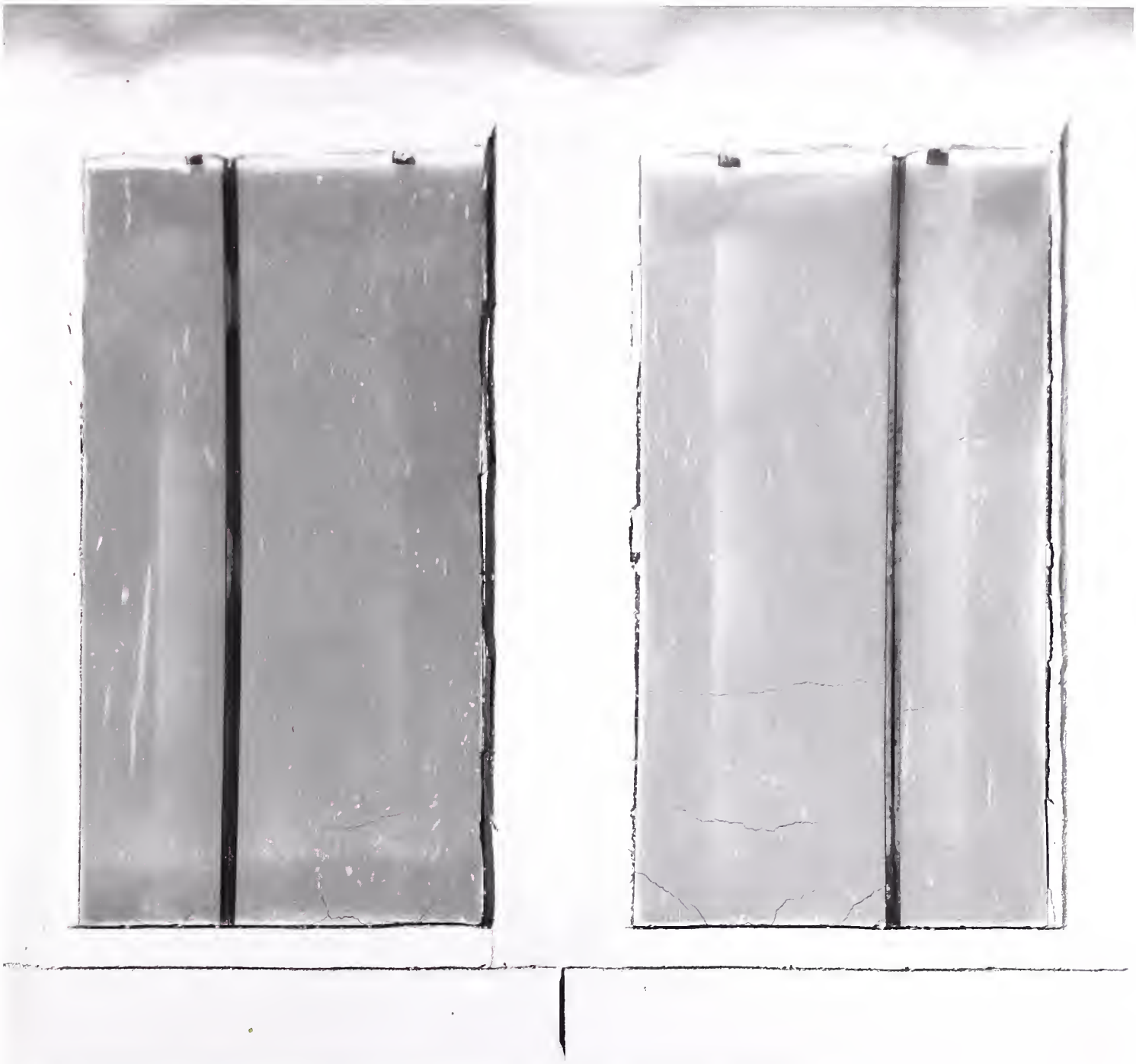

Figure 4. Exposed surface about 10 minutes after end of test.

Oxford NO. 152 1/3 RED

ESSELTE

10%