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NATIONAL BUREAU OF STANDARDS REPORT

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FIRE ENDURANCE TEST
of
TWO BULKHEAD ASSEMBLIES

by

J. V. Ryan and A. W. Bender

for

U. S. COAST GUARD

NBS

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 as to thickness of marine board and joint details. Each served as a barrier to flame passage for the required 60 min, but neither prevented excessive temperature rise on the unexposed surface within the initial 15 min.

1. Introduction

At the request of the U. S. Coast Guard (letter of 16 January 1962, MMT, JJ/164.008/46), two bulkhead specimens were subjected to fire test in compliance with Subpart 164.008-3(b) of Specifications for Bulkhead Panels for Merchant Vessels.

2. Test Specimens

The specimens were submitted by the Union Asbestos and Rubber Company. The materials were delivered to the National Bureau of Standards where they were assembled by representatives of the submittor. Each specimen, when assembled, consisted of two pieces of Unarcoboard 36 with a vertical joint between, a metal joint member system, and a metal frame. The vertical edges of the marine boards were sanded to a slight taper to prevent a binding fit in the metal components. Details of the assemblies are shown in Figure 1.

Measurements made on each piece of the marine board when received indicated the following:

Average* Dimensions

Piece	Length in.	Width in.	Thickness in.	Density lb/ft^3
1	95-31/32	30-1/32	0.747	36.5
2	96-1/16	29-31/32	.741	39.3
3	96-1/16	29-15/16	.740	38.6
4	96-1/16	30-1/32	.741	34.0
5	96	29-31/32	.869	36.3
6	96-1/32	30-1/32	.866	37.4
7	96-1/32	30-1/32	.869	36.2
8	95-31/32	29-31/32	.865	36.8

*Length and width average of 5 measurements to nearest 1/32 in., thickness average of 15 micrometer readings.

Pieces 1 and 5 were used in the width received; pieces 3 and 7 were cut to 17-1/4 in. width. The marine boards were white and moderately hard.

3. Test Method

The specimens were mounted in two openings of a test frame arranged to permit the simultaneous fire exposure of three bulkheads in the wall test furnace. The third opening was filled 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. The peripheral joints between the frame of each specimen and the test frame opening were sealed with a fillet of plaster. This plaster fillet covered all metal on the exposed surface except the vertical joint member between the two pieces of Unarcoboard 36.

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 fires were controlled 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 February 15, 1962 and witnessed by the following:

Paul Gibson, USCG
David J. Linde, USCG
W. H. Dempsey, MA
A. M. LeCompte, MA
W. L. Hanbury, FFC

E. H. Pfaender, Union Asbes.Co.
W. F. Sinclair, " " "
A. W. Summers " " "
R. Wilde " " "
A. P. Buquor, Martin Parry Co.

Throughout the test, the flames in the furnace were luminous and well distributed. The first cracks, observed at 28 min, were across the bottom corners of the wide piece of 7/8 in.-thick board. By 31 min, there were matching cracks on the unexposed and exposed surfaces, but the former were very fine and remained so for the rest of the test. There were no further changes and the test was stopped after the 60-minute temperature readings.

Both specimens continued as satisfactory barriers to flame passage throughout the 1-hr test, there having been only two hairline cracks in the 7/8-in. thick specimen and none in the 3/4-in. thick specimen. The limiting temperature rise of 250°F, at any thermocouple on the unexposed surface of the marine board, was reached at <u>10.2 minutes</u> for the 3/4-in. board and at <u>13.7 minutes</u> for the 7/8-in. board. The fire exposure severity was 100.2 percent. Additional temperature data are represented in Figure 1.

5. Summary

The results of the test indicated that each of the particular specimens tested was a satisfactory flame barrier for one hour, but that the limiting temperature rise was reached at 10.2 min for the 3/4-in. board and at 13.7 min for the 7/8-in. board.

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

For the Director

by

A. F. Robertson, Chief
Fire Research Section

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J. V. Ryan

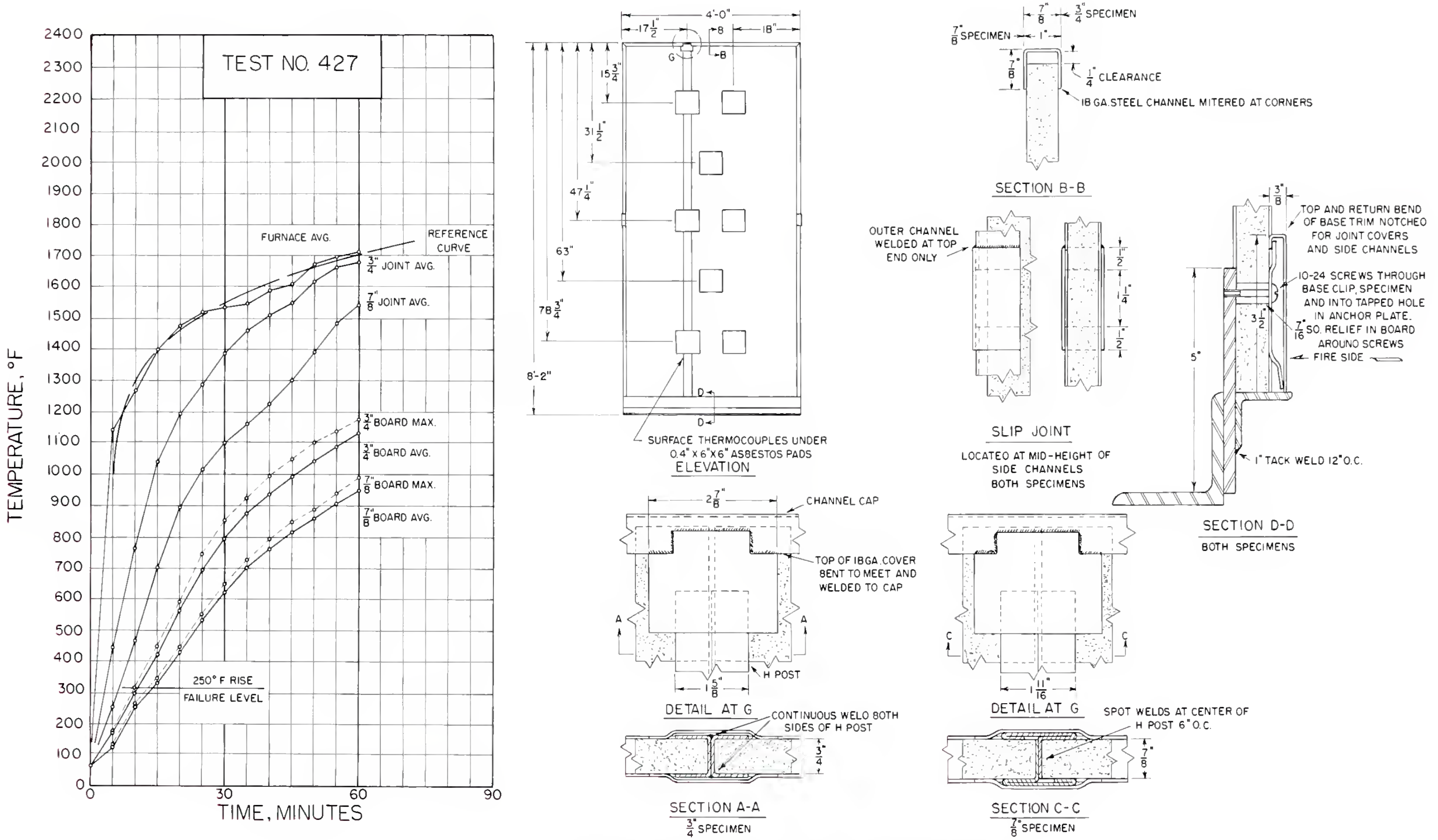

FIG. 1 - TEMPERATURE DATA AND CONSTRUCTION DETAILS