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FIRE ENDURANCE TEST
OF
THREE BULKHEAD ASSEMBLIES

By

J. V. Ryan

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NATIONAL BUREAU OF STANDARDS

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ABSTRACT

Three bulkhead assemblies were subjected to standard fire test to determine their suitability for approval by the U. S. Coast Guard for use on vessels. Two of the bulkheads had marine boards of the same thickness, but differed as to joint members; the third bulkhead had a different marine board. Each assembly was designed to allow for thermal expansion. The three specimens remained effective barriers to the passage of flames for the full 60-minute test period, but only one satisfied the requirement that the unexposed surface temperature remain within specified limits for over 15 minutes.

1. Introduction

At the request of the U. S. Coast Guard, (letter of 31 March 1959), three bulkhead assembly specimens were subjected to fire test in compliance with Subpart 164.008-3(b) of Specification for Bulkhead Panels for Merchant Vessels.

2. Test Specimens

The specimens were submitted by, and shipped from, the Nippon Asbestos Co., Ltd., Tokyo, Japan. The specimens and shipping container were received in good condition. The specimens were labeled as follows: (1) Marine Board 100-P, Joint Type A, (2) Marine Board 100-P, Joint Type B, (3) Marine Board 60-P. They were received assembled and ready to mount in the furnace test frame. Therefore, the details given in the figure at the end of this report are based primarily on examination after test.

Each specimen consisted of two pieces of marine board with a vertical joint member, all mounted in a frame. The frame and joint members were of steel, were painted, and were designed to allow for thermal expansion. The marine boards were hard, white, smooth-finished, and appeared to be of cement-asbestos types. For further details see the figure. No extra samples of materials were received upon which auxiliary tests could be made.

3. Test Method

The specimens were mounted in the three openings of a test frame modified to permit the simultaneous fire exposure of up to three specimens in the wall test furnace. Each opening is about 8 ft 2 in. high and 4 ft 2 in. wide. Care was taken that each specimen frame was restrained against vertical expansion or movement, so that the only relief for the thermal expansion would be that provided by the design and fabrication of the specimen. Eight thermocouples were placed on the unexposed surface of each specimen, distributed as shown in the figure. The junction and several inches of the wires of each thermocouple were covered by a 6- by 6- by .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 E119, which include: 1000°F at 5 min, 1300°F at 10 min, 1550°F at 30 min, and 1700°F at 1 hr. This curve is the "Reference Curve" in the figure.

4. Results

The fire test, conducted on May 12, 1959, was witnessed by Lt Duin, USCG, Washington 25, D. C., and personnel of the National Bureau of Standards, Fire Protection Section. By 5 min the exposed surface plates of the joint members were buckled, the paint was burned off, and the paint on the unexposed surface was darkened. By 18 min similar buckles had developed in the unexposed surface plates of the joint members at a few locations. By 40 min the unexposed surfaces of the marine boards had changed from white to medium gray, the 100-P more so than the 60-P. Also, the cores of the joint members were bright red at five locations where the unexposed surface plates were buckled away from the core. The test was stopped at 1 hr. There had been no evidence of cracking of the marine boards at any time during the test.

The maximum deflection of the 100-P specimen with Joint A was .25 in.; of that with Joint B was .4 in.; and of the 60-P specimen was 1.3 in. Flames did not pass through any of the specimens. The fire exposure severity was 99.4 percent.

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