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BUILDING RESEARCH ASSOCIATION OF NEW ZEALAND

TEST REPORT

FR 494

REPORT ON THE FIRE RESISTANCE PROPERTIES

OF A PLASTER-BOARD TIMBER FRAME PARTITION

BUILDING RESEARCH ASSOCIATION OF NEW ZEALAND INC.
POSTAL ADDRESS: Private Bag, Porirua, New Zealand. TELEGRAMS: BRANZ, Wellington.
LOCATION: Moonshine Road, Judgeford. TELEPHONE: Plimmerton (4) 338-012.

Building Research Assn. of N.Z.
Private Bag, Porirua

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Number FR 494

Date 21 May 1980

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1. INTRODUCTION

1.1 Test Sponsor

New Zealand Fibrous Plaster Manufacturers' Association Inc., PO Box 1087, Wellington.

1.2

The test was in accordance with ISO 834-1975 Fire-resistance tests - Elements of building construction. The fire resistance of non loadbearing test specimens shall be the time, expressed in minutes, to failure under one or more of the following criteria.

1.3 Insulation

For elements of construction, such as partitions which have the function of separating two parts of a building,

(a) The average temperature of the unexposed face of the specimen shall not increase above the initial temperature by more than 140°C.

(b) The maximum temperature at any point on this face -

- shall not exceed the initial temperature by more than 180°C; and
- shall not exceed 220°C irrespective of the initial temperature.

1.4 Integrity

"Initial integrity failure" is deemed to occur when either

(a) cracks, holes or other openings are formed in the test specimen such that flames or hot gases can pass sufficient to cause ignition of a cotton pad; or

(b) sustained flaming, having a duration of at least 10 seconds, appears on the unexposed face of the test specimen.

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"Ultimate integrity failure" is deemed to occur when the partition collapses.

2. DESCRIPTION OF SPECIMEN

2.1 General

The wall specimen represented a non loadbearing timber stud partition 4000mm high x 3000mm wide, covered on both sides with one layer of nominal 16mm thick "Fyrwall Plasterglass (1980)". Forty percent of the frame cavities were insulated with fibreglass batts.

2.2 Construction

2.2.1 Framing

The framing was constructed of 100mm x 50mm (nominal) gauged Pinus radiata, boric treated timber. It consisted of floor and ceiling plates and perimeter studs fixed to the specimen holder with 16mm bolts at 500mm (nominal) centres. Timber studs were nailed to the floor and ceiling plates at 600mm centres and four rows of timber dwangs (noggins) were placed in equally spaced rows over the 4000mm height. The frame was nailed using 100mm x 4mm steel joit headed nails.

2.2.2 Cladding

The cladding sheets were of 16mm (nominal) "Fyrwall Plasterglass (1980)" manufactured by a member of the sponsoring association to the specification supplied to BRANZ. The sheets were fixed to the timber frame as follows:

(i) joints between sheets were staggered on opposite sides of the partition;

(ii) on both sides of the partition a horizontal and vertical wadded joint, and a vertical nailed joint was included;

(iii) the size of nails used for fixing the cladding were 50mm x 2.5mm flat head galvanised nails and these were set just below the surface of the sheet;

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(iv) the sheets were only nailed to the studs. On all the vertical edges of sheets coinciding with studs and on the top and bottom plates, nails were placed at 150mm centres. At other places in the body of the sheets, nails were placed at 300mm centres.

2.2.3 Jointing materials

Joints between sheets, angles around the perimeter of the specimen holder frame, and nail heads were caulked with stopping plaster. The joints and angles were first taped with a nominal 40mm wide open weave fibreglass bandage. The wadded joints were reinforced with 375mm (nominal) long fibreglass rovings.

2.2.4 Insulation

As viewed from the unexposed surface, the two left vertical rows of frame cavities had 75mm thick R11 standard wall fibreglass batts installed in them.

2.2.5 Plans and Specifications

The wall specimen was built according to Drawing No B3 dated 28 February 1980, supplied by the sponsor, as well as a written description received on 28 March 1980.

3. TEST PROCEDURE

3.1 The specimen was tested in the presence of members of the sponsoring association on 24 April 1980. The test was terminated at 150 minutes.

3.2 The specimen-containing frame was sealed to the 4m x 3m furnace and the temperature and pressure conditions controlled as near as possible in accordance with ISO 834, sections 4.1 and 4.2.

3.3 Temperature Measurement

3.3.1 Temperature measurement within the furnace was made using 12 chromel-alumel thermocouples uniformly distributed in a vertical plane approximately 100mm from the exposed face of the specimen according to ISO 834, section 4.1.2.

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3.3.2 The temperature of the unexposed surface of the specimen was measured using chromel-alumel thermocouples on copper discs, according to ISO 834, section 4.1.4. As the specimen had both an insulated and uninsulated section, five thermocouples were placed on each of the sections, one being at the centre point and one thermocouple at the centre of the quarter section. None of these 10 thermocouples coincided with wadded or nailed joints. One further thermocouple was placed on the vertical wadded joint on the insulated section.

3.3.3 The thermocouples temperatures were measured using potentiometric recorders.

3.3.4 In addition to the fixed recording thermocouples, spot checks of unexposed surface temperatures were made using a portable direct-reading thermocouple probe.

3.4 Deflection Measurements

Deflections were measured at the quarter, half and three-quarter points on the centre line of the specimen. These deflections were determined by taking distances (to the nearest mm) offset from horizontal wires tensioned across the unexposed face of the specimen frame. Measurements were taken at 15 minute intervals.

4. OBSERVATIONS

4.1 Figure 1 shows the standard time-temperature curve from ISO 834-1975 in relation to the actual furnace temperatures. The percentage ratio of the area under the measured curve to that under the standard curve was as follows:

0 - 90 minutes	100.4%
0 - 120 minutes	100.6%
0 - 150 minutes	100.3%

4.2 Specimen Behaviour

4.2.1 Loss of Integrity

During the course of the test, no cracks, holes or other openings appeared on the non-exposed face of the specimen and also no flaming was observed on this face. Hence, during the test, the full integrity of both sections of the specimen was maintained as defined by the test standard.

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4.2.2 Insulation

4.2.2.1 Average temperature of unexposed face of non-insulated section of specimen

An average temperature rise of 140°C above the initial temperature was noted at 114 minutes by the fixed thermocouples on the unexposed face of this section of the specimen. Figure 2a shows the maximum and average temperatures recorded by the fixed thermocouples.

4.2.2.2 Maximum temperature of unexposed face of non-insulated section of specimen

A temperature rise of 180°C above the initial temperature was noted by one of the fixed thermocouples at 115 minutes.

4.2.2.3 Average temperature of unexposed face of insulated section of specimen

An average temperature rise of 140°C above the initial temperature was noted at 150 minutes by the fixed thermocouples on the unexposed face of this section of the specimen. Figure 2b shows the maximum and average temperatures recorded by the fixed thermocouples.

4.2.2.4 Maximum temperature of unexposed face of insulated section of specimen

A temperature rise of 180°C above the initial temperature was noted by one of the fixed thermocouples at 148 minutes.

4.2.3 Deflections

The maximum deflection of the specimen up to 150 minutes was 60mm away from the furnace at the centre point of the total specimen.

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5. SUMMARY

5.1 The fire resistance, in minutes, achieved by the non-insulated section of the non loadbearing plaster board lined timber frame construction was -

Insulation: The criteria for the average temperature rise on the unexposed surface of the specimen was exceeded at 114 minutes.

Integrity: The partition maintained its full integrity throughout the test up to 150 minutes.

5.2 The fire resistance, in minutes, achieved by the insulated section of the non loadbearing plaster board lined timber frame construction was -

Insulation: The criteria for the maximum temperature rise at any point on the specimen was exceeded at 148 minutes.

Integrity: The partition maintained its full integrity throughout the test up to 150 minutes.

H.L. Baber
CHEMIST - FIRE DIVISION

D. Bastings
HEAD - FIRE DIVISION

FIG 1. FURNACE TEMPERATURES

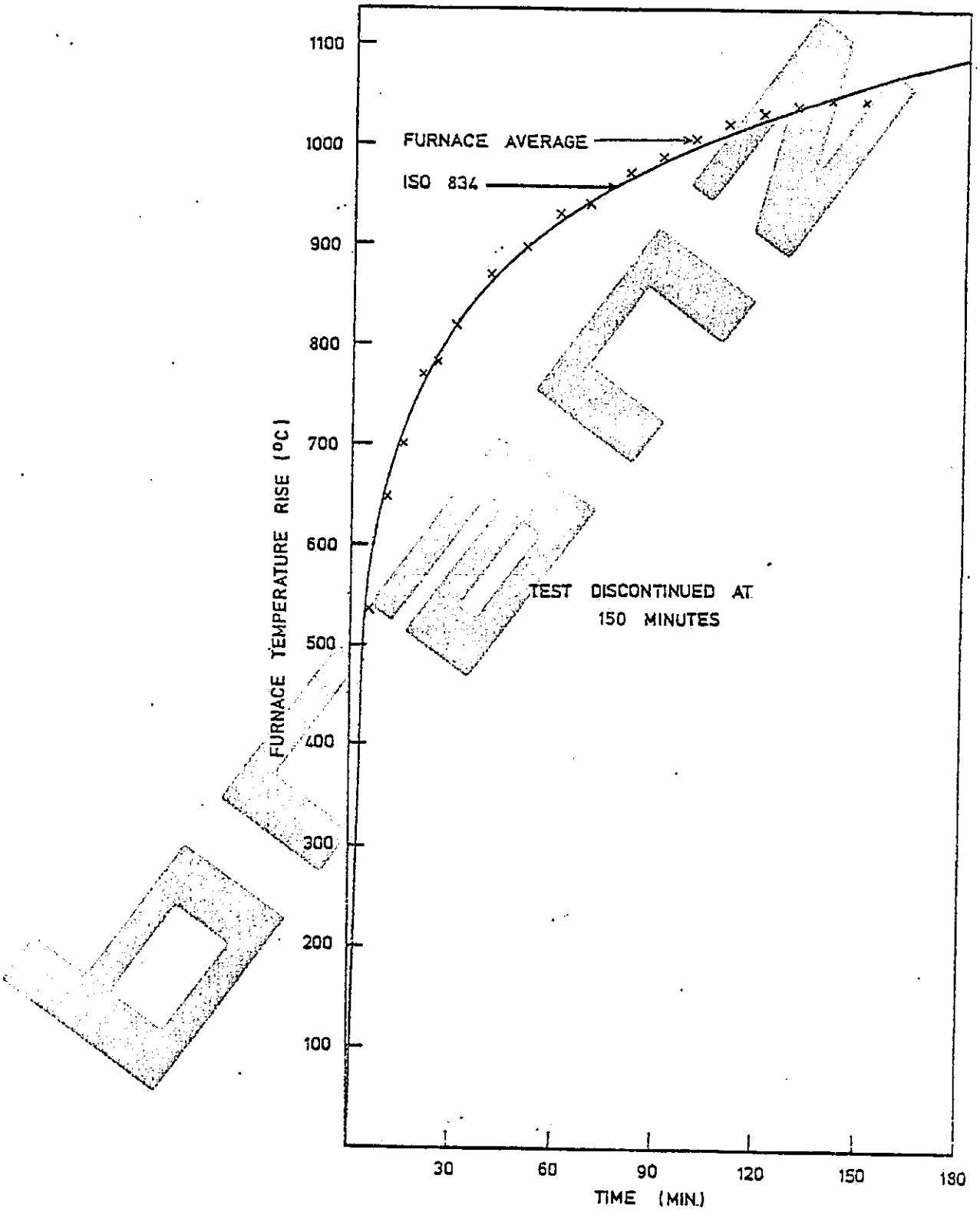

FIG 2a NON-INSULATED SPECIMEN TEMPERATURES

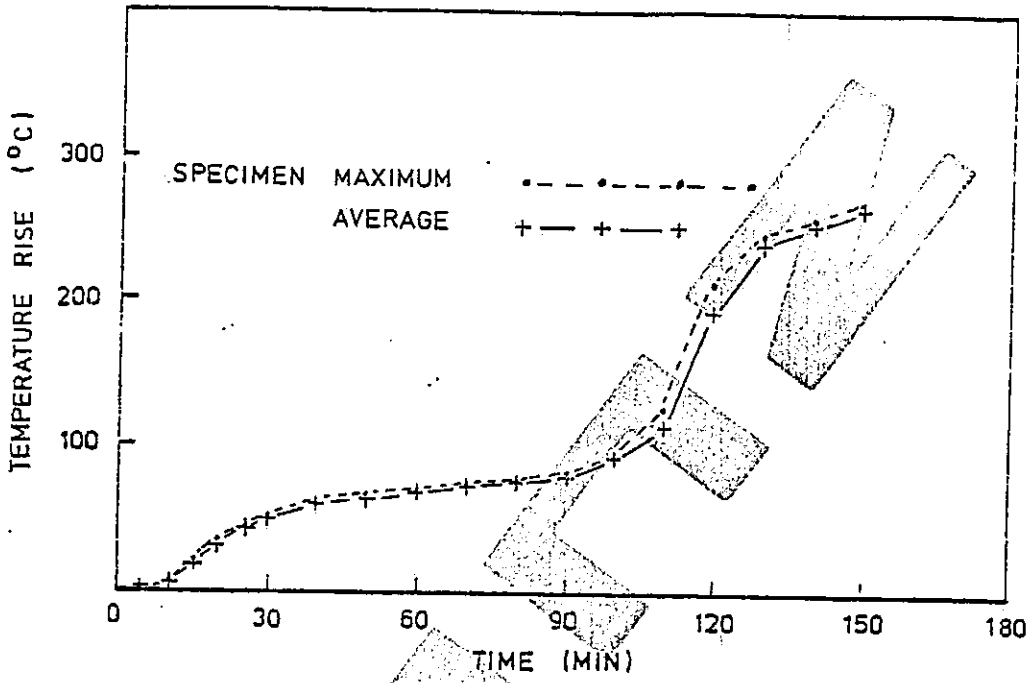

FIG 2b INSULATED SPECIMEN TEMPERATURES