DIVISION OF BUILDING TECHNOLOGY

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REPORT ON THE LARGE SCALE FIRE PROPERTIES OF MICON "THATCHBOR FR" FIRE RETARDANT THATCH TREATMENT

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1. SPONSOR

Micon Coatings cc
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2062

2. USE OF THIS REPORT

The use of this report is subject to the attached *General Contract Conditions*, which form an integral part of this report.

3. PURPOSE OF THE INVESTIGATION

The purpose of the investigation was to evaluate the fire properties of Micon "Thatchbor FR", a fire retardant treatment intended for application to thatched roofs. These large scale evaluations were performed after favourable results were achieved during small scale evaluations.

The thatch panels used in all of the evaluations were constructed with thatching grass that has been pre-treated by a controlled industrial process with "Thatchbor FR". The sisal stitching twine used in the construction of the panels was also pre-treated with a chemical identified as "Twinesayf". The timber poles and laths were pressure impregnated with a fire retardant chemical identified as "Flambor".

4. TEST PROCEDURES

The basis used in the large scale fire evaluations was the American Standard Test Methods (ASTM) E 108 test protocol. This test protocol consist of a number of different evaluations which is intended to determine the relative fire characteristics of roof coverings under conditions simulating a fire originating outside the building. All of the various tests prescribed by this specification were performed as such but applicable observations and comments on the occurrence of flying brands during the other evaluations are reported in the results of each test.

Three classes of fire test exposure are described by the test protocol:

Class A: Applicable to roof coverings that are effective against severe test exposure, afford a high degree of fire protection to the roof deck, do not slip from position, and do not present a flying brand hazard.

Class B: Applicable to roof coverings that are effective against moderate test exposure, afford a moderate degree of fire protection to the roof deck, do not slip from position, and do not present a flying brand problem.

Class C: Applicable to roof coverings that are effective against light test exposure, afford a light degree of fire protection to the roof deck, do not slip from position, and do not present a flying brand problem.

For the purposes of this evaluation the Class A and B test exposures were followed during the intermittent flame exposure test and the spread of flame test, while for the burning brand test a Class A brand was utilised.

The essential elements of the fire test apparatus are shown in Figure 1. In our case the desired air flow was supplied by means of a jet flow type fan blowing air through the air duct. Calibration of the test flame (760 ±28 °C at a position 25 mm from the surface and 13 mm towards the source from the lower front edge) and air current (5.3 ±0.2 m/s midway up the slope of the test roof) was performed prior to any testing as required by ASTM E108. These calibration values are required to be maintained during Class A and Class B testing. Furthermore, all test roofs were tested at a pitch of approximately 30°.

4.1 Intermittent flame exposure test

A test roof (1.3 m long and 1 m wide) was mounted onto the sample framework at an angle of approximately 30° and subject to an intermittent flame from the burner whilst maintaining the required air velocity. The class of testing determines the time periods between flame applications and the number of test cycles as is shown in the table below:

Method of Test	**Flame On (min)**	**Flame Off (min)**	**No. of Test Cycles**
Class A	2	2	15
Class B	2	2	8
Class C	1	2	3

In this case it was decided to follow the Class A and B time intervals and to proceed with the number of cycles required for failure to occur.

During the test (both “on” and “off” periods) the appearance of sustained flaming to the underside of the roof panel was monitored as well as the production of flaming or glowing brands and any displacement or falling away of portions of the roof specimen.

4.2 Spread of Flame Test

This test was performed on a longer panel (4 m long and 1 m wide) which was fitted to a test frame and placed in front of the burner apparatus in a similar manner as with the intermittent flame exposure test. The calibrated gas flame was applied to the specimen for a period of 10 minutes (as required for Class A and Class B exposures) whilst maintaining the required air flow.

The distance to which flaming of the material has spread as well as the presence of burning or glowing brands and displacement of portions of the roof was noted.2

4.3 Burning Brand Test

This test was performed on a 1.8 m long and 1 m wide panel. The burner was not applied to the test roof as before, but a burning Class A timber brand was placed on the surface of the roof panel along the centre near the bottom edge. Before placing the brand in position, it was ignited with a small amount of paraffin and allowed to burn properly. Figure 2 shows the dimensions and construction of the various types of brands used.

The test was monitored until the brand was fully consumed and all evidence of flame, glow and smoke have disappeared from the test roof. The appearance of sustained flaming on the underside of the roof was monitored while the occurrence of flaming or glowing brands form the roof or any displacement of portions of the roof was also noted.

5. RESULTS

5.1 Intermittent flame exposure test

Figure 3 shows the test installation during one of the 2 minute flaming cycles. During the early cycles the material on the exposed surface was charred during the flaming cycles while no flaming was observed on the test panel during the no-flaming cycles (figure 4). During the eighth cycle (when the burner was off) some flaming was observed on the underside of the test panel (figure 5). Some fine ash fell to the ground during the test period but at no stage did any burning or glowing brands fall apart from the test roof.

5.2 Spread of flame test

Figure 6 shows the test panel prior to ignition of the burner while Figure 7 was taken immediately after ignition of the burner. Some charring occurred over the bottom half of the panel with small surface flames observed during the initial stages of the test (figure 8). This flaming subsided after a while although some glowing of the thatch along the bottom edge was noticed (figure 9). Small flames appeared on the underside after approximately 8 minutes (figure 10). No flaming was observed on the panel after the burner had been extinguished although the glowing on the bottom edge persisted (figure 11). The underside of the panel was slightly charred but the small flames had disappeared (figure 12). Although some smoke was still being evolved by the roof, the visible flaming along the bottom edge subsided within 10 minutes of the burner being extinguished (figure 13). At no stage during the test did any burning or glowing brand fall to the floor and the distance of flame spread along the length of the sample (disregarding the length of the burner flame) was taken to be approximately 1.5m.

5.3 Burning brand test

Figure 14 shows the burning brand shortly after being placed in position on the roof. Some charring occurred on the surface but some small flames and glowing was observed in the lower region of the panel as the brand decomposed under the strong air current (figure 15). The flames and glowing disappeared steadily as the brand decreased (figure 16). The underside of the roof was charred in the lower regions with some grass being dislodged in the area directly underneath the brand. No burning or glowing material fell to the ground at any stage during the evaluation.

6. DISCUSSION OF RESULTS AND CONCLUSIONS

In all of the tests, the treated thatch panels displayed good fire retarding properties when compared to untreated thatch. In the case of the intermittent fire exposure test, the panel failed on the 8^{th} cycle during the non-flaming period, which according to ASTM E108 would imply that its performance is just outside the requirements for a Class B roof covering. The spread of flame test revealed that the length of flame spread was sufficiently low for the roof to be classified as a Class a roof covering. The burning brand test results showed that, although the roofing material was charred extensively on the top and underside of the panel, that no sustained flaming occurred on the underside. This result would, based on the size of the brand test, be enough reason for the roofing system to be classified as a Class A roof covering.

This results is very favourable when one considers the reputation of thatch roofs under fire conditions. Also one should note that the ASTM E108 test protocol was only used as a guideline, since its actual intention is to test the fire performance of roofing materials that are applied to a roof deck. A thatch roof would not per definition fall in this category.

Although no rain test has been performed at this stage, we would like to comment on the weather resistance of this particular thatching system. The use of pre-treated thatch would present an improvement in the weather resistance of a treatment when compared to any type of chemical application that is performed after completion of the roofing structure. Post treatments would only affect the grass near the surface, resulting in a thatch layer with an untreated core. With a roof that utilises pre-treated thatch, the entire thatch layer would be treated. The weathering and leaching of chemicals that could possibly occur on the outer surface of a roof surface should therefore not have a significant effect on the fire retardant properties of a thatch layer constructed of pre-treated thatch.

It is therefore our conclusion that, based on the results of this large scale fire evaluations, that a thatch roofing system consisting of thatch pre-treated with Micon "Thatchbor FR", twine treated with "Twinesayf" and timber members treated with "Flambor" would present a significantly decreased fire risk when compared to a normal thatch roofing system which utilises untreated components. It is, however also clear that the intention of the various treatments is not to produce a fire proof thatch roof, but a roof which would burn at a significantly decreased rate. This would generally allow more time for the occupants to escape from the thatch dwelling, assist in fire fighting operations and therefore minimise the fire damage.

J S Strydom
FIRE ENGINEERING SCIENCES
on behalf of the Division of Building Technology, CSIR

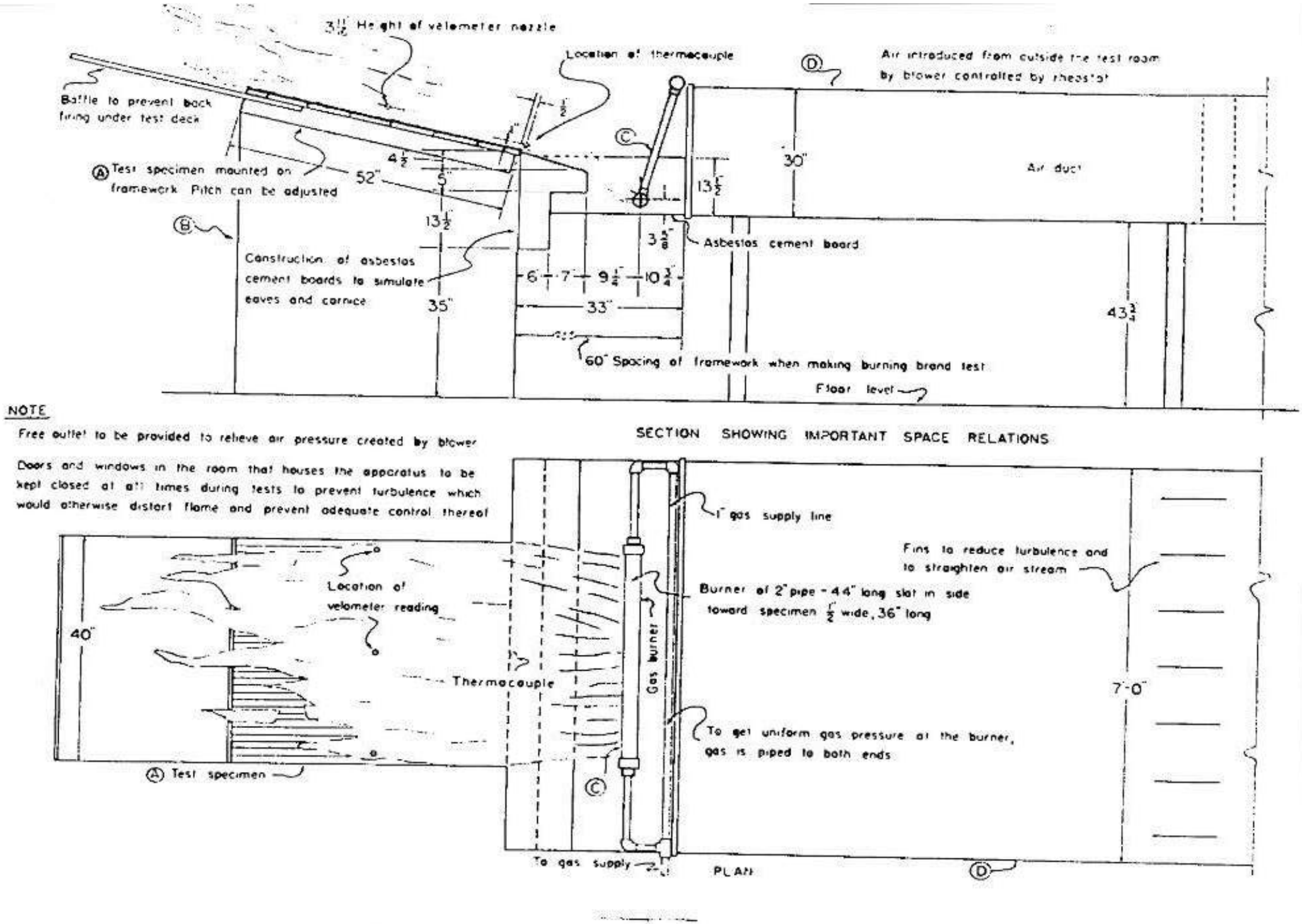

FIG. 1 Schematic Drawing of Fire Test Apparatus

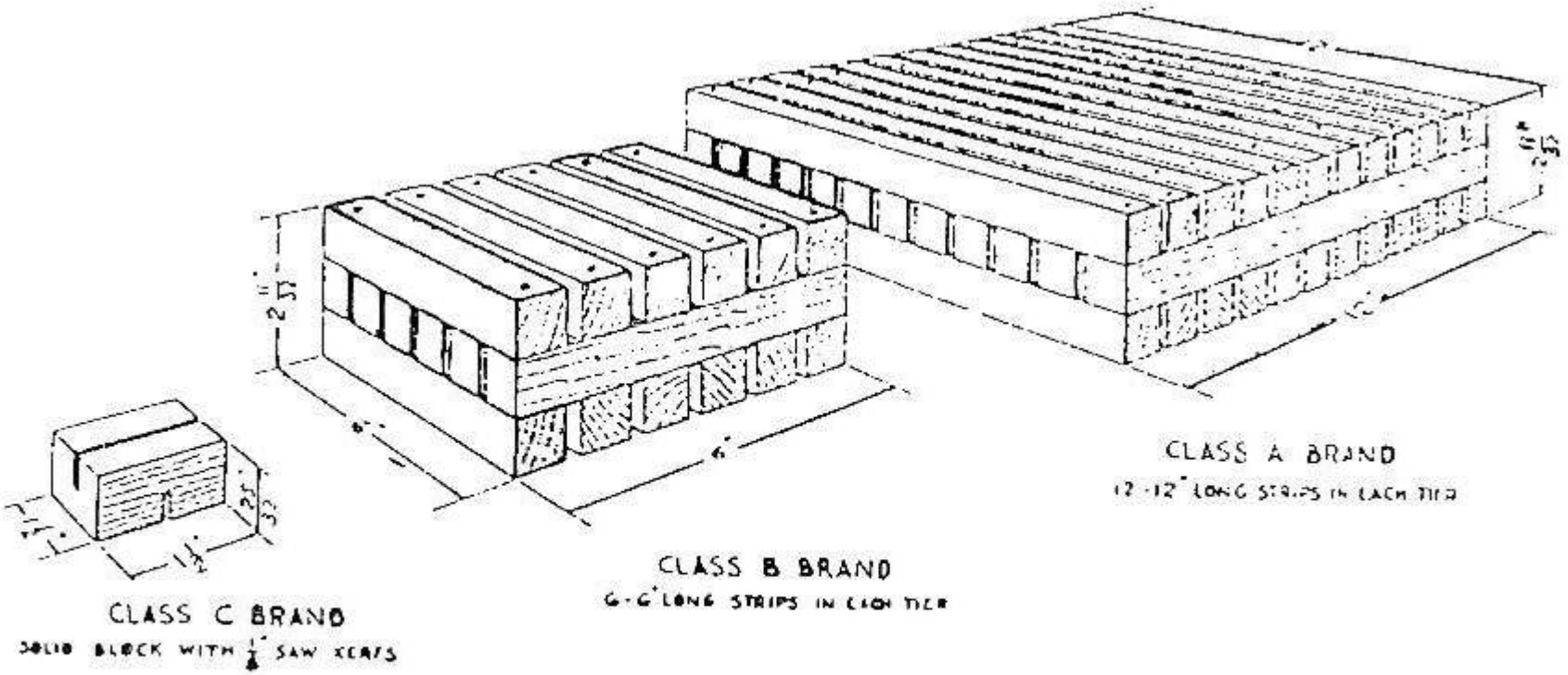

FIG. 2: Brands for Classes A, B, and C Tests

Figure 3: Intermittent flame test
Test set up during a flaming cycle

Figure 4: Intermittent flame test
Thatch roof panel during a non flaming cycle

Figure 5: Intermittent flame test:
Flaming on the underside of test roof during 8th cycle

Figure 6: Spread of flame test:
Test set up prior to ignition

Figure 7: Spread of flame test
Ignition of burner

Figure 8: Spread of flame test
Charring and small flames on surface

Figure 9: Spread of flame test
Flames on thatch panel surface subsided

Figure 10: Spread of flame test
Small flames on underside of panel

Figure 11: Spread of flame test
Burner extinguished

Figure 12: Spread of flame test
Underside of roof immediately after burner extinguishment

Figure 13: Spread of flame test
Glowing on bottom edge disappeared

Figure 14: Burning brand test
Placement of burning brand on thatch panel

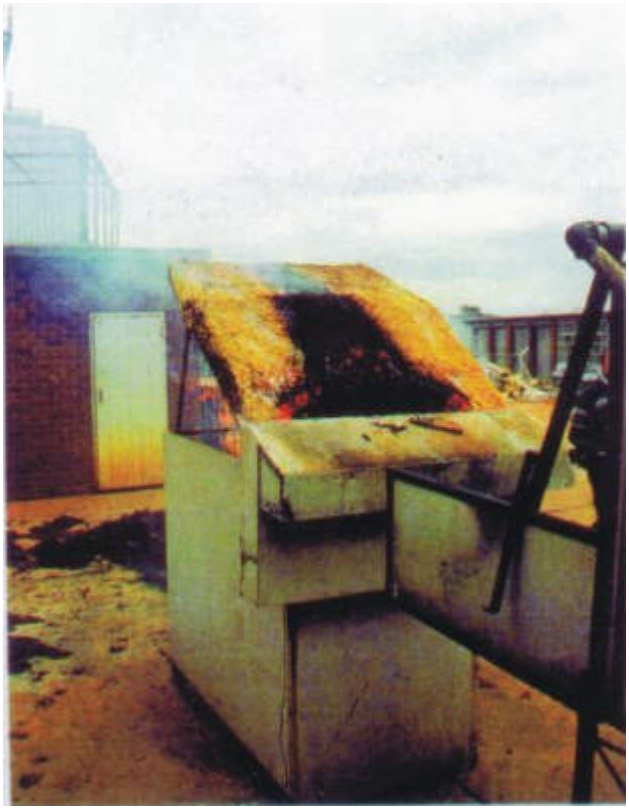

Figure 15: Burning brand test
Glowing and small flames in lower region of panel

Figure 16: Burning brand test
Effect on brand deceased, visible glowing disappeared

Figure 17: Burning brand test
Underside of panel after brand was fully decomposed