Fire resistance of Obeco glass block floor system in accordance with AS 1530.4-2014

Assessment Report

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1 Introduction

This report presents an assessment of the fire resistance of Obeco glass block floor system in accordance with AS 1530.4-2014.

This report is prepared for the purpose of meeting the requirements of NCC 2022 Volume 1 Clauses S1C2 (b) as appropriate for FRL.

This report reviews and confirms the extent to which the reference fire resistance tests listed in section 2 meet the requirements of the standard fire test standards listed in section 3 of the report. The tested construction presented in section 4 are subject to an analysis in Appendix A and the conclusions are presented in Section 4 of this report.

The field of applicability of the results of this assessment report is presented in Section 6 and subject to the requirements, validity, and limitations of Section 6, 7 and 8.

2 Supporting Data

This assessment report refers to various test reports to support the analysis and conclusions of this report. They are listed below;

Report Reference	**Test Standard**	**Outline of Test Specimen**
CSTB report no. RS 98.050	The provisions of the order of 21 April 1983 from the French Ministry of the Interior Fire Resistance of a Building Element.	A full-scale fire-resistance test on a floor composed of three masonry modules, each measuring 1386L x 2080W x 100T comprised of glass bricks measuring 190L x 190L x 100T

CSTB report no. RS 98.050 was sponsored by La Rochère and La Rochère has provided permission to use the test data in these reports for this assessment.

The test identified above is confirmed by this Accredited Testing Laboratory to be equivalent or more severe than a Standard Fire Test in accordance with the test standard specified in Section 4 of this report when applied to the specimens as identified above.

3 Referenced Standards

Standards:

AS 1530.4-2014 Methods for fire tests on building materials, components, and structures Part 4: Fire resistance tests of elements of building construction, Section 8.

4 Conclusion

On the basis of the analysis presented in this report, it is the opinion of this Accredited Testing Laboratory that the tested prototype described in Section 2 will achieve the Fire Resistance stated below when submitted to a standard fire test in accordance with the test methods referenced in Section 3 and subject to the requirements of Section 6, the validity of Section 7 and limitation of Section 8.

Table 1: FRL of glass block floor system

Block name and size (mm)	System configuration	Construction details	Maximum size for single floor module	Maximum size For whole floor system modules (mm)	Maximum load on floor	FRL
GLASS BRICK FLOOR 19/19/10 190 x 190 x 100	As tested in CSTB report no. RS 98.050	Figures 1-5	138mm x 208mm	4200mm long x 2080mm wide 1830mm Span	250Kg/m^2	90/90/-

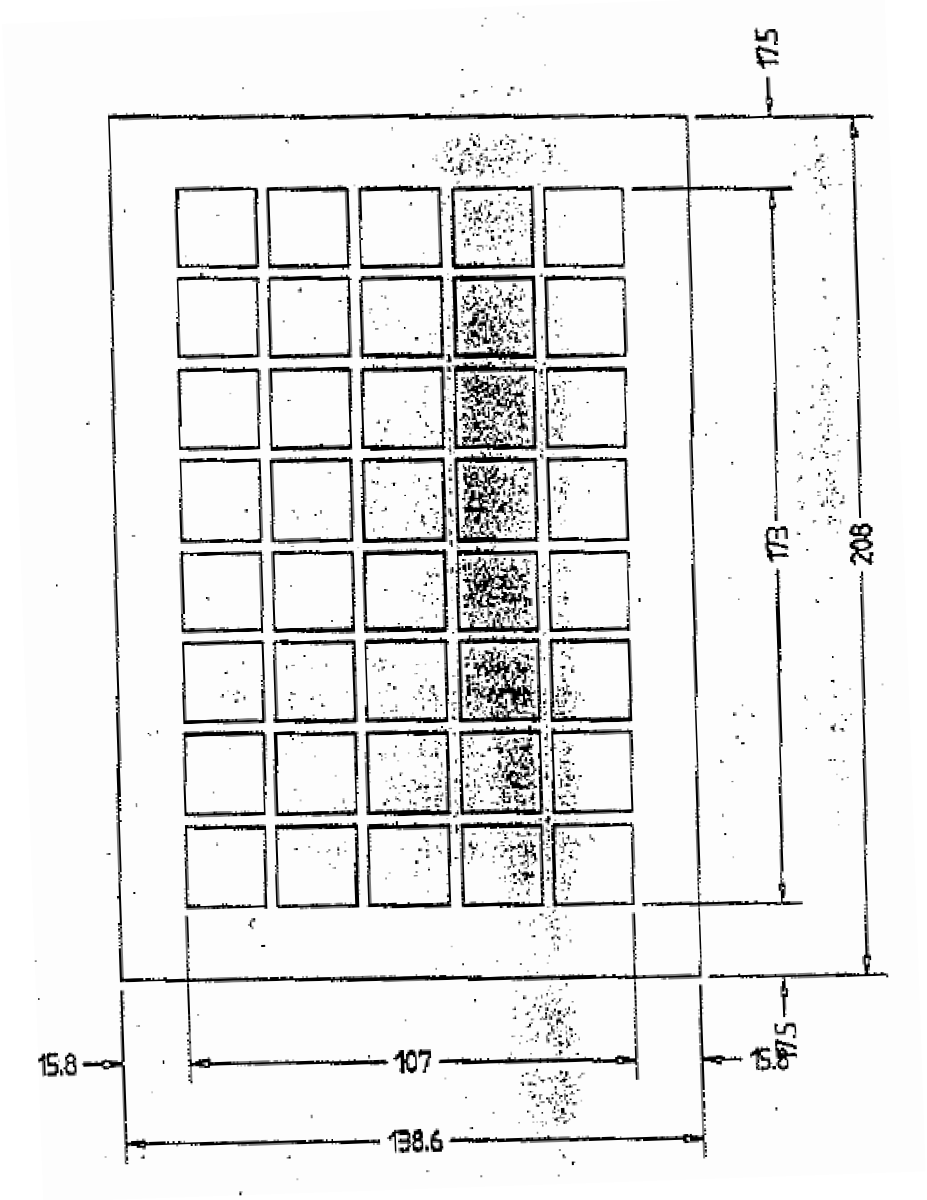

Figure 1: Single glass block floor module (dimensions in cm) – elevation view

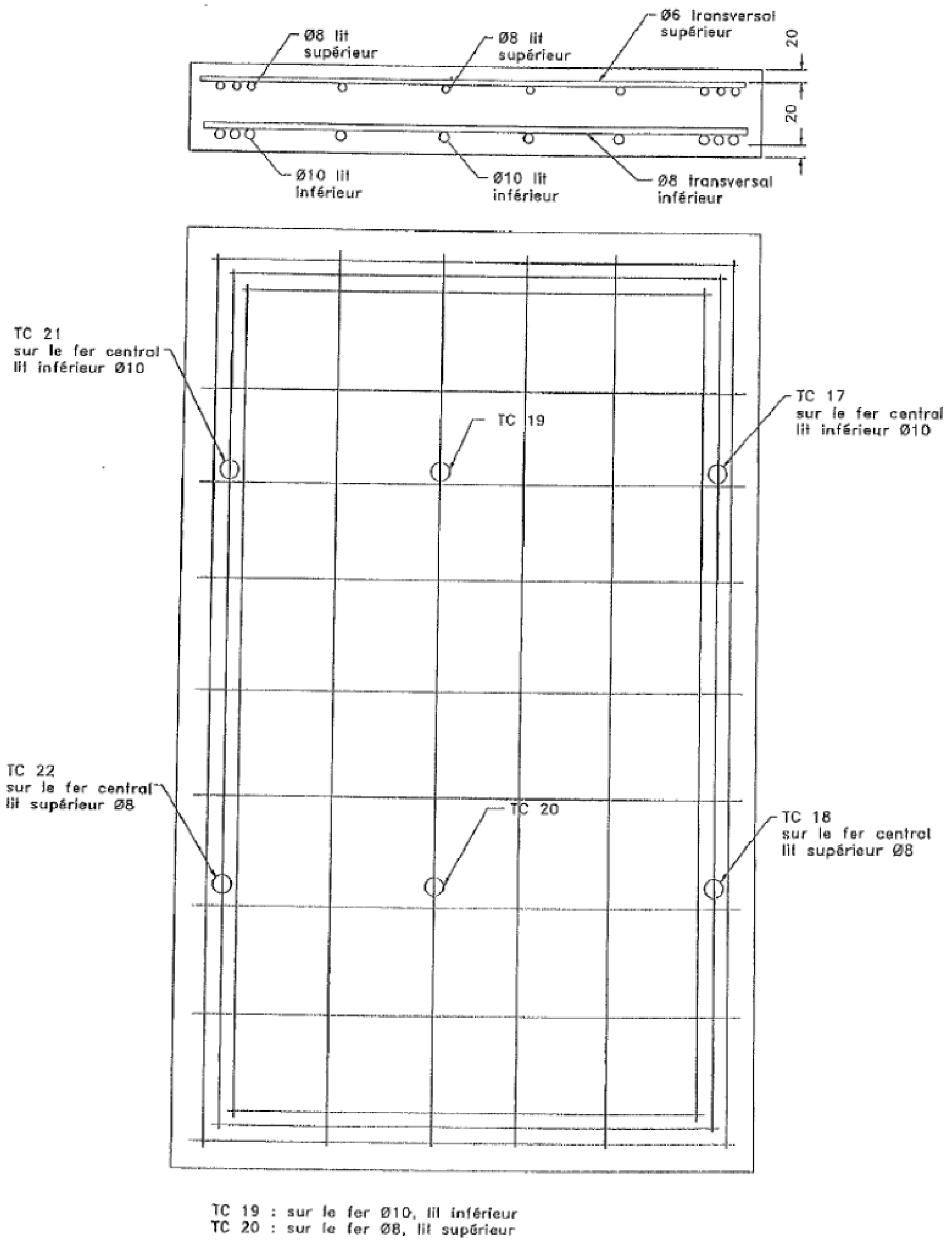

Figure 2: Reinforcement in a single module – elevation view

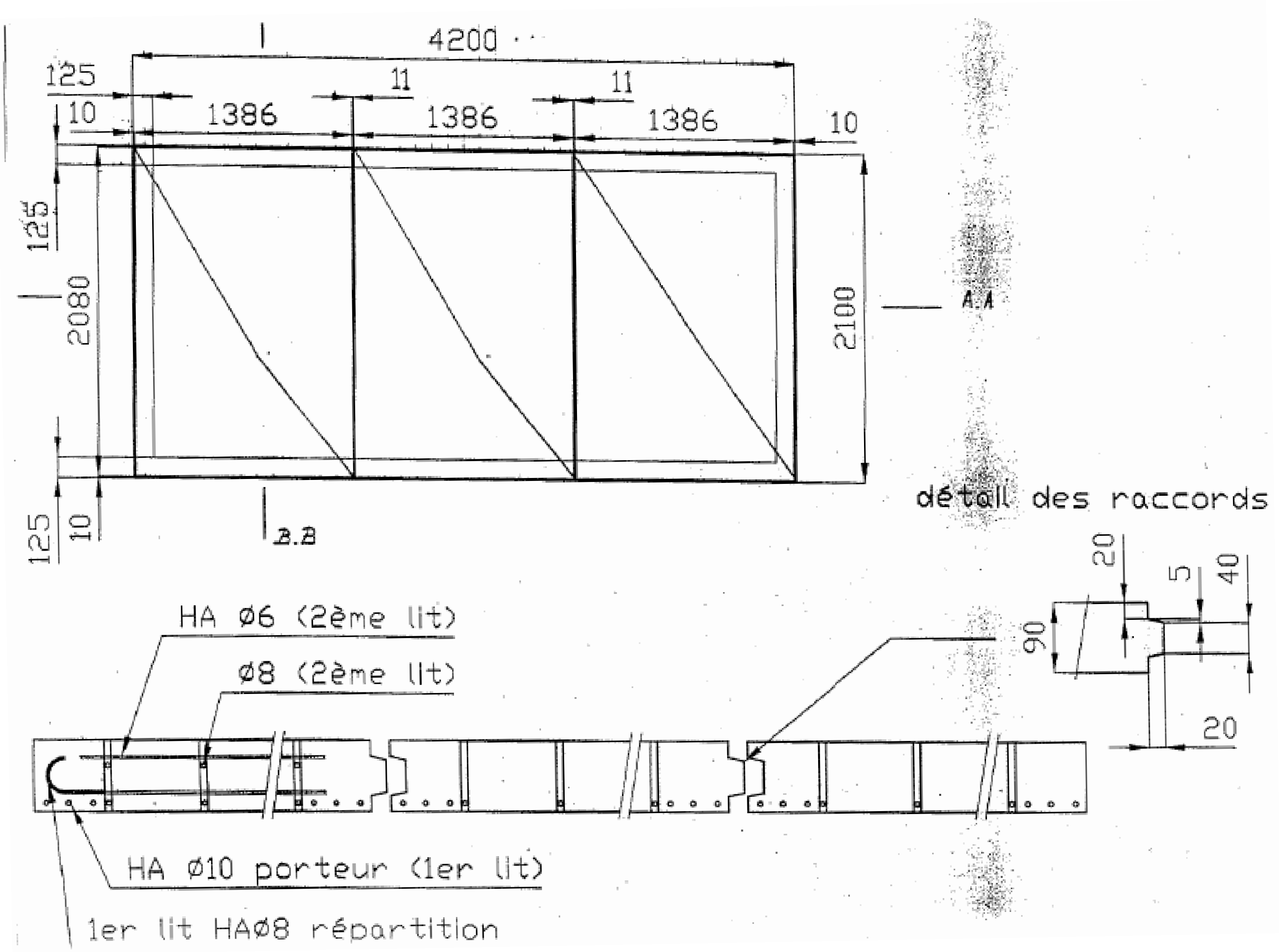

Figure 3 - Floor system comprised three glass block modules jointed together r– section view

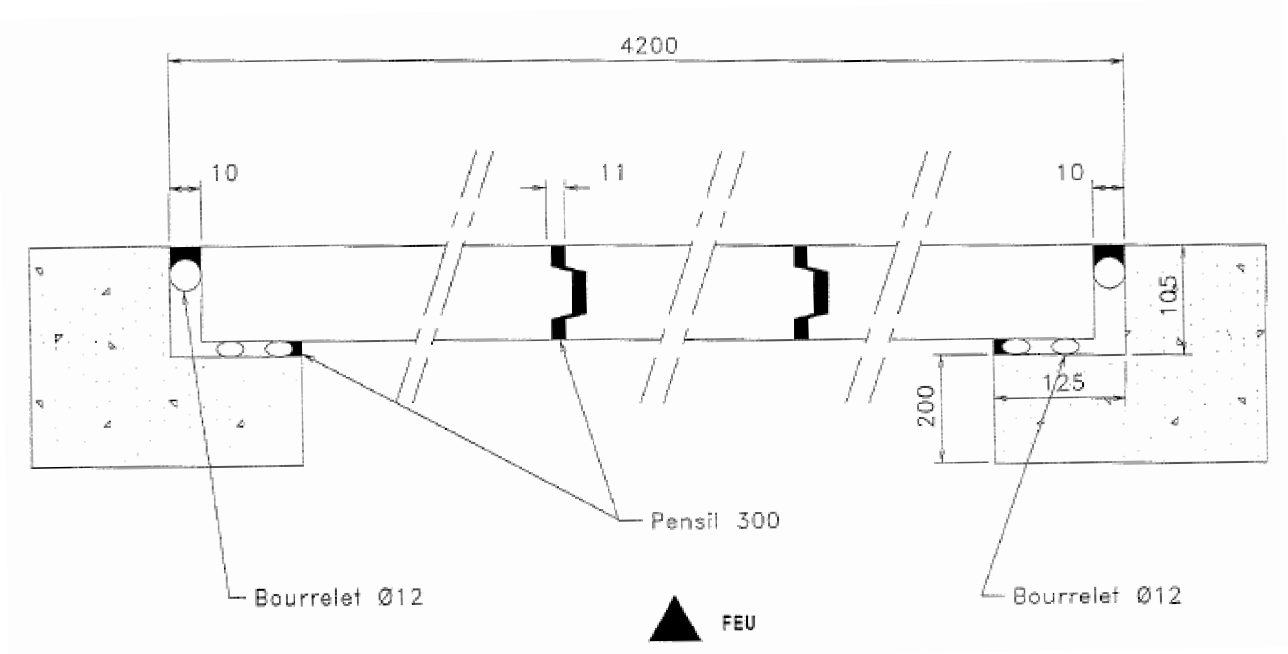

Figure 4 - Floor system joint and surround support detail – section view

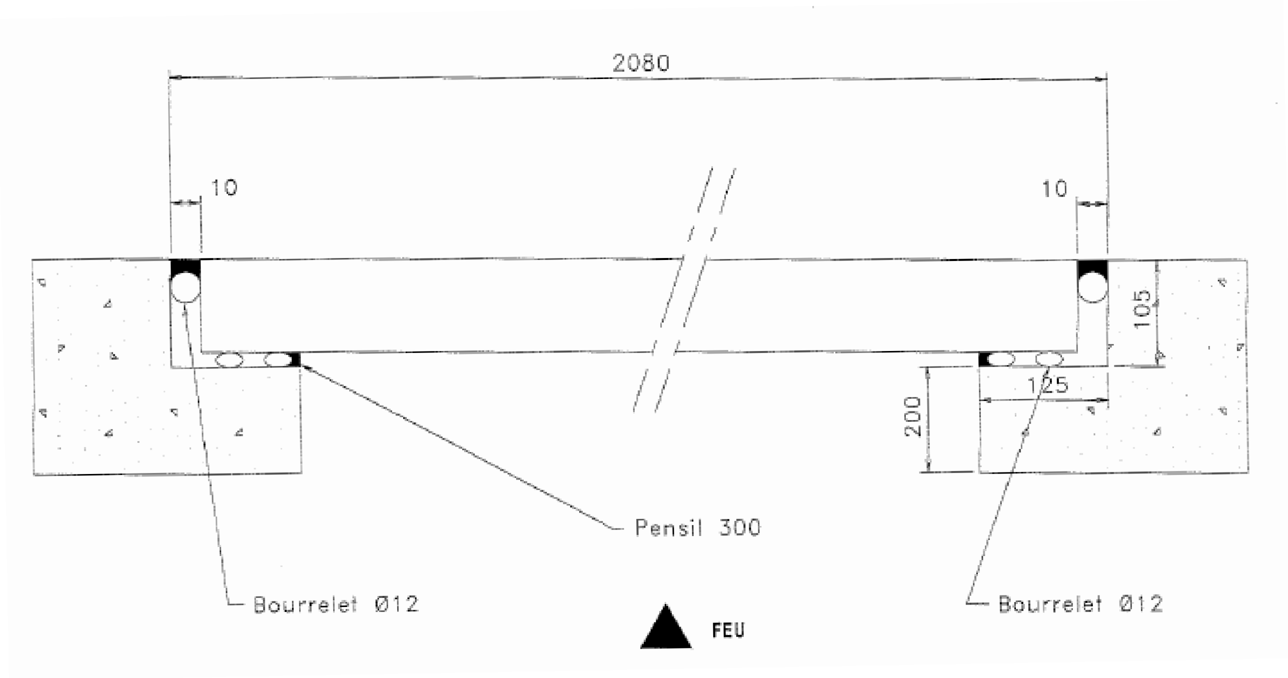

Figure 5 - Floor system surround support detail – section view

5 Direct Field of Application of Results

The results of this report are applicable to floor exposed to fire from below.

6 Requirements

Any variations with respect to size, constructional details, loads, stresses, edge or end conditions that are other than those identified in this report, may invalidate the conclusions drawn in this report.

7 Term of Validity

This assessment report will lapse on 30th June 2029. Should you wish us to re-examine this report with a view to the possible extension of its term of validity, would you please apply to us three to four months before the date of expiry. This Division reserves the right at any time to amend or withdraw this assessment in the light of new knowledge.

8 Limitations

The conclusions of this assessment report may be used to directly assess the fire resistance performance under such conditions, but it should be recognised that a single test method will not provide a full assessment of the fire hazard under all fire conditions.

Because of the nature of fire resistance testing, and the consequent difficulty in quantifying the uncertainty of measurement, it is not possible to provide a stated degree of accuracy. The inherent variability in test procedures, materials and methods of construction, and installation may lead to variations in performance between elements of similar construction.

This assessment report does not provide an endorsement by CSIRO of the actual products supplied to industry. The referenced assessment can therefore only relate to the actual prototype test specimens, testing conditions and methodology described in the supporting data, and does not imply any performance abilities of construction of subsequent manufacture.

This assessment is based on information and experience available at the time of preparation. The test standards and the assessment methodologies are the subject of review and improvement and it is recommended that this report is reviewed on, or before, the stated expiry date.

The information contained in this assessment report shall not be used for the assessment of variations other than those stated in the conclusions above. The assessment is valid provided no modifications are made to the systems detailed in this report. All details of construction should be consistent with the requirements stated in the relevant test reports and all referenced documents.

Appendix A Supporting Test Data

A.1. CTSB report no. RS 98.050

On 26 August 1998 Scientific and Technical Centre for Building (CSTB), France carried out a full scale fire resistance test in accordance with specifications detailed by the Ministry of the Interior on a glass brick floor incorporating modules comprising of 190-mm x 190-mm x 100-mm deep glass bricks that had a double shell of average thickness of 10mm.

The tested floor system measuring 4200mm x 2080mm comprised three juxtaposed modules measuring 1386mm long x 2080mm wide x 100mm thick, with rigidity provided by reinforcement steel rod frames. The framework for each module was made up of two superimposed layers of reinforcement steel in the following configuration:

- First layer of frame made up of twisted and tied 10mm steel rods lengthwise and 8mm steel rods width wise placed on the underside of the module
- Second layer of frame made up of twisted and tied 8mm steel rods lengthwise and 6mm steel rods width wise placed on the surface of the module

The glass blocks were assembled using SECAR 71 based mortar and fireclay with 30-mm between adjoining blocks. The modules were joined using 20mm x 50mm trapezoidal tongue and groove joints and all joints were sealed using PENSIL 300 mastic over set mortar.

The floor comprised of the assembled modules were installed on an embedded groove measuring 125mm x 105mm. The resulting gap was filled using strips of rock wool and sealed using PENSIL 300 mastic on the top and bottom side of the floor.

A load of 250 kg/m² using uniformly distributed dead weights were applied to the floor. The floor failed integrity at 102 minutes after gap formation of more than 45 cm².

A.2. Applicability of the above test data to AS 1530.4-2014

General

The fire resistance test reported in CSTB report no. RS 98-050 was conducted in accordance with the provisions of the order of 21 April 1983 from the French Ministry of the Interior Fire Resistance of a Building Element. It differs from AS 1530.4 2014 Section 8 and the significance of these differences is discussed below.

Furnace Temperature Regime

The specified specimen heating rate in the referenced test is given by:

$T_t - T_0 = 345_{\log}(8t+1)$

Where;

T_t = Furnace temperature at time t, in degrees Celsius.

T_o = Initial furnace temperature, in degrees Celsius, not less than 10°C nor more than 40°C.

t = Time into the test, measured from the ignition of the furnace, in minutes.

The heating regimes in the provisions of the order of 21 April 1983 from the French Ministry of the Interior Fire Resistance of a Building Element and AS 1530.4–2014 vary in that the former is an expression of the temperature rise in the furnace above an initial ambient temperature, and the latter although similar assumes that the initial furnace temperature (To) is 20°C irrespective of the actual ambient temperature. A test conducted in accordance with the provisions of the order of 21 April 1983 from the French Ministry of the Interior Fire Resistance of a Building Element on a warm day (ambient temperature above 20°C) could, therefore, be slightly more onerous than that in accordance with AS 1530.4–2014.

Furnace severity

With reference to CSTB report no. RS 98-050, it was observed that the recorded average temperature was below the required furnace temperature after 20 minutes until the end of the 102 minutes test.

Furnace severity that the glass floor was subjected to for the 102 minutes duration of the test was calculated, and it is found that furnace temperature severity by 102 minutes in the test is more than the Standard AS 1530.4-2014 severity by 90 minutes.

Therefore, it is concluded that if the specimen is tested to standard AS 1530.4-2014 severity for a duration of 90 minutes, the specimen would have the same or better performance compared to the tested specimen in the referenced test at 102 minutes.

Furnace Pressure

It is a requirement of AS 1530.4-2014 that for horizontal elements, a furnace gauge pressure of 20 Pa ±3Pa is established at a position 100mm below the underside of the test specimen above that of the laboratory atmosphere.

The furnace pressure outlined in the provisions of the order of 21 April 1983 from the French Ministry of the Interior Fire Resistance of a Building Element is lower than that of AS 1530.4-2014.

The increase in furnace pressure in AS 1530.4-2014 is only expected to be significant if cracks or fissures had developed in the test specimen.

It is confirmed in CSTB report no. RS98-050 that the specimen did not develop significant cracks before 90 minutes into the test that would be affected by a higher in furnace pressure for the duration of the test. Therefore, the difference in furnace pressure would not significantly affect the performance of the floor.

Specimen construction

AS 1530.4-2014 requires floors to rest on smooth bearing surface and be simply supported at two ends and unrestrained at the remaining unsupported edges.

It is confirmed in CSTB report no. RS 98-050 that the specimen was supported on all edges. AS 1530.4-2014 requires two edges of the floor be supported to make the result applicable to floor systems that are wider than as tested. In this case 4 edges are supported, and the construction that has been assessed meets the requirements of 4.12.1 and as a result the size of the floor panel is limited to the test side and supported on all edges as tested.

Specimen thermocouple arrangements

AS 1530.4-2014 Section 3.3.1.5 specifies that for measuring the maximum temperature of a floor system, thermocouples shall be attached at the following locations:

- Not closer than 100mm from an uninsulated glazed element or 100 mm from the free edge(s) of the test specimen
- Five thermocouples shall be evenly distributed over the test specimen to monitor the temperature of the unexposed surface of a specimen, one in the centre of the specimen and one at centre of each quarter section.

It was confirmed that in CSTB report no. RS98-050, the thermocouples were present in similar locations. Additional thermocouples were present on the reinforcement steel framework, mortar, and sealant.

Based on the above, it is considered that had the specimen tested in CSTB report no. RS98-050 been tested in accordance with AS 1530.4-2014 the insulation performance would be unchanged.

Criteria for failure

The integrity criteria outlined in the provisions of the order of 21 April 1983 from the French Ministry of the Interior Fire Resistance of a Building Element is the same as that of AS 1530.4-2014 Section 8.

Application of Test Data to AS 1530.4-2014

Based on the above discussion, the test identified above is confirmed by this Accredited Testing Laboratory to be equivalent or more severe than a Standard Fire Test as described specified in Section 4 of this report when applied to the specimen and performance limitations as identified above.

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