ANNEX A: PERFORMANCE CRITERIA AND CLASSIFICATION METHOD FOR BS 8414-1

This annex provides a classification system for the test methodology outlined in BS 8414-1 *Fire performance of external cladding systems – Part 1: Test method for non-loadbearing external cladding systems applied to the face of the building*[A1].

A1 TEST METHOD

Figure A1: Example of a typical test facility

Definitions

Level 1
A height 2 m above the top of the combustion chamber opening (Figure A3).

Level 2
A height 5 m above the top of the combustion chamber opening (Figure A3).

Start temperature, T_s
The mean temperature of the thermocouples at level 1 (Figure A3) during the 5 min before ignition.

Start time, t_s
The time when the temperature recorded by any external thermocouple at level 1 equals or exceeds a 200 °C temperature rise above Ts, and remains above this value for at least 30 s (Figures A3 and A5).

System
The complete cladding assembly, including any sheeting rails, cavities, fire barriers and weathering membranes or coatings.

A1.1 Principle of test

The test facility has been designed to allow the external fire performance of both applied and supported non-loadbearing external cladding systems to be determined (Figure A1).

The test facility allows external cladding systems to be installed as close to typical end-use conditions as possible. The test faces consist of a masonry vertical main test face, into which the combustion chamber is located, and a masonry vertical return wall or wing, set at 90° to the main test face. The test specimen should be installed with all the relevant components, and should be assembled in accordance with the manufacturer's instructions. The main test face is at least 8 m high and 2.6 m wide, with the return wing being 8 m high and 1.5 m wide (Figure A2). The distance between the masonry face of the wing wall and the edge of the combustion chamber opening is 250 ± 10 mm with a maximum cladding system thickness of 200 mm. If thicker cladding systems are to be evaluated, the position of the combustion chamber should be adjusted to enable a minimum distance of 50 mm to be maintained between the finished face of the cladding system and the edge of the combustion chamber.

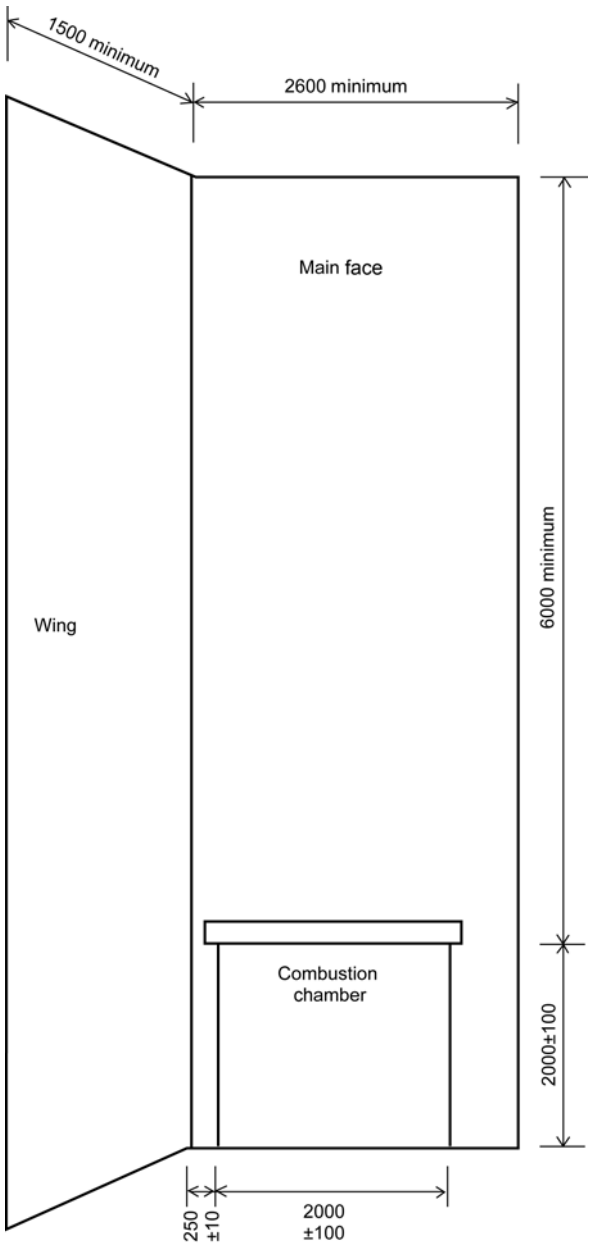

Figure A2: Schematic of test facility (all dimensions are shown in mm)

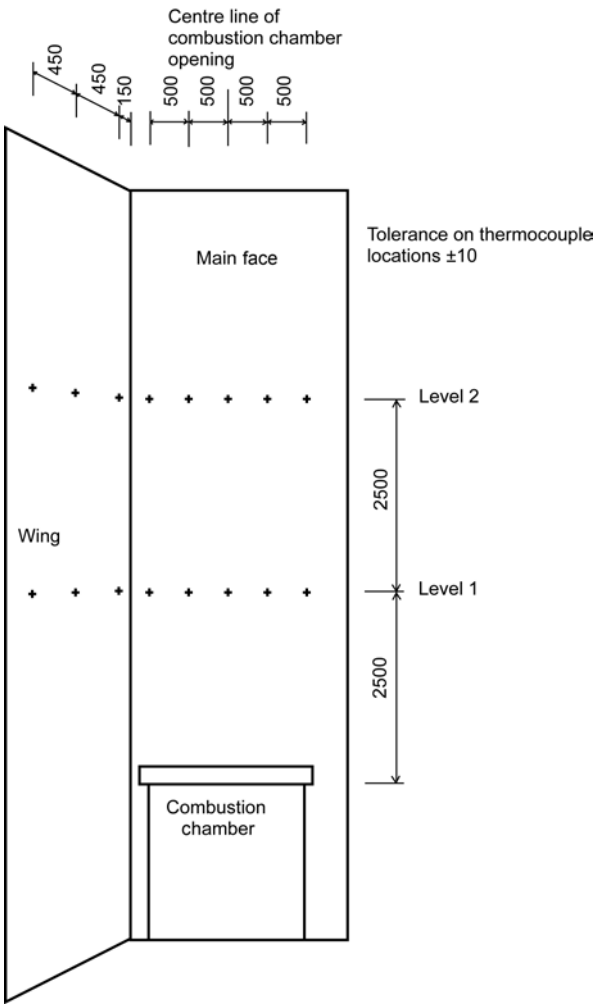

Figure A3: Location of thermocouples (all dimensions are shown in mm)

The test standard provides thermal performance criteria to permit the use of alternative heat sources. A wooden crib is typically used as the heat source for this test, although a gas burner can be used as an alternative. The combustion characteristics of the crib give a total nominal heat output of 4500 MJ over a 30 min period at a peak rate of 3 ± 0.5 MW.

The full details of the test methods can be found in the standard[A1], and although the definitions are repeated above for ease of reference, in all cases the interpretation of test results should be made with regard to the full standard. Figures A2, A3 and A4 show schematics of the test facility and thermocouple locations.

A1.2 Instrumentation

Type K thermocouples are used to monitor temperature at two array locations within the system under test. Figures A3 and A4 summarise the locations of the thermocouples used to monitor the temperatures during the test. At level 2 (Figure A3) the thermocouples are positioned at the mid-depth of each combustible layer, where 'combustible' is defined as referring to a material that does not meet the requirements of Tables A6 or A7 in Approved Document B[A2] – that is, greater than 10 mm thick. Thermocouples are also located at the mid-depth of any cavity that may be present (Figure A4).

A2 PERFORMANCE CRITERIA AND CLASSIFICATION METHOD

The performance criteria and classification method set out in this Annex are based on the latest edition of the BS 8414-1 test method[A1]. In order for a classification to be undertaken, the system must have been tested to the full test-duration requirements of BS 8414-1 without any early termination of the full fire-load exposure period. The primary concerns when setting the performance criteria for these systems are those of fire spread away from the initial fire source, and the rate of fire spread. If fire spread away from the initial fire source occurs, the rate of progress of fire spread or tendency for collapse should not unduly hinder intervention by the emergency services.

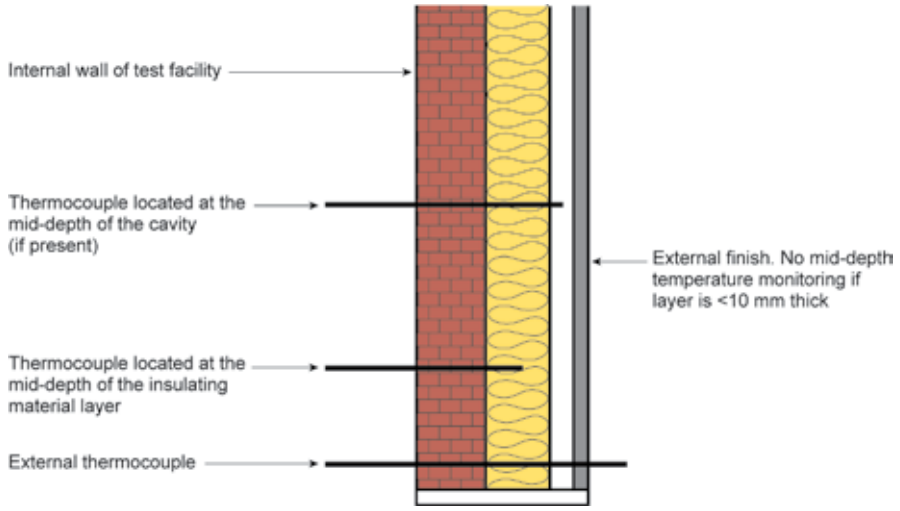

Figure A4: Thermocouple locations within the cladding layers

The performance of the system under investigation is evaluated against three criteria:

- external fire spread
- internal fire spread
- mechanical performance.

The classification applies only to the system as tested and detailed in the classification report. The classification report can only cover the details of the system as tested. It cannot state what is not covered. When specifying or checking a system it is important to check that the classification documents cover the end-use application.

A2.1 Fire-spread start time, t_s

Fire spread is measured by type K thermocouples set at levels 1 and 2 (Figure A3). The start time, t_s, for fire spread is initiated when the temperature first recorded by any external thermocouple at level 1 equals or exceeds a 200 °C temperature rise above the start temperature, T_s, and remains above this value for at least 30 s. An example graph is shown in Figure A5, where ignition of the heat source corresponds to time zero.

A2.2 External fire spread

Failure due to external fire spread is deemed to have occurred if the temperature rise above T_s of any of the external thermocouples at level 2 exceeds 600 °C for a period of at least 30 s, within 15 min of the start time, *t*s. An example graph is shown in Figure A6.

A2.3 Internal fire spread

Failure due to internal fire spread is deemed to have occurred if the temperature rise above T_s of any of the internal thermocouples at level 2 exceeds 600 °C, for a

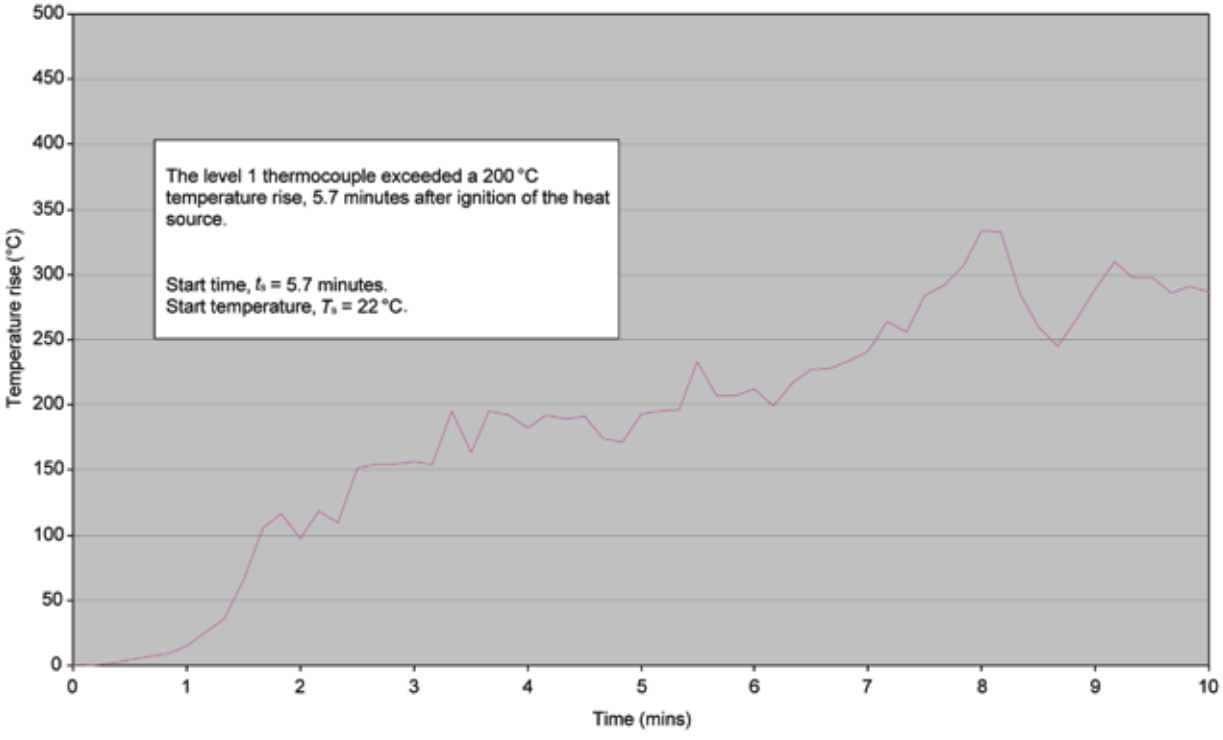

Figure A5: Level 1 thermocouple used to determine start time, t_s

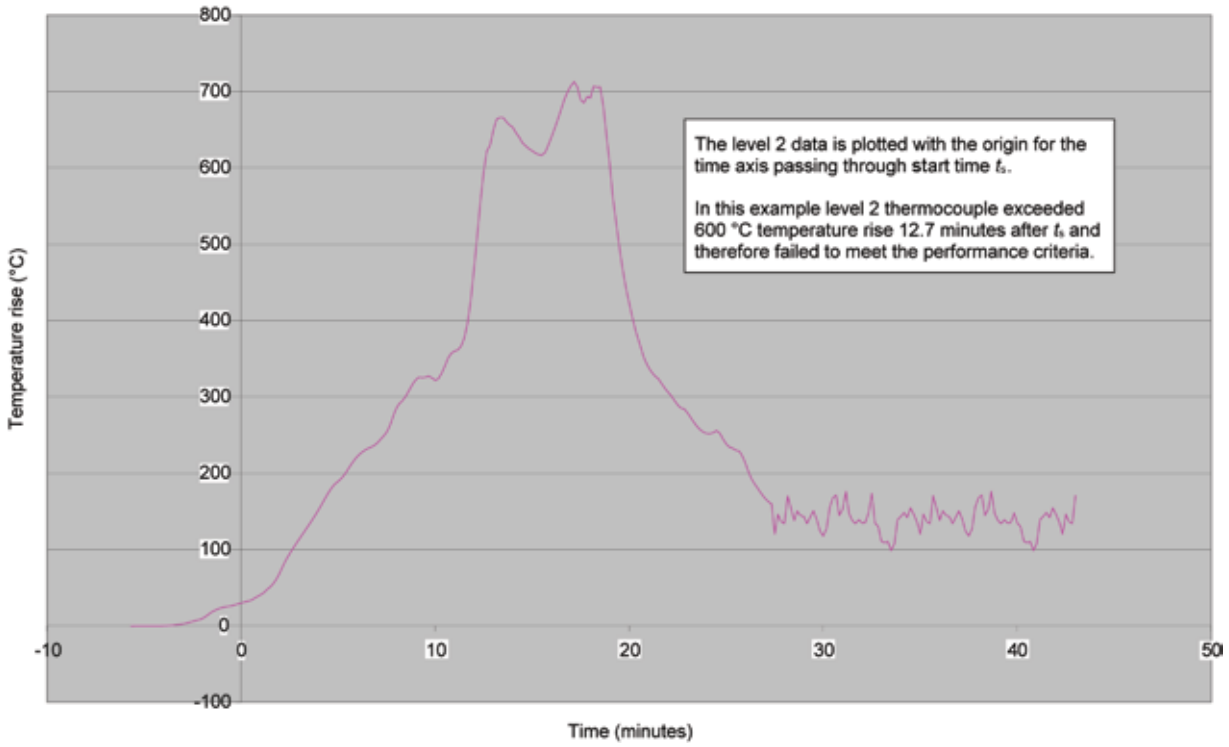

Figure A6: Level 2 thermocouple plotted with start time set to time zero

period of at least 30 s, within 15 min of the start time, t_s. An example graph is shown in Figure A6.

A2.4 Mechanical performance

No failure criteria have been set for mechanical performance. However, ongoing system combustion following extinguishing of the ignition source shall be included in the test and classification reports, together with details of any system collapse, spalling, delamination, flaming debris or pool fires. The nature of the mechanical performance should be considered as part of the overall risk assessment when specifying the system (eg Figure A7).

A3 REFERENCES

A1 BSI. Fire performance of external cladding systems. Part 1: Test method for non-loadbearing external cladding systems applied to the face the building. BS 8414-1. London, BSI.

A2 Department for Communities and Local Government (DCLG). The Building Regulations (England & Wales) 2010. Approved Document B: Fire safety, Volumes 1 and 2, 2006 edition. London, TSO, 2006**.** Available from www.planningportal.gov.uk and www.thenbs.com/buildingregs.

Figure A7: After the test