

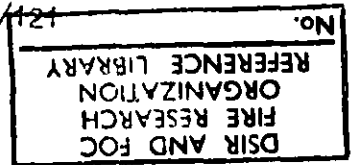
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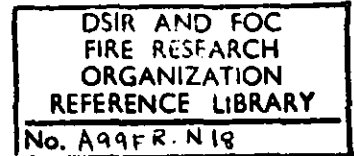
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DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH AND FIRE OFFICES' COMMITTEE  
JOINT FIRE RESEARCH ORGANIZATION

## THE TESTS OF BRITISH STANDARD 476

by

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Present-day test procedure to determine the behaviour of building materials and structures under fire conditions is described and defined in British Standard 476 which seeks to provide standards whereby old and new materials and methods of construction may be accepted or rejected on definite grounds by precepting authorities for their fitness or otherwise for the purpose in view.

This Standard describes several tests only four of which need concern us here. These are the tests for incombustibility, non-inflammability and surface spread of flame which apply to building materials and the test for fire-resistance which refers to building structures.

It is of interest to examine the purpose of each of these tests, so that its significance and application may be understood fully.

### Incombustibility test

This test is intended simply to determine whether or not a material will burn, and whether in consequence it can add to the severity of a building fire. In the words of the Standard "For building purposes a material is either combustible or incombustible, and it has been found possible to place it definitely in one class or another by a simple laboratory test on a specimen which is large enough to be representative."

### Non-inflammability test

This test, which together with the surface spread of flame test, applies only to combustible materials, is intended to measure the tendency of such materials to flame when ignited, since this tendency will, in certain situations, produce from a small source a fire which may become rapidly uncontrollable. While the tendency to inflame can be reduced or suppressed by suitable treatments, for example, fabrics may be impregnated by suitable solutions, such treatments do not generally reduce the amount of heat energy the material would contribute to a major fire in which it was involved. The test provides for the classification of materials in one of three classes of varying degrees of inflammability.

### Surface Spread of Flame Test

This test was devised with the object of measuring the relative ease with which flame could spread over the surface of combustible, inflammable wall and ceiling linings, since in so doing it might increase the speed with which a fire could spread throughout a building, thus further endangering property and human life. Primarily intended for classifying linings used in corridors and escape routes, the test enables such materials to be placed in one of four classes of flame

spread as having surfaces of very low, low, medium or rapid surface spread of flame. It has been shown in subsequent investigations that the test also provides an indication of the relative ease with which a material may be ignited from a small source.

#### Fire-resistance tests

These tests are applicable only to representative elements of building structure such as a wall, a floor, a column, a door or a partition, and not to the component materials individually. The British Standard defines fire-resistance as a "relative term used to designate that property by virtue of which an element of structure, as a whole, functions satisfactorily for a specified period whilst subject to a prescribed heat influence and load." The "prescribed heat influence" is provided by arranging that the exposed part of the element is heated so that its temperature increases in a standard manner intended to represent the rise of temperature in a major building fire after the initial ignition period has elapsed and the fire takes hold. The load, which must be carried by a load-bearing element throughout the heating if it is to be regarded as "functioning satisfactorily", is equivalent to one-and-a-half times the design load. Structures which are used for separating spaces and are therefore required to prevent the passage of fire from one space to another, must fulfil conditions requiring integrity and a specified standard of heat insulation also. The period for which all these conditions are required to be satisfied is one of five "grading periods" ranging from  $\frac{1}{2}$  to 6 hours.

#### The application of the foregoing tests to fire conditions

While it is generally an advantage that building materials should be incombustible, so that they are not only incapable of being ignited by chance sources of fire but in the extreme do not contribute to the severity of a large fire, to require incombustibility in all materials would be not only very restrictive but would be unreasonably severe in many applications. In such cases it is often sufficient to require that materials are not readily ignitable, and if ignited, that their tendency to inflame is limited so that other adjacent materials may not be rapidly involved before first-aid fire appliances can be used to quell what would otherwise be a small fire. The results of the Surface Spread of Flame Test and the Non-inflammability test may be used to assess ease of ignition and inflammability, respectively. Once material has been ignited, and wall and ceiling linings have become involved, it is then essential to ensure that the spread of flame along their surfaces should be as slow and limited as possible, so that personal escape may be effected and larger fire-fighting resources brought into action before the fire assumes major proportions. It is here that the results of the Surface Spread of Flame Test are of importance in selecting the surfaces which will give this advantage, particularly in corridors and escape routes. Recent work has shown that in rooms and other restricted places, where a fire has gained a considerable hold; for example, where internal furnishings are ablaze, the importance of a high performance classification in the surface spread of flame test is less important than the proportion of incombustible material in the wall and ceiling linings in determining the time at which the whole compartment will be involved in fire. Thus an incombustible lining may delay the "flash over" by a much longer period than the combustible lining treated to provide a much reduced surface spread of flame, the latter material behaving little better in this respect than the untreated material, although it served its purpose for a brief period in resisting the initial ignition.

Once the "flash over" has occurred and the whole compartment is involved, it remains for the structure of compartment to contain the fire, each element of structure providing that measure of fire-resistance necessary to prevent penetration or collapse during the prescribed period.