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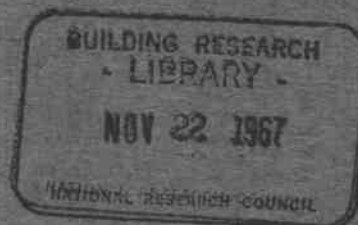
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SELECTION OF STANDARD FIRE ENDURANCE TESTS

BY THE FIRE RESEARCH STATION IN FRANCE

by Murdoch Galbreath



ANALYZED



Ottawa

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DIVISION OF BUILDING RESEARCH

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Technical Paper No. 250
of the
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FOREWORD

The sources of the information contained herein are the published reports of fire tests conducted in accordance with the Standard Methods of Test adopted by decree of the French Government.

Tests of assemblies that contain materials identified by trade name only have been excluded from this paper because these assemblies are not adequately identified by description and it would be difficult to apply the information to Canadian practice.

SPECIAL INTRODUCTION

THIS PUBLICATION HAS BEEN PREPARED TO MAKE AVAILABLE TO CANADIAN READERS PUBLISHED INFORMATION ON FIRE ENDURANCE OF BUILDING ASSEMBLIES OF THE FIRE RESEARCH ORGANIZATION IN FRANCE. IT IS INTENDED FOR INFORMATION PURPOSES ONLY AND IS NOT TO BE REGARDED AS AN OFFICIAL LISTING OR RATING. SUPPLEMENT NO. 2 TO THE NATIONAL BUILDING CODE PROVIDES SUCH RATINGS FOR COMMON MATERIALS AND SYSTEMS CAPABLE OF BEING IDENTIFIED ADEQUATELY BY DESCRIPTION, WHICH MAY BE USED IN THE ABSENCE OF SPECIFIC TEST INFORMATION OR OTHER CERTIFICATION. BUT THE DESIGNER, MANUFACTURER, OR BUILDING OFFICIAL MAY FIND IT NECESSARY TO EXERCISE JUDGEMENT ON MATERIALS OR SYSTEMS DIFFERING FROM THOSE FOR WHICH TEST OR RATING INFORMATION IS AVAILABLE, AND IN SUCH CASES THE INFORMATION NOW ASSEMBLED MAY BE USEFUL.

ALL THE TEST INFORMATION IN THIS PUBLICATION IS INCLUDED WITH THE PERMISSION OF THE ORIGINAL AUTHORS. IN MANY CASES THE DETAILED DESCRIPTIONS PROVIDED IN THE ORIGINAL PUBLICATIONS HAVE HAD TO BE ABBREVIATED OR OMITTED. REFERENCE SHOULD ALWAYS BE MADE TO THE ORIGINAL PUBLICATIONS FOR VERIFICATION OF THE DESCRIPTION AND METHOD OF TEST BEFORE PLACING GREAT WEIGHT ON INDIVIDUAL VALUES. THE VARIOUS ITEMS ARE CROSS-REFERENCED TO THE BIBLIOGRAPHY WHICH LISTS THE SOURCE PUBLICATIONS. NO REPRODUCTION SHOULD BE MADE OF ANY OF THIS MATERIAL WITHOUT THE PERMISSION OF THE ORIGINAL PUBLISHERS.

ACKNOWLEDGEMENT

THE PERMISSION GIVEN BY AUTHORS
TO REPRODUCE THE MATERIAL ON WHICH THIS
PUBLICATION IS BASED IS GREATLY APPRECIATED.

A SELECTION OF STANDARD FIRE ENDURANCE TESTS
BY THE FIRE RESEARCH STATION IN FRANCE

by
Murdoch Galbreath

The National Building Code of Canada recognizes several standard methods of test for fire endurance of building components. These are:

1. CSA B54.3 and 5 of the Canadian Standards Association;
2. ASTM E119 and E152 of the American Society for Testing and Materials;
3. BS 476 of the British Standards Institution.

These tests all follow the same general lines but differ in details. There is much test information available that is based on the French fire test, and though it may not be considered to meet the provisions of the National Building Code, it can provide useful information relating to the fire performance of building assemblies.

The Standard Fire Test used in France is the result of an order concerning fire resistance of building components issued by the Ministry of the Interior in January 1959. An examination of the conditions of test shows a broad similarity between the French test and those noted above, except in the size of the test specimens.

FURNACE TEMPERATURES

In the French test, furnace temperatures follow a time-temperature curve based on the expression

$$T - T_o = 345 \log_{10} (8t + 1)$$

where

T is the temperature in the vicinity of the specimen
in degrees Celsius

T_o is the temperature at the start of the test
in degrees Celsius

t is the time in minutes from the beginning
of the test.

Temperatures at selected time intervals for the ASTM/CSA, U. K. and French tests are shown in Table I.

The French test provides slightly lower temperatures between 10 and 30 min but catches up at 1 hr and after that is a little higher than the ASTM test. Furnace temperatures in the ASTM, the CSA, and the French test are measured by thermocouples enclosed in metal tubes. In the British test bare thermocouples are used; this tends to make this test a little less severe in the early stages.

THERMOCOUPLES ON THE UNEXPOSED FACE

In the French fire test, thermocouples on the unexposed face are covered by asbestos pads as in the ASTM and CSA test methods.

HOSE STREAM

There is no provision for a hose-stream test in the French regulations. It is argued that the hose stream is rarely a significant factor in the test. It was removed from the British test in 1953.

SIZE OF TEST SPECIMEN

The minimum size of test specimen is less in the French test than in the other test methods described. Walls and partitions are 2 m (6 ft 7 in.) by 2 m (6 ft 7 in.) instead of 10 by 10 ft as in the British test or 9 ft and 100 sq ft as in the ASTM test. A comparison of the minimum sizes for test specimens is shown in Table II. A note to the French regulations says that the minimum sizes will be increased as soon as changes in the furnaces can be effected. The test reports published indicate that this has not yet been done.

In assemblies that fail by temperature rise on the unexposed surface, it may be assumed that the size of the specimen is not likely to influence the result significantly. When collapse of the specimen is the end point of the test, however, size will have some bearing on the result, although it is the practice of the French testing authorities to apply additional load to the test assembly to compensate for the reduction in size.

FIRE ENDURANCE CRITERIA

There are four criteria for failure in the French fire tests and three classifications of fire endurance. The end points are:

1. Structural stability. This includes the ability of an element to sustain the applied loads and to perform its intended functions.
2. Adequate thermal insulation.
3. Resistance to the passage of flames.
4. No emission of flammable gases on the non-exposed face.

Failure of thermal insulation is defined as the time when the average temperature rise on the non-exposed face reaches 140C° (252F°) above the temperature at the start of the test or when the maximum temperature rise at any point reaches 180C° (324F°). This is the same as in the other test methods described.

The classifications adopted in the French test for behaviour in the fire test are as follows.

(a) "Stables au feu" describes the performance of elements for which only criterion No. 1 - structural stability - is required.

(b) "pare-flammes" describes the performance of elements for which the criteria of structural stability, resistance to the passage of flames, and no emission of flammable gases (Nos. 1, 3, and 4 above) are required.

(c) "coupe feu" describes the performance of elements for which all of the criteria described above (1 - 4) are required. Degrees of fire endurance in relation to the above classifications are expressed in the following increments, 6 hr, 4 hr, 3 hr, 2 hr, $1\frac{1}{2}$ hr, 1 hr, $\frac{1}{2}$ hr, and $\frac{1}{4}$ hr. For elements transparent to heat such as glass products, and for metal panels, thermocouples are mounted at distances from the centre of the test specimen of 0.6 m (2 ft 0 in.) and 1 m (3 ft 3 in.) and 1.5 m (5 ft 0 in.).

TEST REPORTS

Summary extracts from published reports of French fire tests covering assemblies that can be identified without reference to trade name are included in Appendix A. The information is taken from:

Cahiers du Centre Scientifique et Technique
du Bâtiment No. 71, Cahier 602, December 1964,

described as

"Tableau Récapitulatif général des classements
relatifs à la résistance au feu."

It should be noted that the brief descriptions in the tables do not fully identify the test specimens. Methods of fastening, for example, can be of great importance. The right-hand column in each table refers to the Cahiers of the Centre Scientifique et Technique du Bâtiment, where more detailed reports of the tests are given. For example, 27/232 in the table means No. 27 of Cahier 232 du Centre Scientifique et Technique du Bâtiment.

In the original reference document (No. 71, Cahiers 602) there are descriptions of 364 tests. Only 56 of these have been reproduced in this paper. Some of these were omitted because the fire endurance was less than 15 minutes, and some because the test specimens were very small. By far the greater number of omissions, however, has been because test specimens included materials described by trade name that consequently could not be adequately identified or compared with North American products.

For each of the test references shown in Appendix A, an English version has been provided including conversion of units of measurement to North American practice. The descriptions in English in Appendix B include supplementary information derived from the more detailed test reports referred to in Appendix A.

BIBLIOGRAPHY

1. C.S.A. Standard B54.3, 1964. Methods of Fire Tests of Walls, Partitions, Floors, Roofs, Ceilings, Columns, Beams and Girders. Canadian Standards Association, Ottawa.
2. C.S.A. Standard B54.5, 1963. Standard Methods of Fire Tests of Window and Glass Block Assemblies. Canadian Standards Association, Ottawa.
3. ASTM E119. -61. Standard Methods of Fire Test of Building Constructions and Materials. American Society for Testing and Materials, Philadelphia, U.S.A.
4. ASTM E152-58. Standard Methods of Fire Tests of Door Assemblies. American Society for Testing and Materials, Philadelphia, U.S.A.
5. BS476 Part 1. 1953. Fire Test of Building Materials and Structures. British Standards Institution, London, England.
6. Cahiers du Centre Scientifique et Technique du Bâtiment. No. 37. Cahier 299, avril 1959, Arrêté du 5 janvier 1959. Concernant la résistance au feu des éléments de construction. Texte et commentaires explicatif par J.P. Fackler, 4 avenue de Recteur Poincaré, Paris.

TABLE I
COMPARISON OF TIME TEMPERATURE CURVES
IN THE STANDARD TESTS

Time	Furnace Temperatures °C		
	C. S. A. and A. S. T. M.	U. K.	France
5 min	538* (1000° F)	538	556
10 min	704 (1300° F)	704	659
30 min	843 (1550° F)	843	821
1 hr	927 (1700° F)	927	925
2 hr	1010 (1850° F)	1010	1029
3 hr	1052 (1925° F)	1075	1090
4 hr	1093 (2000° F)	1121	1133

* Equivalent degrees Fahrenheit are shown below degrees Celsius for A. S. T. M. test.

TABLE II
MINIMUM DIMENSIONS FOR TEST SPECIMENS
IN THE STANDARD TESTS

Element	Minimum Dimensions of Specimen		
	ASTM/CSA	U. K.	France*
Doors and Screens	to represent installation**	to represent installation**	1.10 m (3 ft 7 in.) x 1.70 m (5 ft 7 in.) proposed 2 m (6 ft 7 in.) x 2.5 m (8 ft 2 in.)
Walls and Partitions	9 ft and 100 sq ft	10 ft x 10 ft	2 m (6 ft 7 in.) x 2 m (6 ft 7 in.) proposed 3 m (9 ft 10 in.) x 3 m (9 ft 10 in.)
Columns	9 ft	10 ft	2.30 m (7 ft 6 in.) proposed 3 m (9 ft 10 in.)
Beams	12 ft***	10 ft	4 m (13 ft 2 in.)
Floors	12 ft and 180 sq ft	10 ft x 10 ft	3 m (9 ft 10 in.) x 4 m (13 ft 2 in.)

* Proposed dimensions are those which will come into effect in France when changes in furnaces are made (see text).

** No minimum dimension specified but the test specimen is required to represent that which would be installed in a building.

*** 12 ft is a minimum dimension for steel beams in CSA test, ASTM E119 has no provisions for testing beams other than in a floor assembly.

APPENDIX A

Tableau Récapitulatif Général des Classements Relatifs
à la Résistance au Feu. Cahiers du Centre Scientifique
et Technique du Bâtiment No. 71, Cahier 602, Dec. 1964.

LEGENDES DES SYMBOLES

Eléments de construction:

MC.	Murs et cloisons.
Hb.	Hublots.
Pt.	Portes.
Pu.	Poteaux.
Pr.	Planchers.
Prt.	Planchers translucides.
Pe.	Poutres.

Classements:

S. F.	Stabilité au feu.
P. Fl.	Pare-flammes.
C. F.	Coupe-feu.
NC.	Non classable (durée de résistance au feu < 15 mn).

Renseignements supplémentaires:

DS.	Essai spécial.
c.	Classement résultant de l'application d'une peinture ou d'une enduction protectrice sur les faces extérieures de l'élément (MC ou Pt) ou l'hublerie.

Critères de fin d'essai:

ΔT_M	Echauffement maximal trop élevé.
ΔT_m	Echauffement moyen trop élevé.
F	Flèche dépassant la valeur critique.
I	Inflammation de la face non exposée ou passage de gaz susceptibles d'être enflammés.
P	Perforation.
A ou E	Affaissement ou écroulement
S	Arrêt de l'essai au bout d'une durée fixée contractuellement, l'élément continuant à satisfaire aux conditions requises.
R	Risques particuliers imposant l'arrêt immédiat : danger sérieux d'écrasement par exemple.

TABLEAU RECAPITULATIF GENERAL DES CLASSEMENTS RELATIFS A LA RESISTANCE AU FEU

N° de référence	N° de l'essai	Description sommaire de l'élément essayé	Durée	Cause de la limitation	Référence aux descriptions plus détaillées
		MURS ET CLOISONS DEGRE 1/4 D'HEURE			
MC. 15	91 590 B	Cloison bois et laine de verre nue.	C. F. 19 mn	P	27/232
MC. 31	57 389	Cloison sapin avec interposition d'une feuille d'amiante. Epaisseur totale 0.043 m.	C. F. 21 mn	I	30/252
MC. 68	56 223G	Cloison double constituée par deux panneaux de placoplâtre de 0.01 m assemblés par clouage sur réseau bois (chevrons de 0.04 x 0.04 m écartés de 0.40 m).	C. F. 29 mn		43/341
MC. 109	61 1192B	Cloison de 50 mm d'épaisseur, avec joint vertical, constituée de 2 plaques de placoplâtre de 10 mm, entre lesquelles est monté un réseau en carton, type boîte à oeufs, d'une épaisseur de 30 mm.	C. F. 25 mn	I	56/445

N° de référence	N° de l'essai	Description sommaire de l'élément essayé	Durée	Cause de la limitation	Référence aux descriptions plus détaillées
		MURS ET CLOISONS DEGRE 1/2 HEURE			
MC. 1	91 524 A	Cloison en briques plâtrières, épaisseur 0.05 m sans enduit.	C. F. 30 mn	ΔT_m	27/232
MC. 32	57 388	Cloison en placoplâtre sur réseau bois; épaisseur du placoplâtre, 0.04 m, épaisseur totale 0.142 m.	C. F. 57 mn	P	30/252
MC. 43	57 362	Panneau de verre armé maille 1/2 pouce monté sur châssis métallique.	P. Fl. 50 mn	P	32/265
MC. 46	57 365	Panneau double en verre armé maille 1/2 pouce monté sur châssis bois.	P. Fl. 50 mn	P	32/265
MC. 108	61 1192 A	Cloison de 64 mm d'épaisseur, avec joint vertical, constituée de 2 plaques de placoplâtre de 13 mm, entre lesquelles est monté un réseau en carton, type boîte à oeufs, d'une épaisseur de 38 mm.	C. F. 40 mn	I	56/445

N° de référence	N° de l'essai	Description sommaire de l'élément essayé	Durée	Cause de la limitation	Référence aux descriptions plus détaillées
MURS ET CLOISONS DEGRE 1 HEURE					
MC. 2	91 224B	Cloison en briques plâtrières, épaisseur 0.05 m avec enduit de plâtre de 1 cm sur la face exposée.	C. F. 1 h 12 mn	ΔT_m	27/232
MC. 4	91 553	Cloison en briques plâtrières, épaisseur 0.05 m, avec enduit de plâtre de 0.05 m sur chaque face.	C. F. 1 h 20 mn	$\Delta T_M \Delta T_m$	27/232
MC. 44	57 364	Panneau de verre armé mailles 1/2 pouce monté sur châssis bois.	P. Fl. 1 h 2 mn	P	32/265
MC. 45	57 363	Panneau double en verre armé mailles 1/2 pouce monté sur châssis métallique.	P. Fl. 1 h 10 mn	P	32/265
MC. 94	60 910 A	Verre armé, épaisseur 7 mm, mailles carrées de 1 pouce, encadrement chêne.	P. Fl. 1 h 21 mn	A	49/390
MC. 95	60 910 B	Verre armé, épaisseur 5.5 mm, mailles carrées de 1 pouce, encadrement chêne.	P. Fl. 1 h 2 mn	A	49/390
MC. 127	991 R.130	Verre armé 1 x 1.2 m, épaisseur 5.5 mm, fils métalliques de 6/10 mm, à mailles carrées de 1 pouce. Joint élastique en amiante de 2 mm.	P. Fl. 1 h 16 mn	A	59/479

N° de référence	N° de l'essai	Description sommaire de l'élément essayé	Durée	Cause de la limitation	Référence aux descriptions plus détaillées
		MURS ET CLOISONS DEGRE 1 HEURE 1/2			
MC. 3	91 524 C	Cloison en briques plâtrières, épaisseur 0.05 m avec enduit de plâtre de 1 cm sur chaque face.	C. F. 1 h 45 mn	ΔT_m	27/232
MC. 5	91 503 A	Cloison en carreaux de plâtre au mâche-fer avec liaison au plâtre sans enduit, épaisseur 0.06 m.	C. F. 1 h 35 mn	P	27/232
MC. 96	60 910 C	Verre armé, épaisseur 5.5 mm, mailles carrées 1/2 pouce, encadrement béton, avec pare-closes en tôle de 15/10 et cales amiantée.	P. Fl. 1 h 52 mn	A	49/390
MC. 117	61 1151	Panneau de verre armé douci et poli. Dimensions 1.0 x 1.2 m, épaisseur 7 mm; treillis métallique à mailles carrées de 1/2 pouce, diamètre des fils dans les 2 sens : 5/10 de mm.	P. Fl. 1 h 48 mn	A	56/445

N° de référence	N° de l'essai	Description sommaire de l'élément essayé	Durée	Cause de la limitation	Référence aux descriptions plus détaillées
MC. 6	91 503 B	MURS ET CLOISONS DEGRE 2 HEURES Cloison en carreaux de plâtre au mâche-fer avec liaison au plâtre, lissé sur les deux faces, sans enduit, épaisseur 0.06 m. Cloison en carreaux de plâtre au mâche-fer avec liaison au plâtre et enduit de plâtre de 1 cm sur la face exposée. Cloison en carreaux pleins de plâtre pur avec liaison au plâtre sans enduit, épaisseur 0.05 m. Cloison en carreaux creux de plâtre pur, épaisseur 0.07 m.	C. F. 2 h 15 mn	ΔT_m	27/232
MC. 7	91 503 C		C. F. 2 h 50 mn	ΔT_m	27/232
MC. 9	91 535 A		C. F. 2 h 40 mn	ΔT_m	27/232
MC. 11	91 552		C. F. 2 h 27 mn	ΔT_M	27/232
MC. 8	91 503 D	DEGRE 3 HEURES Cloison en carreaux de plâtre au mâche-fer avec liaison au plâtre et enduit de plâtre de 1 cm sur chaque face. Cloison en carreaux pleins de plâtre pur avec liaison au plâtre sans enduit, épaisseur 0.07 m.	C. F. 3 h 30 mn	ΔT_m	27/232
MC. 10	91 535 B		C. F. 3 h 30 mn	P	27/232

N° de référence	N° de l'essai	Description sommaire de l'élément essayé	Durée	Cause de la limitation	Référence aux descriptions plus détaillées
		MURS ET CLOISONS DEGRE 6 HEURES			
MC. 29	56 273 C	Mur en béton banché de pouzzolane de 0.20 m d'épaisseur, avec enduit de 0.015 m de plâtre et de 0.015 m de mortier bâtarde (face non exposée); 5 kg/cm ² .	C.F. 6 h 15 mn	S	30/252
MC. 37	56 273 B	Mur en parpaings creux de pouzzolane de 0.20 m d'épaisseur, avec deux enduits de 0.15 m respectivement au plâtre pur et au mortier bâtarde; charge 5 kg/cm ² .	C.F. 6 h 15 mn	S	30/252
MC. 78	57 400	Mur en parpaings creux de pouzzolane (0.5 x 0.25 x 0.20 m) rejointoyés au mortier bâtarde, avec enduits plâtre de 0.015 m (parement exposé) et mortier bâtarde de 0.15 m (parement non exposé), épaisseur totale 0.28 m; charge unitaire charge 5 kg/cm ² .	C.F. 6 h	S	43/341

N° de référence	N° de l'essai	Description sommaire de l'élément essayé	Durée	Cause de la limitation	Référence aux descriptions plus détaillées
Pt. 4	991 R. 004	PORTES (Pt) DEGRE 1/4 D'HEURE Porte menuisée à panneaux en sapin de 17 mm. Porte chêne de 35 mm tôle sur les deux faces (5/10 mm). Porte chêne de 35 mm tôle sur la face exposée (5/10 mm).	C. F. 15 mn	I	38/306
Pt. 6	57 506 E		C. F. 25 mn	I	38/306
Pt. 8	57 506 J		C. F. 28 mn		38/306
Pt. 5	57 506 D	DEGRE 1/2 HEURE Porte chêne de 35 mm nue. Porte chêne de 35 mm, tôle sur la face non exposée (5/10 mm). Porte spéciale de type anglais de 37 mm (placoplâtre).	C. F. 33 mn	I	38/306
Pt. 7	57 506 F		C. F. 29 mn	I	38/306
Pt. 9	57 506 G		C. F. 30 mn	I	38/306
Pt. 10	57 506 H	DEGRE 1 HEURE Porte spéciale de type anglais de 47 mm (placoplâtre et amiante).	C. F. 1 h 19 mn	I	38/306

N° de référence	N° de l'essai	Description sommaire de l'élément essayé	Durée	Cause de la limitation	Référence aux descriptions plus détaillées
		POTEAUX			
		DEGRE 1/2 HEURE			
Pu. 1	91 532	Poteau chêne 0.15 x 0.15 x 2.30 m, nu. Charge 10 tonnes.	S. F. 52 mn	A	43/341
Pu. 44	61 1091 D	Poteau sapin lamellé collé (à base de mélamine) 10 planches de 20 mm. Dimensions : 0.2 x 0.18 x 2.275 m, charge 18 tonnes.	S. F. 47 mn 30 s	A	52/415
Pu. 45	61 1091 E	Poteau sapin lamellé collé (à base d'urée-formol) 10 planches de 20 mm. Dimensions : 0.2 x 0.18 x 2.275 m, charge 18 tonnes.	S. F. 48 mn	A	52/415
Pu. 58	61 1210	Poteau en bois pin massif 18 x 20 cm longueur 2.275 m, charge 18 tonnes.	S. F. 57 mn	A	56/445
		DEGRE 1 HEURE			
Pu. 2	91 532	Poteau chêne 0.15 x 0.15 x 2.30 m, avec enduit plâtre de 0.01 m sur grillage; charge 10 tonnes.	S. F. 1 h 21 mn	A	43/341
Pu. 8	91 534	Poutrelle métallique HN de 100 mm, long. 2.30 m, avec enduit de plâtre de 0.01 m posé sur grillage, charge 10 tonnes.	S. F. 1 h 2 mn	A	43/341

N° de référence	N° de l'essai	Description sommaire de l'élément essayé	Durée	Cause de la limitation	Référence aux descriptions plus détaillées
		POTEAUX			
		DEGRE 1 HEURE 1/2			
Pu. 3	91 532	Poteau chêne 0.15 x 0.15 x 2.30 m, avec enduit plâtre de 0.02 m sur grillage, charge 10 tonnes.	S.F. 1 h 58 mn	A	43/341
Pu. 4	91 574	Poteau béton armé 0.15 x 0.15 x 2.30 m, sans enduit, charge 10 tonnes.	S.F. 1 h 48 mn	A	43/341
Pu. 9	91 534	Poutrelle métallique HN 100 mm, long. 2.30 m, avec enduit de plâtre de 0.02 m posé sur grillage, charge 10 tonnes.	S.F. 1 h 30 mn	A	43/341
Pu. 38	991 R. 076 D	Poteau en B.A., longueur 2.30 m, de 15 x 15 cm, avec 4 armatures principales ϕ 22 mm; recouvrement sur les fers: 3 cm; charge 26 tonnes.	S.F. 1 h 33 mn	A	49/390
		DEGRE 2 HEURES			
Pu. 5	91 574	Poteau béton armé 0.15 x 0.15 x 2.30 m, avec enduit plâtre de 0.01 m, sur grillage, charge 10 tonnes.	S.F. 2 h 47 mn	A	43/341
Pu. 31	991 R. 059	Poutrelle HN 100 mm, long. 2.30 m, protégée par un enduit de 0.02 m de plâtre posé sur grillage (âme vide), charge 26 tonnes.	S.F. 2 h 30 mn	A	43/341

N° de référence	N° de l'essai	Description sommaire de l'élément essayé	Durée	Cause de la limitation	Référence aux descriptions plus détaillées
		POTEAUX DEGRE 2 HEURES			
Pu. 36	991 R. 076 B	Poteau en B.A., longueur 2.30 m, de 20 x 20 cm, avec 4 armatures principales en fers de ϕ 12 mm; recouvrement sur les fers: 3 cm; charge 26 tonnes.	S. F. 2 h 24 mn	A	49/390
Pu. 37	991 R. 076 C	Poteau en B.A., longueur 2.30 m, de 18 x 20 cm, avec 4 armatures principales en fers de ϕ 14 mm; recouvrement sur les fers: 3 cm; charge 26 tonnes.	S. F. 2 h 10 mn	A	49/390
		DEGRE 3 HEURES			
Pu. 6	91 574	Poteau béton armé 0.15 x 0.15 x 2.30 m, avec enduit plâtre 0.02 m, sur grillage, charge 10 tonnes.	S. F. 3 h 18 mn	A	43/341
Pu. 35	991 R. 076 A	Poteau en B.A., longueur 2.30 m, de 22.5 x 22.5 cm, avec 4 armatures principales en fers ϕ 10 mm; recouvrement sur les fers: 3 cm; charge 26 tonnes.	S. F. 3 h 13 mn	A	49/390

N° de référence	N° de l'essai	Description sommaire de l'élément essayé	Durée	Cause de la limitation	Référence aux descriptions plus détaillées
Pr. 26 S	61 1168	PLANCHERS (Pr.) DEGRE 1/4 D'HEURE Plafond constitué par des caissons en métal déployé garni de laine de verre et suspendu à une charpente métallique en IPN de 200 mm; les classements (S) indiqués correspondent à un échauffement moyen des fers de la charpente égal à 300°C.	S. F. (S) 16 mn	ΔT_m	59/479
Pr. 27	61 1191 A	Elément de plafond placoplâtre, les panneaux de 10 mm d'épaisseur, habillés de papier kraft sur leurs deux faces, étant cloués sur des bastaings espacés de 0.50 m. DEGRE 1 HEURE	C. F. 16 mn 1/2	I	59/479
Pr. 20	993 R. 09	Plancher constitué par une dalle de 4 cm nervurée (hauteur totale au droit des poutrelles 25 cm) bacula avec enduit de plâtre de 1.5 cm. Portée libre: 4 m, charge totale 3 tonnes, appuis libres, sans contraintes latérales. DEGRE 2 HEURES	C. F. 1 h 20 mn	ΔT_M	50/397
Pr. 21	993 R. 99	Plancher en bois, d'un type traditionnel, avec hourdis en augets, constitués de débris de briques avec plâtre, et bacula revêtus de 15 mm de plâtre. Portée libre: 4 m, charge totale: 3 tonnes, appuis libres, sans contraintes latérales.	C. F. 2 h 8 mn	R	50/397

APPENDIX B

GENERAL SUMMARY OF FIRE RESISTANCE CLASSIFICATIONS

(English translation of Appendix A to this paper including some supplementary information taken from detailed test reports referred to in Appendix A.)

MEANING OF SYMBOLS

Elements of Construction

MC	Walls and Partitions
Hb	Ports (round windows)
Pt	Doors
Pu	Columns
Pr	Floors
Prt	Translucent Floors
Pe	Beams

Classification of Fire Resistance

SF	Structurally stable in fire
PFl	Barrier to flames
CF	Fire stop
NC	Not classifiable (fire resistance less than 15 min)

Supplementary Information

DS	Special test
C	Classification due to application of paint or protective covering on exterior surfaces of wall of door or frame

Criteria for terminating test

ΔT_M	Maximum temperature rise too high
ΔT_m	Average temperature rise too high
F	Deflection succeeding the critical value
I	Flaming on the non-exposed face or passage of flammable gases
P	Perforation of the element
A or E	Destruction or collapse
S	End of test at an agreed time. The element continuing to satisfy all the required conditions
R	Particular hazards requiring immediate termination of test: for example, serious danger of collapse.

APPENDIX B - 3

GENERAL SUMMARY OF FIRE RESISTANCE CLASSIFICATIONS

Ref. No.	Test No.	Brief Description of Test Assembly	Fire Endurance	Cause of Failure	Ref. to more Detailed Description
		WALLS AND PARTITIONS $\frac{1}{4}$-hr Fire Resistance Rating			
MC 15	91 590 B	Partition 1.5 m (4 ft 11 in.) by 2.0 m (6 ft 7 in.) by 0.05 m (2 in.) of fir boards 0.018 m (.70 in.) thick fastened to both sides of vertical wood framing members with glass wool and kraft paper between.	CF 19 min	D	27/232
MC 31	57 389	Solid partition 2.0 m (6 ft 7 in.) x 2.3 m (7 ft 6 in.) consisting of two layers of t and g fir with a sheet of asbestos between. Over-all thickness 0.043 m (1.7 in.).	CF 21 min	I	30/252
MC 68	56 223 G	Partition 2.0 m (6 ft 7 in.) by 2.3 m (7 ft 6 in.) by 0.06 m (2.35 in.) thick consisting of one layer of gypsum wallboard 0.01 m (.39 in.) thick fastened to each side of a wood frame, studs 0.04 m (1.57 in.) by 0.04 m (1.57 in.) at 0.40 m (15.7 in.) apart.	CF 29 min	-	43/341
MC 109	61 1192 B	Partition 2.0 m (6 ft 7 in.) by 2.3 m (7 ft 6 in.) by 0.05 m (2 in.) thick consisting of two layers of gypsum wallboard 0.01 m (.39 in.) thick with a cardboard egg crate type of framing between. A vertical joint in the centre of the specimen was formed around a wood spline and the wallboard joints were taped and filled.	CF 25 min	I	56/445

Ref. No.	Test No.	Brief Description of Test Assembly	Fire Endurance	Cause of Failure	Ref. to more Detailed Description
MC 1	91 524 A	WALLS AND PARTITIONS $\frac{1}{2}$ -hr Fire Resistance Rating Partition 2.0 m (6 ft 7 in.) by 2.0 m (6 ft 7 in.) by 0.05 m (2 in.) thick of clay tile* without plaster finish.	CF 30 min	ΔT_m	27/232
MC 32	57 388	Partition 2.0 m (6 ft 7 in.) by 2.4 m (7 ft 10 $\frac{1}{2}$ in.) by 0.142 m (5.59) thick of wood studs. 0.102 m (4 in.) by 0.05 m (2 in.) with gypsum wallboard 0.02 m (.79 in.) on both sides. Over-all thickness 0.142 m (5.59 in.).	CF 57 min	P	30/252
MC 43	57 362	Panel 1.2 m (3 ft 11 in.) by 1.2 m (3 ft 11 in.) by 0.006 m (.24 in.) of wired glass in a metal frame.	PF1 50 min	P	32/265
MC 46	57 365	Panel 1.2 m (3 ft 11 in.) by 1.2 m (3 ft 11 in.) of two sheets of wired glass 0.006 m (.24 in.) thick mounted 0.03 mm (1.18 in.) apart in an oak frame with mastic bedding for the glass.	PF1 50 min	P	32/265
MC 108	61 1192 A	Partition 2.0 m (6 ft 7 in.) by 2.3 m (7 ft 6 in.) by 0.064 m (2.71 in.) thick consisting of two layers of gypsum wallboard 0.013 m (.52 in.) thick with a cardboard egg crate type of framing between. A vertical joint in the centre of the specimen was formed around a wood spline and the joints in the wallboard were taped and finished.	CF 40 min	I	56/445

* more literally "plastering brick"

Ref. No.	Test No.	Brief Description of Test Assembly	Fire Endurance	Cause of Failure	Ref. to more Detailed Description
WALLS AND PARTITIONS					
1-hr Fire Resistance Rating					
MC 2	91 224 B	Partition 2.0 m (6 ft 7 in.) by 2.0 m (6 ft 7 in.) by 0.06 m (2.36 in.) thick consisting of clay tile 0.05 m (2 in.) thick with gypsum plaster 0.01 m (.39 in.) on the side exposed to the fire.	CF 1 hr 12 min	ΔT_m	27/232
MC 4	91 553	Partition 2.0 m (6 ft 7 in.) by 2.3 m (7 ft 6 in.) by 0.06 m (2.36 in.) thick consisting of clay tile 0.05 m (2 in.) thick with gypsum plaster 0.005 m (0.2 in.) thick on each side.	CF 1 hr 20 min	ΔT_m	27/232
MC 44	57 364	Panel 1.2 m (3 ft 11 in.) by 1.2 m (3 ft 11 in.) by 0.006 m (.24 in.) thick of wired glass mounted in an oak frame with mastic bedding for the glass.	PF1 1 hr 2 min	P	32/265
MC 45	57 363	Panel 1.2 m (3 ft 11 in.) by 1.2 m (3 ft 11 in.) of two sheets of wired glass 0.006 m (.24 in.) thick mounted 0.03 m (1.18 in.) apart in a metal frame.	PF1 1 hr 10 min	P	32/265

Ref. No.	Test No.	Brief Description of Test Assembly	Fire Endurance	Cause of Failure	Ref. to more Detailed Description
MC 94	60 910 A	WALLS AND PARTITIONS 1-hr Fire Resistance Rating Panel 1.0 m (3 ft 3½ in.) by 1.2 m (3 ft 11 in.) by 0.007 m (.28 in.) thick of wired glass mounted in an oak frame. Wires 8/10 mm diam. in 1-in. squares.	PFI 1 hr 21 min	A	49/390
MC 95	60 910 B	Panel 1.0 m (3 ft 3½ in.) by 1.2 m (3 ft 11 in.) by 0.0055 m (0.22 in.) thick of wired glass mounted in an oak frame. Wires 6/10 mm diam. in 1-in. squares.	PFI 1 hr 2 min	A	49/390
MC 127	991 R 130	Panel 1.0 m (3 ft 3½ in.) by 1.2 m (3 ft 11 in.) by 0.0055 m (0.22 in.) thick of wired glass mounted in concrete recess between two strips of asbestos and held in place by sheet steel cover pieces. Wires 6/10 mm diam. arranged in 1-in. squares.	PFI 1 hr 16 min	A	59/479

Ref. No.	Test No.	Brief Description of Test Assembly	Fire Endurance	Cause of Failure	Ref. to more Detailed Description
MC 3	91 524 C	WALLS AND PARTITIONS 1½-hr Fire Resistance Rating Partition 2.0 m (6 ft 7 in.) by 2 ft. 0 m (6 ft 7 in.) by 0.07 m (2.80 in.) of clay tile* 0.05 m (2 in.) thick with gypsum plaster 0.01 m (0.39 in.) on each face.	CF 1 hr 45 min	ΔT _m	27/232
MC 5	91 503 A	Partition 2 m (6 ft 7 in.) by 2 m (6 ft 7 in.) by 0.06 m (2.35 in.) thick of gypsum slag blocks set in gypsum mortar no plaster finish.	CF 1 hr 35 min	P	27/232
MC 96	60 910 C	Panel 1 m (3 ft 3½ in.) by 1.2 m (3 ft 11 in.) by 0.0055 m (0.22 in.) of wired glass set in concrete between two strips of asbestos 0.003 m thick (0.12 in.) and held in place by metal cover pieces. Wire in glass 6/10 mm diam. arranged in ½ in. squares.	PF1 1 hr 52 min	A	49/390
MC 117	61 1151	Panel 1 m (3 ft 3½ in.) by 1.2 m (3 ft 11 in.) by 0.007 m (0.28 in.) thick of ground and polished wired glass set in concrete with two strips of asbestos 0.003 m (0.12 in.) thick and held in place by metal cover pieces. Wire 5/10 mm diam. arranged in ½ in. squares. * more literally "plastering brick"	PF1 1 hr 48 min	A	56/445

Ref. No.	Test No.	Brief Description of Test Assembly	Fire Endurance	Cause of Failure	Ref. to more Detailed Description
MC 6	91 503 B	WALLS AND PARTITIONS 2-hr Fire Resistance Rating Partition 2 m (6 ft 7 in.) by 2 m (6 ft 7 in.) by 0.06 m (2.35 in.) thick of gypsum slag blocks smooth on both faces laid in gypsum mortar. No plaster finish.	CF 2 hr 15 min	ΔT_m	27/232
MC 7	91 503 C	Partition 2 m (6 ft 7 in.) by 2 m (6 ft 7 in.) by 0.07 m (2.8 in.) thick, of gypsum slag blocks 0.06 m (2.35 in.) thick laid in gypsum mortar with gypsum sand plaster finish 0.01 m (0.39 in.) thick on the side exposed to fire.	CF 2 hr 50 min	ΔT_m	27/232
MC 9	91 535 A	Partition 2 m (6 ft 7 in.) by 2 m (6 ft 7 in.) by 0.05 m (2 in.) thick of solid blocks of pure gypsum laid in gypsum mortar. No plaster finish.	CF 2 hr 40 min	ΔT_m	27/232
MC 11	91 552	Partition 2 m (6 ft 7 in.) by 2 m (6 ft 7 in.) by 0.07 m (2.8 in.) thick of blocks of pure gypsum laid in gypsum mortar. No plaster finish.	CF 2 hr 27 min	ΔT_m	27/232
MC 8	91 503 D	3-hr Fire Resistance Rating Partition 2 m (6 ft 7 in.) by 2 m (6 ft 7 in.) by 0.08 m (3.15 in.) thick of solid gypsum slag blocks 0.06 m (2.35 in.) thick set in gypsum mortar and finished on each side with 0.01 m (0.39 in.) thick gypsum sand plaster.	CF 3 hr 30 min	ΔT_m	27/232

Ref. No.	Test No.	Brief Description of Test Assembly	Fire Endurance	Cause of Failure	Ref. to more Detailed Description
MC 10	91 535 B	WALLS AND PARTITIONS 3-hr Fire Resistance Rating Partition 2 m (6 ft 7 in.) by 2.3 m (7 ft 6 in.) by 0.07 m (2.8 in.) thick of solid blocks of pure gypsum set in gypsum mortar. No plaster finish.	CF 3 hr 30 min	P	27/232
MC 29	56 273 C	6-hr Fire Resistance Rating Wall 2 m (6 ft 7 in.) by 2.3 m (7 ft 6 in.) by 0.23 m (9.0 in.) thick of a slab of pozzolana* concrete 0.2 m (7.9 in.) thick with a finish of gypsum sand plaster 0.015 m (0.59 in.) thick on the fire exposed side and lime cement mortar 0.015 m (0.59 in.) thick on the unexposed side. Load 5 kg/cm² (71 lb/sq in.).	CF 6 hr 15 min	S	30/252
MC 37	56 273 B	Wall 2 m (6 ft 7 in.) by 2.3 m (7 ft 6 in.) by 0.23 m (9 in.) thick of hollow blocks of pozzolana concrete (45 per cent solid equiv. thickness 3.6 in.) 0.2 m (7.9 in.) thick with finish of pure gypsum plaster 0.015 (0.59 in.) thick on the fire exposed side and lime cement mortar 0.015 m (0.59 in.) thick on the non-fire exposed side. Load 5 kg/cm² (71 lb/sq in.). * a lightweight aggregate composed of volcanic ash or tuff	CF 6 hr 15 min	S	30/252

Ref. No.	Test No.	Brief Description of Test Assembly	Fire Endurance	Cause of Failure	Ref. to more Detailed Description
MC 78	57 400	WALLS AND PARTITIONS 6-hr Fire Resistance Rating Wall 2 m (6 ft 7 in.) by 2.3 m (7 ft 6 in.) by 0.28 m (10 in.) thick of hollow blocks of pozzolana concrete 0.25 m (9.8 in.) thick (44 per cent solid equiv. thickness 4.32 in.) with finish of gypsum plaster 0.015 m (0.59 in.) thick on the fire exposed side and lime cement mortar 0.015 m (0.59 in.) thick on the unexposed side. Load 5 kg/cm ² (71 lb/sq in.).	CF 6 hr	S	43/341
		DOORS $\frac{1}{4}$ -hr Fire Resistance Rating Fir panelled door 1.85 m (6 ft 8 in.) by 0.65 m (2 ft 1½ in.). Styles 0.034 m (1.34 in.) thick panel 0.017 m (0.67 in.) thick in fir frame. Solid oak door. 1.85 m (6 ft 8 in.) by 0.8 m (2 ft 7½ in.) by 0.035 m (1.38 in.) thick built up of vertical t and g strips with steel sheet 5/10 mm on both faces. Door hung in oak frame.	CF 15 min	I	38/306
Pt 4	991 R 004	Solid oak door. 1.85 m (6 ft 8 in.) by 0.80 m (2 ft 7½ in.) by 0.035 m (1.38 in.) thick built up of vertical t and g strips with 5/10 mm steel sheet on side exposed to fire only. Door hung in oak frame.	CF 25 min	I	38/306
Pt 6	57 506 E				
Pt 8	57 506 J		CF 28 min	I	38/306

Ref. No.	Test No.	Brief Description of Test Assembly	Fire Endurance	Cause of Failure	Ref. to more Detailed Description
		DOORS			
Pt 5	57 506 D	$\frac{1}{2}$ -hr Fire Resistance Rating Solid oak door. 1.85 m (6 ft 8 in.) by 0.8 m (2 ft 7 $\frac{1}{2}$ in.) by 0.035 m (1.38 in.) thick built up of vertical t and g strips without steel sheet. In oak frame.	CF 33 min	I	38/306
Pt 7	57 506 F	Solid oak door. 1.85 m (6 ft 8 in.) by 0.8 m (2 ft 7 $\frac{1}{2}$ in.) by 0.035 m (1.38 in.) thick built up of vertical t and g strips with 5/10 mm steel sheet on non-fire exposed side only. In oak frame.	CF 29 min	I	38/306
Pt 9	57 506 G	Special English type* of door. 1.85 m (6 ft 8 in.) by 0.8 m (2 ft 7 $\frac{1}{2}$ in.) by 0.037 m (1.46 in.) thick with oak rails in centre and 0.01 m (0.39 in.) gypsum wallboard and 0.005 m (0.19 in.) plywood on each side. Door set in oak frame.	CF 30 min	I	38/308
Pt 10	57 506 H	Special English type* of door. 1.85 m (6 ft 8 in.) by 0.8 m (2 ft 7 $\frac{1}{2}$ in.) by 0.047 m (1.85 in.) thick with oak rails in centre and 0.01 m (0.39 in.) gypsum wallboard, 0.005 m (0.19 in.) asbestos and 0.005 m (0.39 in.) plywood on each side. Door set in oak frame.	CF 1 hr 19 min	I	38/306
* Described in "Fire Check Flush Doors and Frames," British Standard 459, Part 3, 1951					

Ref. No.	Test No.	Brief Description of Test Assembly	Fire Endurance	Cause of Failure	Ref. to more Detailed Description
COLUMNS					
Pu 1	91 532	$\frac{1}{2}$ -hr Fire Resistance Rating Oak column, 0.15 m (5.9 in.) by 0.15 m (5.9 in.) by 2.3 m (7 ft 6 in.). Load 10 tonnes (11 tons).	SF 52 min	A	43/341
Pu 44	61 1091 D	Glued laminated fir column (melamine base) 0.2 m (7.87 in.) by 0.18 m (7.09 in.) by 2.275 m (7 ft 5½ in.) 10 sections 0.02 m (0.78 in.) thick. Load 18 tonnes (19.8 tons).	SF 47.30 min	A	52/415
Pu 45	61 1091 E	Glued laminated fir column (urea formaldehyde base) 0.2 m (7.87 in.) by 0.18 m (7.09 in.) by 2.275 m (7 ft 5½ in.) 10 sections 0.02 m (0.78 in.) thick. Load 18 tonnes (19.8 tons).	SF 48 min	A	52/415
Pu 58	61 1210	Column of solid pine 0.18 m (7.09 in.) by 0.2 m (7.87 in.) by 2.275 m (7 ft 5½ in.). Load 18 tonnes (19.8 tons).	SF 57 min	A	56/445
1-hr Fire Resistance Rating					
Pu 2	91 532	Oak column, 0.15 m (5.9 in.) by 0.15 m (5.9 in.) by 2.3 m (7 ft 6 in.) with gypsum sand plaster 0.01 m (0.39 in.) thick on wire mesh. Load 10 tonnes (11 tons).	SF 1 hr 21 min	A	43/341
Pu 8	91 534	Column of rolled steel section 0.1 m (3.9 in.) by 2.3 m (7 ft 6 in.) with gypsum sand plaster 0.01 m (0.39 in.) on ceramic metal lath. Load 10 tonnes (11 tons).	SF 1 hr 4 min	A	43/341

Ref. No.	Test No.	Brief Description of Test Assembly	Fire Endurance	Cause of Failure	Ref. to more Detailed Description
		COLUMNS			
		1½-hr Fire Resistance Rating			
Pu 3	91 532	Oak column 0.15 m (5.9 in.) by 0.15 m (5.9 in.) by 2.3 m (7 ft 6 in.) with gypsum sand plaster 0.02 m (0.79 in.) thick on wire mesh. Load 10 tonnes (11 tons).	SF 1 hr 58 min	A	43/341
Pu 4	91 574	Reinforced concrete column. 0.15 m (5.9 in.) by 0.15 m (5.9 in.) by 2.3 m (7 ft 6 in.).	SF 1 hr 48 min	A	43/341
Pu 9	91 534	Column of rolled steel section. 0.1 m (3.9 in.) by 2.3 m (7 ft 6 in.) with gypsum sand plaster 0.02 m (0.79 in.) on ceramic metal lath. Load 10 tonnes (11 tons).	SF 1 hr 30 min	A	43/341
Pu 38	991 R 076 D	Reinforced concrete column 0.15 m (5.9 in.) by 0.15 m (5.9 in.) by 2.3 m (7 ft 6 in.) with 4 rods 0.022 m (0.87 in.) diam. principal reinforcement cover to steel 0.03 m (1.2 in.). Load 26 tonnes (28.6 tons).	SF 1 hr 33 min	A	49/390
		2-hr Fire Resistance Rating			
Pu 5	91 574	Reinforced concrete column 0.15 m (5.9 in.) by 0.15 m (5.9 in.) by 2.3 m (7 ft 6 in.) with gypsum sand plaster 0.01 m (0.39 in.) on wire mesh finish. Load 10 tonnes (11 tons).	SF 2 hr 47 min	A	43/341

Ref. No.	Test No.	Brief Description of Test Assembly	Fire Endurance	Cause of Failure	Ref. to more Detailed Description
		COLUMNS			
		2-hr Fire Resistance Rating			
Pu 31	991 R 059	Column of rolled steel section 0.1 m (3.9 in.) by 2.3 m (7 ft 6 in.) protected by gypsum sand plaster 0.02 m (0.79 in.) thick on ceramic metal lath. Re-entrant spaces in column hollow. Load 26 tonnes (28.6 tons).	SF 2 hr 30 min	A	43/341
Pu 36	991 R 076 B	Reinforced concrete column. 0.2 m (7.9 in.) by 0.2 m (7.9 in.) by 2.3 m (7 ft 6 in.) with 4 rods 0.012 m (0.47 in.) diam. principal reinforcement. Cover to steel 0.03 m (1.18 in.). Load 26 tonnes (28.6 tons).	SF 2 hr 24 min	A	49/390
Pu 37	991 R 076 C	Reinforced concrete column. 0.18 m (7.09 in.) by 0.2 m (7.9 in.) by 2.3 m (7 ft 6 in.) with 4 steel rods. 0.014 m (0.55 in.) diam. principal reinforcement. Cover to steel 0.03 m (1.18 in.). Load 26 tonnes (28.6 tons).	SF 2 hr 10 min	A	49/390
Pu 6	91 574	Reinforced concrete column. 0.15 m (5.9 in.) by 0.15 m (5.9 in.) by 2.3 m (7 ft 6 in.) with gypsum sand plaster. 0.02 m (0.79 in.) thick on wire mesh protection. Load 10 tonnes (11 tons).	SF 3 hr 18 min	A	43/341
Pu 35	991 R 076 A	Reinforced concrete column 0.225 m (8.86 in.) by 0.225 m (8.86 in.) by 2.3 m (7 ft 6 in.) with 4 steel rods. 0.01 m (0.39 in.) diam. Cover to steel 0.03 m (1.18 in.). Load 10 tonnes (11 tons).	SF 3 hr 13 min	A	49/390

Ref. No.	Test No.	Brief Description of Test Assembly	Fire Endurance	Cause of Failure	Ref. to more Detailed Description
Pr 26 S	61 1168	FLOORS AND CEILINGS $\frac{1}{4}$-hr Fire Resistance Rating Ceiling consisting of pressed metal pans filled with glass wool fastened to a metal framework of channels 0.01 m (0.39 in.) by 0.025 m (0.98 in.) and I sections 0.025 m (0.98 in.) by 0.025 m (0.98 in.). The classification shown relates to an average temperature rise in the steel framing of 300C°. The ceiling 3.1 m (10 ft 2 in.) by 4.1 m (13 ft 5 in.) was suspended from 200 mm (8 in.) I beams.	SF(S) 16 min	ΔT_m	59/479
Pr 27	61 1191 A	Ceiling of gypsum wallboard. 0.01 m (0.39 in.) thick covered with kraft paper on both faces nailed to wood joists at 0.53 m (19.7 in.) centres by galvanized nails. 0.03 m (1.2 in.) at 0.15 m (5.9 in.) spacing. Joints taped. Failure by passage of flames at joints.	CF 16½ min	I	59/479
Pr 20	993 R 99	1-hr Fire Resistance Rating Ribbed concrete floor 2.9 m (9 ft 6 in.) by 4.3 m (14 ft 1 in.) having a floor slab 0.04 m (1.57 in.) thick on beams 0.19 m (7.5 in.) deep by 0.12 m (4.7 in.) wide at 0.7 m (27.5 in.) on centres, with ceiling of gypsum sand plaster 0.015 m (0.59 in.) thick on metal lath. Free span 4 m (13 ft 1½ in.). Load 3 tonnes (3.3 tons). No lateral restraint.	CF 1 hr 20 min	ΔT_m	50/397

Ref. No.	Test No.	Brief Description of Test Assembly	Fire Endurance	Cause of Failure	Ref. to more Detailed Description
Pr 21	993 R 99	FLOORS AND CEILINGS 2-hr Fire Resistance Rating Wood joist floor 2.9 m (9 ft 6 in.) by 4.3 m (14 ft 1 in.) with fir joists 0.08 m (3.15 in.) by 0.23 m (9.1 in.) at 0.33 m (13 in.) on centres. Ceiling of 0.015 m (0.59 in.) gypsum sand plaster on metal lath nailed to joists. Joist spaces filled with about 3 in. of gypsum and crushed brick mortar. Wood deck floor 0.022 m (0.87 in.) thick covered with 0.03 m (1.18 in.) gypsum sand plaster wood strips 0.06 m (2.36 in.) by 0.04 m (1.57 in.) and finish flooring 0.022 m (0.87 in.). Free span 4 m (13 ft 1½ in.). Load 3 tonnes (3.3 tons). No lateral restraint.	CF 5 hr 31 min	F	50/397