REQUIREMENTS OF COMPARTMENTATION: FIRE RESISTANCE
A SYSTEM APPROACH TO SIGN OFF AND SAFETY
Internal fire spread – Linings

34. To inhibit the spread of fire within a building the internal linings shall—
   (a) offer adequate resistance to the spread of flame over their surfaces; and
   (b) where they are located in a circulation space, have a low rate of heat release or a low
       rate of fire growth when ignited.

Internal fire spread – Structure

35.—(1) A building shall be so designed and constructed that, in the event of a fire, its stability
       will be retained for a reasonable period.

   (2) A wall common to two or more buildings shall be so designed and constructed that it
       provides adequate resistance to the spread of fire between those buildings and for the purposes
       of this paragraph a dwellinghouse in a terrace and a semi-detached dwellinghouse shall be
       considered as a separate building.

   (3) To inhibit the spread of fire within it, a building shall be adequately sub-divided with fire-
       resisting construction.

   (4) A building shall be so designed and constructed that the spread of fire (and in particular
       smoke) within concealed spaces in its structure and fabric is adequately inhibited.
## Table 4.1 Specific provisions of test for fire resistance of elements of structure and other components of a building

<table>
<thead>
<tr>
<th>Part of building</th>
<th>Loadbearing capacity(^{(1)})</th>
<th>Integrity</th>
<th>Insulation</th>
<th>Method of exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Structural frame, beam or column</td>
<td>See Table 4.2</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>R see Table 4.2</td>
</tr>
<tr>
<td>2 Loadbearing wall (which is not also a wall described in any of the following items)</td>
<td>See Table 4.2</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>R see Table 4.2</td>
</tr>
<tr>
<td>3 Floors –</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) in upper storey of two storey dwellinghouse (but not over a garage)</td>
<td>30(^{(2)})</td>
<td>15(^{(2)})</td>
<td>15(^{(2)})</td>
<td>From underside</td>
</tr>
<tr>
<td>(b) between a shop and flat above</td>
<td>60 or see Table 4.2 ( whichever is greater)</td>
<td>60 or see Table 4.2 ( whichever is greater)</td>
<td>60 or see Table 4.2 ( whichever is greater)</td>
<td>REI 60 or see Table 4.2 ( whichever is greater)</td>
</tr>
<tr>
<td>(c) any other floor</td>
<td>See Table 4.2</td>
<td>See Table 4.2</td>
<td>See Table 4.2</td>
<td>REI see Table 4.2</td>
</tr>
</tbody>
</table>
# Building Regulations

## Table 4.2: Minimum periods of fire resistance

<table>
<thead>
<tr>
<th>Purpose group of building</th>
<th>Basement storey* including floor over</th>
<th>Ground or upper storey</th>
<th>Depth (m) of basement</th>
<th>Height (m) of top floor above ground in building or separated part of building(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>More than 10</td>
<td>Not more than 10</td>
<td>More than 5</td>
<td>More than 5 not more than 18</td>
</tr>
<tr>
<td>Residential (dwellings)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Flats</td>
<td>90</td>
<td>60</td>
<td>30</td>
<td>Not more than 5</td>
</tr>
<tr>
<td>(b) and (c) dwellinghouses</td>
<td>Not relevant</td>
<td>30</td>
<td>60**(2)**</td>
<td>60**(2)**</td>
</tr>
<tr>
<td>2 Residential</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Institutional</td>
<td>90</td>
<td>60</td>
<td>30**</td>
<td>60**(2)**</td>
</tr>
<tr>
<td>(b) Other residential</td>
<td>90</td>
<td>60</td>
<td>30**</td>
<td>90**(2)</td>
</tr>
<tr>
<td>3 Office</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>not sprinklered</td>
<td>90</td>
<td>60</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>sprinklered(3)</td>
<td>60</td>
<td>60</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>4 Shop and commercial</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>not sprinklered</td>
<td>90</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>sprinklered(3)</td>
<td>60</td>
<td>60</td>
<td>30</td>
<td>60</td>
</tr>
</tbody>
</table>
PLASTERBOARDS IN BUILDINGS
Extensive use for internal fit outs

Wall Linings & Partitions

Floors & Ceilings

1. Spread of fire within a building
2. Compartmentation
3. External fire spread
Gypsum plasters and boards provide good fire protection in buildings due to the unique behaviour of gypsum when exposed to fire.

Pure gypsum (CaSO\(_4\)2H\(_2\)O)

- 21% chemically combined water (2H\(_2\)O)
- 79% calcium sulphate (CaSO\(_4\))
- Inert below a temperature of 1200\(^\circ\)C.

When exposed to fire, the chemically combined water absorbs the heat and is gradually released in the form of moisture vapour.
The process of dehydrating gypsum by heat is known as ‘calcination’. This commences at the surface exposed to the fire and proceeds gradually through the gypsum layer.

Calcined gypsum formed on the exposed faces serves to retard the calcination process.

Calcination becomes progressively slower as the thickness of the calcined material increases.
REATION TO FIRE

The Construction Products Regulation (CPR), has harmonised Reaction to Fire standards with the **Euroclass system**.

All CE marked Gyproc plasterboards are now rated against this standard.

<table>
<thead>
<tr>
<th>National classification</th>
<th>Category</th>
<th>Safety level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-combustible</td>
<td>A1</td>
<td>Paperless faced plasterboards</td>
</tr>
<tr>
<td>Material of limited combustibility</td>
<td>A2</td>
<td>Paper lined plasterboards</td>
</tr>
<tr>
<td>Class 0</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Class 3</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F</td>
<td></td>
</tr>
</tbody>
</table>

*decreasing fire safety*
PLASTERBOARDS

Gyproc WallBoard
Gyproc FireLine
Gyproc SoundBloc
Gyproc Moisture Resistant
Gyproc CoreBoard
Glasroc H TILEBACKER
Glasroc F FIRECASE
Rigidur

Manufactured in accordance with EN520

No plasterboard by itself offers a fire resistance

PLASTERBOARDS

30 mins
60 mins
90 mins

Thicknesses
- 6mm
- 9.5mm
- 12.5mm
- 15mm
- 19mm
FLAMES & HEAT

FIRE INTEGRITY
FIRE INSULATION
LOADBEARING

Compartmentation: Fire Resistance
Fire resistance testing
Testing the full system

Undertaken in accredited laboratories

Photo 1. View of the unexposed face at 30 minutes.
### Table 4.1 Specific provisions of test for fire resistance of elements of structure and other components of a building

<table>
<thead>
<tr>
<th>Part of building</th>
<th>Loadbearing capacity(^{(1)})</th>
<th>Integrity</th>
<th>Insulation</th>
<th>Minimum provisions when tested to the relevant part of BS 476 (minutes)(^{(11)})</th>
<th>Minimum provisions when tested to the relevant European standard (minutes)(^{(10)(11)})</th>
<th>Method of exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Structural frame, beam or column</td>
<td>See Table 4.2</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>R see Table 4.2</td>
<td>Exposed faces</td>
<td></td>
</tr>
<tr>
<td>2 Loadbearing wall (which is not also a wall described in any of the following items)</td>
<td>See Table 4.2</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>R see Table 4.2</td>
<td>Each side separately</td>
<td></td>
</tr>
<tr>
<td>3 Floors –</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) in upper storey of two storey dwellinghouse (but not over a garage)</td>
<td>30(^{(2)})</td>
<td>15(^{(2)})</td>
<td>15(^{(2)})</td>
<td>REI 30(^{(7)})</td>
<td>From underside</td>
<td></td>
</tr>
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<td>(b) between a shop and flat above</td>
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<td>See Table 4.2</td>
<td>REI see Table 4.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Two systems co-existing within current regulation documents

Both standards require minimum levels of performance in……

**Loadbearing**

- **performance**
- (R) – to maintain levels of structural

**Fire integrity**

- **gases**
- (E) – to prevent the spread of flame & hot

**Fire insulation**

- (I) – to prevent the spread of excessive heat

**BSi**

- EN 1364-1: 2015 - Non-loadbearing walls (1999)
- EN 1364-2: 1999 - Non-loadbearing ceilings
- EN 1365-1: 2012 - Loadbearing walls (1999)
EN Fire resistance testing

Key differences in testing to BS

Severity of testing & application

- EN fire testing methodology sets out to eliminate variances in furnace severity
  - Fuel sources
  - Furnace geometry

- Use of plate thermometers to measure the heat flux

- More onerous conditions in early stages of a test.

- Stricter ‘Field of Application’ rules
  - Hot state heights
COMPARISON OF TEST RESULTS
EN vs BS achievements

60 minute systems

Report Number BTC 12637F

Report Number BTC 11831F
A FIRE RESISTANCE TEST, ON A GYPROC GYPWALL PARTITION INCORPORATING GYPFRAME 48550 METAL STUDS CLAD WITH A SINGLE LAYER OF 15mm GYPROC FIRELINE BOARD, CONDUCTED IN ACCORDANCE WITH BS EN 1364-1: 1999.

<table>
<thead>
<tr>
<th>Integrity</th>
<th>113 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation</td>
<td>69 minutes</td>
</tr>
</tbody>
</table>

| Integrity - Sustained flaming. | 68 minutes |
| Integrity - 25mm diameter gap gauge. | 67 minutes |
| Integrity - 6mm x 150mm gap gauge. | 65 minutes |
| Integrity - Cotton pad. | 63 minutes |
| Insulation          | 60 minutes  |

What would the impact if each system tested 1 minute less?
60 mins (BS) vs 30 mins (EN)
SYSTEM BASED SOLUTIONS

PLASTERBOARDS

+ FRAMING

+ FIXINGS

+ FINISHING

} Certification

+ Installation

+ Detailing
SYSTEM BASED SOLUTIONS

FIXING PLASTERBOARDS

CORRECT SCREW TYPE TO SUIT FRAMING

[Minimum penetration]

- 10mm Metal
- 25mm Timber

[Maximum centres]

- 300mm (200mm at external corners)
- Correspond with vertical studs (all layers)
- Around perimeter of each board (outer layers only)
BASIC REQUIREMENTS

INSTALLING PLASTERBOARDS

STAGGERING OF BOARD JOINTS
- Vertical joints on either side of partition
- Between layers on same side

BACKING OF INTERMEDIATE JOINTS
- Vertical alignment on studs
- Horizontal backing (outer layer)
  - Timber noggings
  - GFS1 Flat Strap

**No remedial fix**
BACKING JOINTS WITH FIXING STRAP
BASIC REQUIREMENTS

TAPING & JOINTING

REQUIRED FOR FIRE RESISTANCE SUBSTANTIATION OF ALL SYSTEMS

• All outer layer vertical and horizontal joints
• Gyproc Paper Joint Tape
• Suitable Gyproc Joint Filler
TAPE & JOINTING
FRAMING AROUND OPENINGS

FLOOR & CEILING CHANNELS REQUIRED TO SPAN OPENING DISTANCE

- Internal lining of the opening (recommended)
- Line opening with the same specification of plasterboard as on face linings
- Ensures fire integrity of system is maintained regardless of additional insulation specification
SERVICE OPENINGS
FIRE STOPPING OPENINGS
DEFLECTION HEAD DETAILING
REQUIRED TO ACCOMMODATE STRUCTURAL MOVEMENT

4 key principles

- Introduction of dropped soffit section
- Inclusion of Gyproc FireStrip
- Use of DC (Deep) or EDC (Extra Deep) Channels
- Components cut short to accommodate movement
DEFLETION HEADS

PERMISSIBLE DROPPED SOFFIT MATERIALS

Maximum 2 layers

- FireLine
- DuraLine
- CoreBoard
- MultiBoard
- FireCase F
- Timber (minimum depth dimensions 38mm)

Up to 60 minutes only except for 146mm stud systems
INSTALLATION

Dropped soffit materials

- Approx. 5mm deeper than deflection requirement
- Inclusion of secondary section of Gyproc FireStrip if boards finish level
- Best practice – Overlap between boards and dropped soffit
DEFLECTION HEADS
DEFLECTION HEADS

INCREASED FIRE RESISTANCES

Up to 60 minute requirements without additional material

90 minutes + require additional insulation and support

- Insulation – Stone mineral wool (minimum 33kg/m^3)
- Support provided by Stud or Channel nogging

Eliminates requirement for GFS1 Flat Strap
CONTROL JOINT DETAILS

- Coincide with structural movement joints
- Long and continuous partitions
SOCKET BOX DETAILS

DETAILING UP TO 60 MINUTES

- No requirement for additional insulation
- Plasterboard cut neat around opening
- Metal backed box to engage with back of plasterboard (5mm minimum recommended)
- Stud nogging or timber to support socket box
- Gyproc Sealant applied around perimeter
SOCKET BOX DETAILS

Compartmentation: Fire Resistance
SOCKET BOX DETAILS

DETAILING OVER 60 MINUTES

Fire stopping insulation required

GypWall Classic
METAL SOCKET BOX INSTALLATION
Suitable for situations over 60 minutes but not exceeding 120 minutes fire resistance.
RECESSED SKIRTING

REMOVAL OF LAYER OF PLASTERBOARD WILL AFFECT SYSTEMS FIRE RESISTANCE

Options

• Use of sacrificial layer
• Upgrade inner layer of plasterboard
• Use of fire stopping by others
SHAFTWALL

SYSTEM REQUIREMENTS

System installed entirely from one side only

- Offers fire resistance in both directions (not symmetrical)

‘I’ Studs at 600mm centres

‘J’ or EDC Channels should be used at head

Retaining channels continuous
HEAD DETAILING

Standard details include allowance for 15mm downwards deflection

Additional fire-stops inside the channels required
HORIZONTAL JOINTS IN COREBOARD

CoreBoard sections required to back horizontal joints

Gypframe GA3 Angle to provide grounds for screw fixings

Gypframe Sealant to bond and seal CoreBoard patress section.
SHAFTWALL

FRAMED OPENINGS

Require additional CoreBoard inside adjacent framing
Trapped within sleeved Floor & Ceiling Channel
Not required if facing boards returned around edges
Allowable variances

Test evidence as the reference test

Fire test rules allow certain changes to be made in the field of application

- Increasing the stud size
- Increasing the thickness of components
- Decreasing the stud centres
- Decreasing the fixing centres
- Increasing the number of vertical joints of the type tested
- Increasing the number of horizontal joints of the type tested
FIRE AND STRUCTURAL STEEL

BEHAVIOUR OF STEEL IN FIRE
- Steel lose strength at temperatures above 300°C
- Steel melts at about 1500°C
- Loaded steel will lose its design margin of safety at approximately 550°C
- Virtually all structural steel fire protection is designed to the 550°C limiting temperature threshold

STRUCTURAL STEEL SECTION FACTORS
- Structural steel available in many profiles and weights
- The relationship (A) divided by (V) is called the ‘Section Factor (m⁻¹)’
FIRE RESISTANCE & STRUCTURAL PROTECTION

BEWARE THE DIFFERENT CRITERIA

- Structural steel within the cavity of a partition
- Structural steel at the head of a partition
SUMMARY

UNDERSTAND THE PERFORMANCE CRITERIA REQUIRED

TAKE A SYSTEM APPROACH

USE OF APPROVED SYSTEMS

APPLICATION OF APPROVED DETAILS

SUPERVISION / INSPECTION / SIGN OFF
THANK YOU FOR YOUR ATTENTION

FOR FURTHER INFORMATION

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FREEPHONE ROI – 1800 744 480