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BEST PRACTICE GUIDE

ELECTRICAL INSTALLATIONS AND FIRE PERFORMANCE

Electrical installations and their impact on the fire performance of domestic premises used as single family houses

5

ISSUE 3.1



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ELECTRICAL INSTALLATIONS AND THEIR IMPACT ON THE FIRE PERFORMANCE OF DOMESTIC PREMISES USED AS SINGLE FAMILY HOUSES

The aim of this guide is to promote best practice by providing practical advice and guidance for designers, installers, verifiers, and inspectors of domestic electrical installations where the work penetrates linings forming ceilings and walls.

The guidance may also be of benefit to specifiers, builders, building control bodies and other interested parties.

By following the guidance, it is considered that electrical installation work will not compromise the fire performance provisions that are mandatorily required to be incorporated into domestic premises under the relevant building regulations.



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1. INTRODUCTION

This Guide has been produced by Electrical Safety First in association with the bodies indicated on page 2.

It addresses the impact that electrical installations in domestic premises have on the fire performance of loadbearing and non-loadbearing walls and floors (and sometimes ceiling membranes) that have a fire containment function, and/or are required to carry a load for a prescribed period.

Fire safety in buildings generally requires that, in the event of a fire, to allow sufficient time available for people to escape from a building:

- Certain walls, floors and ceilings provide fire resistance for the purposes of constructing fire compartments and/ or protected escape routes, and
- The structure resists collapse.

The advice given in this Guide is aimed largely at preserving the structural stability of the premises as much as the fire separation between areas. For example, in most domestic premises, it is the loadbearing capacity of the floors that is threatened by early failure of ceiling linings, not the fire separating function. In the vast majority of dwellings, walls/ceilings not connected to another dwelling do not have a fire separating function.

Many modern forms of engineered construction have an inherently lower level of fire resistance when compared to more traditional forms of construction,

and are heavily reliant on the plasterboard or similar linings for achieving the requisite level of fire separation.

Much of the guidance is related to the effect that the installation of electrical equipment will have on the performance of the protective linings that are used to provide fire protection to lightweight joisted or studed constructions. In the case of the associated wiring, the need to prevent fire from passing through holes in all elements, whether solid or lightweight, is also addressed.

Amongst lightweight forms of construction are narrow section solid, stress graded timber joists, plywood Orientated Strand Board (OSB) webbed 'I' joists ('timber I beams'), tooth or nail-plated trusses and joists, composite timber studs and lightweight metal studs. Illustrations of these vulnerable forms of construction are to be found in Annex A.

The fire resistance of these elements can easily be compromised by inadequate fire sealing and 'making good' after any penetration to accommodate electrical equipment and associated wiring.

Electrical equipment that has the potential for a significant influence on the fire performance of buildings includes:

- Flush-mounted consumer units;
- Concealed and recessed luminaires, including downlighters;
- Flush-mounted electrical socket-outlets, flex outlet plates and data points;
- Flush-mounted switches, detection and control devices;
- Recessed wall luminaires;
- Concealed speakers.

The above items all require the removal of a part of the ceiling or wall lining, and replacement with glass, thin metal or plastic that does not provide the same level of fire protection to the structural members, causing a reduction in the fire performance of the element. **These are known as partial penetrations.**

In addition to the influence that these partial penetrations have on the fire performance, some installations can penetrate both linings, such as:

- Associated wiring and conduits;
- Ventilation fans and related ductwork.

These installations have a potential to compromise the fire containment capability, and guidance is included for these situations. **These are known as full penetrations.**

In addition to the above items that all have a direct influence on the fire performance of floors or walls, the following items can also have an indirect influence if the lining provides some or all of their support:

- Heavy ceiling-hung luminaires, lighting tracks and overhead projectors;
- Wall-mounted brackets for televisions, heavy speakers and flat screen installations. If the room is involved in fire, the weight of such items may lead to the premature failure of the lining material.

In addition to the risk of the electrical installation reducing the fire separation capabilities of those elements that need to resist fire spread or to remain structurally sound in a fire, a poorly installed electrical installation can potentially be the cause of a fire, for example due to heat generated by loose connections.

When involved in a fire, thermoplastic materials used in the construction of electrical fittings can release significant quantities of dense smoke and toxic products. They can also create flaming molten droplets which have been known to cause fire spread to carpets and furnishing below them.

The fire separating capability of an element of construction is generally measured by the duration for which the element will satisfy the criteria of a fire resistance test as laid down in *BS 476: Part 20* and *BS EN 1363-1*. More information on the relevant test methods and criteria can be found in Annex B.

2. SCOPE

This Guide gives practical advice and guidance for the installation, and the making good following the installation, of electrical equipment and wiring in self-contained domestic premises (including bungalows, multi-storey houses, individual flats and maisonettes) that are designed to accommodate a single family unit. The advice and guidance applies to both new and existing premises.

The Guide does not apply directly to Houses in Multiple Occupation, hostels, caravans or boats, or to the communal parts of blocks of flats or the communal parts of maisonettes, nor does it apply to any premises used for purposes other than a dwelling (such as small shops, factories or similar premises used solely as places of work).

The Guide gives advice on what needs to be done to maintain the fire resistance of walls and ceilings in domestic premises that have been penetrated or partially penetrated in the process of installing electrical equipment and wiring.

It does not consider in detail the impact that the installation of electrical equipment and wiring may also have on the structural, acoustic or energy targets prescribed in building regulations.

The Guide gives recommendations as to what is considered to be best practice, to ensure that electrical installers have adequate knowledge of the construction of the elements that could be compromised by their work.

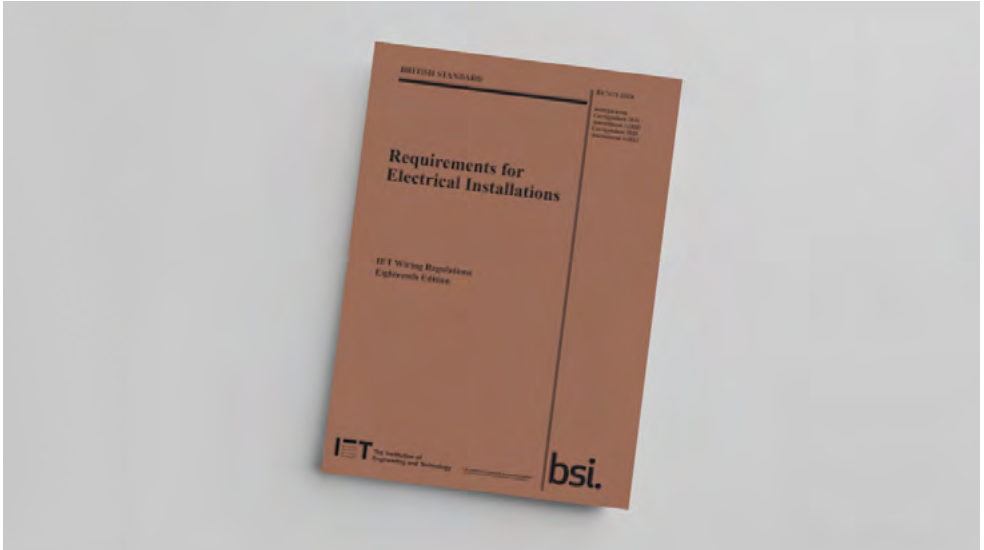
Where an installer wishes to differentiate between new and traditional forms of construction, the guidance given in Annex C may assist. Some investigations may require the services of another professional, such as a surveyor or fire specialist.

Note: This Guide does not necessarily apply to all innovative or unusual forms of construction or electrical equipment. If in doubt, specialist advice should be sought.



*Result of an eight minute fire on lightweight joists
(Courtesy of Manchester City Council - Building Control).*

3. GENERAL ELECTRICAL INSTALLATION REQUIREMENTS



Edition of BS 7671: 2018+A4:2024

This Guide takes into account *BS 7671*: the national standard for the safety of electrical installations.

Section 527 (Selection and erection of wiring systems to minimize the spread of fire) requires that wiring systems are selected and erected to minimise the spread of fire, including:

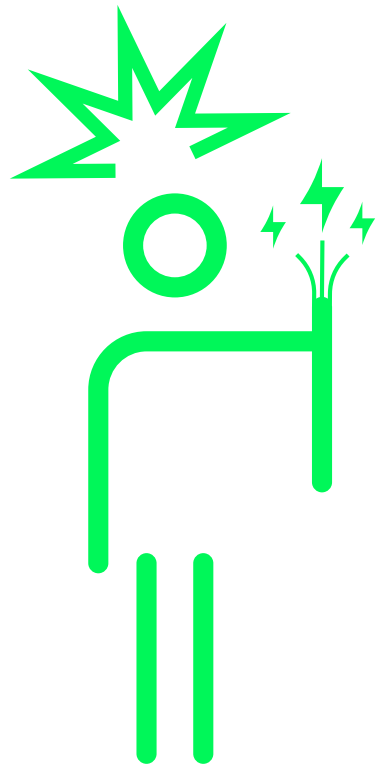
- *BS 7671* requires, in Section 421 (Protection against fire caused by electrical equipment), that equipment must not present a fire hazard to adjacent materials, and that manufacturers' instructions must be taken into account. Section 421 also requires that fixed equipment causing a concentration and focusing of heat (such as spot lamps) shall be at a sufficient distance from any fixed object or building element so that the object or element is not subjected to a dangerous temperature in normal conditions;

- Within a fire-segregated compartment, the risk of the spread of fire must be minimised by the selection of appropriate materials, and by the appropriate construction of the installation (*Regulation 527.1.1*);
- A wiring system must be installed so that the general building structural performance and fire safety performance are not reduced (*Regulation 527.1.2*);
- Where a wiring system passes through elements of building construction such as floors, walls, roofs, ceilings, partitions or cavity barriers, the openings remaining after the passage of the wiring system must be sealed according to the degree of fire resistance (if any) prescribed for the respective element of building construction before penetration (*Regulation 527.2.1*).

Regulation 510.3 requires manufacturers' instructions to be taken into account. Any installation instructions that are considered to be inappropriate should be queried with the manufacturer concerned, and amended installation instructions requested.

All terminations and joints, whether for low voltage (LV) or extra-low voltage (ELV) circuits, must be enclosed in accordance with *Regulation 526.5* to prevent fire spread should a loose connection occur.

As part of the initial verification process, the electrical installer has a duty to ensure that all the necessary fire precautions have been taken, irrespective of which party was responsible for that element of the electrical work (*Regulation 642.3(vii)*).



4. LEGAL

Building regulations for each part of the UK define fire performance objectives for the various elements that make up domestic premises, and give recommended performance levels in guidance supporting those regulations. The objectives are taken into account in this Guide. For further information, see Annex D.

It is vital that the fire performance of critical walls and floors is maintained to at least the level recommended in the guidance supporting the regulations, after the installation of electrical equipment and associated wiring.

For properties in England and Wales, attention is drawn to the *Party Wall Act*. Under this Act, any work undertaken on the party wall between properties which could affect its performance (or indirectly affect the structure of an attached neighbouring property) is a notifiable activity. In Scotland, a building warrant is required for any work that could adversely affect a separating wall or a separating floor.

The fitting of electrical equipment in a masonry party wall has never been considered as being notifiable, but cutting holes in the linings and installing 'plastic' accessories may be deemed to be covered by statutory requirements. Electrical Safety First therefore recommends that the neighbour be advised of the intended work in order to give them the opportunity to object to, comment upon, or prevent the work taking place.

Electrical installation work will often be undertaken on behalf of owners or tenants after the occupation of the premises and, as such, it is not subject to any form of third party audit or final approval. The electrical installer is therefore subject to a duty of care to ensure that the fire performance of the premises is not compromised. In Scotland, certain works require building warrant approval depending on the work proposed and the building type.

Note: In England & Wales, Part P of the Building Regulations and, in Scotland, Building Standard 4.5, make this a requirement, putting the responsibility on the installer if self-certifying the work as compliant with building regulations.

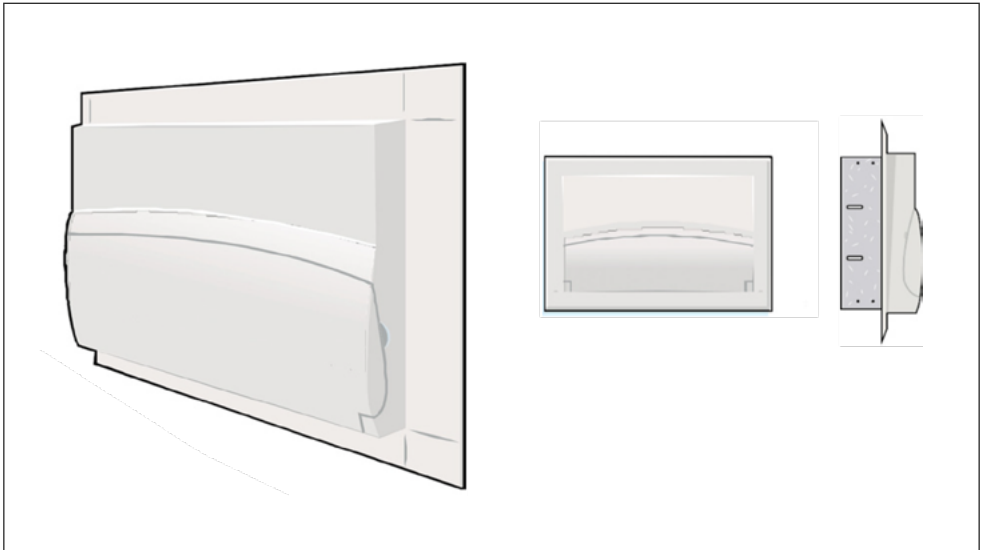
Currently, electrical safety in Northern Ireland is not controlled under building regulations.

5. RECOMMENDATIONS

Flush-mounted Consumer Units.

Flush-mounted consumer units should not be installed in a fire separating wall. Where this cannot be avoided, and subject to the agreement of the Local Authority, the enclosure of the consumer

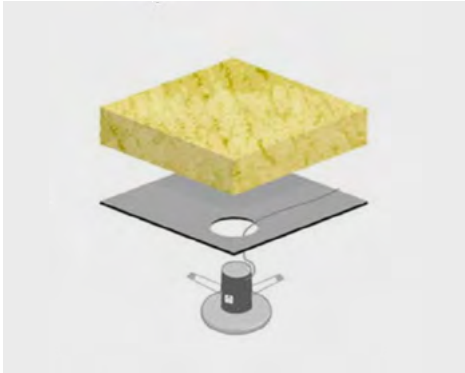
unit or a separate builder's work enclosure around the consumer unit must provide a proven level of fire resistance commensurate with the fire separating element.



Typical flush-mounted consumer unit.

6. DOWNLIGHTERS (RECESSED LUMINAIRES)

When exposed to a fire from below, downlighters may provide far less protection to a cavity and the structural elements within it than the plasterboard they are replacing, unless suitable precautions are taken.



Typical downlighters with integral fire protection.

Electrical Safety First strongly recommends that, wherever possible, downlighters having integral fire protection are selected for use in all ceilings where the lining that is to be penetrated is the sole means of keeping fire and heat out of the cavity.

There are a number of types of downlighter available, and it is important that the type selected for a particular application has test evidence to support its fire performance when incorporated in a ceiling of the type into which it is to be installed.

Generally, the tests should have been carried out in accordance with *BS 476: Part 21: 1987* or *BS EN 1365-2*. The nature of the test evidence can be critical, and is discussed in detail in Annex B.

Not all designs and styles of downlighter may be available with integral fire protection, especially where higher lighting levels and/or larger coverage is required. In these situations, additional fire protection may be fitted at the time of installation in the form of a 'fire hood', a fire protective box, or similar. Where a fire hood is fitted the suitability of the luminaire for that application must be confirmed.

Such separate forms of protection must be fit for purpose and not be easily dislodged or compromised after installation by subsequent work. Any such protection must conform to the guidance given in Annex E.

Electrical Safety First strongly recommends that downlighters installed in a ceiling beneath a roof space have integral fire protection, or are provided with some other suitable form of fire protection, in order to safeguard escape from the premises, restrict the spread of fire, and reduce the risk of premature failure of the roof structure.

In order to avoid the risk of fire (as well as reduced lamp and service life) caused by overheating, downlighters and any associated transformers must not be covered by thermal insulation. Building Regulations do not prohibit the leaving of a small area around downlighters free from thermal insulation where this is necessary to permit the dissipation of the heat they generate. However, due allowance for this should be made in the overall thermal performance of the premises.



Typical fire hood for a downlighter.

A number of studies have shown that the use of “unprotected” downlighters which penetrate into a loft space can cause significant energy loss. The use of approved downlight loft covers allows the insulation to be continuous and uninterrupted thus meeting current Building Regulations fully. Any such downlighter loft covers should be dust tight to IP6X and meet the requirements of *BS EN 60598-1* and *BS EN 60598-2.2*.



Result of a downlighter fire (Courtesy of Manchester City Council - Building Control).

In all cases, manufacturers' installation instructions should be taken into account to avoid downlighters becoming a source of fire.

Guidance on the selection of suitable types of downlighter for particular applications is given in Table 1 of this Guide.



Table 1: Recommendations for recessed luminaries/downlighters in floors and ceilings



Building Type	Location
Bungalow	Roof ceiling
Two-storey house	Roof ceiling
	First floor
	Below roomover garage
	Over basement
Three-storey house	Roof ceiling
	First floor
	Ceiling of garage under room
	Over basement
Loft conversion - 2-storeys to 3	First floor (when loft converted)
Four-storey (or more) house	Roof ceiling
	All floors, including garage and basement ceilings and floors
Flats	
Top floor <5m	Compartment floor
Top floor <18m	Compartment floor
Top floor <30m	Compartment floor
Top floor >30m	Compartment floor
Duplex flats	Intermediate floor

KEY

- 1 Robust Construction - **Annex C**
- 2 Lightweight Construction - **Annex A**
- 3 Modified 30 minutes - **Annex F**

*In all cases, ensure that any thermal insulation installed will not damage luminaries.

Construction	Fire Resistance required	Protection Type			
		Unprotected	Integral Protection	Fire Hood	False Ceilings
All	N/A	Permitted	Permitted	Permitted	Permitted
All	N/A	Permitted	Permitted	Permitted	Permitted
Robust ¹	Modified 30 min ³	Permitted	Permitted	Permitted	Permitted
Lightweight ²	Modified 30 min ³	Not Permitted	Permitted	Permitted	Permitted
All	30 min	Not Permitted	Permitted	Permitted	Permitted
All	30 min	Not Permitted	Permitted	Permitted	Permitted
All	N/A	Permitted	Permitted	Permitted	Permitted
All	30 min	Not Permitted	Permitted	Permitted	Permitted
All	30 min	Not Permitted	Permitted	Permitted	Permitted
All	30 min	Not Permitted	Permitted	Permitted	Permitted
Robust ¹	Modified 30 min ³	Permitted	Permitted	Permitted	Permitted
Lightweight ²	Modified 30 min ³	Not Permitted	Permitted	Permitted	Permitted
All	N/A	Permitted	Permitted	Permitted	Permitted
All	60 min	Not Permitted	Permitted	Permitted	Permitted
All	30 min	Not Permitted	Permitted	Permitted	Permitted
All	60 min	Not Permitted	Permitted	Permitted	Permitted
All	90 min	Not Permitted	Permitted	Permitted	Permitted
All	120 min	Not Permitted	Permitted	Permitted	Permitted
All	30 min	Not Permitted	Permitted	Permitted	Permitted

KEY
 Permitted
 Not Permitted

IMPORTANT NOTE FOR ALL INSTALLATIONS:

Ensure that the fire spread protection system will not thermally affect the wirings to the accessory, and not affect the accessory itself, and/or have an adverse impact on acoustic performance (by enquiry to the manufacturer to clarity).

7. FLUSH-MOUNTED ACCESSORIES (INCLUDING SWITCHES, SOCKETS, FLEX OUTLET PLATES, DATA AND TELEPHONE PLATES ETC)

Numerous flush-mounted accessories are common in modern homes. These generally comprise two components:

- A recessed housing, or back box;
- A face plate with integral socket, switch mechanism, flex outlet etc. and associated wiring terminals.

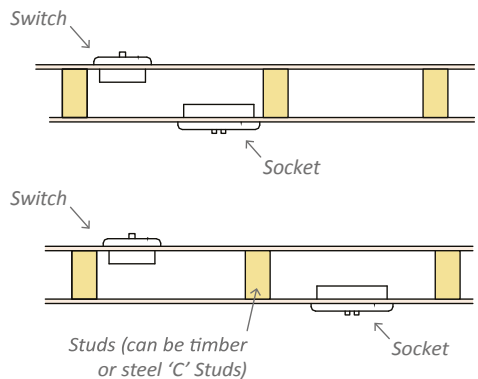


The effect of fire on a socket-outlet (Photo courtesy of Greater Manchester Fire & Rescue Service).

Back boxes may be either moulded plastic or steel construction, but all designs incorporate large knockout sections, many times greater in diameter than the cables passing through them, which make them very permeable in a fire after the face plate has been destroyed by the heat. This permeability will allow hot gases into the cavity of the wall much more rapidly than the plasterboard. For fire separating applications, and for applications relied upon to resist collapse, this should be guarded against by providing additional localised fire protection.

The risks associated with fire penetrating through flush-mounted accessories are significant when they penetrate a 30 minute fire-resisting loadbearing stud wall, 'back-to-back' with other accessories in the same cavity (or interlinked cavities).

Therefore, where flush-mounted accessories penetrate each face of a 30 minute fire separating or loadbearing plaster-board lined wall within the same cavity space each accessory should be fitted with a back box that incorporates integral fire protection, or be fitted with a proprietary fire protection pad, unless evidence of the fire resistance performance of the accessories is available.

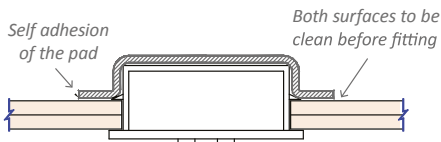


Such back boxes or protective pads must have evidence of performance to demonstrate that they have the ability to maintain the fire separation capability of a wall for 30 minutes, were they to be tested to *BS 476: Part 21: 1987 (loadbearing)* or *BS 476: Part 22 (non-loadbearing)*, or the EN equivalent as appropriate (see Annex B), with plastic accessories fitted in both linings.

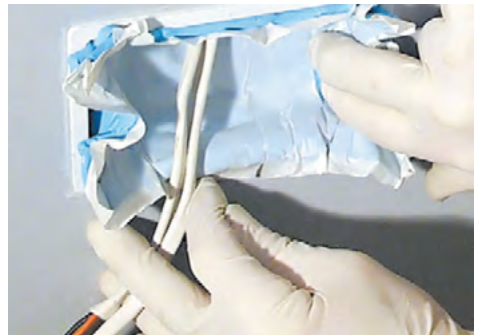
Recommendations for the protection of flush-mounted accessories in timber or metal stud walls in particular situations are given in Table 2 of this Guide.



Fire and acoustic rated covers fitted behind dry lining box (Photo courtesy of Tenmat Ltd).



Fire protection pad fitted externally. The box depth must be selected so that with the pad in place, the required clearance is maintained between the pad and the accessory, and the wiring is not unduly distorted.



Intumescent pad being installed in a dry lining box (Photo courtesy of Knauf Drywall).



Intumescent pad being installed in a dry lining box (Photo courtesy of Knauf Drywall).

Table 2: Recommendations for flush mounted accessories in timber and metal stud walls

Building Type	Location
All Dwelling types	Internal walls within a dwelling that do not have a fire separating function
Bungalow	Internal walls
Two-storey house (detached)	Stairway enclosure
	Wall separating garage from other rooms
Two-storey house (attached)	Stairway enclosure
	Wall separating garage from other rooms
	Separating wall between dwellings
Three-storey house (detached)	Stairway enclosure
	Wall separating garage from other rooms
Three-storey house (attached)	Stairway enclosure
	Wall separating garage from other rooms
	Separating wall between dwellings
Four-storey house (or more)	Stairway enclosure
	Wall separating garage from other rooms
Four-storey plus house (attached)	Stairway enclosure
	Wall separating garage from other rooms
	Separating wall between dwellings
Flats	
Top floor <5m	Walls between occupancies
Top floor <18m	Walls between occupancies
Top floor <30m	Walls between occupancies
Top floor >30m	Walls between occupancies
Duplex flats	Internal stairway enclosure

Installation	Fire Resistance required	Protection Type		
		Unprotected	Applied /integral prot.	Flush-mounted access.
One lining only or back-to-back	N/A	Permitted	Permitted	Permitted
One lining only or back-to-back	N/A	Permitted	Permitted	Permitted
One lining only or back-to-back	N/A	Permitted	Permitted	Permitted
One lining only	30 min	Permitted	Permitted	Permitted
Back-to-back	30 min	Not Permitted	Permitted	Accessory installed with applied or integral protection
One lining only or back-to-back	N/A	Permitted	Permitted	Permitted
One lining only	30 min	Permitted	Permitted	Permitted
Back-to-back	30 min	Not Permitted	Permitted	Accessory installed with applied or integral protection
Fitting in one or both linings	60 min	Not Permitted	Permitted	Should not be fitted in these walls unless unavoidable (not permitted in Scotland)
One lining only	30 min	Permitted	Permitted	Permitted
Back-to-back	30 min	Not Permitted	Permitted	Accessory installed with applied or integral protection
One lining only	30 min	Permitted	Permitted	Permitted
Back-to-back	30 min	Not Permitted	Permitted	Accessory installed with applied or integral protection
One lining only	30 min	Permitted	Permitted	Permitted
Back-to-back	30 min	Not Permitted	Permitted	Accessory installed with applied or integral protection
One lining only	30 min	Permitted	Permitted	Permitted
Back-to-back	30 min	Not Permitted	Permitted	Accessory installed with applied or integral protection
Fitting in one or both linings	60 min	Not Permitted	Permitted	Should not be fitted in these walls unless unavoidable (not permitted in Scotland)
One lining only or back-to-back	60 min	Not Permitted	Permitted	Accessory installed with applied or integral protection
One lining only	30 min	Permitted	Permitted	Permitted
Back-to-back	30 min	Not Permitted	Permitted	Accessory installed with applied or integral protection
One lining only or back-to-back	60 min	Not Permitted	Permitted	Accessory installed with applied or integral protection
One lining only	30 min	Permitted	Permitted	Permitted
Back-to-back	30 min	Not Permitted	Permitted	Accessory installed with applied or integral protection
Fitting in one or both linings	60 min	Not Permitted	Permitted	Should not be fitted in these walls unless unavoidable (not permitted in Scotland)
Fitting in one or both linings	30 min	Not Permitted	Permitted	Should not be fitted in these walls unless unavoidable (not permitted in Scotland)
Fitting in one or both linings	60 min	Not Permitted	Permitted	Should not be fitted in these walls unless unavoidable (not permitted in Scotland)
Fitting in one or both linings	90 min	Not Permitted	Permitted	Should not be fitted in these walls unless unavoidable (not permitted in Scotland)
Fitting in one or both linings	120 min	Not Permitted	Permitted	Should not be fitted in these walls unless unavoidable (not permitted in Scotland)
One lining only	30 min	Permitted	Permitted	Permitted
Back-to-back	30 min	Not Permitted	Permitted	Accessory installed with applied or integral protection

Key:

- Permitted
- Accessory installed with applied or integral protection
- Not Permitted
- Should not be fitted in these walls unless unavoidable (not permitted in Scotland)

IMPORTANT NOTE FOR ALL INSTALLATIONS:

Ensure that the fire spread protection system will not thermally affect the wirings to the accessory, and not affect the accessory itself, and/or have an adverse impact on acoustic performance (by enquiry to the manufacturer to clarity).

8. FLUSH-MOUNTED WALL LUMINAIRES AND CONCEALED SPEAKERS IN WALLS OR CEILINGS

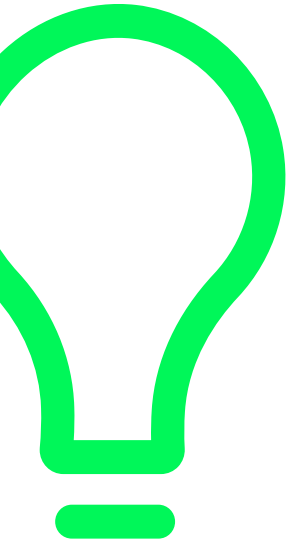
This type of equipment varies significantly in size, design and construction. It is therefore not possible to give specific advice in this Guide in respect of the best method of maintaining the fire performance of the lining(s) penetrated by such equipment.

In principle, however, speakers concealed in ceiling linings should be treated in a similar manner to downlighters, and both luminaires and speakers flush-mounted in walls should conform to the guidance given for flush-mounted accessories.

Where a luminaire or speaker has integral fire protection, this must be to the appropriate test standard (see Annex B).

If the equipment does not have integral fire protection then, when it is being installed in a ceiling or wall that is required to provide fire separation, it has to be provided with a bespoke form of fire protection and, where appropriate, acoustic insulation. It may be difficult for the installer to establish what form of protection is likely to maintain the required fire resistance, and therefore any proposed method of providing protection should be tested, or more reasonably assessed in lieu of test evidence, by those authorities recognised in guidance in support of regulations.

Proprietary protection, where available, is to be preferred.



9. CABLES, CONDUIT AND TRUNKING PENETRATING INTERNAL FIRE SEPARATING WALLS AND FLOORS

This section provides guidance as to what should be done to preserve the fire resistance of elements that are required to provide fire resistance, when cables have to pass through them. The guidance is applicable to situations where insulated and sheathed cables, or cables in plastic conduit or plastic trunking, pass through floors and walls.

The fire risk associated with nonfire performance cables and plastic conduits and trunking passing through building elements is twofold.

- Initially, there is a risk of a loss of integrity due to the heat and/or flames passing through any unsealed holes that have been made to allow the cable to pass through, resulting in flaming on the unexposed side;



Fire seals around cables and trunking.

- Subsequently, the hole in a plaster-board lining could allow fire to get into the ceiling or wall void prematurely, causing ignition of the structure, which could then lead to a loss of loadbearing capacity.

With respect to the first of these, it is important that fire is not allowed to exploit either the initial penetration of the first lining (which could permit fire to get into the cavity), or subsequently to penetrate the second lining (which would allow the fire to effectively bypass the protective barrier).

Sealing the cable ingress point has to take into account that the insulation of non-fire performance cables will probably melt or char away, leaving an unfilled gap between the conductors and the lining. Depending upon the nature of the cable insulation, this may even have the potential to carry the flames on its surface into the void. On a single cable this is unlikely to be a serious risk, but the ability to make an adequate fire seal becomes increasingly difficult as the number of cables increase.

It is common and accepted practice to make good any hole around a cable by using inert filler such as plaster or grout, but this does not compensate for melting/flaming insulation, and will also be ineffective in voids between cables. ❖

It is essential, therefore, that the sealant used to make good holes through which cables pass has intumescent properties: that is, it has the ability to expand and fill any voids that are developing due to movement and/or melting of cables, in order to maintain the fire resistance of the element.

The risk of fire gaining premature access to any void is increased if the cables are run through a plastic conduit or trunking system, or are bunched. Any cosmetic sealing of the gap between the lining and the plastic conduit or trunking will certainly not be able to seal any voids between the cables and the outer plastic casing following the melting of the conduit or trunking.

In elements that require high levels of fire resistance, for instance, in places where people sleep (which may require 60 minute compartment walls and floors), it is recommended that a proprietary cable transit or a fire resisting conduit be installed in the construction element being penetrated, if services have to pass through one or both linings that form the wall.

Note: In Scotland, the guidance clause 2.2.6 (Domestic Technical Handbook) recommends that combustible separating walls do not contain pipes, wires or other services. In buildings with a storey height over 18 m, Clause 2.2.7 states that separating walls and floors must be constructed of non-combustible materials.



10. VENTILATION FANS AND RELATED DUCTWORK

In older properties, ventilation fans were normally fitted on an external wall rather than on an internal wall and, as a consequence, there was not generally a fire safety issue regarding the influence on the integrity and insulation rating of the wall due to such systems.

However, with ever increasing air tightness requirements, controlled ventilation and, often heat recovery is the standard for new builds. This means combustible PVC ducting runs are installed all around the building, often with both return and supplies in each room, which can result in rapid spread of fire and smoke, both horizontally and vertically through the premises. Where such ducting penetrates a fire-rated ceiling, intumescent fan and vent sleeves or fire-rated air valves should be fitted.



Fire rated Ceiling Air Valve installed before a fire.



*Fire rated Ceiling Air Valve sealed after a fire
Photos courtesy of Tenmat Ltd.*

If fire were to enter the cavity of a stud wall or the cavity between the inner wall and any outer 'sheathing', the building can suffer both undue structural damage if modern engineered construction is used, and/or disproportionate fire spread in the cavity in more conventional properties. This cavity spread can result in an indirect loss of fire integrity between adjacent internal enclosures, and therefore fire should be prevented from gaining access to any of the cavities.

When installing a ventilation fan directly into a loadbearing external stud construction wall, the hole cut into the inner and outer lining should be lined out across the thickness of the wall with a continuous noncombustible material, preferably with some insulating properties, through which the extract duct passes. This liner should be fixed in place so that it does not fall away over time.

When the vent from for example, a shower cubicle, is connected to an extended duct which runs within the floor void to an outside wall possibly via an in-line fan, then this length of low melting point ductwork (plastic or aluminium) will have no measurable fire resistance and fire entering into this duct, via the vent, will soon have access to the joists. Indeed, should the fan be in extract mode at the time of the fire, fire will be drawn into this void quite quickly.

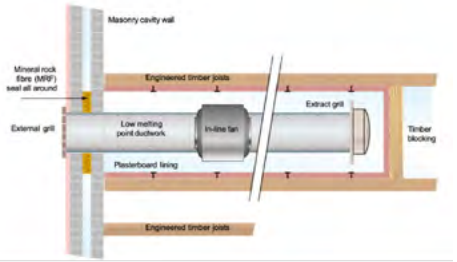


Fig 11a Joist/wall protection when installing vent into conventional masonry wall construction.

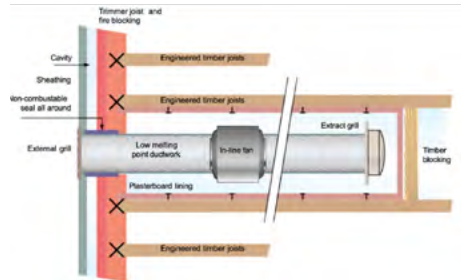


Fig 11b Joist/wall protection when installing vent into a timber frame wall construction.



Fire spread into bathroom via plastic duct
(Photo courtesy of Greater Manchester Fire & Rescue Service).

11. WALL OR CEILING-MOUNTED ELECTRICAL EQUIPMENT

It has become increasingly common to mount heavy equipment such as TVs, speakers, flat screen installations etc on wall brackets, and to hang heavy luminaires, lighting track and projectors etc. from the ceiling.

Plasterboard linings are not designed to carry such weights under fire conditions and, unless these items are fixed on to the structural members in the wall or floor, they could pull down the linings once the board is weakened by the fire.

Weakening of normal and 'sound' grade plasterboard will occur rapidly after fire has consumed the room face paper lining and, whilst fibreglass reinforced board will not fail quite as quickly or as dramatically, fixings will pull through it at a fairly early stage in the fire attack.



Ceiling-mounted projector.

Obviously, early failure of these protective linings will allow fire attack on the studs and joists which again, if of engineered construction (see Annex A) could lead to remature structural failure.

All heavy equipment mounted on the face of walls or hung from the ceiling must be supported completely independently from the fire protective plasterboard linings. Whilst it may be permitted to fix directly to the joists, false ceiling members or studs, none of the fixings should rely solely on plasterboard.

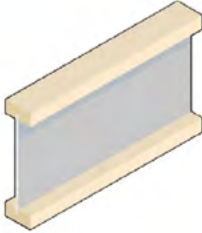
If any additional fixings are needed beyond those that the structure is able to provide, then a section of the lining should be completely removed and the edges of the 'hole' fitted with supports to which 'both' edges of the plaster board can be fixed.

Additional structural members should then be fitted between joists and studs at the required fixing locations and the new plasterboard should be scribed, cut to size/shape and fixed in accordance with plasterboard manufacturers' instructions, before fitting the suspended equipment. Joints between existing and new plasterboard linings should be filled and skimmed with plaster.

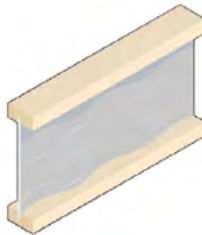
ANNEX A

Examples of forms of modern engineered construction covered by this Guide.

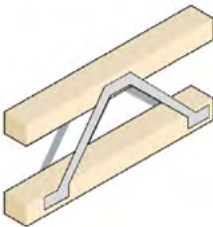
Floor joists



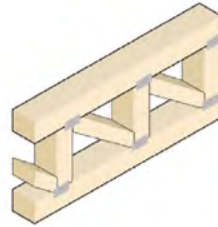
Timber 'I' beams; consisting of Orientated Strand Board (OSB) or plywood webs with solid timber or laminated timber top and bottom chords.



Steel webbed, timber 'I' beams; consisting of corrugated steel webs with timber top and bottom chords.



Space joists; consisting of timber top and bottom chords spaced apart by pressed steel 'boomerangs' Narrow stress graded softwood joists (less than 38mm).



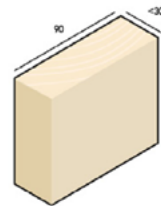
Punched metal plate connected 'truss' joists.



Glue laminated 'timber' studs.



Steel 'C' studs.



Narrow stress graded softwood studs (less than 38 mm).

ANNEX B

Regulatory guidance refers to a number of fire tests which the elements, together with installed components, have to be verified. The ability of the element to satisfy the structural fire requirements and fire separating objectives is determined by a series of established British and European test procedures.

The relevant standards are:

- Non-loadbearing walls and ceiling membranes: *BS 476: Part 22: 1987*, or *BS EN 1364: Parts 1 and 2*;
- Loadbearing elements: *BS 476: Part 21: 1987*, or *BS EN 1365: Parts 1 and 2*;
- Wires, cables and conduit penetrating elements: *BS EN 1366-3*;
- Suspended ceilings that are provided only for the protection of steel beams*: *BS 476: Part 23*.

Note: there is no directly comparable BS EN test for this purpose.

In respect of these tests, the criteria of failure are loadbearing capacity (*BS 476 Part 21* and *BS EN 1365* only), integrity and insulation, which are defined as follows:

Loadbearing capacity is the ability to carry the design loads for the specified period without collapse or exceeding predetermined deflection limits.

Integrity is the ability to resist the passage of flames, or the passage of critically hot gases (measured by means of an oven dry cotton pad).

Insulation is the ability to restrict temperature rise on the unexposed face to a mean temperature rise of 140 °C and a maximum temperature rise of 180 °C.

**The use of a suspended ceiling provided for the purpose of protecting steel beams in lieu of cladding, or spraying them, is a very restricted application and will rarely be found in the domestic sector. Unfortunately, a number of proprietary products available for protecting downlighters will have erroneously been tested to this standard, but these will not be suitable for 'making good' fixed ceilings or suspended ceilings used to provide protection to 'timber' joisted floors or other 'domestic' forms of construction. Annex A.*

Examples of forms of modern engineered construction covered by this Guide

ANNEX C

Guidance on what constitutes robust construction which identifies where unprotected downlighters may be fitted.

When the installer wishes to fit unprotected downlighters, it is necessary to establish the construction in detail and ensure that the floor is of one of the following constructions;

a) First floor of two-storey house – all the following must apply:

- The joists are solid timber not less than 43 mm thick and at no more than 450 mm centres;
 - The floorboards above are either tongue and grooved softwood greater than 18 mm thick or are tight fitting butt jointed softwood boards free from dead knots, or is 'timber' based jointed flooring not less than 18 mm thick;
 - The ceiling consists of 12.5 mm plasterboard or 'sound' lath and plaster with the 'hooks' in good condition;
 - *If downlighters are installed in a compartment floor (or separating floor in Scotland – see Annex F), they must be protected regardless of the construction.
- b) All other floors in a single family unit:

b) All other floors in a single family unit:

As for the first floor above, except butt jointed floor boards are not permitted without an overlay of medium density fibreboard (MDF), hardboard or plywood not less than 4 mm thick;

c) One hour fire resisting floors between flats:

- The joists are solid timber not less than 43 mm thick and at no more than 450 mm centres, and
- The floorboards above are either tongue and grooved softwood boards greater than 18 mm thick and free from dead knots, or is 'timber' based jointed flooring of a similar minimum thickness;
- The ceiling consists of two layers of plasterboard, not less than 30 mm* thick for non-fire rated board or not less than 25 mm thick of fire rated** board.

4. Protected means downlighters that incorporate integral fire protection or which are fitted with fire hoods that comply with the guidance given in Annex E of this Guide.

**Excluding any textured surface which should be removed locally prior to fitting the luminaire.*

***Type 5 to BS 1230 or Type F to BS EN 520.*

ANNEX D

Summary of the recommendations given in national regulatory fire safety guidance:

The requirements given in Table 1 and 2 of this Guide are the 'recommendations' made in the Guidance Documents published in support of the relevant regional regulations. These Guidance Documents offer a prescriptive solution to the 'functionally' expressed regulations in the relevant region of the UK. At the time of publication, the relevant regional regulations that deal with the fire safety issues are:

England & Wales

The Building Regulations 2000.

- *Approved Document B Fire Safety (Volume 1) Dwellinghouses (2019 Edition).*

Scotland

The Building (Scotland) Regulations 2004.

- *The Scottish Building Standards Technical Handbook Domestic (2024).*

Northern Ireland

The Building Regulations (Northern Ireland) 2000, as amended.

- *Technical Booklet E, 2012.*

The above regulations apply only to new build, or to major refurbishments (material alterations) that are notified after the dates given. Buildings already constructed and/or occupied will have complied with the regulations and associated guidance in force at the time of application.

These Guidance Documents would have expressed the recommended fire performance of the structure in terms of the test standards described in Annex B.

ANNEX E

Test procedure to evaluate the robustness of downlighter fire hoods.

1. Introduction

This Annex provides requirements that need to be satisfied by a downlighter fire hood that is considered to be 'robust' in both its construction and fitting, and thereby meets the recommendations given in this Guide.

During installation, in order not to compromise the performance of the downlighter, it is essential that the area immediately above the downlighter and the fire hood remains free from thermal insulation (see 7.9). Subsequent to its installation, however, the fire hood needs to demonstrate its ability to remain in place and resist crushing, that is to be 'robust' in the event of any application of thermal insulation or other material by others.

2. Scope

The purpose of this test procedure is to assess the ability of a downlighter fire hood which has satisfied the fire test requirements of *BS 476: Part 21: 1987* to retain its mechanical stability over its working life whilst providing the requisite level of fire protection to the structure of the building from a downlighter located beneath.

3. Test Protocol

The test protocol is a two part test. The first part deals with the ability of the specimen fire hood to resist compression after the application of the insulation within the test frame. The second part deals with the ability of the fire hood to resist dislodgement subsequent to installation.

4. Test Equipment

The test assembly is designed to simulate a domestic ceiling. It consists of two softwood floor joists 225 mm x 47 mm x 1500 mm long held 450 mm apart, being screwed to similar sectioned timbers at either end.

The base of the test construction consists of a single sheet of 12.5 mm type plasterboard nailed to the underside of the timber framework. Two further sheets of 12.5 mm plasterboard 1500 mm x 300 mm are screwed to the inner face of the two major timber sections in a vertical position.

Midway down the length of the frame, a hole is cut in the centre of the plasterboard on the underside of the test frame. The size of the hole so cut should be equal to that formed in the ceiling to accommodate the downlighter that the fire hood is designed to protect.

A 1400 mm length of 400 mm wide mineral wool (24 kg/m³) is cut sufficient to provide an overall insulation depth of 270 mm within the test frame.

The test assembly is held in position 2 m above ground level by the use of appropriate scaffolding.

5. Test Procedure

5.1 Compression test

The specimen fire hood is located above the hole in the manner prescribed by the manufacturer. Unless the device is identified as being suitable only for installation from above, this will be positioned from below.

Once the specimen has been located in position, the distance between the top innermost part of the fire hood and the lower surface of the plasterboard of the main structure shall be measured in at least 3 places, averaged and noted (a).

Once this has been ascertained, the insulation described above is laid down the length of the test rig so as to be resting on the upper surface of the plasterboard and specimen.

At this point, the distance referred to above will be measured again (b). The insulation shall remain in place for 25 days. After this period, the distance referred to above will be measured once more (c).

Once the above distances have been ascertained, the insulation should be removed and the 'dislodgement test' should be undertaken on the same test specimen

5.2 Dislodgement test

One end of the test assembly will remain supported via a 'hinge', whilst the opposing end is progressively raised or lowered at a rate of 100 mm/ sec until either:-

- a. The specimen fire hood becomes dislodged, in excess of the permitted amount or
- b. The test assembly reaches an angle of 45 degrees.

6. Performance Criteria

6.1 Compression test

In the case of the second measurement (b), a reduction in the average distance of less than 5%, or 5 mm (whichever is the smaller) is acceptable.

For any reduction in excess of this figure, the specimen is deemed to have failed.

In the case of the third measurement (c), there should be no further reduction in distance measured.

6.2 Dislodgement test.

If the specimen moves laterally by more than 10 mm or a gap of 3 mm appears between the specimen and the top surface of the plasterboard prior to, or on completion of, the movement test, then the specimen will be deemed to have failed.

⁵ These test requirements have been developed by IFSA, the Intumescent Fire Seals Association. IFSA is a recognized trade association for manufacturers of intumescent materials and intumescent-based systems, membership of which requires all product claims to be substantiated.

ANNEX F

Glossary of terms

Luminaire:

Equipment which distributes, filters or transforms the light transmitted by one or more lamps, and which includes all the parts necessary for supporting, fixing and protecting the lamps, but not the lamps themselves and, where necessary, circuit auxiliaries together with the means for connecting them to the supply.

Critical application:

An application where the consequences of a failure to provide the fire resistance requirements for an element will have a direct impact on the life safety of the occupants, e.g. between adjacent dwellings.

Compartment wall/floor:

Known in Scotland as separating wall/floor. 'Modified' fire resistance: In domestic applications the fire resistance of the first floor has a loadbearing capacity of 30 minutes, but the integrity and insulation criteria are reduced (modified) to only 15 minutes.

House in Multiple Occupation:

For England and Wales, the legal definition of a House in Multiple Occupation is to be found in Sections 254-260 and Schedule 14 of the *Housing Act 2004* or, in the case of Scotland, the Civic Government (Scotland) Act 1982 (*Licensing of Houses in Multiple Occupation*) Order 2000 as amended.

'Separating floor and wall':

In Scotland, a floor or wall constructed to prevent the spread of fire between buildings or parts of buildings of separate habitation, such as flats and maisonettes.

Three-storey house:

A house in single occupation with two floors above ground floor levels, often referred to as a town house.

House of four storeys, or more:

A house that has three or more floors above ground floor where the height of the uppermost floor does not exceed 18m.

Fire segregated Compartment:

Considered to be an enclosed space, which may be subdivided, separated from adjoining spaces within a building by elements of construction having a specific fire resistance;

- Residential flats - in general terms, each individual residential flat will be its own compartment and there would be fire resisting protecting the common exit routes. In addition, the means of escape areas may also be required to have a degree of fire resistance, and any penetrations would need to be suitably fire stopped;
- Domestic houses will again be their own compartment and a semidetached house should be separated into two. If houses are higher than 2 floors (ground and first) then additional compartmentation may be required. In addition, the means of escape areas may also be required to have a degree of fire resistance and we would expect any penetrations to be suitably fire stopped.

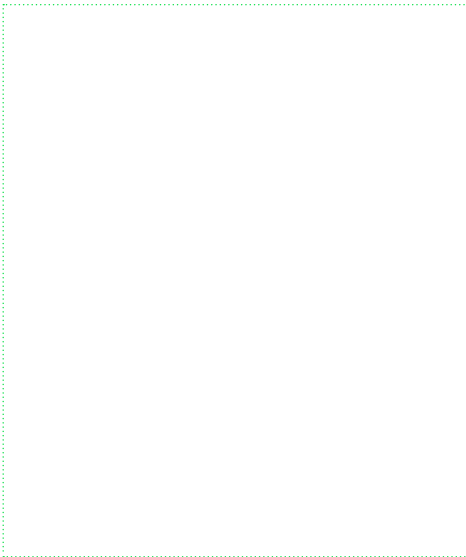
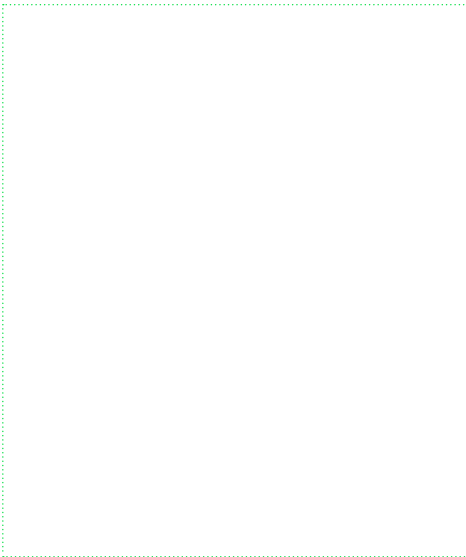
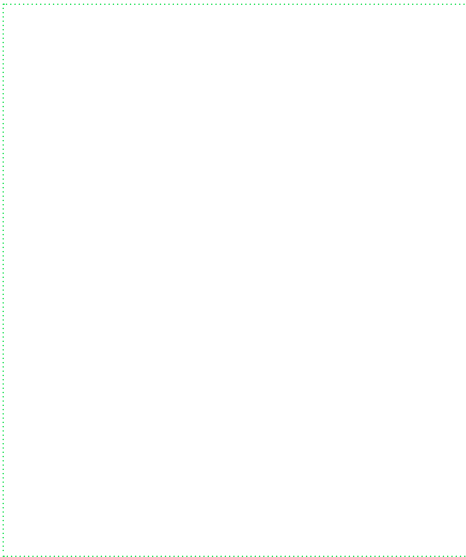
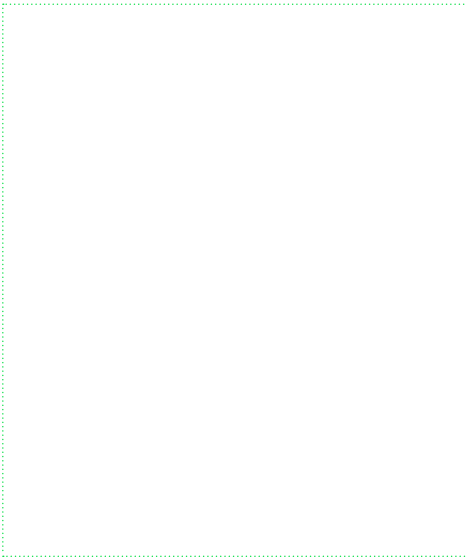
Please note that this is not building specific, and the compartmentation and fire resistance requirements will be dependent on the individual case.



NOTES:

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NOTES:





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