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healthier building

with gypsum products

No. 3

THE BUILDING REGULATIONS

This publication sets out the main requirements of the Building Regulations in relation to gypsum-based products. It is particularly pertinent to all those involved in the design and specification stages of a project.

GPDA

Gypsum Products Development Association

This publication can form part of a structured programme of CPD (Continuing Professional Development)



The Building Regulations and Gypsum Products

The main concern of the Building Regulations is the health and safety of people in and around buildings. This publication addresses those sections of the Building Regulations in which gypsum based products can play their part in protecting the health and safety of building users.

Gypsum plasters and wallboards are the primary materials used for lining walls and ceilings. As well as providing a smooth surface for decoration, gypsum based products also contribute to a building's performance in terms of:

- fire safety
- sound insulation
- condensation avoidance
- thermal insulation.

This publication explains how gypsum based products contribute to the performance of a building in these four respects and in particular, how they help the design team to satisfy the requirements of the Building Regulations that are listed in the table below.

The Healthier Building Campaign

The series *Healthier Building with Gypsum Products* addresses current concerns about the impact on health, the environment and efficiency of the way we build. The series covers five topics:

1. Health and Safety - The CDM Regulations & Safety, Health and Welfare At Work (Construction) Regulations (July 1997)
2. Sustainable Development (July 1997)
3. The Building Regulations (July 1997)
4. Reduction of Waste (November 1997)
5. Efficient Building (November 1997)

The series is aimed at members of the design team and contractors. It is not intended to provide detailed design guidance, which is readily available in manufacturer's product literature, but rather to raise awareness of the issues involved.

The publications can form part of a structured programme of CPD (Continuing Professional Development).

Building Regulations referred to in this publication

Performance aspect	England and Wales	Scotland	Northern Ireland	Republic of Ireland
<i>Fire safety</i>	Approved Document B	Part D	Part E	Technical Guidance B
<i>Sound insulation</i>	Approved Document E	Part H	Part G	Technical Guidance E
<i>Condensation</i>	Approved Document F	Part G4	Regulation C7	Technical Guidance F
<i>Thermal insulation</i>	Approved Document L	Part J	Part F	Technical Guidance L

Fire safety

The cost of fires is high, both in terms of lives lost and property destroyed. Each year about 800 people die in fires and a further 9000 are injured. Inquiries into fatal fires conclude that the design of the building plays a vital part in determining the severity of the fire. This is a strong reminder to all members of the design team of the need to give fire safety a high priority.

The Building Regulations play a major part in setting fire safety standards. There are five principal requirements to ensure the safety of people:

- provide adequate means of escape
- inhibit the contribution of lining materials to the growth and spread of a fire
- ensure that structural elements and components have a minimum level of fire resistance
- prevent the external spread of a fire
- provide access and facilities for the fire service.

The unique fire resisting characteristics of gypsum (see box) mean that it is widely used in construction both as a lining material and to protect elements of the structure.



Spread of flame testing programme

How gypsum behaves in a fire

All gypsum based products provide good fire protection in buildings due to their unique chemical composition. Almost 21% of pure gypsum is composed of water which, at temperatures below 1200°C, is chemically combined in a crystalline form with calcium sulphate, which makes up the remaining 79% of gypsum.

In a fire, as the chemically 'entrapped' water is released, a protective layer of calcined gypsum is formed. Behind this layer, the materials in contact with the gypsum remain below 100°C. This is because the dehydration process causes an endothermic reaction in which heat is absorbed as the chemically entrapped water is driven off.

The fire protection properties of gypsum, therefore, not only delay the passage of fire, but also help to protect the materials behind them from the intense heat of the fire. Once the full thickness of gypsum has been calcinated, it continues to act as an insulating layer.

Some gypsum plasters contain additives that further improve their fire performance. The inclusion of glass fibres in gypsum based boards enhances their fire protection performance by maintaining the integrity of the board in a fire.



Glass reinforced gypsum board being used to provide time protection to structural steelwork

Surface finishes and internal linings

National Building Regulations set down specific requirements to restrict the spread of flame over wall and ceiling surfaces. The highest performance classification for a surface finish in the Regulations is Class O.

Gypsum plasters and glass reinforced gypsum boards are *non-combustible* when tested in accordance with BS 476:Part 4. Gypsum wallboards have a Class 1 surface spread of flame and low fire propagation properties when tested in accordance with parts 6 and 7 of BS 476. They are therefore listed as *materials of limited combustibility* and defined as Class 0 in National Building Regulations.

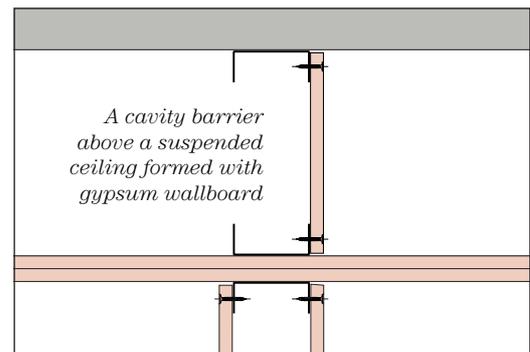
This means that gypsum plasters, gypsum wallboards and glass reinforced gypsum boards can be used without restriction as internal finishes or linings to walls, partitions and ceilings in any room or escape route in a building. By specifying gypsum based products designers can be sure that if a fire does occur, its spread and rate of growth will

not be assisted by the surface materials, allowing more time for people to escape to safety.

Fire resistance of building elements

Fire resistance is not a property of an individual material, but the performance of a complete element of construction. In BS 476:Part 22, fire resistance is measured in terms of stability, integrity and insulation.

All GPDA members publish information giving the fire resistance of various building constructions using their products. The fire resistances quoted are based on the results of extensive fire tests carried out in accordance with BS 476.



Cavity barriers

The Building Regulations contain provisions for cavity barriers and fire stops to prevent flames and smoke from spreading through the concealed spaces of a building's construction.

The easy workability of gypsum wallboard makes it an ideal material for use as a cavity barrier. When tested to BS476:Part 22, 12.5 mm gypsum wallboard meets the requirements for integrity and insulation for cavity barriers, as shown above. There are also other solutions using specialist fire resisting wallboards, with steel or timber framing.

Fire insurance

In addition to the requirements of the Building Regulations, clients and fire insurers may require more stringent fire protection measures. This is because the prime objective of national Building Regulations is the health and safety of people. The insurer's main objective, however, is to minimise damage to the building and its contents. Their requirements can be met using gypsum wallboard systems. The design team should check that there is no incompatibility between the requirements of the Building Regulations and the fire insurers.

Sound insulation

Noise, often referred to as unwanted sound, is an increasing source of complaint. Noise is not only an irritation but can also cause fatigue, anger and depression. This may affect work performance or cause stress which can impair peoples' mental and physical health. The correct specification and design of sound insulating walls and floors can play a big part in reducing sound transmission.

National Building Regulations include prescriptive solutions for sound insulating constructions, but only between dwellings. GPDA members have a range of constructions that tests have shown to meet or exceed the requirements of the regulations. In addition, they also produce a range of systems that can meet the specific needs of individual clients, whether this be for office partitions or multiplex cinemas.

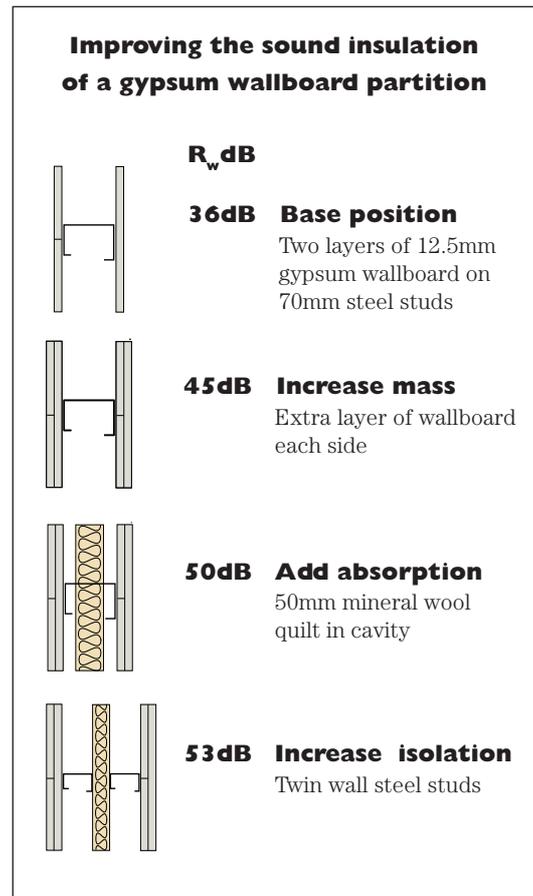
Improving performance

The first step, therefore is to specify a proven construction that can achieve the required level of sound insulation. The diagram on the right shows how the performance of a standard steel partition can be improved by applying the basic principles of mass, isolation and absorption.

The design team should also take note of the following if the expected sound insulation performance is to be achieved:

Flanking sound transmission – check the specification of surrounding constructions, eg suspended ceilings passing over sound insulating partitions.

Airpaths – any gaps or holes in the wall or floor can severely reduce sound insulation performance – specify tape, caulking, sealant or coving at junctions as appropriate; specify wet plaster to seal porous blocks, such as lightweight aggregate blocks



Service penetrations – these should be kept to a minimum. Where socket or switch sockets are necessary, the immediate area around and behind them should be specially detailed to reduce sound transmission. Back to back installations in partition should be avoided.

Special gypsum wallboards

In recent years, denser gypsum wallboards have been introduced that provide increased sound insulation. The greater density also improves impact resistance. The boards weigh between 2 and 4 kg/m² more than standard gypsum wallboards. This increase in mass is sufficient to enhance the sound insulation of the partitions shown above by between 2 and 4 dB. Where sound insulation is important, consideration should be given to specifying these denser gypsum wallboards.

Condensation avoidance

Condensation is a serious and widespread problem. The 1991 House Condition Surveys revealed that 1 in 4 homes suffers from condensation and about 20% have mould growth. Damp homes provide ideal conditions for mould to grow and dust mites to thrive. Apart from the distress this causes, the main potential risks to health are from respiratory illnesses, such as asthma. About 10% of the population is potentially sensitive to mould spores, with the elderly and very young most at risk.

Minimising the risk of condensation at the design stage involves balancing three factors; ventilation, heating and insulation.

Ventilation and thermal insulation

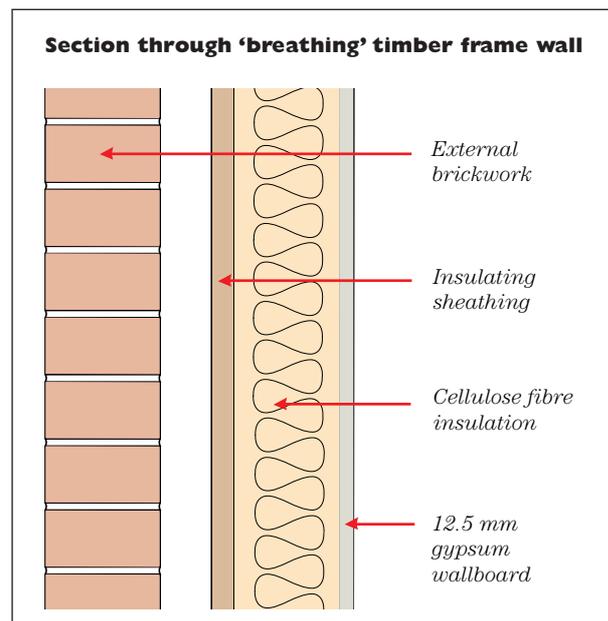
The 1995 revision to the Building Regulations included more stringent requirements on ventilation. For the first time, the provisions have been extended to non-domestic buildings. The main provisions are:

- **rapid ventilation**, eg openable window
- **background ventilation** to all rooms, eg trickle ventilators
- **extract ventilation** of moisture at source, eg extract fan

The 1995 revision to the Building Regulations also improved the thermal insulation requirements (see opposite). Both these measures should help to reduce the incidence of surface condensation and the risk of mould growth in new housing.

Interstitial condensation

Improvements in thermal insulation standards can result in an increased risk of interstitial condensation. This occurs when internal vapour pressure forces moisture through a wall or roof until it reaches a cold surface which is at or below the dew point.



The Building Regulations recognise this risk is greatest where cross ventilation behind the insulation is restricted. This applies particularly to cold deck flat roofs. The vapour control layer limits the rate that water vapour migrates into the wall or roof.

In practice, interstitial condensation is also a risk in timber framed walls and internally insulated masonry walls.

All GPDA members produce gypsum wallboards and thermal boards with an integral vapour control layer. This may consist of a vapour check film bonded to the back of the wallboard or as an integral part of the thermal laminate. These boards provide water vapour resistance well in excess of 15MNs/g, conveniently and at low cost.

To maintain the performance of the vapour control layer, service penetrations should be kept to a minimum. Where cutting is needed, specify a sealant to fill any gaps between the board and the service fitting.

Thermal insulation

Poor thermal insulation standards are a contributory factor in explaining why millions of households are unable to keep warm in winter. The consequences of this are:

- severe condensation and mould growth
- excessive fuel bills and mounting debt
- general ill-health of those living in fuel poverty
- deaths from hypothermia contributing to the excess winter mortality rate each year.

In recognition of these concerns and the need to reduce carbon dioxide emissions, the thermal insulation standards in the Building Regulations have been raised four times in the last 20 years.

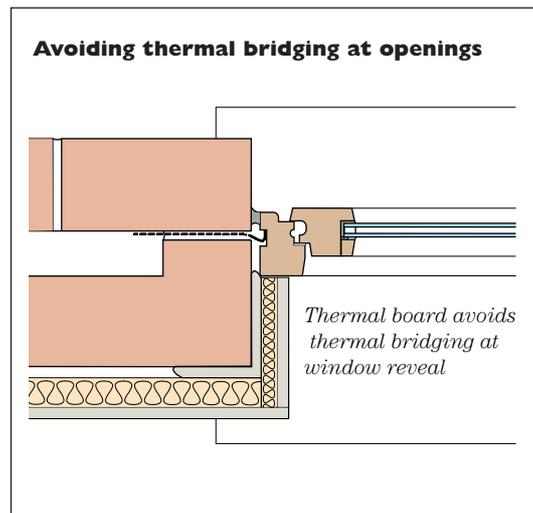
The latest revision, in 1995, sets down three alternative approaches for meeting the requirements of the regulations. The simplest of these is the *Elemental approach* in which maximum U-values are listed for walls, floors, roofs and windows.

Thermal laminates of gypsum wallboard and insulation can be specified to achieve and exceed the insulation standards in the Building Regulations – some typical constructions are shown on the right.

Material alteration and Material change of use

The 1995 revision also required, for the first time, that thermal insulation requirements should apply to existing buildings subject to a Material alteration or Material change of use.

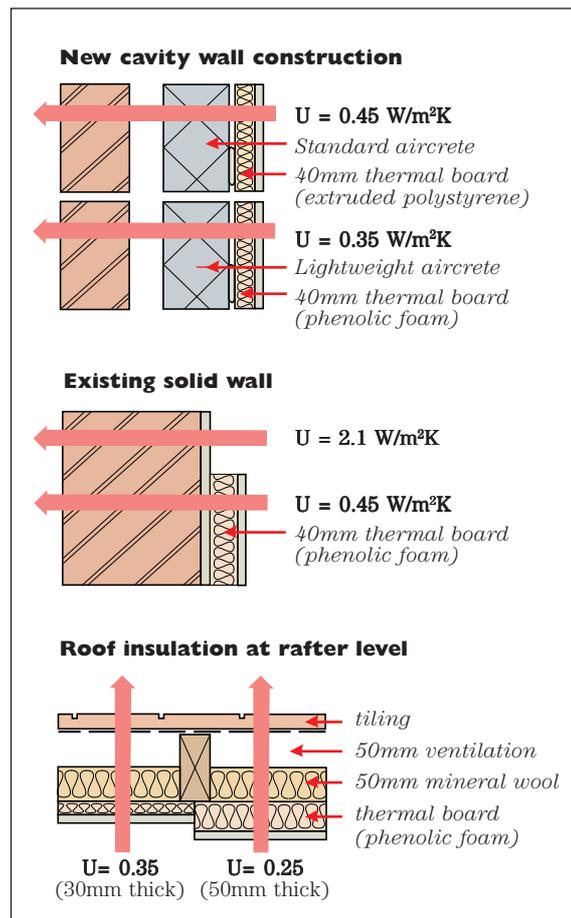
Many existing buildings will have solid walls. The most cost-effective way of improving the thermal performance of solid walls is to add an insulated drylining, as shown on the right.



Thermal bridging at openings

In addition to limiting the overall heat loss from a building, the 1995 revision to the regulations also include requirements for avoiding thermal bridging at openings.

A satisfactory way of complying with the thermal bridging requirements is to use a thermal laminate with a minimum 12.5 mm thickness of insulation to line the reveals and soffit of the openings.



The Gypsum Products Development Association (GPDA) comprises a permanent Secretariat and member companies, in the UK and the Republic of Ireland, all engaged in the manufacture of gypsum products. The primary function of the GPDA is to develop and encourage the understanding of gypsum-based building products and systems and to pioneer new applications for these products.

It also has an ongoing commitment to advise on matters of environmental impact, energy conservation and health and safety, wherever gypsum based products are used. The members promote the use of systems which maximise the conservation of energy and give a high priority to waste reduction and recycling initiatives.



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