



UK Timber  
Frame Association

[www.timber-frame.org](http://www.timber-frame.org)

# TIMBER FRAME AND FIRE SAFETY

Timber is obviously a combustible material, but it is also highly suitable for construction when used correctly. If you are concerned about the fire safety of timber frame buildings, take a moment to read the information in this briefing note.

We aim to give you the facts. If there is something we have not addressed here, or if you have further queries, please email us at [office@timber-frame.org](mailto:office@timber-frame.org).

## Sources of further information:

For information on the Building Regulations (England and Wales) on fire safety which apply to all methods of construction, including masonry, steel and timber frame:

<http://www.planningportal.gov.uk/england/professionals/en/4000000000084.html>

For information on the Scottish Building Standards on fire:

[http://www.sbsa.gov.uk/current\\_standards/legis.htm](http://www.sbsa.gov.uk/current_standards/legis.htm)

For information on the Northern Ireland Building Regulations:

<http://www.dfpni.gov.uk/index/law-and-regulation/building-regulations.htm>

For information on the Construction (Design & Management) Regulations 1994:

[http://www.opsi.gov.uk/si/si1994/Uksi\\_19943140\\_en\\_1.htm](http://www.opsi.gov.uk/si/si1994/Uksi_19943140_en_1.htm)

Additional details on the BRE's authoritative fire tests on multi-storey timber frame (the TF2000 project):

[http://www.chilternfire.co.uk/fire\\_safety\\_services/fire\\_research/fire\\_research.html](http://www.chilternfire.co.uk/fire_safety_services/fire_research/fire_research.html)

For the Construction Confederation and Fire Protection Association Code and Checklist for fire prevention on construction sites:

<http://www.thefpa.co.uk/News/New+Construction+Code+and+Checklist.htm>

To read the HSE information sheet on 'Construction Fire Safety':

<http://www.hse.gov.uk/pubns/cis51.pdf>

For copies of Chiltern International's research into cavity fires:

[http://www.chilternfire.co.uk/documents/The\\_Report.pdf](http://www.chilternfire.co.uk/documents/The_Report.pdf)

To read the Fire Service's advice to residents in high rise dwellings:

<http://www.fireservice.co.uk/safety/highrise.php>

To read a copy of NHBC's 'Guide to Your New Home':

<http://www.nhbc.co.uk/NHBCpublications/LiteratureLibrary/HomeownerDocuments/filedownload,15901,en.pdf>

## 5 Facts on Fire

1. UK building regulations and other fire safety regulations are amongst the most stringent in the world.
2. In most dwelling fires it is the contents and occupants that create the risk.
3. The vast majority of injuries caused by dwelling fires in the UK are gas/smoke inhalation and shock. Fortunately, the numbers of such injuries are reducing year on year.
4. Most fatalities are caused by smoke from fires involving textiles, upholstery and furniture. Victims succumb to smoke long before the structural materials of a house are even involved in a fire.
5. Fire deaths in the UK are now at their lowest level since 1959.

## Building Regulations – protecting people from fire

Building Regulations in England and Wales (and their equivalent in Scotland and Northern Ireland) are the legal requirements that govern how buildings should be designed and built.

The idea for these building codes was first introduced following the Great Fire of London in 1666. The first building regulations also looked beyond fire safety to include structural load bearing walls, foundations, timber in party walls, joist centres, beam bearings, roof coverings and rainwater gutters and down pipes.

Today, all new buildings in England and Wales are legally required to comply with the Building Regulations.

Guidance on how to comply on fire safety is given in Approved Document B, or alternative solutions better suited to a particular site can be agreed between the developer, designer and building control authority.

Modern building regulations are based on the knowledge that how a building copes with fire is not only a factor of the materials used, but of how the building is designed and constructed.

The regulations are very stringent, amongst the toughest in the world, and do not differentiate between types of construction. Timber frame buildings must meet exactly the same fire safety standards as masonry or steel frame buildings.

The building regulations are primarily focused on one thing – public health and safety. Fire regulations address issues such as:

- Means of escape (making sure people can get out of a burning building safely via stairs, emergency windows etc)
- Restriction of spread of fire internally and externally
- Load-bearing capacity and integrity (the ability of the structure of a burning building to stay intact long enough for occupants to escape safely)
- Insulation (making sure parts of a building do not get too hot).

Current regulations for England and Wales prescribe a minimum time that all homes must resist fire in order for occupants to escape. The following is a general guide but specific values should be determined from the building designer and current regulations:

- Houses up to 3 storeys – 30 minutes
- Houses above 3 storeys – 60 minutes
- Flats up to 2 storeys – 30 minutes
- Blocks of apartments between 2-7 storeys – 60 minutes
- Blocks of apartments of 8 storeys or more – 90 minutes
- All compartment walls up to 6 storeys – 60 minutes

Building regulations apply to completed buildings – properties still under construction will never comply.

### **Timber burns – surely that must mean it's a risky building material?**

Of course timber burns. But all building materials are vulnerable to fire:

- Brick and stone flakes and disintegrates.
- Concrete used in high rise buildings can be subject to the violent phenomenon known as explosive spalling, which is hugely dangerous to fire fighters and people trying to flee a building.
- Steel can buckle in severe heat – that was the problem at the Yarl's Wood Detention Centre fire in 2002.

Every building material has its weaknesses if you want to test them in this way. Equally, each mainstream method of construction in the UK, including timber frame construction, has its specific strengths and benefits.

The fire safety of a timber frame structure is determined by tests carried out to British Standards by a UKAS approved fire test laboratory.

The fire safety of a building is far more complicated than whether the materials are combustible or not – the characteristics of the entire system must be taken into account.

So the real question is this: do today's architects, builders, developers and building authorities know how to overcome any weaknesses, maximise strengths and generally use such materials in such a way that our buildings are safe, robust, durable and fit for purpose? And of course the answer is yes.

We have centuries of experience of building with timber in this country. We also have some of the best building regulations and standards in the world.

Of course there is absolutely no room for complacency. Poor workmanship and faulty design will jeopardise the fire performance of any home, and this can put lives at risk. UKTFA's training programmes are helping to address these issues.

Thankfully the UK construction industry – in particular, the house building industry – is increasingly familiar with building with timber frame.

Technical experts such as NHBC, Zurich Insurance, TRADA and BRE consider timber frame to be a perfectly acceptable method of building. Even the most expert risk-assessors, including mortgage lenders and insurers, accept that well-built timber frame homes are as safe and reliable an investment as brick and block homes.

### **Assessing the risk of timber frame**

On every construction project, all members of the team from designer, to developer, contractor and planning supervisor are required to comply with the Construction (Design & Management) Regulations 1994.

This includes producing a risk assessment for the site, its design and construction, and covering the use of any particular building material.

For timber frame the risk assessment should include fire during construction. Alternative ways of working should be sought if the work activities of the main contractor, or follow-on trades, are such that there is a clear risk to the unprotected timber frame. A typical risk assessment would include precautions such as:

- No smoking
- No exposed flames (barbeques etc)
- Fire extinguishers in strategic locations
- Controlled use of timber drilling of large section timber – training of operatives. The use of blunt drill bits can cause timber fire
- Controlled use of blowtorches – training of operatives
- Security and checking against vandalism and arson attacks
- Removal of timber shavings, paper and inflammable materials
- Ensuring skips that contain flammable materials are secure and stored away from the frame
- Ensuring storage of gas cylinders and other dangerous substances well away from the building
- Providing safe egress routes in the event of any emergency
- Providing the local fire and police with information about the site and emergency procedures
- Undertaking a checking procedure to ensure the procedures are followed, noting risks and issues.

### **Multi-storey timber frame buildings**

Four-storey timber frame buildings have been built extensively for the last 20 years, and the first 6-storey timber frame building of its kind was built more than 10 years ago. The Building regulations changed in 1991 to allow buildings to potentially reach 8-storeys (in England and Wales).

If you want to know how multi-storey timber frame buildings cope with severe fire, there is one key piece of research that you must read. The TF2000 project provided a 6-storey experimental timber frame building for the sole purpose of investigating its structural and fire performance.

The results prove that fire resistance of a timber frame structure is achieved by a combination of the timber structure itself, the internal lining material and the insulation. In all these elements, a well built timber frame home will meet all current Building Regulations and Standards in the UK.

To download an extract from the TF2000 report 'Multi-storey timber frame buildings - a design guide' (PDF file), go to the UKTFA website.

### **Cladding on homes**

Timber and other methods of cladding the outside of a building are all acceptable, so long as they meet the Building Regulations. Test evidence is often required to demonstrate compliance with the relevant regulations.

At certain locations on the outside of a building there are fire regulations that must be met – for example, at steps in the roof line or where boundary conditions require surface spread of flame and fire resistance from outside. In all cases, technical advice is needed to ensure the cladding material is appropriate for the location. These requirements are for any form of construction method, not just timber frame.

In practice, most timber frame buildings are clad in brick, often as a result of local planning requirements and the public's design preferences.

The Brick Development Agency has published a report on the good performance of brick-clad timber frame buildings and the TF2000 project. To download a copy, go to the UKTFA website.

### **Fires in cavity walls**

According to official UK fire statistics, cavity fires (where a fire breaks out in a cavity wall construction or cavity materials are responsible for fire development) are very rare, representing about 0.07% of all fires attended by the fire brigade.

Statistics indicate no fatalities or injuries resulting from cavity fires, and material damage has been minimal.

Fire brigades have thermal imaging tools to help them locate the seat of a cavity fire very quickly after arriving at the scene.

Independent research for the Government by Chiltern International Fire shows that no one method of building is more or less at risk than another.

### **Information for homeowners**

Fire officers will point out that in most fires it doesn't usually matter what material is used for the load-bearing structure of your home. Your curtains, wallpaper and sofa are enough to cause deadly fume poisoning, and this is the most common cause of injury and death from fire.

However, if you live in a timber frame home, you can take comfort from knowing that fire safety has been addressed at every stage in its construction.

- Design stage – your Q-Marked timber frame home has been designed to comply with stringent UK building regulations on fire resistance.
- Manufacture – your Q-Marked timber frame home has been precision made to meet the fire design requirements. This includes fire resistant plasterboard on the inside and flame retardant breather membranes.
- On site – your Q-Marked timber frame home has been inspected by a building control officer or approved inspector to check that its construction complies with building regulations. The Q-Marked timber frame supplier provides the builder with technical backup to guide and support the frame detailing in order to achieve quality built homes.

NHBC and Zurich Insurance provide commonsense guidance for owners of all new homes, including information on how your home is built and should be maintained.

### **How timber frame performs in fire**

If timber is protected from direct attack by a fire source, it cannot ignite and burn before a temperature in excess of 400°C is reached at the timber surface.

When fire does take hold, timber reacts differently to other common structural materials:

- Uniform charring at a low rate when the plasterboard has fallen away
- Low heat conduction
- No deformation at high temperatures

Contrary to many people's expectations, timber used in construction performs well in fire. It will not flake, spall, melt, buckle or explode. Timber burns steadily at a predictable rate. In the charring process charcoal is formed on the surface of the timber, which serves to insulate and protect the core.

This also explains statements from fire fighters who prefer to enter a burning building made out of timber, because they have learned to estimate how long they can safely remain in the building.

Well built timber frame homes perform well in even the most ferocious fires. See the last page of this briefing note for a recent case study.

### **Uncompleted buildings and fires on construction sites**

All buildings under construction are very vulnerable to damage from fire and other hazards. The HSE estimates that there are around 11 construction fires every day (although the vast majority of these are not on house building sites).

No construction method is immune – for example, there are frequent problems on site from the collapse of walls of thin-joint blockwork, and masonry homes are targeted by arsonists just as much as other sites. Even small building sites can have oil tanks, flammable paints, combustible polystyrene, LPG cylinders and other materials lying around.

The majority of fires can be prevented by designing out risks, taking simple precautions and by adopting safe working practices.

Site security is the responsibility of the developer and contractor.

The Construction Confederation and Fire Protection Association have published a Code of Practice for fire prevention on high value construction sites. Compliance with this Code often forms a condition of insurance.

The Code describes a series of simple precautions and safe working practices which, if adopted, will ensure that adequate detection and prevention measures are incorporated during the design and planning stages, and that work on a site is undertaken to the highest standard of fire safety.

There is also a checklist which is particularly helpful in offering a tick-list of things to consider, including storage of flammable materials, hot work on site and many other issues.

If a construction fire occurs the primary aim is not to save the building, but to make sure everyone on site reaches safety as soon as possible.

Timber frames will burn faster and more completely when the panels are incomplete – ie. not yet protected by the usual internal fire-resistant plasterboard and external cladding.

In such cases, the fire brigade may decide that it is easier to let the frame burn to the ground than try to put out the fire. As long as foundations are unaffected by the fire, it is usually easy to arrange for another timber frame structure to be built on the same site fairly quickly – and that is what most developers choose to do.

### **Reducing arson on housing sites**

Theft, arson and vandalism are serious problems on building sites. The losses from theft and vandalism suffered by the construction industry have been estimated at around £400 million a year - over £1 million every day.

The Government's annual UK fire statistics show that two thirds of fires in construction industry premises are started deliberately. Motives range from revenge, fraud, and crime concealment to simple vandalism and fire-play.

All housing developments are vulnerable, regardless of the construction type, although the scheduled 'just in time' delivery of timber frame systems and its fast construction time can help to reduce the window of opportunity for criminal gangs and random acts of vandalism.

Working with its member companies, the UKTFA is developing new initiatives to help improve site security and reduce the risk of arson. This includes new risk assessment processes, proportional to the size of site, its location and proximity to well-known problem areas, time and speed of build. Recommendations can then be given on a range of security solutions, from the safe storage of materials and site staff training, to CCTV and overnight lighting.

### **Masonry industry research - the "Vienna Study"**

Prof. Dr. Ulrich Schneider from the Technical University of Vienna conducted a study into 'Fire-safety analysis in concrete and timber frame construction' in 2004. The report was prompted by what the researchers described as "worrying changes" to building regulations in Austria and Germany regarding fire safety.

Germany had produced a set of draft technical guidelines covering fire-safety for homes, particularly for multi-storey construction up to 13m, but apparently Austria had not got technical guidelines like this – the report states "there are no fire-safety guidelines for timber frame construction [in Austria]". Our contacts in Austria tell us that such guidelines are in preparation, covering all methods of construction.

Clearly those issues do not apply to timber frame homes in the UK where we have very good fire regulations for both low rise and multi-storey construction.

Professor Schneider also looked at five selected countries (Austria, Germany, the USA, Japan and Finland), found out how many people die in fires each year in those countries, and has tried to make a direct link between number of deaths and the market share of timber frame homes in each country. No attempt has been made to look at behaviours or any other social or regulatory factors at play in these countries. Unsurprisingly, there is no causal link that these, or any other researchers, could find.

### **No more mud-slinging!**

There are single-issue lobby groups funded by concrete block manufacturers who attack timber frame on its fire performance.

Understandably, they are defending a market which is under severe competitive threat from both timber and steel frame, and from the increasing use of these modern methods of construction. And fortunately, their impact on the timber frame market is minimal – timber frame continues to grow in popularity, industry favour and public acceptance.

The UK Timber Frame Association is a trade association rather than a lobby group, although we do promote the benefits of timber frame. If you want to discuss concerns about fire or any other issue, please do contact us and we will do our best to give you the facts. We also recommend you talk to independent experts such as NHBC, Zurich Insurance, TRADA and BRE.

In the meantime, we call for an end to the smear campaigns. Everyone has long since grown bored with the war of words.

Each method of construction, including brick and block, has its own merits. Each is equally suited to building in the UK, and is safe, durable and cost effective. Timber frame and all other forms of mainstream construction meet the Government's regulations on fire, flood and other health hazards. End of story.

Bryan Woodley, chief executive of the UKTFA, says it's time for dialogue, cooperation and the end of negative campaigning.

"We have a wonderful opportunity with the Olympics, the development of sustainable communities and the largest housebuilding programme we've ever seen. We have a good story to tell, and what the country needs now is for the building materials industry to work more closely together to promote confidence in the high quality of UK housebuilding."

# FIRE AND TIMBER FRAME CONSTRUCTION – A CASE STUDY

The Sorting House is one of Manchester’s most central and desirable residential developments, providing 104 one and two-bedroom duplex apartments around a central courtyard garden and with basement car parking.

The development is a conversion and substantial extension of one of central Manchester’s landmark buildings, the turn of the century Royal Mail Sorting Office.

Working with the developers, Pace Timber Systems designed, manufactured and erected a four storey timber frame extension on top of the old building. The development was completed in 2003.

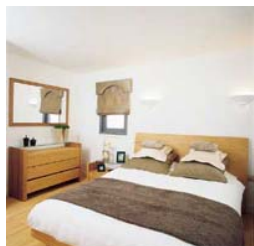


The Sorting House Manchester

## Disaster strikes at 2am

Very early on a Tuesday morning in July 2005, the tenant in one of the top floor apartments discovered that fire had broken out in the bedroom – almost certainly a result of candles left unattended on a ledge.

The fire was very serious, consuming furnishings and personal belongings within just a few minutes and creating an extremely ferocious fire that blew out the windows and destroyed pretty much everything in the room.



A typical interior

Thankfully, the tenant escaped with her life although she suffered from the effects of smoke inhalation – by far the most common and dangerous effect of most house fires.

## Reassured residents

The fire brigade was able to contain the fire within just one part of the apartment and extinguish it. Within a short time, loss adjusters and fire investigators arrived to examine the apartment and assess the extent of the damage.



The ferocious fire blew out the window and destroyed almost everything inside the bedroom

What they saw was not pretty. But to their delight, they found that the walls and ceiling had remained completely intact – behind the burned plasterboard they found the timber frame structure and insulation in pristine condition, completely unaffected by the inferno.

The concierge at The Sorting House said: “It’s amazing. When we pulled away the damaged plasterboard, we realised that the fire had failed to damage the timber frame structure underneath. Repairs are starting and will be completed pretty quickly and easily, I expect. It has been a huge reassurance to many of the residents – nobody can tell us that timber frame buildings are any more vulnerable to fire than any other buildings now. I’m really impressed.”



Burned plasterboard is ripped away to show no damage to the timber frame structure at all

The experience in Manchester confirms the results of fire tests by independent scientists at the Building Research Establishment (BRE), which show that the fire resistance of a modern timber frame structure is achieved by a combination of the timber structure itself, the internal lining material and the insulation. In all these elements, a well built timber frame home will meet all current Building Regulations and Standards in the UK.