



TRADA TECHNOLOGY LTD



The Institute of
BUILDING CONTROL

LOFT CONVERSION GUIDE



For contractors and designers

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The Loft Conversion Guide has been developed to set best practices for loft conversions. It is important to note that this is a comprehensive guide, however not all methods of conversion, or regional variations have been covered.

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INTRODUCTION - MAKING THE MOST OF WASTED SPACE

Converting existing roof spaces can be the easiest and most cost-effective way of increasing living accommodation in many houses. Rooms in the roof can provide attractive and interesting internal spaces ideal for extra bedrooms, bathrooms, studies, playrooms or even leisure rooms. Compared to the alternative of building an extension, converting the roofspace is usually straightforward and involves far less red tape. The added bonus of a loft conversion is that no garden is sacrificed for the extra space.

This Guide to Loft Conversion is divided into three main sections.

Part 1

ASSESSING THE FEASIBILITY OF A LOFT CONVERSION

Part One is intended for contractors and enables them to assess the feasibility of a proposed loft conversion by working through a step-by-step assessment of the existing building and the planning situation. Once the principles of these checks are understood the simple checklist provided on Page 18 will serve as the basis for preparing a feasibility study for the client and professional designer involved in the project.

Part 2

TECHNICAL INFORMATION FOR DESIGNERS

Part Two is intended primarily for designers and deals with the Building Regulations/Standards as they relate to loft conversions. This section examines each aspect of the design covered by the Regulations/Standards and describes what the minimum requirements are. This section is supplemented by an additional inserted document covering the different Regulations/Standards pertaining to each region of the British Isles. A number of specification options are also made for each element of the design, including the detailing and installation of dormer windows and roof windows.

Part 3

CARRYING OUT THE CONVERSION

Part Three is intended for the contractor undertaking the loft conversion once the design and specification have been prepared and plans approved by the Council. This section includes the general principles of loft conversion work and some useful hints and tips on each aspect of the proposed project.

Fig 1



NB: All roof conversions must comply with the Statutory Building Regulations/Standards and therefore will require approval from the Building Control Surveyor. Some conversions may also require planning approval, depending on the location of the property and the amount of change to the external appearance, such as the introduction of roof windows or dormers etc. These aspects are covered in more detail on page 19.

Part 1 - ASSESSING THE FEASIBILITY OF A LOFT CONVERSION

Before taking a proposed roof conversion to the design stage it is essential to assess the feasibility of the project. This means inspecting the loft to assess the internal space, the type of roof structure and the general condition of the existing structure. A detailed checklist is provided at the end of this section on Page 18. The feasibility study should give a general indication of the suitability of the loft for conversion and its potential uses.

Is the existing roofspace suitable for conversion ?

Some shapes and forms of roof lend themselves more readily to conversion than others. The key factors to assess are the roof shape, its internal height and width and the pitch.

ASSESSING THE ROOF SHAPE

The overall form and profile of the roof will have a major bearing on whether the roof is suitable for conversion to usable space. Here are some of the most common forms of roof shape

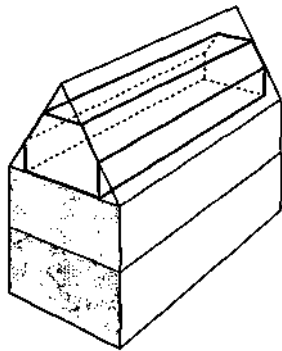


Fig 2a

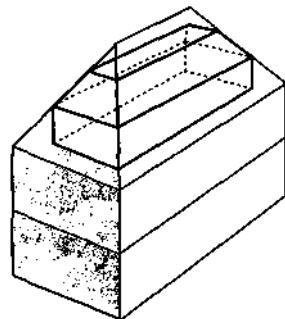


Fig 2b

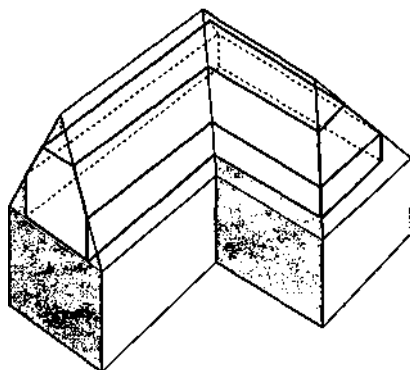


Fig 2c

GABLED ROOFS:

Ridge roofs with gable end walls are generally easier to modify in order to accommodate space in the roof than hipped roofs. Party or gable end walls, together with any internal load bearing walls, can usually support any new beams or trussed purlins which may be required. Figure 2a opposite.

HIPPED ROOFS:

The conversion of hipped roofs can be complicated unless internal load bearing cross walls are available or extra beams are inserted at floor level to support secondary beams or purlins. Figure 2b opposite.

ROOFS WITH INTERSECTING PITCHES (VALLEYS):

Intersecting pitched roofs with valleys can also be difficult to convert unless existing internal cross walls are present to provide support for new timber beams or purlins. New columns or walls may be required at these intersections to support beams or purlins forming the new roof space. Figure 2c opposite.

Table 1: Possible conversions based on pitch and span

Roof pitch/ Roof spans(m)	6.5	7.0	8.0	8.5	9.0
35°	-	-	-	-	✓
40°	-	-	✓	✓	✓
45°	✓	✓	✓	✓	✓
50°	✓	✓	✓	✓	✓

ASSESSING THE AVAILABLE SPACE

If the overall shape of the roof is suitable, the next step is to check the basic internal dimensions of the roof space available for conversion.

THE FINISHED DIMENSIONS

The finished internal room dimensions should allow for:

- the thickness and depth of the new floor joists
- the depth of rafters and any thermal insulation below them.

If the habitable space within the roof volume is to have side walls, the usable floor area is calculated between these walls.

THE PITCH

The pitch of the roof can be obtained from inside the roof by either:

- measuring the angle with a protractor, adjustable set square or proprietary level
- measuring lengths x and y as shown on Figure 3 to find the roof pitch angle from tangent $A = y/x$; x and y can be measured at any convenient point provided the angle between them is 90°

See Table 2.

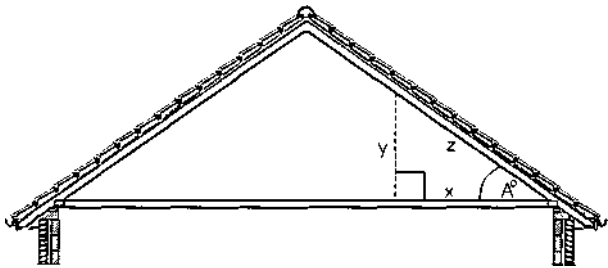


Fig 3

Table 2: When x = 1.0m

y	Pitch
0.70 m	35°
0.84 m	40°
1.00 m	45°
1.19m	50°
1.43 m	55°

THE MINIMUM CEILING HEIGHT

The size and shape of the existing roof space will determine whether it can be used for living accommodation (or possibly only increased storage). A ceiling height of 2.3 metres is the preferred minimum for habitable rooms, i.e. rooms other than bathrooms and kitchens. Figure 4. This height need not be maintained over the whole floor area and the usable floor space of rooms can be based upon the height needed for standing and walking or accommodating furniture. Lower room heights may be acceptable for bathrooms, corridors, kitchens or storage.

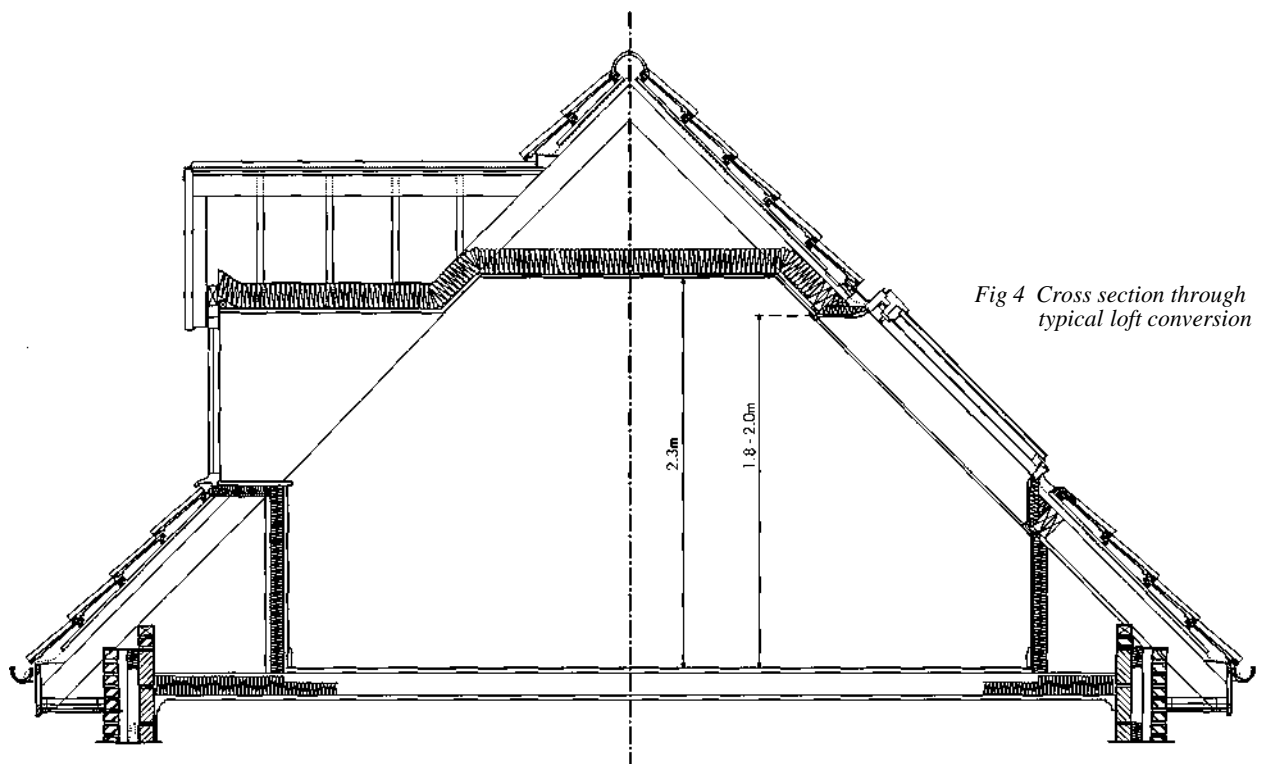


Fig 4 Cross section through typical loft conversion

THE MAXIMUM CEILING HEIGHT

There is no upper limit on the height of rooms and the sloping ceiling can, subject to structural limitations, run from the floor level to the ridge. It is often more convenient to fit a ceiling and side walls to limit the usable volume. It is common for the side walls to be between 800mm and 1200mm high so that low furniture can be placed in front of them. Except where the walls are formed as deep beams to support the roof structure, there is no restriction on fitting access doors into them so that the eaves space can be used as storage. Rigid insulation can be fixed to the back of the doors to maintain some thermal performance.

SPACE FOR ACCESS AND FIRE ESCAPE

The conversion of a roof space into habitable accommodation must include provision for safe access and exit. This requires a fixed staircase which should comply with the requirements of the appropriate Building Regulations/Standards in respect of its pitch, headroom, stair width and balustrading (see Appendix Legislation) and for safe access, normally an emergency exit.

Is the type of existing roof structure suitable for conversion?

Not all types of roof structure are suitable for conversion, so it is essential to assess what type you are dealing with. Some types of roof structure will need to be replaced entirely in order to be suitable for conversion. This is beyond the scope of this booklet, which is limited to the introduction of usable space into existing forms of roof.

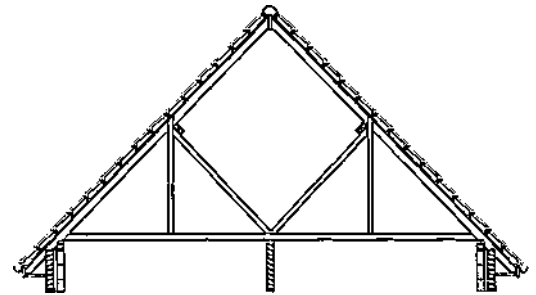


Fig 5a

TRADITIONAL RAFTER AND PURLIN CONSTRUCTION

Until the 1960s most roofs were usually made up by carpenters on site. Early roofs used large section timbers to form the basic frame, supporting purlins and rafters from these members. Figures 5a and 5b. As construction techniques developed smaller section timbers were used and the geometry of roof framing developed to enable these to satisfy design requirements. Most of the earlier types of roof relied upon support from loadbearing internal walls for all but the smallest spans. Figure 5c.

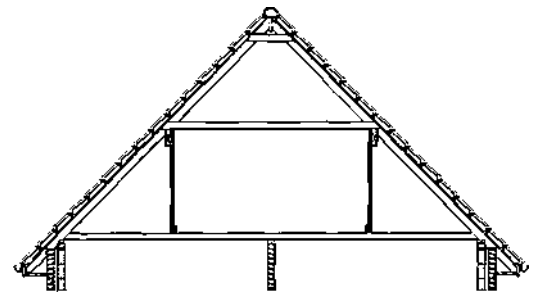


Fig 5b

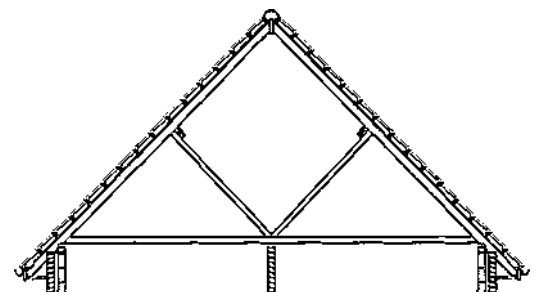


Fig 5c

TRUSSED RAFTER ROOF CONSTRUCTION

Since 1945 a number of different types of prefabricated trusses have been developed. These do not rely on support from internal walls and are usually at approximately 1.8 or 2.4 metre centres, supporting purlins and intermediate rafters. Figure 5d.

The function of the purlin in a framed roof varies depending on the roof design. Roof space conversion may require moving existing purlins to improve headroom or to enable a dormer window or roof window to be installed. The majority of houses built since 1965 use timber trussed rafters which span external walls and usually do not rely on internal load bearing walls for support. Figure 5e. These are relatively light weight trusses manufactured by specialist companies. The timber members are joined together using pressed steel plates. Trussed rafters are now normally spaced at 600mm centres, but 400mm centres were common in the past. Modifying trussed rafter roofs to form acceptable volumes is possible, but should only be attempted using specialist advice. The lack of existing internal load bearing walls to support new load bearing floor construction and the restricted space to insert new structural beams requires careful consideration. Older trussed rafter roofs commonly have low roof pitches, from 22.5° to 30° making them more difficult to convert into habitable spaces. With the more steeply pitched roofs now common, there is more potential space in the roof and specialised ways of modifying trussed rafters are now available.

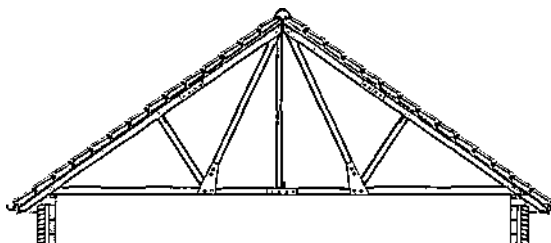


Fig 5d

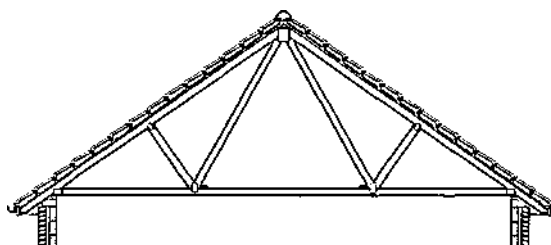


Fig 5e

Is the condition of the existing construction suitable for conversion?

Having established the feasibility of converting the roof structure to provide accommodation, it is essential to check the condition of the existing structure before design work for any roof conversion is undertaken. This means checking both the roof itself and the walls supporting it.

A roof inspection should include:
<ul style="list-style-type: none">• the condition and dimensions of the timber structure
<ul style="list-style-type: none">• the type and condition of external and internal wall construction
<ul style="list-style-type: none">• the presence of internal load bearing wall support
<ul style="list-style-type: none">• the type and condition of any party (separating) wall
<ul style="list-style-type: none">• the position and size of existing water storage tanks and services

If the house is of timber frame construction all loads must be taken by the timber frame walls and not the masonry cladding. (Advice on identifying the differences between masonry and timber frame walls is given in TRADA Wood Information Sheet 0-10 "Surveys of timber frame houses".)

TIMBER SIZES AND CONDITION

Sizes of existing timber members should be measured, together with their spacing, span and overall length. Existing timbers may also need to be stress graded, and the timber species identified if structural calculations are required. Existing roof timbers have the same structural capacity as new timbers of the same size and species unless they have deteriorated. All roof timbers should be inspected for decay or insect infestation. Remedial treatment should be carried out or the timbers replaced depending upon the extent of attack found. Expert advice may be required.

POSITION OF STORAGE TANKS

In most houses the water tank is positioned in the roof space (Figure 6a) and this may have to be moved to a new position in order to create a clear usable space (Figure 6b). The weight of water storage tanks should be included in structural calculations and the method of transferring their weight to the support walls identified. The location of drainage stacks and vents must also be considered.

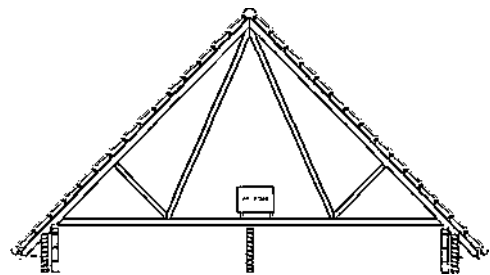


Fig 6a

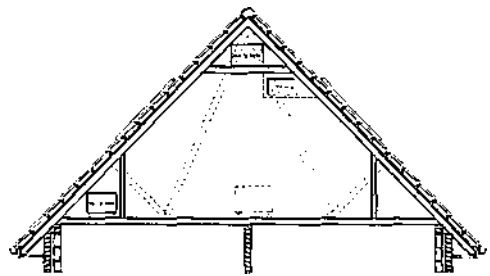


Fig 6b

ROOF COVERINGS

Old tiled or slated pitched roofs were sometimes constructed with square edged timber boarding but without an underlay - some had neither sarking nor underlay. In roofs where the coverings have been fixed without underlay, the structure and battens should be carefully inspected to determine their condition and remedial measures taken if necessary. Roof tiles or slates fixed to battens over underlay should be checked to ensure that this is properly lapped and weathertight. Where there is evidence of water ingress, it is advisable to install a new underlay.

REPLACING THE ROOF COVERINGS

The fixings for tiles or slates on pitched roofs more than twenty years old should be checked. Slipping tiles or slates are a sign that the fixings have corroded and require replacing. If the existing tiles or slates are sound they can be refixed using new corrosion resistant fastenings, making good with replacement tiles or slates as required. If it is intended to use new tiles, the weight of these relative to the original covering should be checked. If the weight of the new finish is greater, the loadbearing capacity of the roof structure should be checked. In some cases the use of lightweight composite or metal tiles/slates simulating traditional tiles may be a useful way of reducing roof loading. New roofing should be carried out in accordance with the recommendations of BS 5534: Part 1: Code of Practice for Slating and Tiling - Design.

CEILINGS

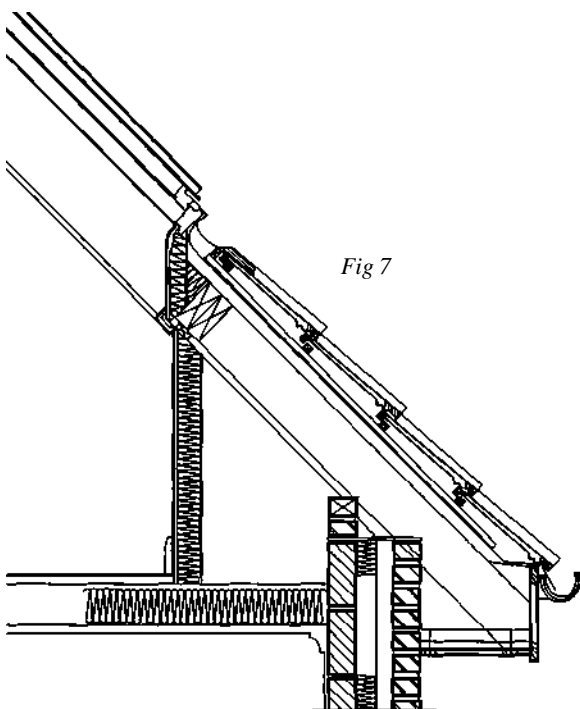
Until about 1940 most houses were constructed with ceilings of plaster and timber laths. In this case the plaster should be firmly attached to the laths. Cracking in the plaster indicates a weak bond and its condition should be assessed by applying pressure to the ceiling from below. Movement of the plaster indicates a loose bond to the laths and the plaster should be replaced, or the ceiling re-lined with plasterboard. Loose plaster on lath is unlikely to withstand the vibrations caused by building work or wetting during reconstruction.

Most modern ceilings are of plasterboard. Cracking of existing plasterboard ceilings may be due to inadequate support caused by the omission of noggins at the plasterboard joints. Because plasterboard can be damaged by moisture, it is important to ensure that the building is kept reasonably weathertight during reconstruction, particularly where the existing ceilings are to be retained.

ROOF INSULATION

In older roofs existing insulation which is dirty or damaged should preferably be removed. The dust and loose fibres should not be inhaled during removal and face masks and gloves should be worn.

Existing insulation which is in good condition can remain in position during alterations to existing roofs if the building work remains dry. Insulation at the new floor level provides a useful contribution to sound insulation between the existing and new rooms above. Its retention will also help restrict the passage of heat through from the rooms below. Figure 7



SUPPORTING WALLS

MASONRY WALLS

The strength of existing masonry walls can be an unknown quantity. Check that there are no visible defects such as cracks, crumbling surfaces, open joints or dampness. Defects must be repaired. The bearing strength of brickwork or stonework can be determined by the mortar joints. Hydraulic lime was used as the binding agent for mortar until the late 19th Century, and this has considerably less strength than the Portland cement mortar which came into common use after this time.

More recently, some types of ultra-lightweight concrete block which have limited load bearing capacity have been used for external and internal walls and should be carefully checked before significant extra loading is applied to them. Concrete block density is particularly critical if structural beams, purlins or joists are to be supported on steel hangers. It should be noted that not all masonry walls will have sufficiently adequate foundations.

Existing lintels to be identified and checked for suitability.

TIMBER FRAME WALLS

Modern timber frame structures rely on the structural timber members in the walls to transmit loads to the foundations. When single wall plates are used at the top of the wall the rafters and floor joists should align with the vertical studs in the supporting walls. However where double wall plates (head binders) are used at the top of load bearing walls the rafters or floor joists do not have to coincide with the vertical studs.

It is important to establish which internal timber-frame walls are loadbearing, i.e. the walls on the upper floor are coincident with walls below and supported on foundations at their base - sleeper walls or concrete footings.

Attic conversions can increase the dead load carried by the external walls and the capacity of existing wall framing should be checked.

SEPARATING WALLS

The construction of separating or party walls will vary according to the age of the building. Some houses may have inadequate acoustic and fire separation from the adjoining house in the roof space if the thickness of brickwork or blockwork has been reduced. In older houses there may be no separating wall at all within the roof space between adjoining properties.

If the roof space is to be converted into habitable accommodation the separating walls must be upgraded to meet current Regulation/Standard requirements and provide total separation from the adjoining house, including any occupied roof space.

MASONRY AND TIMBER SEPARATING WALLS

Masonry separating walls may be of brickwork or concrete blocks of various densities. Timber frame houses will commonly have timber frame separating walls comprising two adjacent walls lined with multiple layers of plasterboard. These are constructed similarly to other timber frame walls and usually have the capacity to carry additional loads from a roof space conversion. It is important that the fire resistance of the wall or its acoustic performance is not impaired by any alterations carried out.

Conversion checklist - at a glance

The following is a suggested list of the features to be checked when assessing the feasibility and possible method of converting a roof space into an attic space:

ROOF	a) Structure	<ul style="list-style-type: none"> i) Type of roof construction ii) Presence of bracing iii) Condition of timber and any evidence of decay or insect attack
	b) Construction	<ul style="list-style-type: none"> iv) Type and condition of tiles/slates and fixings v) Presence and condition of underlay vi) Roof ventilation provision vii) Type and condition of insulation
	c) Other features	<ul style="list-style-type: none"> viii) Water storage tanks and supply pipes ix) Drainage stacks and ventilation pipes x) Passive vent ducts xi) Chimneys and other services
EXTERNAL WALLS	a) Masonry	<ul style="list-style-type: none"> i) Thickness (mm) ii) Solid or cavity construction iii) Bearing for wall plate iv) Position of large span openings v) Adequacy of existing lintels
	b) Timber	<ul style="list-style-type: none"> vi) Position of wall studs vii) Presence of separate head binder viii) Position of large span openings
SEPARATING WALLS	a) Masonry	<ul style="list-style-type: none"> i) Thickness (mm) ii) Perforations iii) Existence of fire stops between wall and roof iv) Type of brick or block v) Condition of mortar
	b) Timber	<ul style="list-style-type: none"> vi) Correct thickness of plasterboard linings (see Appendix Legislation) vii) Existence of fire stops between wall and roof viii) Any structural members penetrating wall lining
INTERNAL PARTITIONS	a) Masonry or timber	<ul style="list-style-type: none"> i) Identify which walls are loadbearing and supported on adequate foundations

What legislation will be involved?

Most loft conversions will not require planning permission, but it is always a good idea to consult the local planning officer about your plans to check if permission is required: their advice is free.

All loft conversions must comply with the Building Regulations/Standards, details of which are available from the Building Control Surveyor. Unofficial loft conversions may still be subject to both planning and building control after the project is completed and are likely to make a property difficult to sell on in the future. If the work was carried out without permission you can ask your local authority about a regularization certificate.

PLANNING PERMISSION

Planning legislation allows accommodation to be extended into the roof space without planning permission, providing the extension is within the rules set out under the Town & Country Planning Legislation. Such alterations are made under what are known as permitted development rights. Alterations and inclusions are defined under Schedule 2 which is separated into two classes:

- Class A Part 1 Enlargements, improvements or alterations of dwellings generally.
- Class B Enlargement or conversion of a dwelling that involves addition or alteration to the roof.

For Scotland, alterations and inclusions are defined under Schedule 1, Part 1, Classes 1 and 2.

The primary aims of planning control are to prevent excessive increases in the house volume and to prevent an increased height or substantial change of the shape of a roof, that will affect the visual relationship of a building to its neighbours. However, planning permission is not required unless the roof volume is increased by more than a certain percentage

(which varies under the various national Regulations, see Appendix - Legislation). In planning terms the 'volume' of a house includes the roof, whether occupied or not, therefore merely converting the roof will not increase the existing volume. The advantage of using the space within the existing roof height and shape is that, in the majority of cases, planning approval will not be required for the conversion. However the roof conversion is part of a larger extension of the house, the total increased volume will have to comply with the statutory limits. Planning approval will always be required if there is a change of use of the building involved or if the property is a flat or maisonette. Planning approval will also be required where rooflights project above the roof plane on the slope facing the highway, or in Scotland on any roof plane where the window extends 10cm above the plane of the roof.

Permitted development rights are restricted in Conservation areas, Areas of Outstanding Natural Beauty and on listed buildings. Any alteration to a building which affects its appearance in these circumstances will always require planning permission for any alteration. Any work to a listed building, even if it does not alter the appearance will require listed building consent. Always check with your local Planning Authority whether planning permission is required for a proposed roof conversion.

BUILDING CONTROL

Where conversion of buildings, other than single family dwellings, is planned, all building work must conform with the statutory requirements of the relevant national Building Regulations or Standards. These cover the requirements, such as structural stability, thermal insulation, fitness of materials, etc. They are supported by examples of construction that are accepted as capable of meeting the requirements. Other methods may be acceptable, but compliance must be demonstrated to the satisfaction of the Building Control Surveyor. As the easiest way to comply is to conform with the form of construction shown, this principle has generally been adopted in this booklet.

Building Control Surveyors often adopt a flexible approach to conversions because of the individual nature of the work, but they should be consulted at an early stage in the design.

Where conversion of buildings other than single-family dwellings is planned, or where the building exceeds two floors before alteration, there may be more stringent requirements to be met.

The following is a summary of those aspects of any roof conversion that will be covered by the statutory requirements. There are three sets of Building Regulations/Standards for the UK and detailed requirements of the various national Regulations are included in the Appendices:

1. England and Wales
2. Scotland
3. Northern Ireland

The Republic of Ireland has its own Regulations, as do the Channel Islands.

**APPLYING FOR PLANNING AND
BUILDING CONSENT**

If the proposed project requires planning consent then an application needs to be made to the local authority using the relevant forms. The application will need to include details of the design (four copies) showing how it affects the appearance of the buildings concerned. There is a fee payable to the local authority who are required to notify the applicant of the decision of the planning committee within eight weeks. The application can be made by anyone involved in the project, but is often made by the architect, surveyor or designer concerned.

Building Regulation consent (with the exception of Scotland) can be applied for in one of two ways, either a Full Plans Application or by giving a Building Notice. A Full Plans Application is the most common route and involves sending in two sets of plans showing all details and calculations subject to the Building Regulations, accompanied by the relevant application form available from the local authority.

An inspection fee is payable after the first visit by the Building Control Surveyor and is an amount equal to three times the full plans fee. The local authority are required to give their decision within two months. The Building Control Surveyor will then visit the site at key stages during construction to ensure that work complies with the regulations.

The alternative of giving a Building Notice costs the same but the total fee must be paid when the Building Notice is given. Full plans are not required but it is probable that the Building Control Surveyor will request a layout plan of the loft conversion with details of beam sizes etc and may request supporting structural calculations. The Building Notice must be issued forty eight hours before work commences and the onus is on whoever is carrying out the work to comply with the Building Regulations. The Building Control Surveyor will visit the site frequently to ensure that work complies with the Regulations. In Scotland a

Legislation checklist - at a glance

Planning permission

Most loft conversions will not require planning consent unless the roof space is increased by more than a % volume. (See appendix for National Regulations.)

Planning permission will always be required if there is a change of use to the building if the building is in a conservation area, is a listed building or is in an area of outstanding natural beauty.

if the dormers or rooflights project above the roof plane on the slope facing the highway, or any roof plane in Scotland where the window extends 10cm above the plane of the roof.

If the roof window covers more than 10% of the roof area.

Applications should be made to the local authority.

Building Control

All building work must conform with the relevant National Building Regulations or Standards. (See appendix for National Regulations.)

Applications should be made to the local authority or approved inspector.

building warrant is required before work commences.

Part 2 - TECHNICAL INFORMATION FOR DESIGNERS

Complying with the Building Regulations

This section is for those designing the loft conversion or for those contractors undertaking work under the Building Notice procedure. It includes details of how to comply with the Building Regulations/ Standards for each aspect of the building design.

STRUCTURAL STABILITY

New structural members or alterations to existing structural members in order to convert an existing roof should be checked by a structural engineer. To ensure both the stability of the existing structure and the structural sufficiency of the new structure, formal calculations may be requested by Building Control in support of an application for approval.

MEANS OF ESCAPE

A house which is extended or altered to add a third storey should comply with the Means of Escape provisions. In the case of four or more storeys Clause 4.4 of BS5588: Part 1:1990 should be followed.

The conversion of a roof space which provides one or more new habitable rooms at second floor level should include the following provisions:

- i) The existing stairway at ground and first floor level should be enclosed within 30 minute fire resisting walls, including any glass panels, and the stairway should open directly to a final exit, or to a space which provides two escape routes, each to a final exit, and separated from each other by fire resisting construction and self closing fire doors.
- ii) All doors to habitable rooms opening into a stair enclosure should be fitted with a self closing device, and new doors should be fire resisting. This includes any habitable room at ground floor level.
- iii) The new stairway should comply with the requirements of the regulations. A new stair within an existing stairway enclosure should be separated from any new rooms by a self closing fire door of fire resisting construction, or, when rising from an existing room, should be separated from that room and the rest of the house by fire resisting construction and a self closing fire door at the top or bottom of the new stairs.
- iv) Every habitable room, including a kitchen (but not a bathroom) in an upper storey which has only one escape route must have an emergency window which can be either in the external wall or roof. Opening windows in second floors, if they are intended as secondary means of escape for rescue by ladder, must be positioned at a certain height above floor level and provide an adequate size opening for easy escape. The dimensions and location vary in the national Regulations but sufficient space must be provided at ground level on which to stand a ladder.
- v) Escape routes over balconies or flat roofs (of fire resisting construction) will require to be protected by guard-rails in accordance with the Regulations.
- vi) The installation of self-contained smoke alarms to improve escape is now strongly recommended (see Appendix - Legislation).

FIRE RESISTANCE

All roof conversions must conform with the fire requirements in the national Regulations. This largely concerns the conversion of an upper floor ceiling to a new floor construction, which must then achieve the fire resistance of an intermediate floor - normally 30 minutes. There are certain accepted lesser provisions in the national Regulations depending on the accommodation provided and the number of storeys.

The requirement for fire resistance includes any member supporting a floor, even if this extends beyond the actual floor area of the accommodation, i.e. between the outer wall of an attic space and the external wall at the eaves. (Note, if the roof accommodation will be of a different occupancy, such as a separate flat, to that on the floor below, it may be necessary to achieve full Separating Floor fire resistance, usually 60 minutes.)

If an existing floor supports a new staircase to habitable space in the roof, this floor may have to be upgraded to achieve full 30 minutes fire resistance (see Appendix - Legislation and reference to BRE recommendations).

If an attic wall forms part of a separating wall between properties, it must achieve the full fire resistance of a separating wall.

Any opening, such as a window or roof window, to an attic will have to meet an AA fire rating, if it is located within 6.0m of an adjoining boundary or "notional" boundary.

To comply with this requirement the glass has to perform to BS 476 : Part 3 : 1958 and certification must be available.

A gable wall to an existing roof space which is accessible for repair or maintenance only is defined in the Building Regulations as forming part of a roof. In converting the roof space into habitable rooms it may be necessary for the gable wall to have fire resistance. This will depend on the proximity of the boundary or notional boundary.

If the roof space incorporates a chimney or a flue any new construction must comply with the space separation requirements for combustible material. No combustible material other than a floorboard, skirting, picture rail, mantle-shelf or architrave should be closer than 200mm to a flue in a chimney or 40mm from the outer surface of a masonry chimney. Nails, screws or other metal fixing timber to a masonry chimney should be at least 50mm from the flue. Always remember to consider the position of the chimneys and ventilation stacks in relation to the position of windows.

SURFACE SPREAD OF FLAME

Walls and ceilings to any new accommodation within the roof must comply with the appropriate Spread of Flame requirements in the national Regulations (see Appendix - Legislation).

Plasterboard will meet the Spread of Flame requirements. Timber having a density of more than 400kg/m³ may be used painted or unpainted as Class 3. Timber products can be treated to provide Class 1 and 0 surface spread of flame. A surface which slopes at an angle of 70° or more to the horizontal is deemed to be a wall.

SOUND INSULATION

All walls separating dwellings must have adequate airborne sound insulation. Existing separating walls in roof spaces may not provide adequate resistance to airborne sound if the roof is converted into occupied space on one side of the separating wall. If an attic room abuts a separating wall, the wall must therefore be lined to provide equivalent sound insulation to the separating wall elsewhere in the building. However, if the roof space on the other side of the wall is not occupied, the ceiling to the upper floor will contribute to the sound insulation of the occupied space below.

Gaps left in existing separating masonry walls should be filled with bricks or blocks and mortar and the wall surface rendered with a sand and cement mix. Thin brick or lightweight block walls should be lined with separate timber framed walls weighing at least 20 kg/m^2 spaced 25mm from the masonry wall. (12.5mm plasterboard fixed to ex 50 x 50mm softwood framing with mineral wool between the frame and the masonry should be adequate.) The timber frame should be fixed only to the floor and roof structure with any gaps between the framing and the floors and roofs sealed with acoustic sealant. Separate timber frames will reduce the roof space dimension between separating walls by approximately 90mm in an end terrace or semi-detached house and 180mm in a centre terrace house.

A plasterboard lining to existing timber frame separating walls will normally be adequate for fire resistance but additional plasterboard may be required to improve sound insulation. The minimum plasterboard thickness should not be less than 30mm fixed in two layers (19 + 12.5mm) or three layers of 12.5mm, all with staggered joints.

Proprietary mineral fibre/plasterboard laminates can be used to line timber frame and masonry separating walls to improve both sound insulation and fire resistance. Manufacturers should be consulted for details of performance and fixing.

Although there is no requirement for sound insulation between rooms within a dwelling, improved airborne and impact sound insulation of floors can be achieved between new rooms in the roof and rooms below by packing new floor joists at their bearings and ensuring that they clear the existing ceiling. Existing insulation between ceiling joists can be retained as a sound absorbent blanket. An improvement of between 5 and 10 dB may be assumed over a conventional timber joist floor, but will depend partially on the existing ceiling construction.

VENTILATION OF ROOMS

Windows to habitable rooms must include an opening area proportional to the floor area of the room, normally 1:5, with some part of the ventilation opening at least 1.75m above the floor level. Background ventilation is required for all habitable rooms and should be controllable, secure and located so as to avoid draughts. Bathrooms with an external wall should preferably be provided with an opening window. Extract ventilation should also be provided by a mechanical fan which may be operated intermittently or by a passive stack ventilation (PSV) system. Rooms with sanitary fittings may have natural ventilation or extract fans that may be operated intermittently with an overrun. Kitchens must have either a mechanical extract or a PSV system. (The particular national requirements for ventilation are set out in the Appendix - Legislation.)

VENTILATION OF ROOF SPACE

The introduction of a room into a previously open roof space will restrict the flow of natural ventilation through the roof intended to avoid condensation. The existing ventilation provision, if any, at the eaves will, therefore, have to be increased to a continuous 25mm opening, or equivalent area, at the eaves if insulation is introduced into any part of the pitched roof. A 50mm ventilation gap must also be provided over any insulation in the pitched roof to ensure adequate cross-ventilation of the overall roof space. If roof trimmers at openings restrict this flow, the spaces between the trimmed rafters must be interconnected by openings to provide a lateral flow of air.

Roof vents must also be added at the ridge to provide high level extract and should also be provided below dormer windows.

VAPOUR CONTROL

Where accommodation occurs within a roof space, it is important to incorporate a vapour control layer on the warm side of the insulation for both walls and sloping ceilings. BS 5250: 1989 recommends a 500 gauge (125 micron) polythene sheet fixed between the lining and the insulation dressed up the room walls and across the roof slopes. It may be omitted at the flat ceiling level if the roof space above is ventilated. A vapour control layer may not be necessary when the insulation is placed above the rafter level to provide a warm roof, but the insulation manufacturer should be consulted.

Adequate room ventilation is required to prevent the build up of water vapour within the rooms. Extract ventilation to bathrooms and kitchens and background ventilation to habitable rooms should provide sufficient ventilation for this purpose.

ACCESS

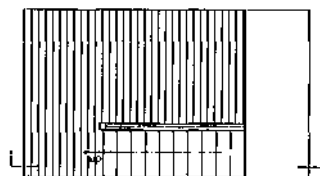
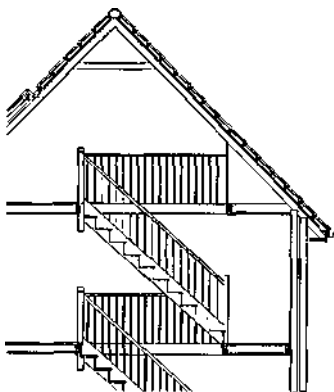
The dimensions and pitch of any stair leading to a room within the roof must conform with the requirements of the appropriate national Regulations/Standards.

They must also conform with requirements for escape, and will require some form of fire protection. Fire resisting doors must be self-closing FD20 type when tested for integrity in accordance with BS 476: Part 8 (1972) or Part 22 (1986).

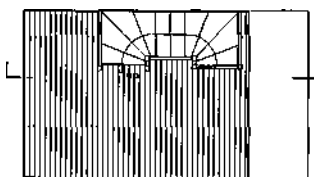
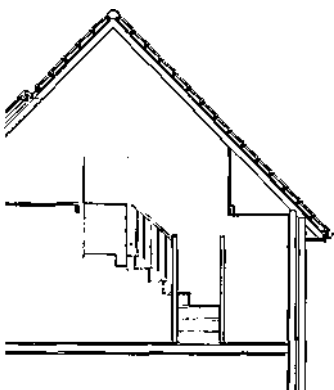
Adding room(s) in the roof space to a two storey building effectively increases it to three storeys with consequent increased requirements, but, if the new accommodation is limited in area, certain accepted lesser provisions may be permitted under the national Regulations compared with the requirements for new buildings. There is no restriction on the type of staircase, which may be a straight flight Figure 8a, a winding staircase Figure 8b, a quarter landing Figure 8c or a half landing Figure 8d. Loft ladders may not be used to provide access to rooms in the roof other than for storage accommodation.

In instances where there is insufficient headroom at the top of a staircase a VELUX roof window can provide additional height as well as light and ventilation.

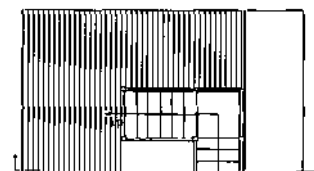
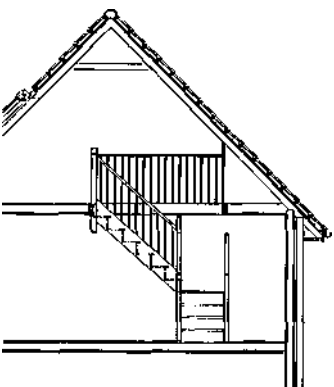
An alternative means of achieving the required head height is to create a dropped landing. This also creates an interesting design feature.



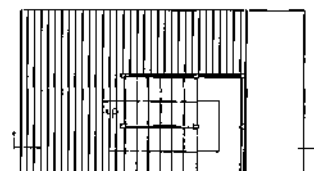
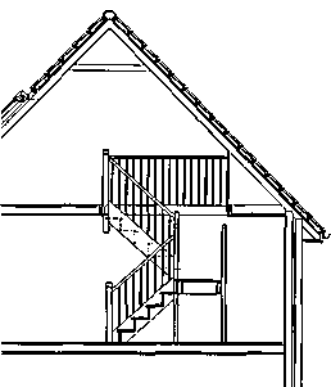
*Fig 8a
Straight flight*



*Fig 8b
Winding*



*Fig 8c
Quarterlanding*



*Fig 8d
Halflanding*

THERMAL INSULATION

The majority of houses are insulated above the upper floor ceiling with a ventilated 'cold' roof space above.

Any habitable accommodation inserted into the roof space will be above this insulation and will, therefore, have to be insulated in line with the requirements of the current national Regulations. This can be done by either insulating the whole roof pitch (from ridge to eaves), Figure 9a, or by insulating around the new accommodation only. Figure 9b.

The first method is simple to do, but will involve more insulation material, particularly in the apex of the roof, and will also increase the volume of the house to be heated. Ventilation in this case would only be necessary over the insulation. If the roof finish is to be replaced, fitting insulation above the rafters would result in a "warm" roof precluding the need for ventilation above the insulation. Figure 9c.

The second method is more usual because it saves on the amount of insulation required, but may involve more work. The walls, any part of the sloping ceiling and any horizontal ceiling over the habitable space will in this case need to be insulated.

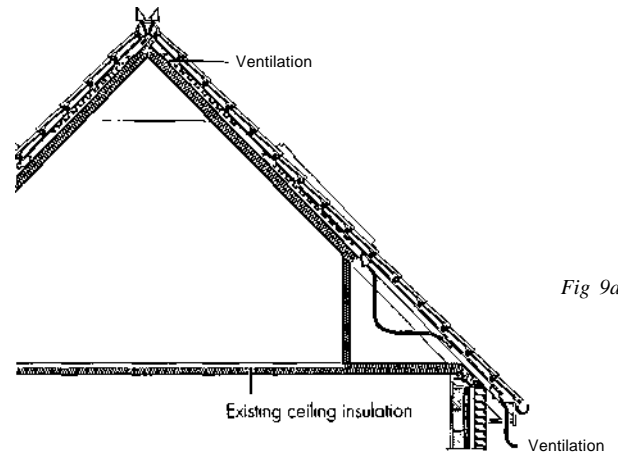


Fig 9a

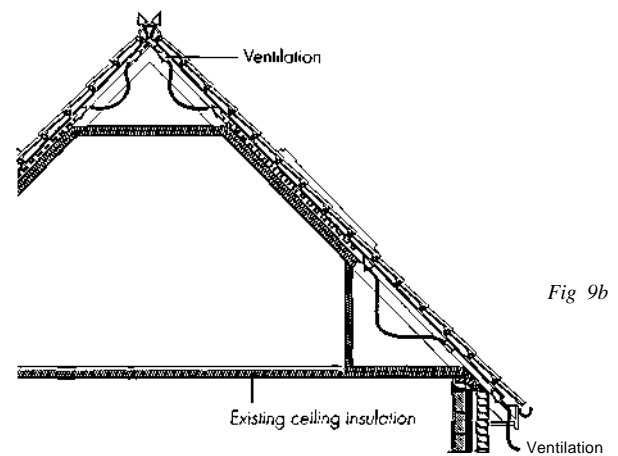


Fig 9b

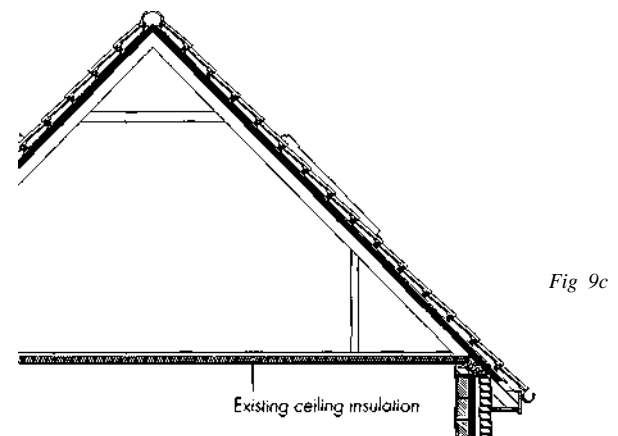


Fig 9c

In both methods involving a "cold" roof construction, it may be necessary to increase the rafter depth either generally or locally to contain the insulation and provide the ventilation space above. This can be done by adding battens to the underside of the rafters.

Any existing ceiling area between a side wall of the room in the roof and the eaves will still require to be fully insulated and must be ventilated above the insulation.

Any external gable walls in the roof accommodation will have to be insulated to conform with the thermal requirements for external walls. This can be done by using a plasterboard with insulation laminated to the back face or in timber-frame construction by inserting mineral wool insulation between the studs before lining them with a vapour control layer and plasterboard. Any roof windows in the attic space should be double glazed. The actual published U-value of the glazed units will be used to calculate the permitted glazed area relative to the overall thermal performance of the building envelope.

DAYLIGHT AND VIEW OUT

Within some national Regulations there is a specific requirement that glazed areas must be equivalent to a proportion of the floor area, but any habitable space should have a source of daylight and a view out. Good practice would suggest a minimum glazed area equivalent to 1 / 10 of the floor area for this purpose.

These facilities can be provided by windows in gable walls, dormer windows or roof windows in the slope of the roof. These should all conform with the statutory requirements for ventilation and emergency escape where required.

Planners are often concerned that the general appearance of a roof should not be affected by the conversion of the roof space, even if the height and shape have not been affected. In many cases dormer windows are accepted for their general 'traditional' appearance, but they may have considerable impact on the scale, shape and appearance of a roof relative to surrounding roofs and will require planning approval.

If a roof overlooks a 'highway', any projection above an existing roof plane will require planning approval and the addition of dormers would represent a 'projection'. Roof windows parallel to the slope of roof may not require planning approval as they do not project significantly and will therefore have a limited effect on the appearance of the roof. In a particularly critical environment, such as a conservation area, the recessed type of roof window can be used instead of a standard type.

PLUMBING

Where a new bathroom is located in a roof space conversion, provision will be required for hot and cold water supplies and drainage. The cold water storage tank must be positioned at a sufficiently high level to provide adequate pressure to the appliances. The space for cold water storage tanks should allow both for the thickness of insulated lagging and provide access for maintaining the ball valve.

In roof space conversions room heights are often restricted and space for storage tanks limited. It is sometimes possible to increase the roof space over stairways to accommodate the water tank by accepting a lower ceiling height on landings. Roof access panels should be positioned to allow easy access to the ball valve in restricted spaces. If there is no space for a new storage tank at a higher level it may be possible to connect the new services to the mains supply in which case pressure will usually be adequate not to require a storage tank. Alternatively a pumped system could be installed.

Where pipe-runs from the hot water cylinder will be long, and the appliances will only have occasional use, for example a visitors bathroom, the use of electric instantaneous water heaters to basins and shower might be considered as an alternative.

DRAINAGE

The position of the existing drainage stack will influence the location of sanitary fittings in that there is a maximum permitted length for unvented branch connections from baths and wash basins. The recommended maximum waste lengths are given in the national Regulations. (See Appendix - Legislation.) If the lengths of branch pipes exceed these requirements they must be directly ventilated to the external air, to a ventilated drainage stack or a ventilating stack. Stack pipes are usually 100mm diameter, but in houses of not more than two storeys the diameter of the ventilating part may be reduced to 75mm above the highest wet connection. This reduction in diameter is useful for running the ventilating pipe between rafters when using ridge ventilators. Alternatively a ventilating pipe may sometimes terminate inside the building if fitted with an air admittance valve.

HEATING

Rooms formed in roof space conversions usually have low heat losses due to the high elemental insulation requirement for roofs.

An existing wet central heating system may be adapted to provide extra radiators if the existing boiler has sufficient capacity. Alternatively, off peak or on peak electric heaters may be used. If the conversion forms part of a larger refurbishment then a new central heating system may be viable.

GENERAL REQUIREMENTS

Any re-roofing necessary in converting the roof must conform with the performance of the original roof in terms of fire resistance, durability and general fitness for purpose. Preservative treatment to roof timbers is not mandatory, except in particular situations such as in areas at risk of attack from House Longhorn beetle (as defined in national Regulations, see Appendix - Legislation), evidence of previous infestation of woodworm or previous fungal decay.

Conversion checklist - at a glance

Structural stability	i) New or altered structural members should be checked by a structural engineer.
Means of escape	i) See detailed Regulations.
Fire resistance	Largely concerns conversion of upper floor ceiling to a new floor construction which must then achieve 30 minutes fire resistance. It is necessary to check: i) Any member supporting a floor, ii) Attic separating walls, iii) Any opening e.g. roof window, iv) Gable wall, v) Chimney or flue.
Surface spread of flame	i) Plasterboard, ii) Timber (painted/unpainted/treated).
Sound insulation	i) Separating walls.
Ventilation of rooms	i) Windows in habitable rooms must have an opening area proportional to the floor area, ii) Background ventilation is required for all habitable rooms.
Ventilation of roof space	i) 25 mm continuous provision at eaves, ii) 50 mm provision over any insulation in the pitched roof.
Vapour control	i) Incorporate a vapour control layer on the warm side of the insulation, ii) Ensure adequate room ventilation to prevent the build up of water vapour within the rooms.
Access	i) Dimensions and pitch of stair, ii) Escape requirements, iii) No restriction on type of staircase (though loft ladders may not be used for habitable rooms).
Thermal insulation	i) Insulate whole roof pitch or ii) Insulate around new accommodation only.
Daylight and view out	i) Minimum glazed area equivalent to 1/10 of floor area, ii) Impact of window on appearance of building.
Services	i) Plumbing: Where provision for water services is required cold water tank should be sufficiently high to obtain adequate pressure. Allow space for insulation, ii) Drainage: Maximum permitted length for unvented branch connections from baths and wash basins. If exceeded, branch pipes must be directly ventilated to the external air. iii) Heating: Existing wet central heating system may be adapted if existing boiler has sufficient capacity. Electric heaters or a new central heating system may be viable, iv) Re-roofing: Must conform with the performance of the original roof.

The structural design of the conversion

This section is intended for the designer or contractor concerned with the detailed structural design, specification and construction drawings. Several specification solutions for each element of the conversion are suggested.

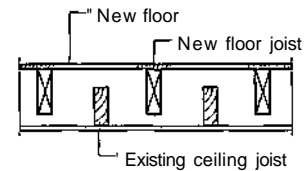


Fig 10a

FLOOR JOISTS

Existing ceiling joists are very unlikely to be adequate to act as floor joists. Four methods of carrying the increased loading are possible:

1. Fit new deeper joists between existing ceiling joists, packed up at end bearings to leave a gap above the existing ceiling. Figure 10a.

However, if existing binders are to be removed the existing ceiling joists will require support from the new floor joists and their weight should be added to the floor joist dead load. New floor joists can be nailed directly to the existing ceiling joists if they are adjacent or they can be connected by metal straps. Figure 10b.

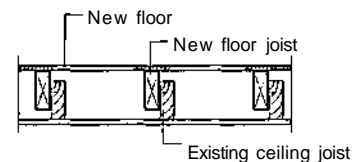


Fig 10b

2. Introduce new floor beams projecting below the ceiling to reduce the span of the existing joists. These may, therefore, require their own fire protection. Figure 10c.

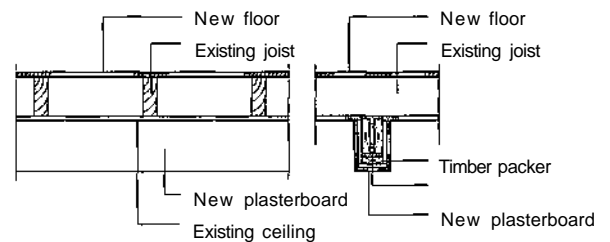


Fig 10c

3. Carry joists on the bottom of beams within the roof space. These beams may also be designed to support new ceiling joists. Figure 10d.

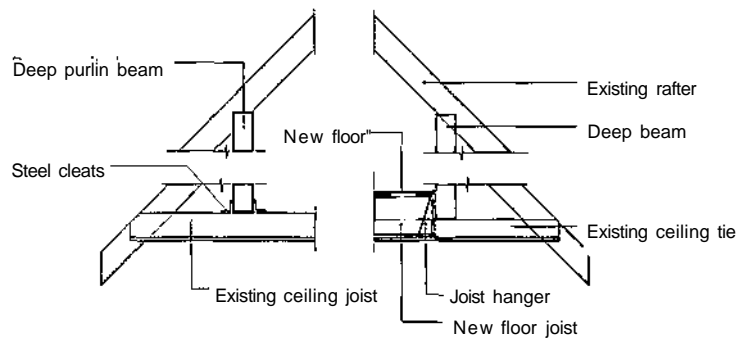


Fig 10d

4. Add more joists of the same depth, thus sharing the increased load. The disadvantage of this is that after one or two heating seasons the new joists may shrink, thus decreasing their depth and resulting in an uneven floor and ceiling cracking. Unless new joists can be supplied at a moisture content similar to the existing joists at the time of construction this method is best avoided. Figure 10e.

5. Position new steel beam above existing ceiling ties. Insert new floor joists into beam web. Figure 10f.

Wherever possible, new floor joists in roof conversions should be connected to the existing rafters to improve the resistance to horizontal thrust at the eaves. The need to reduce new floor joists at their end bearings to suit existing roof slopes may require a check on their structural adequacy.

Partition loads in the roof space should not be supported by the floor decks only. Additional joists will usually be required below internal non-load-bearing partitions running parallel with the floor joists.

Floor openings formed for stair access can impose heavy loads on trimmers. These concentrated loads are either transferred by trimming joists onto existing load-bearing walls, or onto new walls or floor beams. To minimise concentrated loads the staircase should fit into the floor framing with the minimum cutting of joists.

Double joists may be required as trimmers to frame stair openings. Trimmers should be supported by fully nailed galvanised steel joist hangers of suitable strength. Joist hangers should suit the joist thickness and the joist must be properly seated in the hanger.

In timber frame construction vertical posts or studs must be accurately located below new beams or purlins and the loads transferred to the ground. This may require additional timber members to be introduced into the wall.

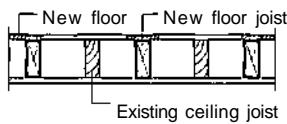


Fig 10e

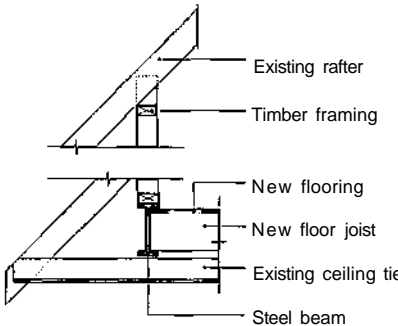


Fig 10f

FLOOR BEAMS

Beams to support floor joists can be of solid timber, glulam timber, structural timber composites or steel. Generally timber based materials offer the advantage of lighter weight for beams, they may be cut to suit site dimensions, and they are available in a wide range of sizes, species and stress grades.

The structural design of timber beams will need to be undertaken for each case individually and generalisations cannot therefore be made. Loads on beams should be assessed and beams designed in accordance with standard engineering principles. (See Appendix - Legislation.)

Exposed beams supporting floors must provide 30 minutes fire resistance. This can be achieved by oversizing timber beams to provide sacrificial material. Timber burns at a known "charring rate" which is laid down in BS 5268: Part 4: Section 4.1: 1978 as 20mm per half hour for woods of density less than 650 kg/m³ and 15mm per half hour for hardwoods above this density. Figure 11.

Structural floor beams of glulam timber are of attractive appearance particularly suitable when left visible in loft conversions. They can also be sized to incorporate sacrificial timber for fire resistance and can be treated with flame retardant treatments to achieve Class 1 surface spread of flame if required.

Exposed steel beams will require added protection to achieve 30 minutes' fire resistance. This can be achieved by facing the beams with non-combustible material or with sacrificial timber based on the charring calculation as above. It is recommended that any downstand beam leaves a minimum headroom of 2.0m, which is the mandatory minimum

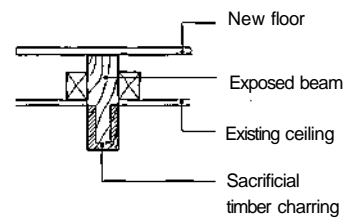


Fig 11

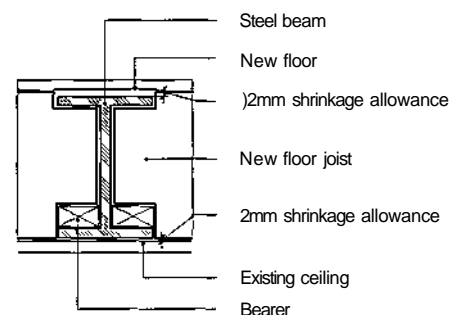


Fig 12

height for landings and stairways. When steel beams are used and timber joists are fitted between them, it is important to allow for the shrinkage which will occur when the joists dry to their equilibrium moisture content.

The floor deck or ceiling should not bear on the steel beam and cause distortion of the floor or ceiling. A movement gap of approximately 12mm between the steel and the floor deck and 5mm between the steel and ceiling will generally be adequate for moisture movement. Figure 12.

If new floor joists are to be installed over an existing ceiling it is advisable to allow 10mm clearance between the underside of the joist and the ceiling to allow for possible deflection of the joists under floor loading.

FLOOR DECKS

Floor decks to habitable roof space should be laid in accordance with the recommendations of the TRADA Approved Document "Timber Intermediate Floors for Dwellings (excluding compartment floors)".

To reduce vibration and damage to existing plaster ceilings to be retained, fixing floor decking to any floor joists by screwing is preferable to nailing.

SOFTWOOD BOARDING

Softwood boarding should be to BS 1297 (1987) "Specification for tongued and grooved softwood flooring". The moisture content of boards for installation in new buildings should not exceed 19%. This is expected to reduce to around 10% in centrally heated conditions resulting in shrinkage of the boards after fixing. In attic conversion work the house is probably already heated; therefore to avoid excessive shrinkage and possible distortion it is recommended that floorboards should be installed at a moisture content of 12% or less if the roof space is enclosed at the time.

Floor boards should be tightly cramped before nailing, and all nails should be punched below the board surface. Nails should be 3.0mm diameter and the length 2.5 x thickness of the board. Two nails should be used at each support. The ends of boards should be butted over joists with both boards adequately supported. End joints should be staggered so that they are at least two board widths apart. Any board should span at least three joists.

PLYWOOD

Plywood for flooring should be of WBP grade to BS 6566: Part 8 "Specification for bond performance of veneer plywood". Plywood thicknesses for flooring are normally selected from manufacturers or published tables. Plywood sheets can be tongued and grooved, (normally only the long edges have the tongue and groove), or square edged. Square edged boards should be laid with the grain of the face ply at right angles to the joists. All edges should be supported on joists or noggins. All plywood should be fixed with either 3.3mm diameter annular grooved nails or screws of length at least 2.5 x thickness of board. Screws should be inserted through predrilled countersunk holes. (Information on use and fixing of plywood - APA, COFI or Finnish Plywood.)

WOOD CHIPBOARD

Wood chipboard flooring: Type C4 or C5 flooring grade chipboard to BS 5669: Part 2 is recommended for flooring.

Chipboard sheets can be tongued and grooved on all four sides. T & G boards should be laid with long edges at right angles to joists. All boards should be fixed with 3mm diameter annular grooved nails or screws of length at least 2.5 x thickness of board.

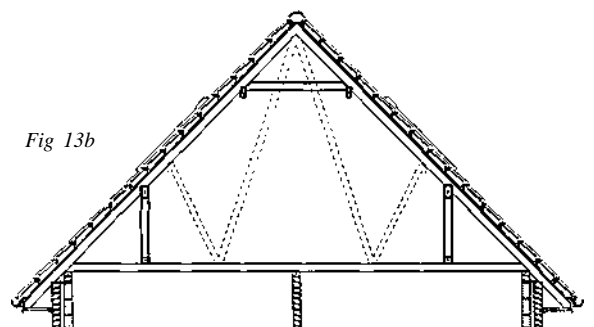
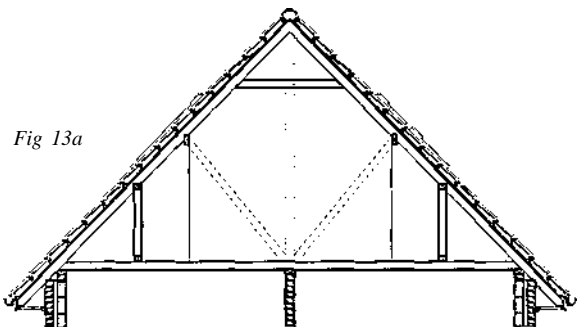
Boards should be conditioned before fixing by loose laying them for 24 hours. A 10mm expansion gap should be left between the chipboard edge and the walls at the perimeter of all rooms which can be under the skirting. All T & G joints should be glued.

ROOF BEAMS

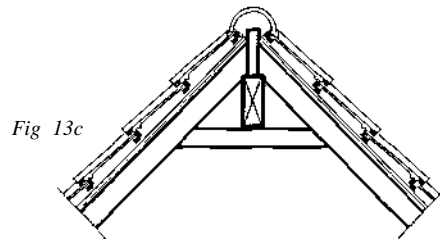
When purlins or their supports have to be removed to form usable space, alternative support must be provided to the rafters. It is important to establish the total function of the existing purlin since in some cases purlins and ties may provide resistance to outward thrust as well as vertical support.

A number of alternative solutions are possible depending upon the size and construction of the roof, such as the following (either individually or in combination):

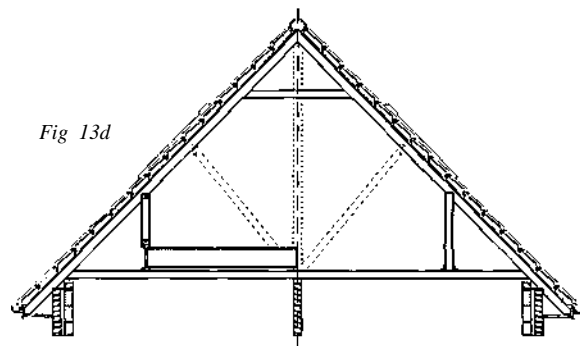
1. If existing purlin support has to be removed provide alternative support on existing load-bearing walls below or onto a new supporting structure in the roof space. Replace existing ties with new collars at the new ceiling level. Figure 13a.
2. Insert new purlins at the new ceiling level together with new ceiling ties. This may necessitate additional rafter support because of the longer rafter span between the new purlin and the eaves. This can be provided by an additional purlin or by stiffening the rafters with new timber alongside the existing. Figure 13b.



3. Insert a ridge beam, in which case no tie members are needed. The simplest way of installing a ridge beam into an existing roof is to connect each pair of rafters with a bridging member seated on the purlin. Inserting a ridge beam should be considered when it is necessary to remove tie members, e.g. existing ceiling joists. Adding a ridge beam minimises outward thrust in the rafters providing these are notched or fixed with metal brackets to lower purlins or wall plates. Figure 13c.



4. It is uneconomic to use solid timber purlins for unsupported spans in excess of 4.0m. Internal load bearing walls or posts should be used where the span exceeds 4.0m. For larger spans, or where no intermediate support is possible, fabricated timber or steel beams should be considered. Figure 13d.



5. Deep beams may be used to support both roof and floor load, using either metal hangers or timber ledgers nailed to the beams to carry the floor joists. Figure 14. Nailing patterns for ledgers should be calculated (refer to TRADA publication 'Timber frame housing: Structural recommendations' for information) .

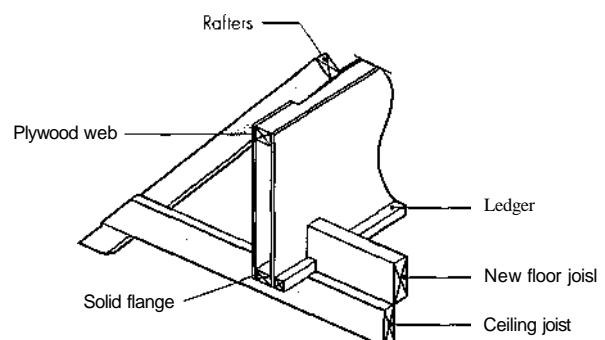


Fig 14 Fabricated purlin

ALTERNATIVE TIMBER BEAMS INCLUDE:

- Structural timber composites,
eg Glulam purlin Figure 15a
- Plywood web I-beam Figure 15b
- Plywood box-beam Figure 15c
- Steel flitch beam Figure 15d

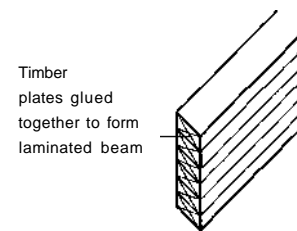


Fig 15a Glulam purlin

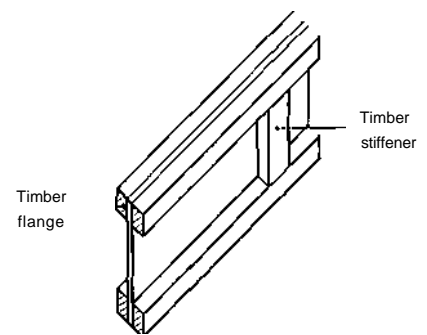


Fig 15b Plywood web I-beam

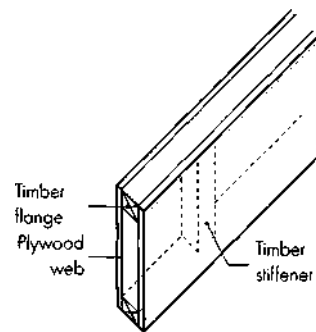


Fig 15c Plywood box-beam

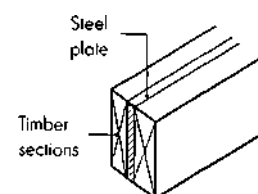


Fig 15d Flitch beam

BEAM SUPPORTS

Beams can be built into existing cavity walls but to allow for end supports the beams must be approximately 200mm longer than the clear span of the room or space. Timber beams should not be built into external solid masonry walls. Heavy duty galvanised steel hangers are an alternative means of supporting timber beams. Steel hangers should comply with BS 6178: Part 1 and be appropriate for the strength of the masonry and the load to be supported. Hangers should be supported directly by bricks or concrete blocks with the face of the hanger tight against the wall face.

If the crushing strength of an existing wall is doubtful, pockets may be formed in the masonry to accommodate concrete padstones to provide the required strength. Precast concrete or steel lintels may be built into the wall to act as padstones.

Timber beams in timber frame walls must be supported only by timber posts or studs. This may require walls to be opened up to insert new timbers. Alternatively it may be possible to position the post against the wall face. Exposed posts will require fire protection equivalent to that of the beams supported. If it is necessary to insert new studs on posts into an external timber frame wall, the vapour control layer must be reinstated and the effect on the thermal insulation of the wall considered.

RAFTERS

If new rafters are to be inserted between existing ones, they should be selected from span tables in the national Regulations. The effective span for rafters is shown in Figure 15 and, if purlins are repositioned, it is essential to check the effective rafter span.

The overall rafter length required should be checked against the availability of suitable timber and provision for lapped or spliced joints made when necessary.

Requirements for thermal insulation in roof conversions may require deeper rafters than are structurally necessary in order to provide a ventilation space above the insulation. Where existing rafters are retained it may be necessary to add timber battens to increase the depth to accommodate the insulation and provide ventilation space.

CALCULATION OF ROOF LOADS

The roof imposed load and deadload from roof tiles or slates, timber battens, underlay or boards, rafters, insulation and linings is measured on the slope.

The total weight is resolved to produce a vertical load on plan (see Appendix - Legislation).

Roof windows and dormers

The specification of the windows is particularly important in loft conversions. Not only are they crucial in providing sufficient light, but they also play a vital role in providing ventilation and a means of escape in the event of fire. The Building Regulations/Standards lay down specific rules about the size and type of window unit suitable for installation. Roof windows are also the element of a loft conversion most likely to concern the planners.

ROOF WINDOWS

Incorporating a roof window will usually reduce the total roof load since the weight of the window may be less than that of the roofing materials which it replaces. The imposed load on the roof is unaffected. Narrow roof windows can be fitted between rafters at 600mm spacing, otherwise trimmed openings should be formed as for dormers. Figures 16a and 16b.

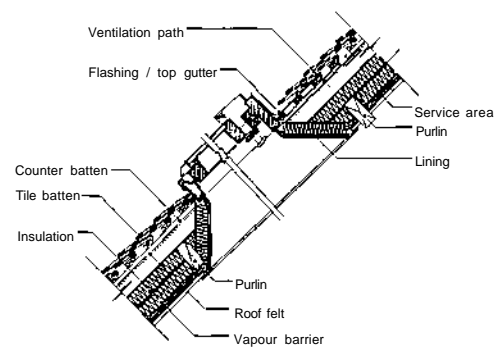


fig 16a

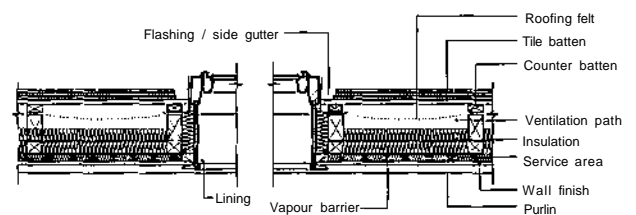


Fig 16b

DORMERS

Incorporating a dormer window will usually increase the total roof load. The dead load of the dormer construction is generally greater than that of the pitched roof which it replaces.

Since dormer windows are likely to be wider than the spacing of the rafters, it will usually be necessary to trim rafters in order to accommodate them. The opening should be formed with trimmers supported off single or multiple trimming rafters on either side. Trimmers should be either connected with galvanised steel angles and bolts or nailed to a structural specification. Figures 17a and 17b.

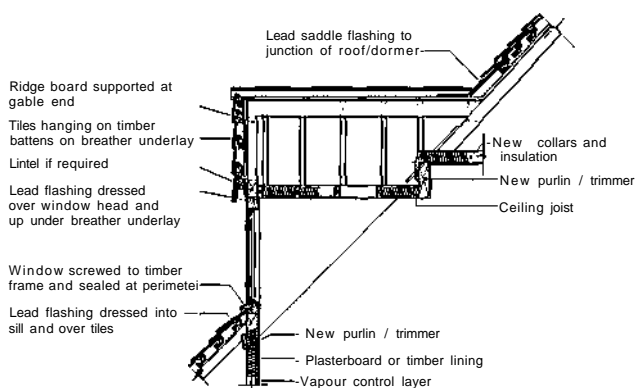


Fig 17a

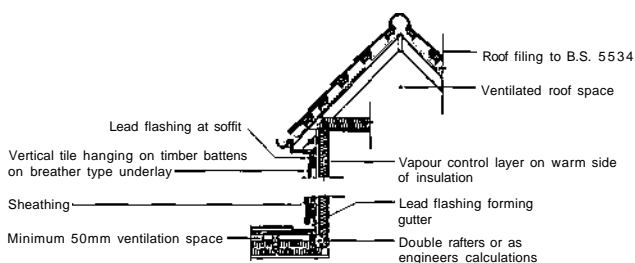


Fig 17b

DESIGN FOR DAYLIGHT, VENTILATION AND VIEW

In converting a roof space it is possible to use windows in the gable wall, dormer windows or roof windows, to meet any Regulation requirements for ventilation and emergency escape, but also to provide daylight and a view out.

Roof windows installed at 45° pitch can generally provide up to 40% more daylight than dormer windows because there is not the restriction of the roof and side walls of the dormer. Figure 18. There can also be more flexibility in that the location, number and size of roof windows, either used singly or in combination, is almost unlimited and can thus provide an even distribution of daylight.

Because of their high admission of daylight, particularly on the south side of a roof, roof windows should incorporate shading devices such as tinted glass or external or internal blinds.

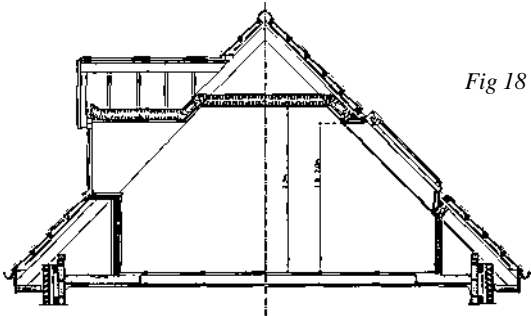


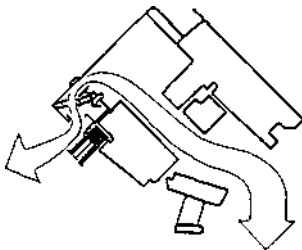
Fig 18

VENTILATION

Roof windows individually provide more controlled ventilation and better distribution of air than dormer windows because the dormer bays tend to restrict internal circulation. A number of roof windows can provide a good overall distribution of air, including cross-ventilation. When open, roof windows provide effective rain protection while still providing good ventilation at low level. When closed, i.e. when the sash is firmly locked in the frame, the roof window vents can provide background ventilation and will satisfy the statutory requirement for ventilation. Figure 19.

Traditional single glazed roof windows in low pitched roofs (under 30°) sometimes suffer from condensation drips, but roof windows with insulated glass and controlled ventilation can generally avoid this, even in low pitched roofs. The use of low-E glass will reduce the risk still further.

*Fig 19
VELUXventilation
control bar*



VIEW

The view out from a roof window or dormer should be considered. A narrow window will have a restricted lateral view, particularly from dormers because of their side walls. A dormer or roof window in the slope of a roof, particularly of relatively low pitch, will have a limited downward view if the wall to the roof space is set back from the eaves. Figure 20. If the dormer window is located close to the eaves of the building, full height windows, possibly with a balcony, can provide a good downward view.

If the side wall of the attic room is located at the eaves a good downward view can also be provided by a roof window that is vertical for the height of the side wall and then follows the roof pitch. These windows can also provide access to small balconies and offer an excellent escape facility.

For an upward view, roof windows can have a considerable advantage over dormer windows in that the roof window can be extended as high as necessary up the slope of the roof, whereas a dormer will always have the upward view restricted by its roof.

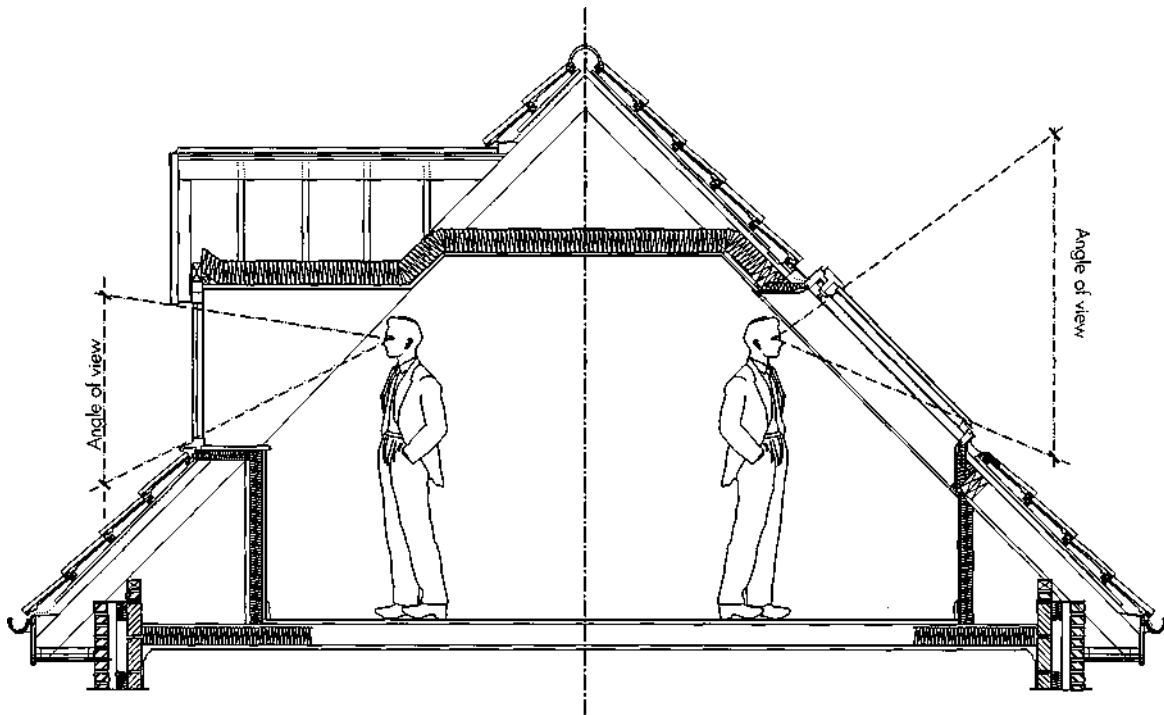


Fig 20

INSTALLATION OF DORMERS AND ROOF WINDOWS

Both dormers and roof windows require trimmed structural openings. It is important to ensure that when there is insulation between the rafters the ventilation path above the insulation is not blocked by the trimmer, or the framing of the dormer or roof window. Where only one rafter has been trimmed a 25mm diameter hole in the flanking rafters will ensure sufficient cross ventilation into the adjoining space between rafters, if the hole is located above the insulation level. Figure 21.

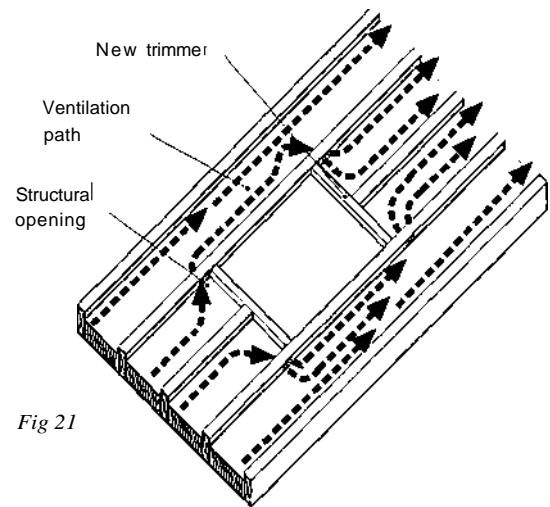


Fig 21

For wider roof windows, where a number of rafters have been trimmed, a series of 25mm diameter holes, should be drilled into all the trimmed rafters as well as the flanking rafters. It is necessary to ensure that these holes do not impair the structural performance of the rafters. The location and size of the holes should be checked with the professional responsible for the structural design of the roof.

Where battens are added to the top of existing rafters to provide the necessary extra depth for the ventilated space above the insulation, gaps can be left between the battens at the trimmed openings to allow adequate cross flow of the ventilation past the opening.

CARPENTRY

Besides requiring a trimmed opening, dormer windows also need carpentry to create the roof valleys between walls of the dormer and the existing roof, as well as their own framing and roof structure. Lead work is also required to form flashings between the dormer walls and roof, and in the valley between the dormer roof and existing roof. In some cases new dormer windows will interrupt the existing gutters and new pipework may be necessary. The dormer pitched roofs will also require their own gutters and the discharge of these onto the existing roof must be considered.

Other than forming the trimmed opening, roof windows require no additional carpentry and are supplied with their own metal flashings to weatherproof the junction between the existing roof finish and the window. To ensure a tight weatherproof seal around the roof window the prefabricated flashing to the roof windows must be fitted under, or dressed over, the roof finish as appropriate in accordance with the manufacturers' instructions. Preformed flashings are available for fitting between coupled roof windows.

Normally the introduction of roof windows does not affect the existing roof drainage but if the part vertical, part sloping roof windows are used at the external wall of the building, interruption of the existing gutters may be involved and new pipework will be required, particularly if the lower part of the window provides access to a balcony.

VAPOUR CONTROL LAYERS

For both types of window it is important to ensure that the vapour control layer is sealed tightly around the glazed opening.

For dormer windows a polythene vapour control layer may be continued from the attic ceiling level up the inside of the dormer framing across the dormer ceiling and be stapled securely around the window opening. Alternatively foil-faced plasterboard can be used to line the walls and ceiling of the dormer. For roof windows a polythene vapour control layer should be turned up the inside faces of the trimmed opening and stapled or taped to the roof window frame before a preformed lining is fitted. If preformed melamine-faced linings are used these will provide effective vapour control if sealed to both the vapour control layer and roof window frame. If the lining is to be site fabricated foil-faced plasterboard can be used for the same purpose.

OPERATION

Dormer windows normally have conventional side-hung or top-hung casements or vertical sliding sash windows. For cleaning purposes, reflex or reversible hinges are preferred for casement windows in dormers, because the outside faces of the glass can then be cleaned from inside. Access for maintenance and painting may still be restricted. Trickle vents provide the necessary background ventilation. If an emergency escape window is fitted with reflex hinges they should allow the window, when fully opened, to give a maximum clear opening of 850mm (h) x 500mm (w). Security is ensured by the use of conventional window locks. Opening restrictors should be used if there is a risk of persons falling out.

Roof windows are generally supported on centre pivot hinges, which allow the window to remain at any opening position without other restraint, Figure 22. For low pitched roofs, or windows considered as an emergency means of escape, top-hung windows can be used instead, Figure 23. Where required for safety purposes windows should be fitted with restrictors,

Security of roof windows is achieved by a locking device on the ventilation flap, which permits ventilation but prevents the window being opened from the outside. These multi-point catches also ensure consistent pressure on the weatherseal.

Both centre-pivot and top-hung windows can be rotated to provide access for cleaning. Repainting of the prefinished external aluminium cladding is not necessary.

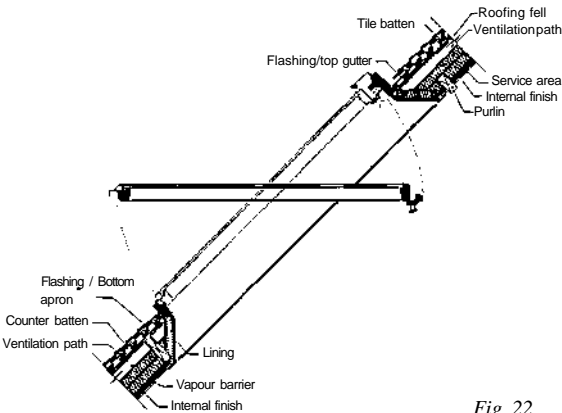


Fig 22

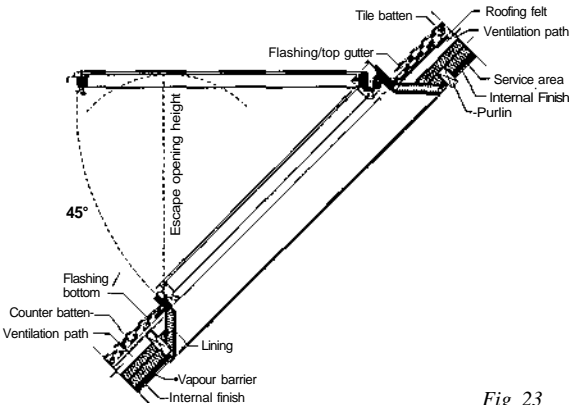


Fig 23

Roofwindows and dormers checklist — at a glance

	Roof Window	Dormer
ROOF LOAD	Usually reduces weight of total roof load.	Usually increases the total roof load.
TRIMMING RAFTERS	Narrow roof windows can be fitted between rafters. Generally, trimming will still be required.	Usually necessary to trim rafters to accommodate dormer.
DAYLIGHT	At a 45° pitch provide up to 40% more daylight.	Daylight restricted because of side and head walls.
DESIGN FLEXIBILITY	Flexibility in terms of location, number and size of windows.	Aesthetically pleasing in conservation areas. Position may be determined by planning constraints.
VENTILATION	Controlled ventilation and distribution of air.	Dormer bays tend to restrict internal circulation.
VIEW	Good all round view.	Good downward view. Restricted upward view. Restricted side way view.
CARPENTRY	Trimmed opening required. Flashings supplied.	Trimmed opening plus carpentry to create the roof valleys between walls of the dormer, the existing roof and flashings and the dormer itself.
VAPOUR CONTROL LAYERS	Polythene vapour control layer.	Polythene vapour control layer.
OPERATION, SAFETY AND SECURITY	Centre-pivot for ease of operation. Top-hung for low pitched roofs or means of escape.	Side-hung or top-hung. Access for cleaning and maintenance may be restricted.

Part 3 - CARRYING OUT THE CONVERSION

The eventual sequence of work in converting the roof to habitable space will depend on many different factors including the type and condition of the existing roof structure, the design of the proposed conversion and the specification. There are however, some general principles that are best adhered to in carrying out work on loft conversions and this section deals with some of these.

The principles of loft conversion

1. If the roof covering is to be removed at any stage, protection will be required to any work within the roof. Any materials that might be damaged by water should not be installed until the roof is weatherproof. If the roof finish is to be removed, the opportunity to introduce an effective underlay should be taken, if one does not already exist. This will provide both temporary and long-term protection to the roof space. This may also present the opportunity to introduce insulation which sits on the roof rafters (warm roof) rather than under or between them. This may increase the available space and head height in the roof space.

It is worth noting that due to the speed of installation of VELUX roof windows the roof is exposed to the elements for a significantly shorter period than with a dormer window.

2. All new timber should be stress graded for strength and also marked with its grade. This will reduce wood shrinkage to the minimum. "Dry graded" timbers should always be used in any roof conversion, but some further drying out and possible shrinkage will still take place in a dry warm internal environment.

3. The new floor may have to provide a working platform and therefore any new structural members should be installed first. This would also allow the opening for the staircase to be formed, improving access for both workforce and materials. Caution must, however, be taken when bringing items up through the stairwell.

4. If major modification is required to the roof structure, introducing the new floor structure will tend to stabilise the existing structure.

5. If floor or roof loads are to be taken on existing or new load-bearing walls or columns, these will need to be modified or erected as the first step.

6. Any new structural roof members should be installed before existing members are removed or modified in any way.

7. If existing ceilings are to be maintained, the upper surface must be protected as much as possible from moisture, dirt and mechanical damage.

8. Wet trades, such as new blockwork or plasterwork, should be carried out while the space under the roof is still "open" to permit reasonably quick drying out by ventilation.

9. If the new attic floor is to provide a working platform, the deck should be robust enough and sufficiently protected to withstand damage from the building activities, or a temporary deck material should be used until there is no longer a risk of wetting or mechanical damage.

10. The sequence of operations in the conversion should be approved by the professional responsible for the design of any structural alterations and by the customer.

General guidance for contractors

ACCESS FOR MATERIALS

Roof space conversions differ from other work only because of the restricted space normally available for completing the building operations. This confinement of work into small spaces has special needs such as providing adequate space to manoeuvre large structural members into position and storing larger items such as baths close to where they will be required before the space is closed off.

ELECTRICS

Electrical wiring for power and lighting circuits can be fitted within the stud framing of walls and partitions and between rafters. Where wiring is fitted into thermal insulation it may be necessary to derate the cables to prevent overheating. Contact between PVC sheathed cables and polystyrene insulation should be avoided.

PLUMBING

It is essential that sufficient space is left to install cold water storage tanks and service pipes within the new roof space and to insulate them both adequately to prevent freezing and to reduce the noise of water movement, especially if the new rooms are to be used as bedrooms. Pipes for central heating and water services to fittings are normally required to be accessible and therefore should not be fitted into external walls unless suitable access provision is made. This can make it difficult to achieve the fire resistance requirements of the wall. It is usually possible to run pipes in the floor zone or in the eaves space to avoid this problem. Where services are run in roofs or walls incorporating a vapour control layer it is important that the latter is neatly sealed around outlets or other penetrations.

WALL LINING

Internal linings can be of plasterboard, reinforced gypsum board, plywood, OSB, chipboard or softwood boarding. The limitations of surface spread of flame in the national Regulations may require wood or wood based materials to be treated to improve their characteristics to Class 1 in accordance with BS 476: Part 7. (See Appendix - Legislation.)

Plasterboard lining can be either of 9mm or 12.5mm square edge boards plus a skim coat of plaster or taper edge boards which are designed to be drylined, i.e. the joints scrimmed and filled. Reinforced gypsum boards need to be jointed in accordance with the manufacturer's instructions. Both types give the necessary surface spread of flame performance.

Other board linings may be overpainted or could be of the self-finished types intended for wall linings. All wall and ceiling lining boards should have all their edges supported.

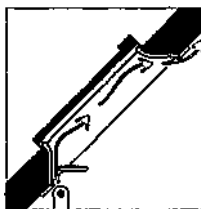
In terms of roof window linings, standard VELUX preformed linings maximise the admittance of light whilst minimising the risk of condensation.

DECORATION

When the roof space conversion has involved a lot of new construction it is advisable to wait until the new timber structure has dried to its equilibrium moisture content before carrying out decorative work on internal walls or ceilings. It is likely that some shrinkage cracking will occur during the first heating season, but once equilibrium is reached no further movement should normally occur. It is, however, recommended to line the walls and ceiling with good quality lining paper before decorating. An initial finish of emulsion paint might be applied that could then be replaced with wall paper or similar decorative lining later.



The preformed VELUX roof window linings give optimum light distribution . . .



. . . and provide the ideal pattern of warm air circulation to help prevent condensation.

REFERENCES AND BIBLIOGRAPHY

ENGLAND & WALES

Town and Country Planning (England and Wales). Town and Country Planning General Development Order 1995. Statutory Instrument 1995 No 418. London, HMSO. 1988

UK Parliament

Building and Buildings. The Building Regulations 1991 (as amended). Statutory Instruments 1991 No 1065. London, HMSO.

Department of the Environment and The Welsh Office. The Building Regulations 1991:

Approved Document A: Structure. London, HMSO. 1991 (1992 edition)

Approved Document B: Fire. London, HMSO. 1991 (1992 edition)

Approved Document C: Site preparation and resistance to moisture. London, HMSO. 1991 (1992 edition)

Approved Document E: Sound. London, HMSO. 1991 (1992 edition)

Approved Document F: Ventilation. London, HMSO. 1991 (1995 edition)

Approved Document H: Drainage and waste disposal. London, HMSO. 1990 (amended 1992)

Approved Document K: Stairways, ramps and guards. London, HMSO. 1991 (1992 edition)

Approved Document L: Conservation of fuel and power. London, HMSO. 1991 (1995 edition)

Approved Document to Regulation 7: Materials and workmanship. London, HMSO. 1991 (1992 edition)

Timber Intermediate Floors to Dwellings (excluding compartment floors), AD TRADA 1992 (revised 1993)

SCOTLAND

Town and Country Planning (General/Untitled development) (Scotland) Order 1992.

UK Parliament. Building and Buildings: The Building Standards (Scotland) Regulations 1990. Statutory Instruments 1990 No 2179 (SI87). London, HMSO. 1990

The Scottish Office. Technical Standards for compliance with the Building Standards (Scotland) Regulations 1990. Edinburgh, HMSO. 1990 (plus revisions 1993, 1994 and Nov 1996).

Technical Standard Part B: Provisions deemed to meet the Standards

Technical Standard Part C: Structure

Technical Standard Part D: Structural Fire Protection

Technical Standard Part E: Means of Escape from Fire

Technical Standard Part G: Resistance to Precipitation, Condensation

Technical Standard Part H: Walls and Floors to Resist Sound Transmission

Technical Standard Part J: Conservation of Fuel and Power

Technical Standard Part K: Ventilation of Buildings

Technical Standard Part M: Drainage of Buildings, Provision of Sanitary Facilities

Technical Standard Part P: Miscellaneous Hazards

Technical Standard Part Q: Facilities for Dwellings

The Scottish Office. Small Buildings Guide - for compliance with Part C of the Technical Standards. Edinburgh, HMSO. 1990 (plus revisions 1993)

NORTHERN IRELAND

Northern Ireland Assembly. Building Regulations (Northern Ireland) 1994. Statutory Rules of Northern Ireland 1994 No 243. Belfast, HMSO. 1994

The following Technical Booklets published by HMSO, Belfast:

Technical Booklet C: Site preparation and resistance to moisture. 1994

Technical Booklet D: Structure. Belfast, 1994

Technical Booklet E: Fire Safety, 1994

Technical Booklet F: Fuel and Power, 1991

Technical Booklet G: Sound (conversions). Belfast, 1994

Technical Booklet H: Stairs and ramps (1994)

Technical Booklet N: Drainage. 1994

BRITISH STANDARDS

BS 476 Fire tests on building materials and structures Part 7: 1987 Method for classification of the surface spread of flame of products Part 8: 1972 Test methods and criteria for the fire resistance of elements of building construction Part 22: 1987 Methods for determination of the fire resistance of non-loadbearing elements of construction

BS 585 Wood stairs Part 1: 1989 Specification for stairs with closed risers for domestic use, including straight and winder flights and quarter or half landings Part 2: 1985 Specification for performance requirements for domestic stairs constructed of wood-based materials

BS1297:1987 Specification for tongued and grooved softwood flooring

BS 4211: 1987 Specification for ladders for permanent access to chimneys, other high structures, silos and bins

BS 5250: 1989 Code of practice for control of condensation in buildings

BS 5268 Structural use of timber

Part 2: 1989 Code of practice for permissible stress design, materials and workmanship

Part 3: 1985 Code of practice for trussed rafter roofs

Part 4: Fire resistance of timber structures

Section 4.1: 1978 Method of calculating fire resistance of timber members

BS 5395 Stairs, ladders and walkways Part 1: 1977 Code of practice for the design of straight stairs Part 2: 1984 Code of practice for the design of helical and spiral stairs Part 3: 1985 Code of practice for the design of industrial type stairs, permanent ladders and walkways

BS 5534 Slating and tiling

Part 1: 1990 Design

BS 5669 Particleboard

Part 2: 1989 Specification for wood chipboard

Part 3: 1992 Specification for oriented strand board (OSB)

BS 5950 Structural steelwork in buildings Part 1: 1985 Code of practice for design in simple and continuous construction: hot rolled sections

BS 6178 Joist hangers Part 1: 1990 Specification for joist hangers for building into masonry walls of domestic dwellings

BS 6399 Loading for buildings

Part 1: 1984 Code of practice for dead and imposed loads

Part 3: 1988 Code of practice for imposed roof loads

BS 6566 Plywood

Part 8: 1985 Specification for bond performance of veneer plywood

CP 3 Code of basic data for the design of buildings

Chapter V Loading

Part 2: 1972 Wind loads

TRADE PUBLICATIONS

Prices and a full list of publications are available on request.

Books

TBL 52: 1989 Timber frame housing: Structural recommendations

TBL 58: 1994 Timber Frame Construction

TBL 61: 1989 Energy efficient housing - A timber frame approach

Design Aids

DA 1: 1988 Design examples to BS 5268 Part 2

DA 4: 1984 Load tables for nailed ply-box beams

DA 5: 1984 Load tables for glued ply-box beams

Standard Design Sheets

SDS 539 Domestic room in the roof construction: Sheathed rafter panels

Wood Information Sheets

WIS 0-10: Structural surveys of timber frame houses, 1992

IS 0-12: 1987 Room in the roof construction for new dwellings, 1993

WIS 0-13: Principles of pitched roof construction, 1993

WIS 2/3-3: Flame retardant treatments for timber, 1993

WIS 4-18: Moisture meters for wood, 1991

BRE PUBLICATIONS

BR 143: 1989 Thermal insulation: avoiding risks, 1994

DAS 124: 1988 Pitched roofs: renovation of older-type timber roofs - re-tiling or re-slating (Design)

DAS 125: 1988 Pitched roofs: re-tiling to re-slating of older-type timber roofs (Site)

Digest 208: 1988 Increasing the fire resistance of existing timber floors

OTHER SOURCES OF INFORMATION

HO Booklet FB2 "Wake up! Get a smoke alarm" HMSO 1990

Plywood - American Plywood Association

Council of Forest Industries of British Columbia

Finnish Plywood International

Chipboard OSB - Wood Panel Products Federation

APPENDIX

NATIONAL LEGISLATION

The requirements for Building Regulations in Great Britain are not common to all parts of the UK but are subdivided regionally. These national requirements are set out in the following statutory documents:

- The Building Regulations - England and Wales
 - Approved Documents
- The Building Standards (Scotland) Regulations
 - Technical Standards
- The Building Regulations - Northern Ireland
 - Technical Booklets
- The Building Regulations - Republic of Ireland
 - Technical Guidance Documents

Converting the roof space of any dwelling into accommodation will require compliance with a number of Regulations in every region of the UK. Because these requirements vary somewhat between the regions they are listed separately for simplicity. See inside back page for relevant Building Regulation insert.

BUILDING REGULATIONS - ENGLAND & WALES - APPROVED DOCUMENTS

The current versions of the following Approved Documents are applicable to any roof conversion but others may also be relevant depending on use and service requirements.

- A1 Loading (structural stability)
- B1 Means of Escape
- B2 Internal Fire Spread (linings)
- B3 Internal Fire Spread (structure)
- B4 External Fire Spread
- C4 Resistance to Weather and Ground Moisture
- E1 Airborne Sound (walls)
- E2 Impact Sound (floors and stairs)
- F1 Means of Ventilation
- F2 Condensation in Roofs
- H1 Sanitary Pipework and Drainage
- H3 Rainwater Drainage
- K1 Stairs and Ramps
- L1 Conservation of Fuel and Power
- N1 Glazing, Materials and Protection
- AD to support regulation 7

There follows summaries of the particular parts of the ADs most relevant to roof conversion (Note that this is not an exhaustive list and that other Regulations may be relevant in specific situations. Designers and builders must satisfy themselves that all the requirements of the Regulations are met in any proposed conversion.)

AD A1 - Loading

This deals with the requirements of Part A, Schedule 1 to the Building Regulation which states that: "(1) The building shall be constructed so that the combined dead, imposed and wind loads are sustained and transmitted by it to the ground:

- a) safely; and
- b) without causing such deflection or deformation of any part of the building, or such movement of the ground, as will impair the stability of any part of another building
- c) in assessing whether a building complies with subparagraph (1), regard shall be paid to the imposed and wind loads to which it is likely to be subjected in the ordinary course of its use for the purpose for which it is intended."

Calculations for structural timber should be carried out in accordance with BS 5268 "Structural use of timber", Part 2. All structural timber should be stress graded. Steelwork should be

calculated in accordance with BS 5950: 1985 "Structural use of steelwork in building".

Calculations for new floor and roof structure should be based on the dead and imposed loads defined under BS 6399 "Loading for buildings", Part 1: 1984 and for wind loading CP3 Chapter V: Part 2: 1972.

Any roof conversion that affects the overall dimensions or shape of the original building may require the structural performance of the building as a whole to be re-assessed under these Codes.

This AD contains strength classes related to stress grading of various species of timber and it also contains tables showing the sizes of floor, ceiling and roof members necessary for spans when using these strength classes.

A map shows basic wind speeds to be considered in designing roofs and floors to resist lateral loads.

If converting the loft involves replacing the roof finish with a heavier material, the additional loading must be taken into account but wind uplift will be reduced. If a lighter roof finish is to be used the effect of increased wind uplift must be considered.

AD B1 - Means of Escape

This AD sets out the requirements and dimensions of doors, passages and stairs to be provided for Escape in Fire. It has a particular section applicable to Loft Conversion (para 1.23-1.31) covering the enclosure of any existing stair, the provision and requirements of doors, limits on glazing, the provisions of new stairs (cross referenced to AD K1, the fire separation of the new storey and the provision, location and size of windows to be used as secondary means of escape or rescue.

A window or roof window to be used for escape must have a clear opening width of 500mm and height of 850mm, the bottom of which must not be more than 1100mm above floor level and not less than 800mm.

The recommendations and requirements for the provision of smoke alarms is included in this AD. The guidance in "Wake-up! Get a smoke alarm" Home Office booklet FB2, HMSO 1990 is recommended.

AD B2 - Internal Fire Spread (linings)

This section of the AD covers control of the spread of fire across ceilings and wall surfaces. Table 10 defines the requirements for dwellings - there are no exclusions or exemptions for loft conversions. There are limitations on the use of thermoplastic rooflights or windows glazed with thermoplastic materials.

If the roof space incorporates a chimney or flue, any new

construction must provide sufficient separation between combustible materials and the flue. No combustible material other than wood trim, such as skirtings, architraves or floorboards should be closer than 200mm to a metal flue, or 40mm to the outer face of a masonry chimney.

AD B3 - Internal Fire Spread (Structure)

This section of the AD is concerned with the fire resistance of elements of structure against collapse, fire penetration and the conduction of heat. (Roofs are not regarded as elements of structure but loadbearing walls are.)

There is a specific section (para 77) covering "Floors in Domestic Loft Conversions" which allows the use of modified 30 minutes resistance for the floor if the conversion to a two storey building is within the following limits:

- a) only one storey is being added
- b) the new storey contains no more than 2 habitable rooms (bathrooms and toilets are not considered 'habitable' rooms).
- c) the total area of the new storey does not amount to more than 50m².

Then the existing first floor construction may be accepted if it has at least a modified 30 minutes standard of fire resistance in those places where:

- d) the floor separates only rooms (and not circulation spaces) provided that the provisions in (BI) Section 1 are met.

Appendix A, Table A1 (3)a states that for a floor in an upper storey of a 2 storey dwelling, the load bearing structure requires 30 minutes "stability" but only 15 minutes for "integrity" and "insulation", when exposed to fire from the underside.

For loft conversions of 3 or more storey buildings there are no exceptions and the relevant full fire resistance will be required for the floors.

Where a wall of an attic room adjoins another property, the wall will have to provide the full fire resistance of a separating wall, ie 1 hour. If the roof space was not previously occupied it will be necessary to upgrade the wall to achieve this by adding blockwork and plaster, or an additional layer of plasterboard to timber-frame separating walls (see TRADA Publication "Timber-Frame construction").

AD B4 - External Fire Spread

This section of the AD concerns the risk of fire spread across boundaries between neighbouring properties. The requirements for fire resistance depend on the proximity of the boundary or

"notional boundary", which is defined within the AD. For loft conversions within existing buildings the alteration will not be affected by the proximity of this boundary, except that there may be restrictions on the size, number and location of openings, both in the wall and roof. These are set out in Diagram 42 of the AD.

It may be necessary to upgrade the fire resistance of a gable wall if this becomes the external wall of a previously unoccupied roof space, depending on its proximity to the boundary.

If the roof finish is replaced as part of a loft conversion it must not be of inferior fire performance to the original roof. (Most types of roof finish are permissible, with the exception of thatch or shingles, within 6m from a boundary.) Any roof windows or dormers must also conform with the level of fire resistance required and, although unwired, minimum 4mm thick glass is acceptable in all cases. There are limits on some types of certain types of plastic glazing when used close to a boundary.

AD C4 - Resistance to Weather and Ground Moisture

The requirements for the weather resistance of external walls or roofs may be relevant to loft conversions if the external wall or roof finish is changed. The AD under Sections 4 and 5 sets out acceptable principles and some forms of construction that will meet the requirements of the Regulations.

AD E1 - Airborne Sound (walls)

This will be relevant to a loft conversion only if any of the walls are also separating walls. If the roof space was not previously occupied it is unlikely that the wall between adjoining roofs will achieve the necessary resistance to sound transmission, particularly in many post-war houses where only single skin masonry walls, or trussed rafters faced with plasterboard were used in the roof space. Where lightweight single block walls have been used it may be simplest to improve their acoustic performances by adding a separate timber framed lining with mineral wool insulation and a minimum 30mm of plasterboard. This has the advantage of little increase in weight but can achieve the required resistance to sound transmission if tightly sealed around the edges (see Type B under wall type 4).

If a timber-frame wall exists between properties an additional layer of plasterboard with joints staggered over the existing board will be sufficient to bring the acoustic resistance up to the full separating wall performance (as Type 4 A).

AD E2 - Airborne Sound (Floors)

Covers airborne sound resistance between separating floors.

AD E3 - Impact Sound (Floors and Stairs)

Covers impact noise through separating floors.

Neither of these are normally relevant to loft conversions, which are usually of the same occupancy as the accommodation below. If the new floor must act as a separating floor it should conform with the requirements of both E2 and E3. Various methods of achieving the necessary performance are shown in the AD.

AD F1 - Means of Ventilation

All habitable rooms require adequate ventilation which consists of "rapid ventilation" in the form of opening windows equivalent to 1 /20th of the floor area, some part of which is at least 1.75mm above the floor level, and "background" ventilation with an opening equivalent to 8000mm². A bathroom (with or without WC) or kitchen requires opening windows (no minimum size) plus a background ventilation opening of 4000mm². In addition, kitchens require either mechanical extract capable of 30 litres per second (or 60 litres per second if away from the hob) and bathrooms require 15 litres per second. Passive stack ventilation is a satisfactory alternative method of ventilation permitted for both types of room*. A separate WC requires a window 1 /20th of the floor area or mechanical extract of 6 litres per second and a background ventilation opening of 4000mm².

- * Information on "passive stack ventilation" is contained within BRE Paper 13/94.

AD F2 - Condensation in Roofs

This AD covers the provision of ventilation to avoid condensation in 'cold' roof spaces. All roofs with insulation above the upper floor ceiling will require a continuous 10mm ventilation opening at the eaves to ensure cross ventilation.

If an attic room is introduced into the roof the natural cross flow of ventilation is reduced and the continuous ventilation gap at the eaves must be increased to 25mm and additional openings equivalent to a continuous 5mm opening introduced at the ridge. In addition, if the whole, or part, of the roof slope is insulated a continuous 50mm ventilation gap must be provided over the insulation. (The only exception to this is if a 'warm' roof is used in which the insulation lies above the roof structure.

In order to limit vapour transmission into the roof void it is recommended that a vapour control layer is included in the walls and ceiling of any occupied roof space.

The AD refers to BS 5250 "Code of practice for the control of condensation in buildings" and BRE Report BS 262 (1994) "Thermal insulation; avoiding risks".

AD H1 - Sanitary Pipework and Drainage

If any kitchens, bathrooms, shower rooms or WC's are to be added in a loft conversion the drainage should be taken where possible to the existing stack. The AD contains the limits on waste pipe lengths between appliance and stack. The ventilation required for branch pipes and stacks is also set out in this AD. If air admittance valves are located within the existing roof space, it may be necessary to move them or add an externally ventilated stack when converting the roof. These will have to correspond with the limits set out in the AD or may be designed in conformity with BS 5572: 1978, "Code of practice for sanitary pipework".

AD H3 - Rainwater Drainage

Converting an existing roof space to an attic would not normally affect existing rainwater drainage provision, unless existing gutters will be interrupted by dormer windows (the possible increased roof area resulting from adding the dormer roofs is unlikely to be significant). Adding roof windows will not usually affect existing gutters and there will be no change to the area of the roof to be drained. If the roof is replaced by one of steeper pitch or extended in some other way as part of a conversion, the increased area should be taken into account in calculating the provision for rainwater drainage. This AD sets out the method of calculating this and the diameter of gutters and outlets required.

AD KI - Stairs and Ramps

This AD contains the requirements for the dimensions, pitch and going of any stairs providing access to any internal space. There are also some forms of stair and ladder acceptable for loft conversions containing only one room and a bathroom, although these are not recommended if sufficient space is available for a conventional stair. Retractable ladders are not acceptable as a means of escape.

AD LI - Conservation of Fuel and Power

This AD includes various methods by which either the thermal performance of the building fabric can be assessed or the level of insulation of the various elements must be set in order to ensure that the overall performance meets the requirements of the Regulations. The AD now requires the thermal performance of elements to be calculated based on an average of the constituent parts of the element and their relative proportions, ie mortar joints as well as lightweight concrete blocks or rafters as well as the insulation material. In any conversion of a roof into habitable space under the simple Elemental method of calculation, the roof, external walling, ceiling and windows must conform with the levels set out in the AD.

If the whole plane of the roof is to be insulated this must achieve a U-value of $0.25\text{W/m}^2\text{K}$. If only part of the roof forms a sloping ceiling to an attic space the AD allows a U-value of $0.35\text{W/m}^2\text{K}$ for this element, but the flat ceiling over the attic must achieve $0.25\text{W/m}^2\text{K}$. The external walls of the attic space must achieve a U-value of $0.45\text{W/m}^2\text{K}$. (If a roof exceeds a pitch of 70° it is treated as a wall.) Under the Elemental method of calculation a window area (inclusive of roof windows) of 22.5% of the floor area is permitted. (The AD allows either the floor area of any "extension" or the floor area of the existing building plus "extension" to be taken into account in calculating this percentage.) The 22.5% assumes basic double glazing but the AD now contains a table that includes the calculated U-values of various thicknesses of double-glass unit combined with the frame material and these figures can be used to justify a higher percentage of window to floor area when calculated under the Target U-value method.

Where new accommodation in the roof does not extend for the full width of the roof, the ceiling of the existing upper floor must be insulated between the eaves and wall of the attic space unless the whole plane of the roof is insulated. Although there is not a

requirement to upgrade any insulation here to the current levels, it would seem sensible to do so when converting the roof space. The AD also emphasises the need to reduce air leakage to a minimum and also to avoid thermal bridging around any openings.

ADL2

Covers the controls of heating and hot water, and the insulation of pipework and hot & L3 water cylinders. These would be relevant to roof conversions if heating or hot water services are to be included in the conversion.

AD - To support Building Regulation 7 (Fitness of materials)

This AD sets out the requirements for materials and workmanship in construction to satisfy "fitness for purpose" and ensure sufficient standards for health and safety and adequate durability of the building elements.

The AD lists the authorities that provide acceptable tests, standards and certificates.

The AD also includes the requirement for protection against the House Longhorn Beetle established in part of Southern England.



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