compariqo

TECHNICAL STANDARDS 2023

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THE PERFECT PARTNER

Contents

TS_June_2023-v1

Scope

To satisfy the Requirements of this manual you must comply with:

• The requirements of the Building Regulations. This will be dependent upon the location within the United Kingdom England and Wales
• Approved documents A to S plus Workmanship and materials
• Northern Ireland- Technical Booklets B-V
• Scotland- https://www.gov.scot/policies/building-standards/monitoring-improving-building-regulations/
• All other statutory technical requirements e.g. Water Regulations, the Gas (Installation and Use) Regulations, etc.
• The latest British Standards: https://shop.bsigroup.com/categories/construction-and-building
• The additional requirements set by The Compariqo Policy.

Requirements

The Compariqo Technical Standards are divided into several sections corresponding to the various areas of construction.
The Requirements and other statutory constructional requirements are shaded for ease of identification. These Requirements are in addition to compliance with Building Regulations and for the avoidance of doubt compliance with the Requirements is mandatory.

All dwellings and commercial buildings covered by a warranty from The Compariqo Policy, shall comply with the Requirements in force at the time that documents for the dwelling were deposited with the relevant authority for the purposes of the Building Regulations. The pages following the Requirements provide guidance on showing compliance.

For the purpose of this Manual, the term Building Regulation refers to the equivalent or corresponding statute in the various countries covered by this manual, i.e. England & Wales, Scotland, Northern Ireland.

Building Regulation requirements are described in functional terms (in italic text) and reference is made to any corresponding regulation in England & Wales, Scotland and Northern Ireland. Where a Building Regulation requirement is not currently applicable in a particular country then, where noted, it shall be treated as a Compariqo requirement.
When interpreting these Requirements and Guidance the standards of construction achieved shall never fall below the minimum standard set by the controlling Building Regulations.
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When interpreting these Requirements and Guidance the standards of construction achieved shall never fall below the minimum standard set by the controlling Building Regulations.
In determining whether compliance with the Requirements has been achieved:

• It is for the building control body (Local Authority or Approved Inspector) to satisfy themselves on the compliance of plans and work with the Building Regulations. It should be noted that where a dispute arises, Compariqo may delay the issuing of the Insurance Certificate until settled.
• For the avoidance of doubt, when several standards are referred to, the higher standard shall apply
• The decision of Compariqo shall be final in determining these Requirements.

Requirements:

• The Construction shall comply with the Building Regulations
• Paths and drives shall be laid to falls and be adequately drained
• Site fill and consolidation of subsoil under paths, drives, outbuildings etc. shall be carried out using non-organic materials and achieve an appropriate level of compaction, due account being taken of the final use of the filled area
• Where on-site sewage treatment and disposal systems are included in the warranty and/or soakaways are proposed a porosity test shall be carried out to ensure that the ground conditions are suitable for that form of drainage discharge

• Subsoil drainage shall be provided within the vicinity of outbuildings, hardstanding's, paths, drives and the like if the ground is liable to waterlogging or if the presence of a water table is likely to affect the stability of the ground
• Subsoil drainage shall be provided in garden areas if the ground is liable to constant waterlogging within 4 metres of the dwelling
• Garden areas shall be laid to levels and gradients appropriate to the levels of the buildings, adjacent highways and services
• An adequate method of rainwater disposal shall be provided to all permanent outbuildings

External doors and windows shall be designed and constructed so as to:

• Not allow moisture through frames
• Be provided with a draught strip
• Shed water from the building in an effective manner
• Provide an adequate deterrent to forced entry into a dwelling

The enveloping walls and floors of a dwelling, including jambs, sills and heads of door and window frames, shall be designed and constructed so as to:

• Prevent build up of excessive condensation within the fabric of the construction
• Prevent cold bridges causing local surface condensation to occur, and prevent the excess flow of air into a dwelling The width of internal stairways shall be such as to offer safe passage to users of the building

The following accommodation and amenities shall be provided to a dwelling:

• adequate whole house heating and domestic hot water supply
• electrical installation with an adequate number of lighting points and socket outlets
• gas supply to kitchen cooker position (where a mains supply passes adjacent to the dwelling)
• adequate storage space at each floor level
• adequate space with a 13 amp socket outlet for a refrigerator
• TV point in at least one room wired to an accessible connection point

Building service installations shall be designed and constructed so that they:

• operate in a safe manner
• are provided with adequate controls to allow their operation, isolation and drainage
• are provided with adequate means of access where necessary for the purposes of inspection, maintenance and replacement

All service installations requiring periodic attention by the user shall be provided with adequate operating and maintenance instructions
Finishes to walls, floors, fixtures and ceilings in conjunction with levelling and supporting surfaces should provide adequate resistance to impact, wear, water, and light chemical attack, due account being taken of the location of the element. In addition, externally located finishes should have resistance to frost and ultra-violet radiation

Decorative elements shall be completed to adequate basic levels of visual quality (higher standards which may be agreed between the builder/developer and the purchaser are not included in this Requirement)

Adequate vehicular and/or pedestrian access shall be provided:

- from an adjacent street, to an entrance of the dwelling and to any garage or other parking area within the curtilage of the site
- from the dwelling to any garage and outhouse

Detached garages and outbuildings shall be:

- structurally stable and withstand movement of the subsoil, due account being taken of the ground conditions and wind exposure for the site
- reasonably resistant to rain and ground water (however detached garages are not designed to form a 'dry' environment unless specifically specified)

Retaining walls and garden walls shall be stable, withstand movement of the subsoil and be adequately protected from the adverse effects of ground moisture and freezing. In addition, retaining walls shall be constructed so as not to allow the build-up of ground water
All external ramps and steps providing access to a dwelling shall be safe to use
Garden areas shall be reasonably cleared of builders' materials prior to handover and left suitable for planting and or turf (including top soil)

Accuracy, quality of finish and protection:

- Any element covered up by another element shall be finished to adequate standards in order to properly receive the covering element and be adequately protected prior to being covered up
- Any element not covered up by another element shall be provided to an adequate basic standard of visual finish and protected prior to handover (Higher standards which may be agreed between the builder/developer and the purchaser are not included in this Requirement) Compariqo Requirements (continued):

Design and construction:

- Adequate investigations shall be carried out to identify design data which vary from site to site
- Total and differential movement of an element shall be adequately limited or accommodated, such that damage does not occur to itself or to other elements
- Methods of fixing, jointing, bonding, supporting, tying together, surface preparation and sealing of elements shall be adequate, due account being taken of the location and anticipated life of the element

- The design and construction of any element and choice of materials shall be such that a reasonable level of safety to persons is provided
The method of achieving compliance with any Requirement shall not result in the failure to comply with another Requirement
- Any element which performs the role of more than one element shall comply with the Requirements applicable to each element
Every dwelling shall be cleared of builders materials and debris and adequately cleaned prior to handover

Materials and workmanship:

All materials, with the exception of decorative materials, shall have a minimum life span of not less than 30 years for items affecting structural stability, 15 years for roof coverings and 10 years for non-structural items, due account being taken of their intended location and use

• Materials shall be adequately treated to prevent their premature decay or decomposition and adjacent materials shall be compatible with each other

• Materials shall be stored, protected and properly treated prior to being incorporated into the dwelling

The Requirements shall be met whilst the building is in service

If a product has an independent test certificate e.g BBA or BRE, DIN etc and is installed by an "approved installer" [e.g. approved under an industry scheme or by the manufacturer as in the case of Sika render systems] we should not require additional insurance

Conversion Requirements

Where deemed necessary the developer/builder should commission a comprehensive survey and report by an Expert for the structure of the building or elements of structure, to indicate the condition and lifespan of those elements
Provision of integral damp-proof course and damp-proof membrane to provide an effective barrier against rising damp. DPC injection to include an insured certificate issued to each property, acceptable to The Compariqo Policy
Independent inspection and treatment of timbers against fungal and insect attack, where necessary, together with replacement of all rotting timbers and associated work necessary to remedy the cause of dampness. Timber treatment to include an insured certificate issued to each property, acceptable to The Compariqo Policy
Historic buildings shall achieve to reasonable as is practicable level of sound insulation. The results of the "test and declare" testing shall be displayed in the building
Where required by Compariqo the developer/builder shall provide an underwritten guarantee for specialist works

Other Statutory Constructional Requirements

All elements of construction covered by this Manual shall comply with any relevant statutory requirements.
Services passing through the building envelope shall comply with the requirements of the relevant Gas, Water, Electricity and Drainage Authorities The protection of building services

supplies and installations in waterlogged ground shall satisfy the requirements of the Supply Authority.

• The method of on-site sewage treatment and disposal shall comply with the requirements of the Sewage / Water Authority / Environment Agency.
• The method of discharge of a private drain or sewer into a public sewer shall comply with the requirements of the Sewage Authority / Environment Agency The ventilation of voids under ground floor slabs shall be to the satisfaction of the local Gas Authority.
• Every dwelling shall be provided with a wholesome supply of drinking water to the satisfaction of the Water Authority.
• Heating appliances shall comply with the requirements of the Local Authority with regard to the Clean Air Acts (smokeless zone requirements).
• The location of services within the finishes shall comply with the requirements of the Gas, Water, Electricity and Drainage Authorities.

Low and Zero Carbon Housing

The Building Regulations Approved Documents Part F 2010 & L 2013 for England and Wales regarding the ventilation and energy performance of dwellings requires designers and builders have to ensure that new dwellings minimise uncontrolled air leakage and provide proper ventilation. Reduced air permeability is recognised as having significant impact on reducing energy consumption and carbon emissions. Therefore, all new dwellings are required to be pressure tested to ensure that their air permeability does not exceed the standards in Approved Document L (also see this section.)

Minimizing air leakage is critical to building performance. It not only saves energy but also improves comfort by eliminating drafts. Equally importantly, reducing draught uncontrolled air leakage enhances durability by allowing rain screen walls to function effectively and prevents moist air from leaking outward and condensing within the building fabric. A continuous sealed air barrier that separates indoor conditioned space from the outdoors must be provided. It can be located anywhere within the building fabric provided the vapour permeability rating of the air barrier will not trap moisture within the wall cavities.

All combustion equipment shall be independently vented and have either sealed direct-vent, induced-draft or forced draft venting systems with electronic ignition. Induced draft and forced draft vented equipment shall be capable of positive shutdown in the case of venting system blockage. A carbon monoxide detector shall be installed in flats/houses containing either combustion appliances or attached garages.

Low or zero carbon housing should incorporate the principles of occupant health and comfort, affordability, resource conservation and reduced environmental impact. These homes reduce greenhouse gas emissions and minimize the detrimental impacts of housing.

The design of these dwellings should be undertaken in the following order and include:

- Climate specific design
- Energy and resource-efficient construction
- Passive solar heating and cooling
- Natural daylighting
- Energy-efficient appliances and lighting
- Renewable energy systems (e.g. photovoltaics, solar thermal and ground source heat pumps, etc.)
- Water conservation and re-use
- Land and natural conservation
- Sustainable community design and green infrastructure practices.

The benefit of good design includes:

- Lower energy bills
- Less concern about disruption to the energy supply or cost escalations
- Healthier living
- Greater comfort
- Reduced carbon emissions and other pollutants
- Improved affordability from a life-cycle cost basis
- Increased opportunities for sustainable redevelopment

Renewable Energy Systems

The following renewable energy systems should be considered when designing low zero carbon dwellings:

a) Combined heat & power
b) Bio-mass heating
c) Solar thermal for space and domestic water heating
d) Solar electricity
e) Solar ventilation air preheat
f) Ground source heat pump
g) Wind

Security

Design – General

The Building Regulations Approved Document Q was introduced in 2015 and was effective from the 1st of October and applies to all new dwellings including those formed by a material Change of use. The regulations go some way to meeting the requirements of the Secure by Design standards however more comprehensive security can be provided to the dwelling and site by following the guidance and objectives of Secured by Design. These standards are designed to encourage the building industry to adopt recommended crime prevention

guidelines, in both house and estate design, thus gain approval; to use an official Police approved logo in marketing of new houses.

To gain approval under the Secured by Design initiative, it is important for the designer to consult with the Architectural Liaison Officer of the relevant Police Authority at an early stage of the design Security provisions apply to houses, flats and maisonettes and cover the following matters:

- Passive security measures such as estate layout, landscaping and the design of doors and windows
- Active security measures such as intruder alarms and security lighting (also refer to section regarding External Works).

Further information about Secured by Design can be found at: www.securedbydesign.com

Further information regarding community safety, security and risk solutions can be found at:

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Finishes – generally check that there is no damage, drips, chips or faults in the appearance of any decorated surface. Ensure that all aspects of the finished home are of a reasonable basic quality standard of visual finish.

Services – generally check that all services, boilers, fires etc. are installed in accordance with the manufacturer's instruction, together with the legislation associated with that appliance. Please note that all operating manuals should be retained and handed over to the purchaser as part of their Customer Information Pack. Always ensure that suitable access for maintenance is provided and the following certificates available for:

- Gas Safe Certificate
- Electrical Approved Document Part P certificates
- RSD or PCT documents
- EPC
- Approved Document Part L documents
- Building Control Final Certificate

Superstructure – ensure that all finishes are to a reasonable basic visual standard, the brickwork/rendering and roof covering is of a consistent nature in quality of finish and workmanship. All windows and door frames must be reasonably sealed where abutting the external envelope to prevent weather penetration. All rainwater goods must be in place and connected to the drainage system and all timber products are suitably treated / decorated to give a reasonable finish and protection against the elements.

Roof space – the roof space should be accessible, with all insulation in place and, where fitted (in a cold roof the loft hatch must be insulated, draught stripped and secured with a catch. Access must be provided to and round the water storage tanks within the loft space.

Ground works and drainage – generally all external decorations should be complete, boundary walls built, drainage connected and tested, paths and drives complete / serviceable and the plot free from any builder's debris.

Miscellaneous – supply evidence of insured guarantees where applicable. The whole house should be clean, free from builder's material/rubble and be complete prior to handover/conveyance.

Insured guarantees are required for:

- Timber treatment, materials and workmanship
- Chemical injection, materials and workmanship

Insurance backed guarantees are required for:

- Remedial wall tie replacement, materials and workmanship
- Basement tanking, materials and workmanship
- Roof covering where applicable

Establishing Fitness of Materials and Workmanship

The following methods exist for establishing the fitness, and assuring the quality of materials and workmanship.

Past experience

Past experience may show that a material is suitable for its intended use or that a method of workmanship is adequate for a particular type of construction.

British Standards or European Standards

Compliance with a British Standard or an equivalent European Standard generally assures the adequacy of a design, method of construction or product where appropriate for a specific use.

Product certification schemes

Product certification schemes operated by independent assessment organisations exist for assuring the conformity of a product to a specific standard, e.g., the Kitemark Scheme operated by the British Standards Institution.

Quality assurance schemes

Various quality assurance certification schemes exist for design, construction and product manufacture. Firms registered under such schemes are considered to have the capability to produce or perform to a consistent level of quality within a defined scope of registration. Quality Assurance schemes registered by the National Accreditation Council for Certification Bodies (NACB) provide assurance as to the integrity of such schemes. Quality Assurance schemes do not, however, certify conformity with a particular product or service standard, or that the standard is adequate for a specific application.

Agrément Certificates

Agrément Certificates issued by the British Board of Agrément (BBA) supply independent certification of the adequacy of a particular product, for a specific use, in cases where a British Standard does not currently exist.

Construction Products Directive

The CE mark is a claim that a product, when properly used, enables the construction works in which it is incorporated to meet the relevant essential Requirements of the EC Construction Products Directive. The claim is normally based on compliance with a harmonised European Standard or European Technical Approval.

The essential Requirements encompass:

- Mechanical resistance and stability
- Safety in case of fire
- Hygiene, health and environment
- Safety in use
- Protection against noise
- Energy economy and heat retention

As with national standards, different classes of performance may be permitted in order to suit varying situations such as climate and required levels of protection. Therefore, products should be carefully selected to ensure that they are fit for their intended purpose.

Tests and calculations

Calculations and destructive or non-destructive tests can show that a design, construction and/or product is adequate for a specific purpose. The NAMAS Accreditation Scheme for Testing Laboratories provides a means of ensuring that tests are conducted in accordance with nationally accepted criteria.

See Appendix C for approved test laboratories.

Tests for reclaimed materials
Reclaimed materials must be subject to a third party test to show suitability (unless specifically seen and accepted on site by Compariqo prior to incorporation of the particular material in the construction).

Expert

Where the appointment of an Expert is recommended, the person to be appointed should possess the qualifications, experience and professional indemnity insurance appropriate for the type and complexity of work to be undertaken.

Suitable Experts normally include:

• Registered Architects
• Chartered Civil and Structural Engineers
• Chartered Building Surveyors
• Members of the Chartered Institute of Building
• Members of the Royal Chartered Institute of Surveyors
• Members of the Architects and Surveyors Institute (Building Surveyors)

• Corporate Members of the Association of Building Engineers or Corporate Members of the Incorporated Association of Architects and Surveyors (Architects/Building Surveyors)
• UKAS and ANC members
• Certified Surveyor in Structural Waterproofing (CSSW)

Guidance for Innovative Designs and Construction Methods

In general, designs and construction methods which cannot be shown to meet the Requirements by any of the methods set out in this manual must be approved in advance by Compariqo in writing, generally before commencement on site.

All structural elements should be designed by an Expert when not in accordance with either:

• Approved Document A (England and Wales)
• Technical Standards Part C (Scotland)
• Small Buildings Guide (Scotland)
• BS 8103:1
• This technical manual

Where the structural elements of a building are designed by more than one Expert, then one Expert should be nominated to be responsible for certifying the overall stability of the structure.

To ensure durability, materials should generally be selected as follows to suit the exposure of a particular location:

- BS 5628 – masonry units and mortar
- TRADA Floor Span Tables
- BS 8110 – concrete
- BS 5268 and BS EN 338 – structural timber
- BS 5950 – structural steel.

The findings and recommendations of any site investigation report should be considered when selecting masonry, mortar and concrete for below ground use.

Structural elements should not be cut, drilled or notched on site, except in accordance with the recommendations set out in this Manual. Manufactured structural components should not be modified without the express permission of the designer and manufacturer.

If a structural element supports heavy service loads, e.g., a cold-water tank, it should be specifically designed for this purpose.

The dimensional accuracy of the completed structure should be within the permissible tolerances specified by the manufacturer of elements to be supported by, or accommodated within, the structure.

Where prefabricated structural components rely on additional site fixed elements or fixings for their own stability, or provide stability to other elements, then a nominated person should be responsible for ensuring that all necessary assembly information is supplied to site and that the completed work complies with the design.

Prefabricated structural components should not be altered on site or any major repair carried out without the specific approval of the Expert responsible for the design.

Prefabricated structural components should be clearly identified by indelible marking.

The rigidity of a framed structure should be sufficient to prevent damage or visual defects occurring to all elements within or supported by the structure.

Workmanship on building sites should follow BS 8000 and Regulation 7 to the Building Regulations.

Compariqo Warranty Cover for Modern Methods of Construction (MMC)

Ensuring our quick assessment

For all MMC properties, we will need to carry out a technical assessment of your project before we can agree to register it for cover under our warranty policy scheme. MMC is a process in a pre-defined logical sequence, using precise components made under controlled conditions. The result is a building with enhanced performance characteristics in terms of quality, time, waste, value and delivery certainty.

The assessment process is not just a desktop overview of your proposals and specification of the project, but will also include factory audits and site visits. We understand that you need to make quick progress on site. In order to help you do this we set out below how we can help each other to streamline the assessment process.

The flow chart overleaf shows you the stages, from notification of the project to our decision to accept, or unfortunately on some occasions to decline.

What are we looking for?

In order to understand your project, we need to know as much as possible about it as soon as possible. In particular we need:

• Single point of responsibility for project design co- ordination. The project co-ordinator to be responsible for ensuring compatibility of all individual construction elements.
• Project – Drawings, plans, elevations and specifications.
• Project method statements.
• Erection manuals and confirmation of erection by trained/approved contractors.
• Maintenance requirements.
• Structural Engineer load calculations for all elements of the system and cladding details including fixing calculations.

• Structural Engineer's Report – to comment on structural adequacy of elements and confirm life expectancy of building.
• Experts' reports – these will be in addition to the Structural Engineer's report and should include specialist reports and test evidence data from manufacturers.
• Independent assessment of components or system from BBA, BM TRADA, BRE, WIMLAS, European Technical Approval (ETA) or conformity to International, European and British Standards.
• Best practice guidance from industry bodies, BRE, BM TRADA, CIRIA, ETA, BS etc.
• Information from manufacturers, builders and clients.
• Past performance of similar systems.
• Third party Manufacturer's Warranties
• Factory audit required if system is not already approved by Compariqo

What we expect

• The project must achieve compliance with Compariqo Technical requirements and the Building regulations.
• The fabric of the building must prevent moisture penetration to the inside of the building.
• Any habitable areas either below or partially below ground level must be provided with a minimum grade 3 tanking system or equivalent and ten year insured certificate.

• Specialist roofing systems and proprietary externally applied weather proofing/insulation systems should have a contractors guarantee and/or ten years insured certificate.

• Windows, doors and internal services should comply with current standards.

• Life of building to be at a minimum of 60 years in accordance with CML requirements

Assessment of MMC Systems, Additional Information

The following provides guidance on the assessment procedure undertaken by the technical department during both the desktop and factory/site inspection stage.

Verification by Desk Study

The durability assessment shall involve a review of the following information supplied by the applicant:

• All materials used in their system shall include specification of any coating finishes for the purpose of corrosion protection, UV protection (i.e. zinc, paint etc).
• The life expectancy of all materials.
• Assessment of long-term performance of materials where relevant.
• Protection from weather during delivery and installation of the various building systems, elements or components.

Achievement of the weather-tightness of the building by consideration of the following aspects.

• Type of roof covering and method of installation,
• Where relevant, use of drainage cavities in walls,
• Adequate use of damp proof course(s),

Sealing around windows and doors
Roof and ground drainage.
Assessment of the hygrothermal performance of the building system, element or component including thermal transmittance and any associated risk of condensation.
• Effect of different materials in contact (i.e. examination of chemical and physical compatibility).
• Where relevant, provision of movement joints in the system to allow thermal expansion of components without detriment to the weather tightness of the building.
• A schedule, clearly detailing the maintenance requirements including cleaning, re-sealing and replacement of any component or element having life expectancies of less than 60 years.

Product Specification

The manufacturer/supplier shall provide the following:

• Clear identification of the scope of the building system e.g. number of storeys;
• All engineering drawings showing construction details, junction details and connections, with manufacturing tolerances;
• Test reports/calculations relating to performance of the building system/element or component;
• Competency and /or training requirements of installers;
• Full detailed site installation/assembly instructions including any diagrams;
• Critical site assembly checklist for use by on-site inspectors;
• Risk assessments for the installation and construction process;

• Procedures for the adaptation/change of use of the building system, elements or components in response to the following scenarios:
a) Insertion of a 2m x 2m opening for a new patio door;
b) Fixing of heavy items to external walls, ceiling and stairs – e.g. stair lift, ceiling hoist for disabled;
c) Fixing of heavy items to external walls;
d) Adding a conservatory;
e) Removal of internal load bearing walls;
f) Accessibility for modifications to plumbing and electrical services;
g) Cutting or drilling holes through elements to accommodate modifications to service requirements.

Mechanical Resistance and Stability

Evaluation of the structural configuration to identify:

• Clearly defined paths through which the actions are transmitted to the ground.
• Adequate strength, stiffness and stability to resist the applied loads to which the system will be subjected.

Structural members, the stability of which relies on the assumption that they are restrained in position and their connections to a bracing member are of sufficient strength and stiffness to provide the required restraint.
• Robustness to disproportionate collapse

Guidance on the Party Wall Act 1996

This Act came into force in England and Wales on 1st September 1997. It is important to understand the essential elements although its relevance to a particular site or development will vary according to circumstances.
In any situation it is possible that a number of adjoining owners may be affected, i.e. Freeholder, Head Lessee, Sub Lessees, even a person or organisation under contract to purchase.

Party Walls and Party Structures

The Act gives owners of property, separated by a Party Wall, rights over the whole of that wall and thus beyond title boundary, which is normally, but not always, in the centre of the wall. These rights can be pursued following the service of an appropriate notice. This sometimes produces consent from the adjoining owner but often dissent. Assuming the latter the Act demands that each owner appoints a surveyor (they can agree on the same surveyor but this is rare) which leads to the delivery of an Award to each owner, signed by the surveyors.
Examples of the rights gained over the Party Wall are:

• Raising or, where appropriate, reducing the height
• Underpinning
• Cutting into
• Removing corbels or footings etc.
• Strengthening/rebuilding

Should you be working in a building which remains part tenanted, the floor between your work and the tenant will almost certainly be defined as a party structure and most works of a significant nature on this floor will require notice.

Simple Fence Or Open Boundary

In these circumstances a notice can be served which gives the right to place a wall immediately adjacent to the boundary with foundations extending on to the adjoining owner's land. By agreement with the adjoining owner it is possible to place the wall astride the boundary.
Excavation and Below Ground Works
Notice also has to be served when carrying out excavation within 3 metres of an adjoining building or structure and to a lower level than the existing foundation. In other circumstances, usually piling, it is necessary to serve notice within 6 metres of the adjoining building or structure.

Summary

Unless you have "in house" expertise in the workings of this Act, you should gain professional advice. Failure to serve appropriate notice, which in most cases is two months prior to the commencement of work, could lead to the delay of a relevant part of the works, or at worst the whole contract.

There are many positive aspects to the Act. In many circumstances you are no longer limited by the laws of property and trespass. The Act lays down a simple timetable for the response to notices and other matters and a procedure for resolving disputes between the appointed surveyors.

The intention of the Act is to give certainty in your dealings with the adjoining owner.

Further advice can be found at: www.communites.gov.uk Building Regulations section

In addition to the following guidance, reference shall also be made to the Scope & Requirements section.

Section 1 - Site Investigation

Site Investigation – General

All Compariqo registered sites should have a full site investigation report as outlined in this section. If the site is contaminated then Site Preparation Insurance (SPI) is required.
NB. Compariqo will not be able to offer Warranty cover on contaminated Custom Build sites.

Additional guidance is also contained in the following current design and construction standards or guides:

BS 5930 Code of Practice for Site Investigation

Building Research Establishment

Report 211 Radon: Guidance on protective measures for new dwellings
Report 212 Construction of new buildings on contaminated land
Digest 318 Site Investigation for low-rise building: Desk study
Digest 348 Site Investigation for low-rise building: The walkover survey
Digest 363 Sulphate and acid resistance of concrete in the ground
Digest 383 Site Investigation for low-rise building: Soil description
Digest 414 Protective measures for housing on gas contaminated land

DETR [Department of the Environment, Transport and the Regions

• Waste Management Paper 27: Landfill gas
• Planning Policy Guidance: Planning and Pollution Control, PPG 23
• CLR Report No 12: A quality approach for contaminated land consultancy
• TBA Report from Parkman Environment "Housing Development on Contaminated Land"

DETR Welsh Office

• Schedules of Industrial Uses and Potential Contaminants
• Planning Policy Guidance: Development of Unstable Land PPG 14

DETR Welsh Office, Scottish Office

• Special Waste Regulations The Controls on Special Waste, How they affect you

The investigation of the geology and previous use of any site is fundamental to best practice.

Before the substructure is designed a site investigation must be undertaken by a competent Geotechnical expert. Copies of which should be made available to the Compariqo Surveyor prior to commencement of work.

The purpose of the investigation is to identify the character and variability of the underlying strata of the site and the adjoining land (which may also affect the performance of the substructure). See diagram 1.01. This will enable the design of all the elements of the substructure to be best suited to the conditions particular to a site.

• Reducing extra construction costs through an economic foundation design
• Reducing the risk of unacceptable whole or differential settlement
• Reducing the risk of contractual disputes because of unforeseen design changes
• Ensuring the safety of site personnel

Designing "in" a construction that will suitably eliminate potential health hazards from contaminated land and determine how much unsuitable material should be removed.

Site Investigation Procedures

The level of investigation required is generally obtained after carrying out:

• Preliminary desk top study
• Site walk over study

This will then determine the following:

• The design of a suitable ground investigation programme - e.g. by trial pits and/or boreholes
• Soil and rock classification including identification of fill materials or made ground
• Identification of groundwater levels
• Laboratory testing to determine physical and chemical characteristics
• Report and recommendations

Ground Investigation may include:

• Cable percussion boring
• Rotary drilling
• Trial pits – a minimum of two per plot is advised
• In situ testing
• Dynamic probing
• Rock discontinuity surveying
• Plate bearing testing
• Percolation testing-for soakaway drainage design
• Assessment of slope stability

Reports should show that the following has been considered:

• The risks of general subsidence or land-slip (e.g. caused by geological faults, excessive slopes, current and past mineral workings etc.),
• The effect of the proposed construction operations on the overall ground stability,
• The risks caused by excessive vibration from adjacent sources,
• The effect of ground water conditions, including level and flow,
• The effect of flooding of the site, both before and upon completion of the construction,
• The presence of existing substructures, sewers, drains and service runs and the effect they will have on the foundation design,

The extent to which ground water and subsoil contains or is contaminated with:

– chemicals aggressive to concrete and other materials used below ground (e.g. sulphates, acids or strong alkaline substances).
– materials which by expansion may disrupt the substructure
– materials which might affect the health or safety of occupants in or near buildings on the site – the level of radon risk and the precautions required.

Contamination Assessment

This is needed to ensure legislation regarding health hazards is complied with. Potential chemical attack to substructure work can be determined. An assessment of possible groundwater contamination can be made.

This will include an assessment/testing of the following:

- Soils
- Groundwaters
- Radiological
- Biological

Environmental Risk Assessment of Land

Introduction

In order to build, appropriate local authority approvals are always required. When development is planned on previously used sites or land adjacent to a site containing a risk to the built environment, additional precautions are needed. This section provides guidance on the research and precautions needed in order to obtain Compariqo protection against liabilities imposed by statute on the developer or land owner. This applies to development on land ranging from green fields to sites with known contaminants present. This now also applies to buildings that are being converted for residential use. Diagram 1.01 outlines the process involved in site investigation and risk assessment for any contaminated site, it will also assist in achieving insurance cover for the land and development.

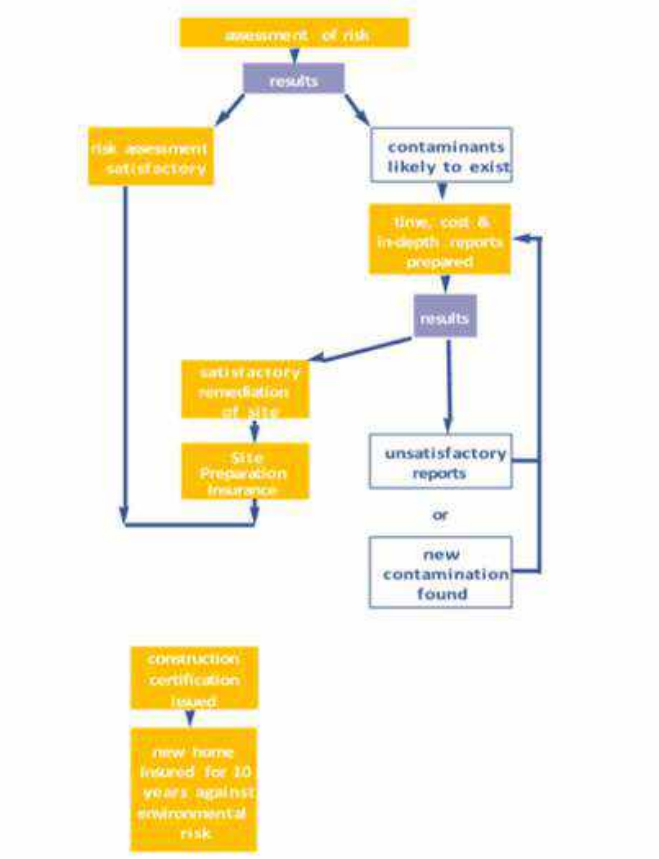


Diagram 1.01 Environmental risk assessment of land

Contaminated Sites

It is a condition of Compariqo providing cover on contaminated sites that Site Preparation Insurance (SPI) cover is taken out by the developer and is approved by Compariqo.
Where SPI cover is being sought then the following information will be required:

- A4 site plan with site outlined in red
- Copies of the site remediation reports
- Environment Agencies Approval

Historic buildings

The aim is to improve the resistance to contaminants and moisture as much as possible but it has been recognized that this is not always practical. In arriving at an appropriate balance between historic building conservation and improving resistance to contaminants and moisture the advice of the Local Planning authority's conservation officer should be sought at an early stage in the design process.

Further information can be found within the following documents:

• BS 7913 Guide to the principles of the conservation of historic buildings
• SPAB Information Sheet 4 The need for old buildings to breathe.
• BRE Report BR 267 Major alterations and conversions
• BRE GBG 25 Buildings and radon

An assessment is required in all cases. The level and depth of the assessment will be determined by the historic knowledge of the site. A suitably qualified consultant should carry out the assessment.

Appointment of consultants

• Specialists and consultants must have:
• experience of similar projects
• detailed understanding of current legislation
• detailed understanding of and access to the relevant skills and expertise necessary for the project
• the ability to prepare comprehensive reports identifying hazards, risk assessment and conclusions drawn
• adequate professional indemnity insurance for the works undertaken

Definition of contamination

The "Registers of Land Subject to Contaminated Uses" identify the following eight uses:

• Manufacture of gas, coke or bituminous material from coal
• Manufacture or refining of lead, steel or an alloy of lead or steel
• Manufacture of asbestos or asbestos products
• Manufacture, refining or recovery of petroleum or its derivatives, other than extraction from petroleum bearing ground
• Manufacture, refining or recovery of other chemicals, excluding minerals
• Final deposit in or on land of household, commercial or industrial waste other than waste consisting of ash, slag, clinker, rock, wood, gypsum, railway ballast, peat, bricks, tiles, concrete, glass, other minerals or dredging spoil; or where the waste is used as fertiliser or in order to condition the land in some beneficial manner
• Treatment at a fixed installation of household, commercial or industrial waste by chemical or thermal means
• Use as a scrap metal store, within the meaning of section 9(2) of the Scrap Metal Dealers Act

The risk of other potential contaminants which might affect the insurability of the site should be researched to identify whether they occur on, or adjacent to the land.
Desk top assessment

• timing – normally during purchase negotiations, valuation or development planning. The initial phase of the assessment should be completed as part of the feasibility study and prior to any decision to insure the environmental risk.
• scope – the site and surrounding area up to at least 250m or 500m where there is a known risk of contamination and free draining soils.
• key elements – investigation of the soils and underlying geology including ground and surface water drainage.

land usage – current and previous land usage of the site and surrounding areas.
See "definition of contamination".
existing site information – from the vendor of the land, current or past monitoring and previous knowledge.
current legislation and the role of regulatory bodies.

Assessment of geotechnical & contamination

Contaminated land should be assessed using the following framework:

Site assessment

An appropriately qualified person must carry out a walkover inspection of the site and adjacent areas. The purpose is to assess and correlate the information from the desk top assessment with the physical evidence on site. A walkover inspection will assess:

- The surface ground conditions
- Site and adjacent area topography
- Any residues in stores, tanks or pipes
- Any evidence of contamination
- Any surface or sub-surface impediments to development
- The extent and location of any trial excavations, boreholes, samples or other physical investigation required.

Introduction

Evidence from the desk top assessment and the walkover inspection will determine if further ground investigation is necessary. The preliminary information gathered will be used to establish the ground investigation requirements and to identify:

- Any necessary safety precautions.
- Location and extent of boreholes, trial pits etc.
- Samples or other physical investigation required.

Health and safety

All work must comply with the Health and Safety at Work Act. Before any work starts a COSHH (Control of Substances Hazardous to Health) assessment must be made and a safety plan prepared to cover all the works including those of any sub-contractors. The Construction (Design and Management) Regulations 2015, (CDM Regs) impose a responsibility to ensure safety regulations are met.

Preparation for ground investigation

Where it is necessary, buildings, structures or rubble may have to be removed. Care must be taken not to spread contamination during site clearance works. Where contaminants are suspected, tests to identify them will be necessary. If rubble, wastes, residues etc. are likely to interfere with the investigation they should either be removed or safely contained. This work will normally be carried out by specialists.

Remote sensing

Techniques such as ground penetrating radar, infra red photography or thermography can be used to detect unusual ground conditions caused by geotechnical or chemical conditions. The benefits of remote sensing should be considered.

Trial pits and trenches

BS 5930 gives guidance. Trial pits and trenches are most useful for shallow depth investigation up to 3m to 4m. They allow good visual inspection, particularly in areas of fill or where the strata has been disturbed. Samples may be taken from any location in the trial pit or trench but the location must be accurately recorded and annotated as a disturbed sample.

Boreholes

BS 5930 gives guidance on drilling techniques in various ground conditions e.g:

- Rotary drilling – boulder clay and rock
- Shell and auger – soils and weak rock
- Continuous flight auger – soils

Boreholes are normally used when the ground to be investigated is below 4m to 5m. Useful for:

- Confirming deep geological conditions
- Taking disturbed and undisturbed samples
- Establishing the location of groundwater
- Groundwater sampling and monitoring
- Determining the hydrology and water permeabilities
- Gas monitoring.

Spike tests

Spike tests are for detecting ground gases and should be used where the desk top assessment suggests:

- There is fill material on the site
- There is a landfill site within 250m
- There are pathways for gas migration.

If spike test surveys reveal methane levels > 1.0% v/v or carbon dioxide levels > 1.5% v/v further investigation will be needed. Spiking surveys are straight forward but if gas is not detected it cannot be assumed that none is present.

As with all tests, results should be analysed by a suitably qualified experienced person.

Probe tests

Used to determine the density of the soil, also for sampling and monitoring environmental hazards e.g. chemicals, gases, liquids etc.

Sampling

BS 5930 and BS 10175 give guidance on the spacing of samples (see table 1.01 below). The strategy must be to ensure that areas of contamination are not missed. The purpose is to determine the range of chemicals in the ground and groundwater and the geotechnical properties. The pattern of sampling must be dependent on the findings of the preliminary investigations and will be most frequent in areas of known or suspected contamination. An accurate plot of all sampling points is essential.

area in hectares	minimum sampling points
0.5	15
1.0	25
5.0	85
Spacing between points: 10m to 30m (BS 5930)	

Table 1.01: Sampling for Contamination Assessment

Sample handling, analysis and testing

Packaging and handling of samples for analysis must be undertaken using appropriate methods. Analysis must be carried out by properly qualified and accredited laboratories that can demonstrate their experience in testing environmental samples, e.g. the National Measurement Accreditation Service (NAMAS) scheme or UKAS.

- In-situ testing – e.g. simple physical, geological and soil bearing capacity test.
- Laboratory testing – chemical testing of rocks, soils, gases and groundwater. Physical testing of strength, relative density, consolidation properties, permeability, etc.
- Analysis – Testing should include tests for, water soluble boron, total sulphates, phenols and cyanide, sulphide, solvent extractable material, pH levels and total metals: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc.

Risk assessment

Following the site investigation, an assessment which includes the identification of health and environmental risks will be required. If a risk has been identified the assessment must be followed by evaluation and management through a remediation scheme.

Risk management

Land risk management includes the identification and control of:

- Sources of potential hazards
- Receptor at risk or target e.g. adjacent river, agricultural land, house foundations and structure, people living or working on the land, workers during remediation, construction and future maintenance.
- Critical pathway – the route by which the hazard can gain contact with the receptor.

Hazard identification

A hazard can be identified at any stage of the site assessment and can be defined as a situation with the potential to cause harm to the receptor and can be geotechnical, biological, chemical and physical. Hazards, critical pathways and receptors can be identified from the desk top assessment and will be confirmed and quantified (or not) by the ground investigation.

Hazard assessment

Factors involved in the assessment are:

- The nature and intensity of the hazard
- The critical pathway between the source and the receptor.
- The nature of the pathway, as a barrier or partial barrier or the potential to increase the intensity of the hazard.

Construction Details

Radon is generally drawn into buildings because of small ‘‘gaps’’ within the construction in the same way that air is drawn into buildings. This is mainly through floors.

Remedial Action

Remedial Works

If it is suspected or known that there are contaminated gases below the proposed building or that the ground covered by the building is within 250m of a landfill site, further studies will be required to determine if any further remedial actions are necessary.

The following should be considered for buildings near landfill sites:

• Methane levels below 1% – suspended concrete floor (ventilated) will be adequate.
• Carbon dioxide levels of 1% – possible measures to prevent ingress to building.
Carbon dioxide levels of 5% (or more) – specific design measures to be taken.
• Passive protection is the most viable method of ensuring that contamination levels remain at an acceptable level.

In other cases, the advice of an Expert should be obtained. The research plus the Expert's recommendations should be used to assess the current and future risks posed by the gases. The design of measures to protect the building and its occupants should be included within the design of the building. Arrangements should also be made for monitoring and maintenance.

Remedial Measures

If only moderate contamination has taken place, handling of the fill materials should comply with both the "Health and Safety at Work Act" and the "Control of Pollution Act". The main contractor will also be required to produce a construction stage health and safety plan, detailing their management structure, method of working and information provided to the workforce as per the Construction Design and Management (CDM) Regulations 2015.

All contaminated materials should be removed to a licensed tip.

Any service trenches, in only moderately contaminated ground, should be excavated and filled with clean stone so that site operatives do not become endangered during future maintenance.

Fill

Site fill and consolidation of subsoil under paths, drives and outbuildings etc. shall be carried out using non-organic materials and achieve an appropriate level of compaction, due account being taken of the final use of the filled area.

Solid Contaminants

There are several possible courses of action, these include:

• Sealing: this is achieved via the use of an imperforate material laid between the building and the contaminant. This must be sealed at joints, service entries and the edges etc.
• Removal: all of the contaminated ground should be removed to a depth of 1.0 m below the level of contamination – unless the Local Authority agrees to less. This should be removed from site to a licensed tip.
• Filling: the ground covered by the building should be covered to a depth of 1.0m with materials which will not react with any remaining contaminant.

Hazardous Conditions

Only the total removal of the contaminants will provide a complete remedy. Such procedures should only take place with the benefit of Expert advice.

Further guidance may be obtained from the BS Draft for Development BS 10175: Code of Practice for the Identification of Potentially Contaminated Land and its investigation and BS 5930: Code of Practice for site investigations.

Section 2 - Foundations

General

When considering foundation designs, they should be linked directly to the site investigation report. The Developer should ensure the correct foundation is provided and inspected by the Building Control body and Compariqo prior to any concrete being poured.

Foundations and ground consolidation works should be designed and supervised by an Expert when not in accordance with either:

• Approved Document A (England & Wales)
• Technical Standards C (Scotland)
• Technical Booklet D (N. Ireland)

Additional guidance is also provided in the following current design and construction standards:

• BS 5950:3.1 Structural use of steelwork in building
• BS 6399 Loadings for buildings
• BS 8004 Code of practice for foundations
• BS 8103 Structural design of low rise buildings
• BS 8110 Structural use of concrete
• CP 3, Chapter V, Part 2
• The Small Buildings Guide, (Scotland)

Where specialist design is needed, they must be

• Produced by a Competent Person
• Supported with structural calculations and clear instruction
• Submitted to Compariqo
• Available for inspection

Workmanship

During the on-site foundation process all work must be:

• Available for inspection prior to concrete pour
• Conducted in accordance with design of foundations
• Conducted by competent personnel

Common Types

Strip and Mass Fill Foundations

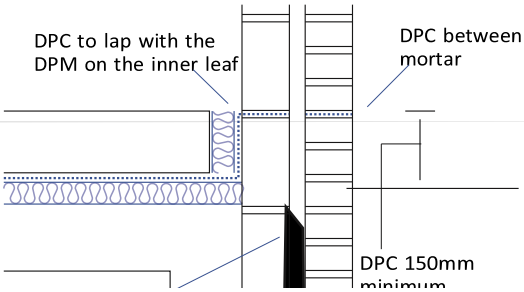


Diagram 2.00 – Strip Foundations

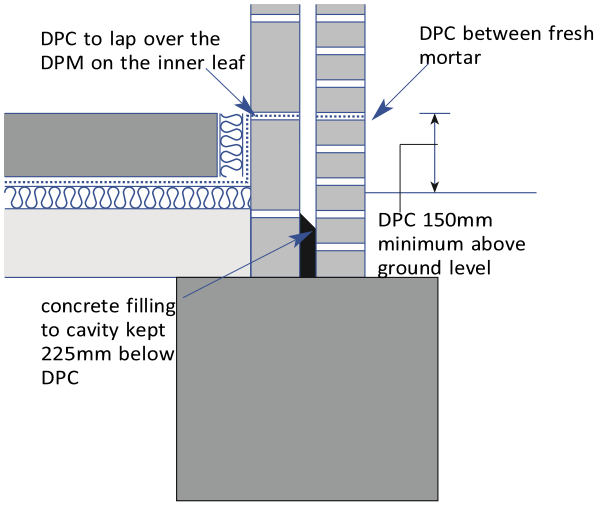


Diagram 2.01 – Mass Fill Foundation

Subsoil conditions

The subsoil should not:

- Impair the stability of the structure by being a weaker type of soil at foundation level.
- Be "made up" ground.

Design

The following provisions should be taken into account:

• Strip foundations should be 600mm minimum width.
• Foundations should be situated centrally below the wall.
• Minimum thickness of strip foundations should be 150mm.
• Steps in foundations must not be of a greater dimension than the thickness of the foundation.
• Where foundations are stepped (on elevation) they should overlap by twice the height of the step, by the dimension of the foundation, or 300mm – whichever is the greater.

Depth

The depth of all foundations will be determined by specific site conditions. All foundations must bear onto virgin stable sub-soil. Except where strip foundations are founded on rock, the strip foundation should have a minimum depth of 450mm, measured from finished ground level to their underside to avoid the action of frost. This depth, however, will commonly need to be increased in areas subject to long periods of frost or in order that loads are transferred to suitable ground. Where trees are situated close to a proposed building founded on a clay soil, the foundation depth/design will be affected.
In shrinkable soils, which are subject to volume change, the Modified plasticity index must be considered when determining the minimum depth as follows:

Modified Plasticity Index	Volume Change Potential	Minimum Depth (mm)
<10	Low	750
20-40	Medium	900
40-60	High	1000
>60	Very High	Refer to specialist

Engineered Foundations

All engineered foundations should be designed by a qualified structural engineer.

Engineered foundations include Raft and piled. All drawings, calculations and technical information should be made available to Compariqo and be available for inspection prior to concrete pour.

Raft foundations

A raft foundation is a reinforced concrete slab under the whole of a building or extension, 'floating' on the ground as a raft floats on water. This type of foundation spreads the load of the building over a larger area than other foundations, lowering the pressure on the ground.

Piled Foundations & Floors

Piling is a method of creating deep foundations for a variety of structures in almost any ground type. Pile shafts can be constructed using concrete, steel, timber or a combination of these, such as with steel reinforced concrete piles. Typically, the purpose of a piled foundation is to transfer loads from the ground level to a depth where a higher bearing capacity can be achieved. These solid columns are effective for building on sandy or unstable ground and for foundation works within proximity to trees (where seasonal ground movement may present a hazard to foundations constructed on shallow ground).

There are two basic methods; bored piles, in which the concrete is cast in place, and precast concrete piles that are driven into the ground.

With cast in place piles, the hole is bored into the ground, a reinforcement cage installed, and the hole gradually filled with concrete. Precast concrete piles may be square, octagonal or other shape in cross section. They may be cast to the full length needed or units may be joined to form longer lengths. Precast piles need heavier reinforcement than cast in place piles as it is needed to carry the stresses due to transportation and installation as well as the final loads from the structure. Alternatively, they may be pre-stressed. Depending on the nature of the, the piles may be supplied with a cast iron or steel shoe to aid driving. As a combination of the two methods of construction, precast concrete shells may be driven into the ground and the interior filled with concrete.

Pile layout

Pile layouts can be readily designed to accommodate an individual plot. A good design will seek to achieve cost savings in foundation excavation and materials by the incorporation of large ground beam spans between piles, and a small number of piles.

A typical pile layout is shown in diagram 2.03 below.

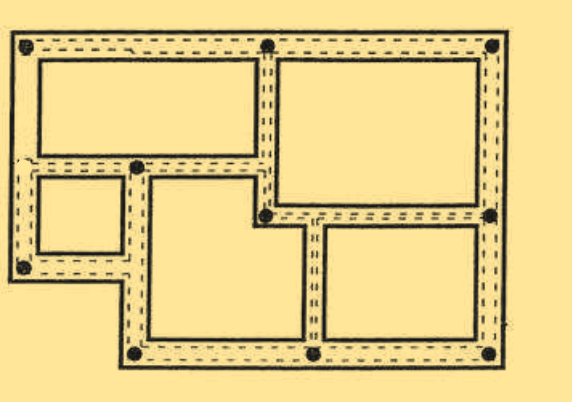


Diagram 2.03 – Typical Pile Layout

Foundations and Proximity of Trees in Clay Soils

Introduction

Damaging Effect of Clay

Changes in moisture contents of clays can cause heave or shrinkage which, in turn, can cause cracking and movement of foundations, floor slabs and hence whole structures. Clay shrinkage is caused during dry spells generally from moisture abstraction by vegetation, whereas clay heave is often caused by the removal of trees and hedgerows or alternatively due to substantial wetting after prolonged dry spells. The extent of movement may be decided from a number of factors, e.g., clay type, vegetation and tree type, the distance from the foundation excavation to the tree and / or geographical location.

Location of shrinkable clay soils

Clay soils may be found nationwide. All are shrinkable to varying degrees, although clays of most concern are found within an area south east of a line drawn between Exeter and Hull (See diagram 2.04). Clays situated south east of this line are likely to be classified as medium to highly shrinkable, with those to the north west of this line in general having a medium to low shrinkability potential.

Guidance on the probable soil conditions in a locality can be obtained from geological survey maps, available from British Geological Survey at Kegworth near Nottingham, (maps may be available for inspection at local libraries and from the local Building Control Authority). Local variations are common and additional guidance should be sought by undertaking ground investigations. The interaction of trees and clay soils should be borne in mind when considering appropriate ground investigations.

All clays require an assessment of shrinkage to be made to aid in foundation design. The most accurate way of achieving this is via a soil sample analysis in a laboratory.

Site identification of clay types

A clay can be recognised as being smooth and silky to touch with no grains visible to the naked eye. A clay may also contain silt sized particles (barely visible to the naked eye) together with sand (which will be visible and would give a more gritty feel).

The shrinkage potential of clay soils may be classified according to their plasticity. In general, the finer the soil (more clay particles and less silt or sand sized particles), the greater its shrinkage potential.

In order to accurately determine the shrinkability of clay soils, laboratory tests need to be carried out, such tests being:

- Determination of natural moisture content.
- Of the liquid limit
- Of the plastic limit
- Of the plasticity index (PI)

Although recommended, laboratory tests are not always necessary. Where local knowledge is available regarding the soil type or from visual inspection (the soil has a high sand and or stone content) it is evident that the clay type would not fall within the category of high shrinkability.

Where the soil type cannot be readily identified and in the absence of laboratory testing a high shrinkage potential should be assumed.

Diagram 2.04 – Guidance on the Location of Highly Shrinkable Clay Soils

Water Demand	Tree/Height (m)	Soil Volume Change	Distance to Tree (m)							
			2	5	10	15	20	25	30	35
High water demand Broad-Leaf	Hawthorn (10m)	High	ER	2.5	1.5	1	1	1	1	1
		Medium	ER	2.5	1.35	1	0.9	0.9	0.9	0.9
		Low	2.25	1.8	1.1	1	0.75	0.75	0.75	0.75
	Weeping Willow (16)m	High	ER	ER	2.25	1.65	1	1	1	1
		Medium	ER	2.5	1.95	1.45	0.9	0.9	0.9	0.9
		Low	2.35	2.1	1.65	1.2	0.75	0.75	0.75	0.75
	English oak (20m)	High	ER	ER	2,5	2	1.5	1	1	1
		Medium	ER	ER	2.2	1.75	1.35	0.9	0.9	0.9
		Low	2.4	2.25	1.8	1.45	1.1	0.75	0.75	0.75
	English Elm (24m)	High	ER	ER	ER	2.25	1.85	1.45	1	1
		Medium	ER	ER	2.3	1.95	1.6	1.25	0.9	0.9
		Low	2.4	2.25	1.95	1.65	1.35	1.05	0.75	0.75

In situations where trees are within the area of influence of the proposed foundations, appropriate measures must be taken to counter the potential effects of changing ground conditions in shrinkable clay soil s. That applies to any tree regardless of its size and maturity.

For foundations with a depth of more than 1.5m, a compressible material should be installed at the inside of the foundation to combat heave. The compressible material should be placed 500mm from the inside surface of the foundation.

No trees present

The minimum depth for a foundation on a clay soil, where no trees are present or have been removed within the last three years, is:
• 0.9m (900m) for low to medium volume change potential soils (PI value of 0-40%)
and
• 1.0m (1000mm) for high volume change potential soils (PI value > 40%), or
• in accordance with the Building Control Policy whichever is the greater.

This minimum depth is required to ensure that the natural climatic affects i.e. drying and frost, do not affect the stability of the proposed foundation.

Section 3 - Drainage

Foul and stormwater drainage

Every drainage system should be designed and constructed in accordance with the guidance contained in the following appropriate document:
England & Wales: Approved Document H – Drainage and waste disposal

Scotland: Technical Standards Section 3 – Environment

N.Ireland: Part N – Drainage

Additional guidance is also provided in the following current design and construction standards:

- BS EN 12056-2 Sanitary pipework
- BS 6367 Drainage of roofs and paved areas
- BS 6297 Design and installation of small sewage works
- BS EN 752 Building drainage

The relevant Building Control body and Compariqo should approve the construction of the drainage system. In the absence of an inspection and / or final test by the Approved Inspector, will need to be consulted.

The following clauses provide guidance on the interpretation of the COMPARIQO Requirements with regard to individual elements covered in this Manual and where appropriate, propose guidance on ways to meet these requirements.

Drainage – General

Where impervious surfaces such as drives, paths, hard-standings, etc. drain to a rainwater drainage system, a trapped gully should be provided. Impervious surfaces may drain to a permeable area of the garden provided that it is free draining.

Proprietary drainage systems should be designed and laid in accordance with the manufacturer's specification. The drainage system, including manholes, gullies, pipe connections, etc. should be protected from damage throughout the course of the construction works. Prior to handover, the drainage system should be rodded clean and its efficient operation checked.

Workmanship should comply with BS 8000:14.

Rainwater should discharge into a rainwater drainage system, or a soakaway located at least 5.0m from any building or watercourse. The soakaway should have a minimum capacity of 1m3. For soakaway design, refer to BRE Digest 365.

Pipework

Flexible drainage systems should be provided where ground movement is likely to occur, e.g. filled sites, mining areas and sites with shrinkable clay.

Drain runs should, wherever possible, avoid passing adjacent to tree roots. Where this cannot be avoided, adequate precautions should be taken in accordance with the recommendations of the relevant Building Control body and the pipe manufacturer.

Drainage trench excavations should be taken down to solid ground or where this is not possible, the drainage system should be designed to accommodate any movement and made up with a well compacted backfill to the required formation levels. Quality of backfill should be in accordance with the manufacturer's recommendations.

The depth of drains and the protection provided over the drain should be adapted to the traffic normal for the location in accordance with the recommendations of the relevant Building Control body and the pipe manufacturer.

Pipes should be laid in accordance with the manufacturer's instructions and any independent third party certification acceptable to COMPARIQO.

Pipes should be securely stored so as to avoid damage occurring. Plastic pipes and fittings should be stored away from direct sunlight.

Manholes, access chambers, gullies and rodding eyes

The cover level of manholes, access chambers, gullies and rodding eyes should suit the adjacent finished ground levels and be provided with covers capable of withstanding the traffic normal for the location.

Covers should be finished level with any adjacent paving or building and bedded so as to accommodate the adjacent finished surface of the ground.

Manholes should be of a suitable size so as to permit access for inspection and maintenance.

In sealed systems narrow shaft type accesses should generally not be deeper than 600mm, or be in accordance with the manufacturer's instructions and any independent third party certification acceptable to Compariqo.

Inspection chambers and manholes within buildings should have mechanically fixed airtight covers unless the drain itself has watertight access covers.

Manholes deeper than 1m should have metal step irons or fixed ladders.

Catchpits should be provided to all land drainage systems which connect to a drain or sewer.

Quality of backfilling under drives, garages, paths, etc.

Backfill to trenches under drives, garages and paths should be carried out using non-organic matter which should be fully compacted. Where drains have less than 600mm cover they should be protected by either encasing in concrete or by a reinforced concrete raft cast over the drain which may form part of the drive, garage, path, etc.

Planning drainage

The design and layout of a drainage system should be kept as simple as possible and be capable of conveying and discharging its contents, without causing nuisance or danger to health and safety from leakage, blockage or surcharge throughout its anticipated lifetime.

There may be technical and economic advantages in providing a drainage system to serve more than one property but such an arrangement may cause difficulties in conveyancing or apportionment of maintenance costs. Designers should consider this when preparing drainage layouts.

Sewers serving more than 1 property should normally have a minimum diameter of 100mm.

For more than 10 dwellings the minimum diameter should be 150mm. For housing it is preferable for drains to be laid externally where provision can be made for ready detection of blockages and their removal. A drain trench should not impair the stability of a building. When drains are laid parallel to the foundation, care should be taken that the foundations are not undermined.

Written permission is required from the Water and Highway authority before any work in connection with drains is started.

The authority's requirements vary but will be either:

• A separate system – separate sewers are provided for foul and surface water
OR
• A combined system – both foul and surface water use the same pipeline. In rural areas where no public sewer is readily available, special consent may be given for foul water to be discharged into a cesspool or septic tank and surface water to a soakaway, ditch or natural watercourse or lake.

Provision of access to drains

As the majority of drainage is underground it is necessary to provide access to the system to allow rodding and the removal of debris. BS EN 752 and Approved Document H (Technical Standards for Scotland : Section 3, N.I. Part N) detail recommendations for the siting and sizing of access fittings.

Guidance on access to drains includes:

Every drain length should be accessible for maintenance and rodding without the need to enter the building

• Access should be provided at the head of a drain run
• Access should be provided within 22m of every junction with another drain, unless there is an inspection chamber at the junction
• Access should be provided at changes of direction, pipe size or gradient
• Every soil and vent and WC pan connection must discharge into an inspection chamber
• Access should be provided at suitable locations to aid the testing of pipe runs
• Each drain length must be roddable from at least one point.

to:	Access fitting		to junction branch	to inspection chamber	to manhole
	small	large			
start of external drain (from stack or ground floor appliance)	12m	12m	–	22m	45m
rodding eye	22m	22m	22m	45m	45m
access fitting small. 150mm x 100mm or 150mmø	–	–	12m	22m	22m
access fitting large. 225mm x 100mm	–	–	45m	22m	45m
inspection chamber	22m	45m	22m	45m	45m
manhole	–	–		45m	90m*

Table 3.00

type of depth to invert	access to (m)	min internal dimensions (mm) rectangular	circular	min nominal cover size (mm) rectangular	circular	remarks
access fitting	0.6 or less	(1) 150 x100 (2) 225 x100	150 225	150 x100 225 x100	150 same size as access fitting	the depth restriction is imposed because of the limited access afforded by these items
inspection chamber	0.6 or less	225 x100	190 dia for drains up to 150mm dia	-	190	the depth restriction is imposed as for the access fitting
	1.2 or less	450 x 450	450	min 430 x 430 max 300 x 300	430 360	
	> 1.2	450 x 450	450			
rodding eye			not less than 100 dia	same size as pipework		

Other requirements

(1) **Gradient** – Pipes should be laid to even gradients and any change in gradient should be combined with an access point

(2) **Direction** – Pipes should be laid in straight lines but may be laid to slight curves if these can be cleared of blockages

(3) **Junctions** – Connections should be to inspection chambers or manholes but connections to junctions are acceptable if access is provided to clear blockages. In all cases discharge to be in the direction of flow

(4) **Bends** – Bends should be positioned in or adjacent to terminal fittings, inspection chambers or manholes and at the foot of discharge stacks. Bends should have as large a radius as practicable Gradient – Pipes should be laid to even gradients and any change in gradient should be combined with an access point

Table 3.01

type	size of largest pipe	min. internal diameter min clear opening size	dimensions(mm) (mm)	diameter
<1.5m deep to soffit of pipe	<150	750 x 675	1000	750 x 675 1200 x 675	N/A
	225	1200 x 675	1200		
	300	1200 x 750	1200		
	>300	1800 x (DN+450)	The larger of 1800 or (DN+450)		
>1.5m deep to soffit of pipe	<225	1200 x 1000	1200	600 x 600	600
	300	1200 x 1075	1200		
	375-450	1350 x 1225	1200		
	>450	1800 x (DN+775)	The larger of 1800 or (DN+775)		

Notes

(1) Larger sizes maybe required for manholes on bends or where there are junctions

(2) The minimum size of a manhole serving any drain from more than 1 property should be 1200mm x 675mm or 1200mm diameter

(3) Further guidance is available for manhole shafts > 3.0m deep

Table 3.02

Special protection – rodent control

Where the site has been previously developed, the Local Authority should be consulted to decide whether special precautions are necessary for the control of rodents. These measures can include:

- Sealed drainage – secondary access covers to pipework within inspection chambers.
- Intercepting traps – regular maintenance of these will be required to prevent blockages. They should only be installed in chambers where maintenance can be carried out from the surface.
- Rodent barriers fitted within discharge pipes or the drainage system.
- Metal cages on ventilator stack terminals to discourage rodents from exiting the drainage system.
- Fixed metal or plastic gratings to gullies in order to prevent dislodging by rodents.

Other requirements

- Pipes should be laid to an even gradient and any change in gradient should be combined with an access point
- Pipes should be laid in straight lines but may be laid to slight curves if these can be effectively rodded
- Connections should be to inspection chambers or manholes, but connections to junctions are acceptable if access is provided to clear blockages. In all cases discharge should be in the direction of flow
- Bends should be positioned in or adjacent to terminal fittings, inspection chambers or manholes and at the foot of discharge stacks. Bends should have as large a radius as practicable
- The system should be ventilated at or near the head of each main drain to allow free passage of air throughout, the maximum length of any branch serving a single appliance being 6m and for a group of appliances 12m
- Where appliances are not fitted with integral traps at the point of discharge a trap must be provided using either a trapped gully or low back trap

Foul Water

Foul water drainage is permitted to discharge to one of the following systems listed in order of priority:

- A public sewer; or where this is not reasonably practicable,
- A private sewer communicating with a public sewer; or where this is not reasonably practicable,
- Either a septic tank which has an appropriate form of secondary treatment or another wastewater management system; or where that is not reasonably practicable,
- A cesspool

Main drainage

The drainage system will be deemed to be acceptable to if compliance with Building Regulation requirements – foul and surface water drainage is achieved.

Testing and inspection

After laying gravity drains and private sewers they should be tested for water tightness using either a suitable:

- Air test or;
- Water test

Where separate drainage systems are provided connections should be proven to ensure that they are connected to the correct system.

Septic tanks

General Description

- They are designed to separate and settle solids which are present in sewage, leaving the resultant liquids to be absorbed in the soil. Dispersal is via a sub-surface looped irrigation system of rigid perforated land drains laid in excavated trenches with gravel fill
- All septic tank installations must possess independent third party certificates acceptable to COMPARIQO and / or comply with BS 6297 Design and installation of small sewage treatment works and cesspools
- Sizing of tank depends on the number of residents served by the development (As an indication see table 3.03)

number of residents	4	9	13
capacity in litres 27003600			4500
capacity in gallons 600800			1000

Table 3.03: Sizing of septic tank

time taken to fall 250mm	overall length of drain run required in metres for capacity tanks 2800 litres	3600 litres	4500 litres	6000 litres	7500 litres	9000 litres
30 mins	up to 15	30	50	80	120	140
1 hour	up to 30	60	90	150	225	280
2 hours	up to 60	120	180	300	–	–
3 hours	up to 90	200	360	–	–	–
For drain runs in excess of 100m the trench may be widened to 1m and the length halved from the above figures						

Table 3.04

Design

The following design considerations should be taken into account:

• Legal requirements to obtain "Consent to Discharge" from the Environment Agency.
• Siting should be no closer than 7m from any habitable parts of the building, preferably downslope.
• The dispersal system should be a minimum of 10m from the nearest watercourse and a minimum of 1m above the local water table.
• Emptying vehicles should have access to within 30m of the tank.
• Prevent leakage and ingress of sub-soil water.
• Have adequate ventilation to comply with the manufacturers recommendations
• Dry site – 150mm level base of concrete required (with pea gravel fill)
• Wet site – 200mm layers of hardcore/concrete is required (with concrete back fill). The tank should be filled with water to avoid flotation during installation.
• The drainage system should be lengths of perforated pipe (except for the first 3m) laid to falls of approximately 1 in 200. Do not use corrugated land drain pipework.
• Due consideration of changes in water table levels should be considered for outfall drainage.
• Use 30 – 50mm gravel to surround the pipes. Lay a polythene membrane between any topsoil and gravel to avoid contamination.

Foul Water

Soil porosity tests should be carried out in accordance with BS 6297 section 15.3.2.

The test involves:

Excavating a hole 300 x 300mm to a depth of 250mm BELOW the proposed invert of the land drain.
Fill the hole with water up to 250mm deep, allow to drain overnight.
Refill to a depth of 250mm and note the time taken to drain away. Repeat twice.
Use table 1.19 to calculate length of outfall drainage for capacity of tank.
A notice should be fixed within the property describing necessary maintenance and occupier's responsibilities.

The following items should be considered when choosing a site for a cesspool:
Should have sufficient capacity below the level of the inlet of at least 18,000 litres for 2 users. This size should be increased by 6800 litres for each additional user.

• Should have no openings except for the inlet, access for emptying and ventilation.
• Siting should be no closer than 7m from any habitable parts of the building, preferably downslope.
• Emptying vehicles should have access to within 30m.
• Traffic loadings should be avoided.
• Due to the tendency of cesspits to become buoyant they should be surrounded by concrete.
• Dry sites – they can be backfilled with pea gravel with a concrete base.
• Wet sites – should be bedded onto pea gravel, which is laid on a 150mm concrete base. Backfill with concrete should occur with the tank being filled with water to avoid flotation during installation.
• A notice should be fixed within the property describing necessary maintenance and occupier's responsibilities.

Sewage treatment plants

Biotec sewage treatment plants employ a development of the aerobic biological process for the purification of sewage and waste water. There are 4 stages:

• Initial stage – retention of coarse solids for subsequent breakdown
• Reduction stage – pollutants removed by presenting the sewage to the micro-organisms in the presence of oxygen
• Additional treatment to provide nitrification
• Treated effluent is discharged via the outlet. The discharge should be at least 10m from a watercourse and any habitable building

Prior to installation there is a legal requirement to obtain a "Consent to Discharge" from the Environment Agency.

Installation

~~The following~~ should be considered prior to installation:
• Siting should be no closer than 7m from any habitable parts of the building, preferably downslope.
• The tank should be vented
• If the packaged treatment plant requires power to operate it should be able to adequately function without power for up to 6 hours or have an uninterruptable power supply.
• Periodic emptying to prevent excessive build up of surplus sludge is required. It is therefore recommended that emptying vehicles should have access to within 30m.
• A notice should be fixed within the property describing necessary maintenance and occupier's responsibilities.

Pump systems

There are 2 basic types of standard pump set;

• The Septic Tank and Integral Pump set.
• The Domestic Sewage Pumpet

Where gravity drainage is impracticable, or protection against flooding due to surcharge in downstream sewers is required, a pumping installation should be installed. Where foul water drainage from a building is to be pumped, the effluent receiving chamber should be sized to contain 24-hour inflow for disruption in service.

Design Consideration for location of pumps

Units should be installed below ground

Mains supply of 230 volt, single phase 50Hz is recommended

• Dry site – 150mm concrete base with pea gravel backfill
• Wet site – 150mm layers of hardcore concrete base with backfilling of concrete

Surface Water

Surface water drainage is permitted by the use of one of the following systems listed in order of priority:
An adequate soakaway or some other adequate infiltration system; or where this is not reasonably practicable,

1. A watercourse; or where this is not reasonably practicable,
2. It should be noted that this 'priority' is the reverse, previously described for foul drainage. It should help to minimise surface water entering the foul drainage system, which can often overload the capacity of the sewer and cause flooding.

Mains drainage

BS EN 752 adopts the "flat rate of rainfall" method for assessing the peak discharge of surface water and is suitable for drains that do not exceed 200m in length. (See table 3.05) It assumes a flat rate of rainfall of 50mm/hour. This rainfall intensity is regarded as satisfactory by most regulatory bodies, however some areas of the country are susceptible to heavy rainfall so 75mm/hour may be required by the authority. All of the rainfall on impervious areas should be assumed to reach the drain, whilst all pervious areas should be disregarded from the equation.

paved areas	plan area
flat roof plan	area of roof
30° roof pitch plan	area x 1.29
45° roof pitch plan	area x 1.50
60° roof pitch plan	area x 1.87
70° roof pitch elevational	area x 0.5

3.05of area drained

Soakaways

Soakaways can only be considered in permeable ground conditions and should be positioned in areas where stability and support to foundations of adjacent structures can be maintained. Where any doubt exists as to the suitability of the ground, it may be necessary to obtain permeability figures by ground investigation. This should be carried out by a recognised Soils Engineer or Geologist who will then recommend on the suitability of soakaways. Further information is given in BRE Digest 365 and BS 6297.

Modern soakaways are generally constructed of perforated pre-cast concrete rings to allow water to percolate away. Other soakaways may take the form of land drains, traditional brick built pits jointed in honeycomb bond, or a combination of the above.

Soakaways and other forms of infiltration drainage may not be possible. Infiltration devices should not be built:

• Within 5m of a building or road or in areas of unstable land;

• In ground where the water table reaches the bottom of the device at any time of the year;

• Close enough to other filtration devices such that the overall capacity of the ground is not exceeded and the effectiveness is not impaired.

• Where the presence of any contamination in the runoff could result in pollution of the groundwater source or resource.

Percolation tests should be carried to confirm the suitability of an infiltration system.

Soakaways should be designed in accordance with BS EN 752-4 or BRE Digest 365 Soakaway design.

Combined systems

It may be necessary to install surface and foul water drains separately even where a site is being served by an existing combined sewer. This should be confirmed with relevant authorities prior to designing the drainage.

When a one pipe system is installed, it is important that all surface water fittings have an integral trap so that foul gases do not cause nuisance.

BS EN 752 states that a combined drain should be capable of accepting peak surface and foul water flows. It is also good design practice to ensure that self cleansing velocity (0.75l/s) is achieved when only foul water flow is entering the drain (i.e. when there is no rain).

Separate systems

Separate systems of drains should be provided for foul water and rainwater where:
The rainwater is not contaminated; and
The drainage is to be connected either directly or indirectly to the public sewer system and either –
The public sewer in the area comprises separate systems for foul water and surface water; or
A system of sewers, which provides separate conveyance of surface water, is under construction or is proposed.

Subsoil drainage of gardens

Avoid flooding of garden areas

Subsoil drainage may be necessary in garden areas where:

• Site works have affected the natural flow of ground water within 4m of the dwelling e.g. exposing of underground springs
• Ground water table rises to within 250mm of the finished ground within 4m of the dwelling
• The drainage of the subsoil is poor and the ground contours make the site prone to waterlogging within 4m of the dwelling

Layout of land drains

On sloping sites drain runs should be located perpendicular to the fall of the site.

Land drains should be located adjacent to paths, drives and outbuildings. The pipe soffit should be located at least 400mm below the finished ground level and the backfill consolidated to the same degree of compaction as the adjacent soil.

Where retaining walls are provided, a land drain should be provided on the retained soil side of the wall, adjacent to the foundations.

Where required, land drains should be laid across the site in a regular pattern. The spacing between each drain will depend upon the permeability of the subsoil, varying from 3m for heavy clays to 18m for permeable soils.

Construction of land drains

Drain materials should comply with either:

- BS 1194 Concrete porous pipes
- BS 65 or BS 1196 Clayware pipes
- BS 4962 Plastic pipes
- Or possess independent third party certificates acceptable to Compariqo

Generally the minimum pipe diameters currently available for each land drain material provide adequate drainage capacity for individual plots. On multiple plot sites (where collector land drains are used), or very wet sites, larger diameter pipes may be necessary and should be sized in accordance with manufacturer's design data.

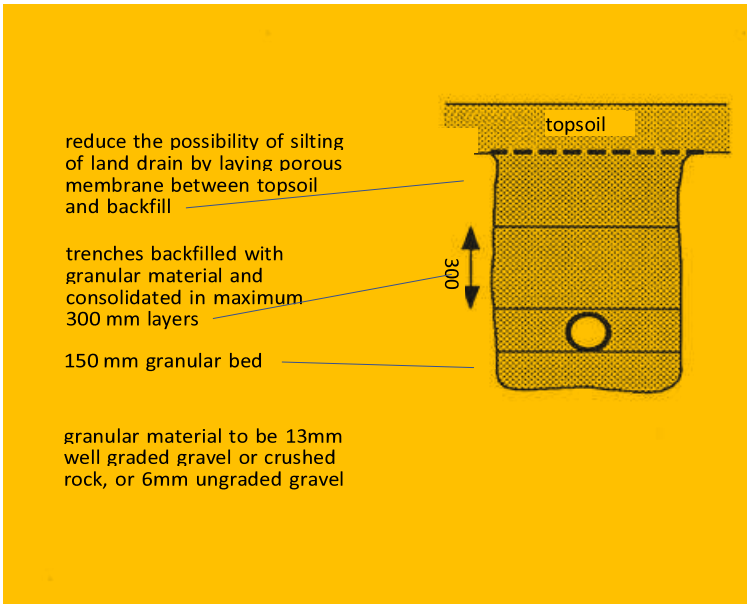


Diagram 3.00: Backfilling of Trenches

Land drains should be jointed in accordance with manufacturer's instructions with perforations laid uppermost where appropriate.
Diagram 3.01 and 3.02 show typical subsoil drainage schemes for single and multiple plot sites.

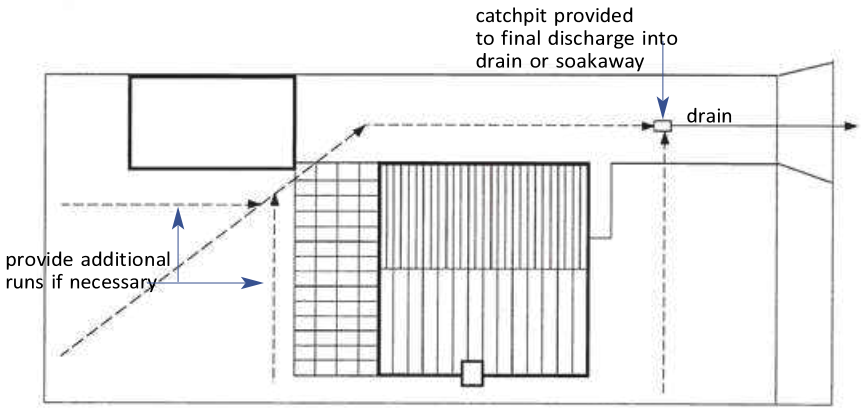


Diagram 3.01

Land drains should be bedded and backfilled with either:

• 13mm well graded gravel or crushed rock, or
• 6mm ungraded gravel (pea shingle)
It is recommended that a membrane is laid over the granular backfill to prevent silting of the drain (See diagram).

Ensure proper drainage of groundwater away from the site.

Land drains should discharge into either:

• A soakaway located in porous ground located at least 5m from any building. For soakaway design refer to BRE Digest 365
• A watercourse (subject to approval of the Water Authority)
• A storm drain
• A foul drain (subject to the approval of the Water Authority).

Where final discharge is into a drain or soakaway, a catchpit should be provided (See diagram 1.31 and 1.32).

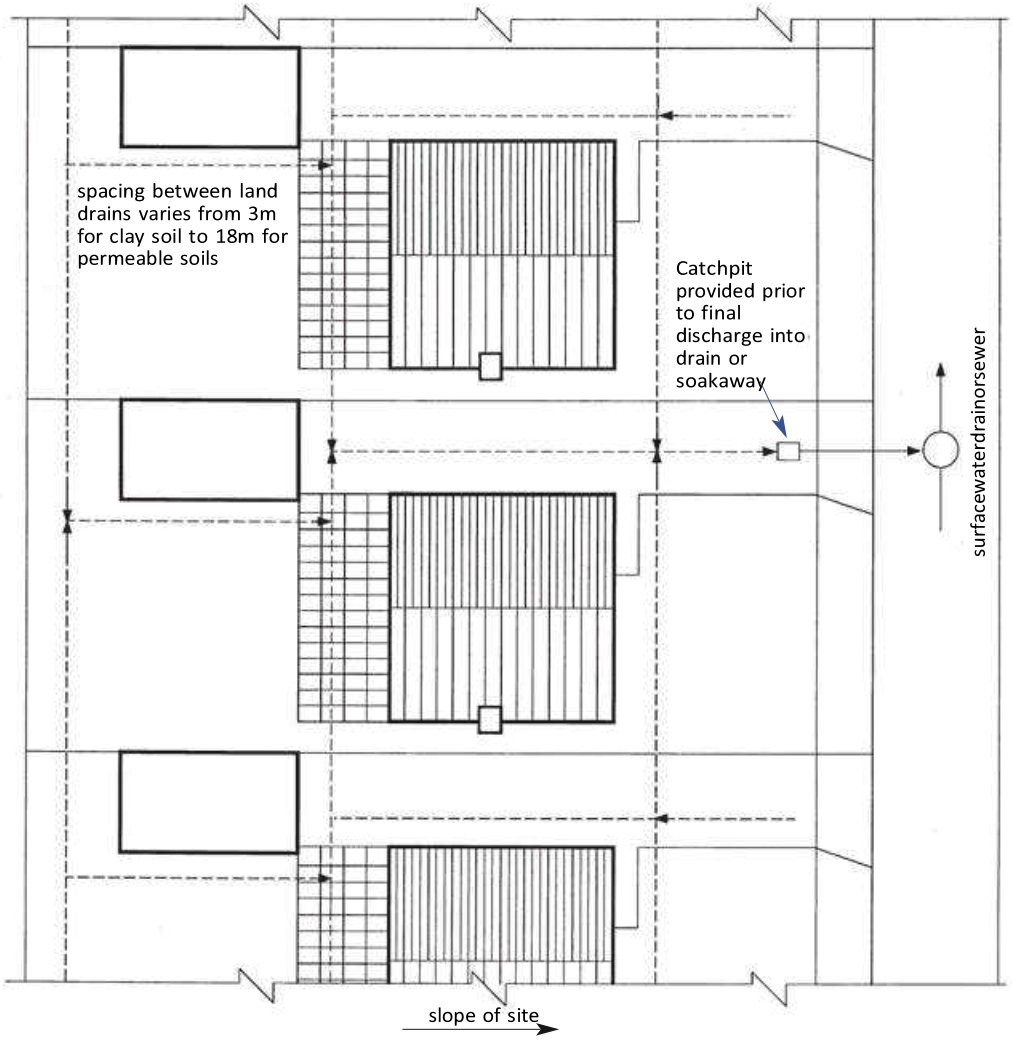


Diagram 3.02 Typical Subsoil Drainage for Multiple Plots

Section 4 - Basements

General

Ways of achieving compliance with the requirements the basement should be designed and constructed in accordance with the guidance contained in the following appropriate document:

The guidance within BS8012 should be followed with Designers involved holding a qualification such as Certified Surveyor in Structural Waterproofing, CSSW. The designer must also hold sufficient professional indemnity insurance for the project

It should be noted that a 10-year insurance backed warranty for workmanship and materials is a requirement of Compariqo. This is also highlighted on the self build application form. The CSSW will be expected to carry out a risk assessment on all projects which will follow the following

Site Investigation

Before starting any design or construction work, a site investigation should be made to establish the ground conditions (including the type of subsoil), the level of the water table (including the provision for natural drainage), the location of any existing drains or other services, the presence of contaminants and whether there is a risk from radon and other gases.

Contaminants

If the site investigation indicates the presence in the ground of solid or liquid contaminants, natural gases (e.g. radon) or landfill gases, then appropriate measures should be taken to limit their effect on the basement and on the remainder of the dwelling.

In addition to complying with the provisions of Approved Document C, the possible effects of contaminants on the materials used in basement construction should be considered (please also see Site Investigations).

Underground Services and Drainage

With the agreement of the appropriate statutory authority, any services which are affected by the construction work should be re-routed around the building, or the building and the services should be designed to enable the services to run under the building, again with their agreement.

The building should be orientated and designed to avoid the risk of increasing hydrostatic pressure. Where this is not practicable, the waterproofing system should be designed to withstand a full hydrostatic head. Provision should be made for maintainable sub-ground drainage to control or maintain the external environment for which the waterproofing system was designed.

Exclusion of Moisture

Walls and floors below external ground level and the junctions between them should:

• Provide resistance to ground moisture reaching the internal surface of the wall or upper surface of the floor so that the environmental conditions in the basement are appropriate to the intended use
• Not be adversely affected by moisture from the ground.

Key to levels of protection

Grade 1 Allows some seepage and damp patches
Grade 2 Allows no water penetration but moisture penetration is acceptable
Grade 3 No water penetration and provides dry environment

Grade 2 is recommended as a minimum for garages, Grade 3 is required as a minimum for habitable accommodation.

BS 8102 Specifies three types of waterproof protection

Type A (Barrier) Protection

Type A (Barrier) Protection, also historically referred to as ‘‘Tanking’’, provides protection against ground water ingress by applying a waterproof material to the internal or external walls and floor slab of a basement or underground structure forming a barrier between the structure and any groundwater present. Historically, methods for Type A systems included internal, external and sandwich.

Type B (Structurally Integral) Protection

Type B protection is provided by the structure itself against water ingress. Type B Protection relies heavily on the design and materials incorporated into the external shell of the structure. Design, materials, as well as the quality of the workmanship contribute to the success of Type B Systems.

Type C (Drained) Protection

Type C protection is provided by the incorporation of an appropriate internal water management system. Type C Protection allows moisture or running water to penetrate through the external wall or floor of the structure and to travel behind the membrane in a controlled drainage system. Type C systems collect and manage any water ingress by diverting it into a designated safe point of disposal (such as a sump pump/package pump station).
Combined systems should be used where Grade 3 protection is required, and the below ground wall retains more than 600mm measured from the top of the retained ground to the lowest finished floor level.

Tanking

Similar wall constructions can be used for Grades 2, 3 and 4 with improvements in dryness being obtained by the degree of heating, ventilation and moisture control.
It is advisable to provide ventilation to all basements (heated or unheated) so that any moisture vapour either generated within the dwelling, or brought in through the structure, is adequately controlled.

General

Combined systems should be used where Grade 3 protection is required, and the below ground wall retains more than 600mm measured from the top of the retained ground to the lowest finished floor level.

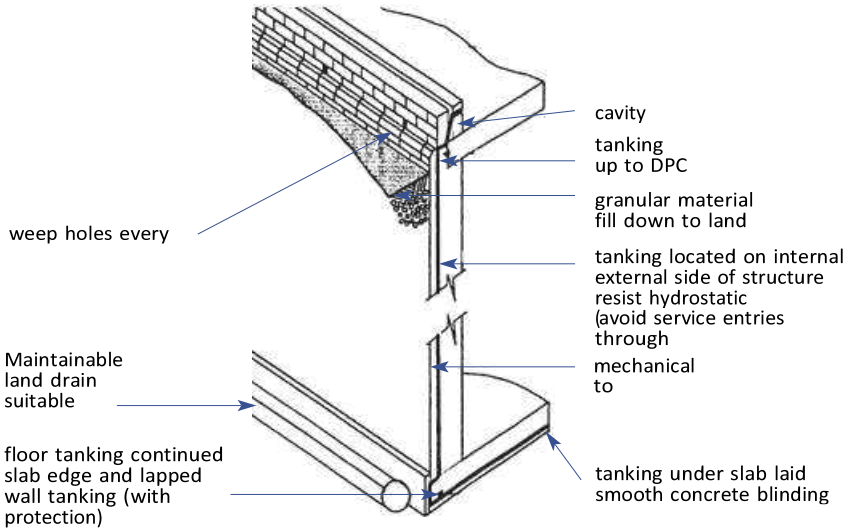
Alternatively, where the builder has demonstrated that the water table is permanently below the underside of the lowest floor slab, a Type B structurally integral concrete system is acceptable without further protection from a combined system.

Tanking to basements should be properly connected to and made continuous with wall DPCs (See diagrams 4.00 – 4.05).
Perforations of the tanking membrane, e.g. by service entry pipes should be avoided.

All tanking systems should be installed in accordance with the manufacturer's instructions.

SHEET MATERIALS SUCH AS POLYTHENE ARE NOT DEEMED SUITABLE FOR TANKING.

Diagram 4.00: Tanking to basements



Tanking should be designed to resist mechanical damage and the effects of hydrostatic pressure. The tanking system can be provided to the internal (a loading coat should be provided to prevent accidental damage to the water proofing membrane) or external face of the basement wall, alternatively the wall itself can be designed to resist the passage of moisture and the forces applied (See diagrams 4.01 and 4.35).

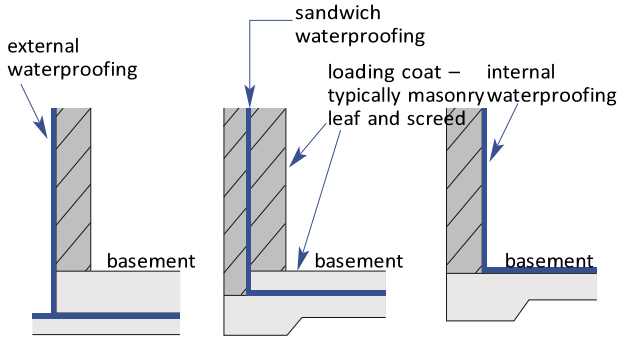


Diagram 4.01: Types of tanking protection to basement

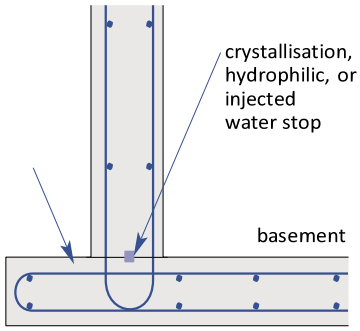


Diagram 4.02 Structurally integral construction basement construction

All basements should be designed by an Expert to be structurally stable and resist the passage of moisture. A high level of workmanship and site supervision is essential, particularly when incorporating a reinforced concrete design in accordance with BS 8110.

Which ever system or design is proposed, it is essential that the specification and/or the manufacturer's details shall be forwarded to Compariqo prior to commencement and preferably at design stage, for approval.

A maintainable land drain should be provided around the perimeter of the basement at low level and the side of the basement wall back filled with granular material.
Workmanship should comply with BS 8000:4.

The following criteria should be considered in the selection of the waterproofing system to be adopted:

Establish the position of the water table with respect to the underside of the lowest floor level according to the classification as follows
HIGH – The water table is above the underside of the lowest basement floor slab level (where because of insufficient permeability of the soil, percolating water is held above the underside of the lowest floor level, resulting in hydrostatic pressure)

LOW – The water table is permanently below the underside of the proposed basement floor level
VARIABLE – The water table varies between the two levels described above. The duration of this condition will dictate design requirements

- Establish the drainage capabilities of the soil (usually via soil analysis)
- Establish whether or not the tanking should be continuous:

o NO – Where the water table is below the lowest floor level and the drainage characteristics of the soil are good, and will confidently remain so

o YES – In all other cases (preferred option). In all situations a maintainable land drain should be provided at the base of the retaining wall (basement wall)

- Choose a suitable construction method to meet the tanking/waterproofing requirements. Typical tanking details are shown in diagrams 1.34 – 1.38
- Consider the type of foundation and its suitability for providing a continuous waterproofing structure
- Establish the most suitable form of tanking system to suit the site conditions. In considering which system, it is important to take account of any aggressive materials found in the soil or ground moisture. All systems whether cementitous, a liquid applied or sheet membrane should have third party accreditation and be installed in accordance with the manufacturer's instructions (preferably by an approved installer)
- The designer of a basement must ensure that all necessary details (service penetrations, change of level or direction, window/door reveals etc.) are shown
- A high level of workmanship and supervision is essential for all tanking systems

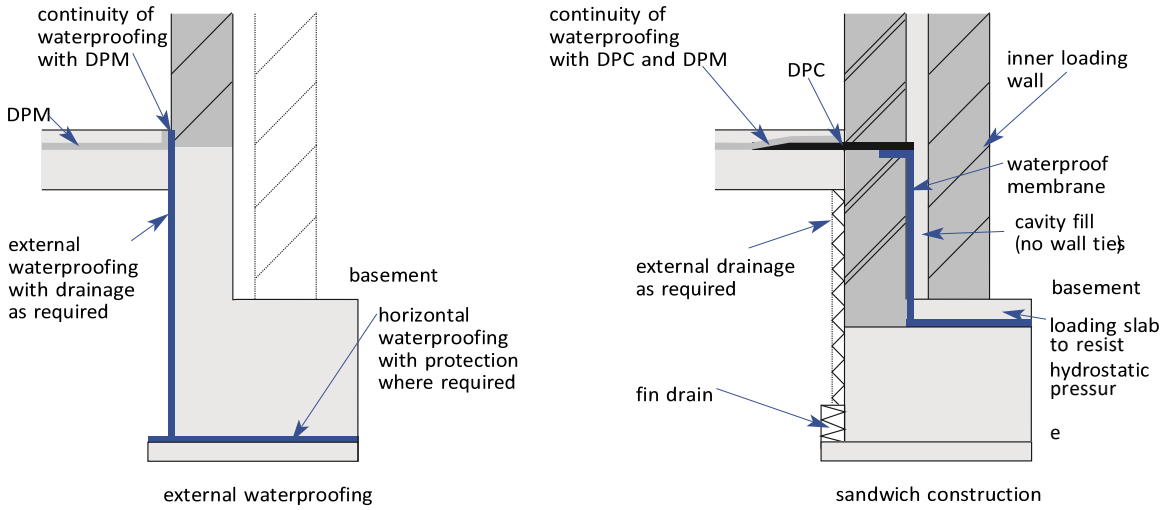


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Diagram 4.03: Maintain continuity of waterproofing

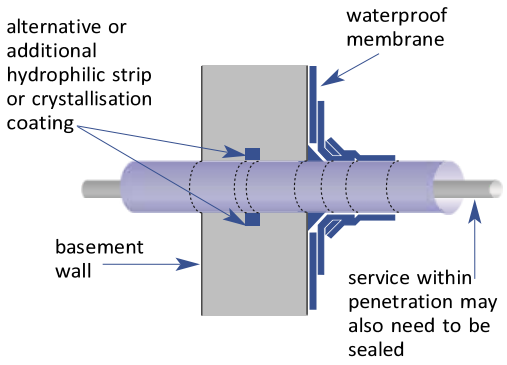

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Diagram 4.04: Penetration of services through waterproofing

Detailing

Once the type of wall construction and the location of the tanking system have been established, consideration must be given to the detailing, particularly the continuity of the damp-proofing system to prevent any potential ingress of moisture. Diagrams 1.36 – 1.38 provide typical guidance on how to overcome linking details to achieve continuity.

These diagrams are only to be used as a guide, the principles will remain but specific details may change depending upon the tanking system and wall type adopted.

Ventilation & Drainage

Ventilation to basements

Habitable rooms including kitchens, utility rooms, bathrooms and non-habitable rooms (such as store rooms and workshops) located within a basement should meet the requirements of Approved Document F.

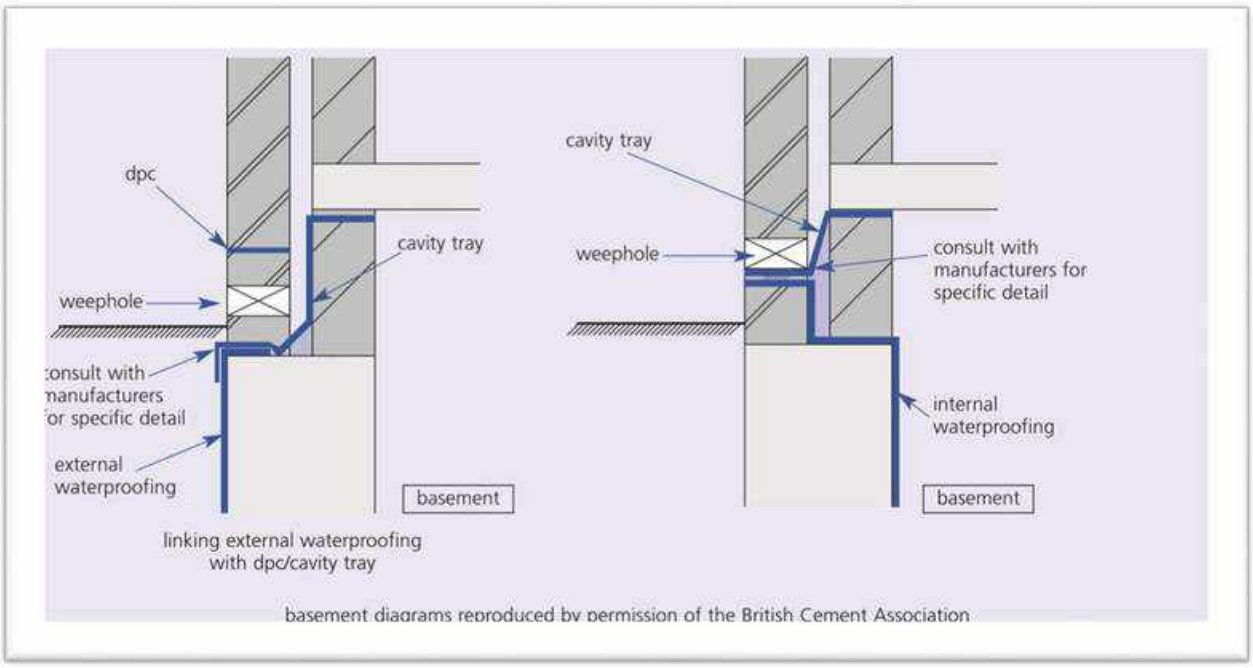

Diagram 4.05: Continuity of waterproofing – linking with superstructure

Drainage

All penetrations through a basement wall should be avoided wherever possible.

All pipework and drainage within a basement should comply with the requirements of BS EN 752.

Wherever possible the soil and vent pipe (SVP), serving the dwelling should be located on the outside of the basement construction. SVP's can be located externally even where there are drainage connections within the basement, however the system must be designed to reduce waterproofing penetrations to a minimum. The use of proprietary mini pumped systems can be adopted to overcome the need for such service installations.

Where service connections through basement walls cannot be avoided by design and/or layout, they should be designed along the guidance given in diagram 1.37. Where drainage connections pass through the basement wall, allowance should be made for future potential movement. Provide a rocker pipe having a maximum length of 600mm, positioned not more than 150mm from the external face of the basement wall. All other service entries should be designed to allow tolerance for movement of the ground and/or the structure (consult the supply company for further guidance on suitable tolerances).

Surface water drainage should comply with the requirements of Approved Document H and BS EN 752. Access areas of basement level and lightwells to windows should be provided with suitable surface water drainage to prevent flooding.

Means of escape

There is a risk that in the event of a fire in a basement or ground storey, a single stairway may become blocked by smoke. If the basement contains any habitable room an alternative means of escape shall be provided.

Additional guidance

- British Cement Association - Basement waterproofing: Design guide.
- British Cement Association - Basement waterproofing: Site guide.

Section 5 - Walls

Construction from Foundation to DPC

Bricks and blocks below DPC

Bricks and blocks may be used below DPC where there are no soil borne sulphates.

Bricks should be selected in accordance with table 5.00. and BS 3921.

Where sulphates in soils and/or ground-water are present suitability of brickwork and blockwork below DPC should be confirmed with the manufacturer. Sulphate resisting cement may be necessary.

Suitable blocks have:

Blocks of density greater than 1500kg/m3. A compressive strength greater than or equal to 7N/mm2

Some autoclaved aerated blocks.

Use	Brick type			Notes on Mortar
	Clay	Calcium Silicate*	Concrete	
Foundation to DPC	FL, FN, ML, MN**	Class 3	Strength > 20 N/mm2	
Foundation to DPC sulphates in soils	FL, FN, ML, MN**	Class 3	Strength > 20 N/mm2 All Class 1 sulphates and some in Class 2 (consult manufacturers). Engineering quality concrete bricks up to Class 3 sulphates.	Where sulphate levels are class 3 or higher use sulphate resisting Portland cement

Unrendered external walls protected from saturation	FL, FN, ML, MN	Class 3	Strength > 7 N/mm2	
Unrendered external walls not protected from saturation	FL, FN	Class 3	Strength > 15 N/mm2	Use sulphate resisting cement in mortar with Type N clay bricks
Rendered external walls	FL, FN, ML, MN	Class 3	Strength > 7 N/mm2	Use sulphate resisting cement in mortar and base coat of render with Type N clay bricks
Copings, capping's, sills etc	FL, FN	Class 4	Strength > 30 N/mm2	
Internal	FL, FN, ML, MN, OL, ON	Class 3	All	
Notes: *Minimum Class indicated: a higher class (e.g. up to 7) is equally acceptable. **If the site is wet or the masonry at or near ground level may be subject to saturation use FL bricks or FN bricks with sulphate resisting cement				

Table 5.00: Selection of bricks

DPC & DPM

Resistance to Ingress of Moisture

Damp-proof membrane (DPM) and damp-proof course (DPC)

A DPC should:

• Be laid in a smooth mortar bed and lapped at junctions
• Not obstruct or bridge cavities unless specifically designed to do so, e.g. cavity trays.

A DPM should:

• Be provided under all ground supported slabs and made continuous with the DPC in the wall by the use of 100mm laps
• Be laid on a smooth blinded surface in such a manner so as to avoid accidental perforation.
• Be installed in ground supported slabs of integral garages.

A DPC and DPM should be protected during storage and construction operations such as power-floating or tamping so as to avoid perforation. Unavoidable perforations of DPMs by services should be fully sealed to maintain the integrity of the membrane.

Workmanship should comply with BS 8000:4.

Suitable damp-proof membranes

Damp-proof membranes should be either:

• Minimum 1200g (300µm) polythene (laid on sand blinding when located below the slab).
• Cold applied bitumen or coal tar, minimum 2/3 coats laid beneath screed (see manufacturers details for the appropriate number of coats).
• Hot applied mastic asphalt (laid beneath or over a screed).

Other damp-proof membranes should possess current independent third party certificates acceptable to COMPARIQO.

Avoid moisture ingress in stepped concrete floors

Ensure that vertical damp-proof membranes are located behind the wall and provided with suitable protection against damage (See diagram 1.40).

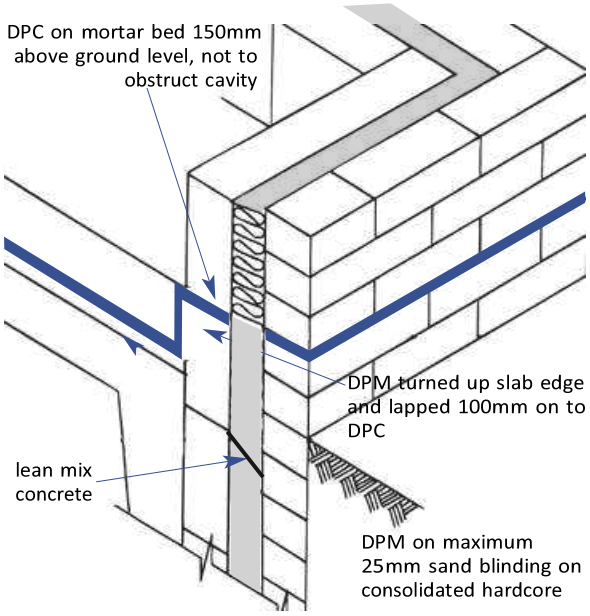

Diagram 5.00: Damp proof course and membrane

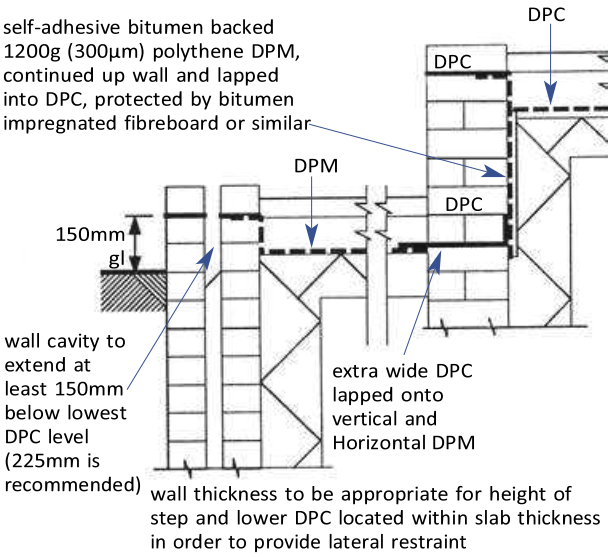

Diagram 5.01: Stepped ground floor slab

Ground Floors

Introduction

Subjects covered in this section include:

- Traditional ground supported concrete floors
- Suspended timber floors
- Precast concrete beam and block floors
- Thermal insulation to floors

Level of floor

Maximum of 4mm out of level per metre for floors up to 6m across, and maximum 25mm overall in any other case.
Flatness of floor
Max ± 5mm deviation from a 2m straight edge with equal offsets.
Skirting to floor gap

A gap up to 5mm can be expected between floor covering (without covering) and bottom of skirting in a new house. The gap between floor finish and skirting may increase because of drying out shrinkage and deflection, particularly on timber floors. A gap of 10mm, exceptionally 15mm may be seen on floors with long spans or heavy items of furniture on the floor.

Choice of Ground Floor

Use a ground floor construction appropriate for the site conditions. This should be directly linked to the site investigation report and is the responsibility of the Developer.
Suspended floors may be appropriate when building in the following situations:

- Oversite fill depth exceeding 600 mm
- Sloping ground
- Shrinkable clay soils
- Soils of low bearing capacity or filled sites
- High water table
- Aggressive soils
- Presence of trees

Avoid clay heave or shrinkage damaging concrete floor

Changes in moisture content of clays can cause heave or shrinkage which in turn can cause cracking and movement of ground supported floors. Clay heave is often caused by removal of trees and hedgerows, whereas clay shrinkage is caused during long dry spells.

The extent of the movement depends upon the plasticity of the clay and requires a detailed site investigation and report performed by an Expert (also see Foundations).

Damage to floors caused by clay heave or shrinkage is avoided by using suspended floors with a void below that will accommodate any ground movement.
See Suspended Floor details and table 1.14 for dimensions of associated voids

Prevent settlement of ground supported slabs

Fill beneath concrete floors should generally not be used on sloping sites greater than 1 in 15, nor exceed 600mm in depth compacted in layers of a maximum thickness of 150mm unless a suspended reinforced floor is constructed.

Ground Supported Concrete Floors

Do not commence site filling until all topsoil, tree roots and other organic matter have been removed.
Use well graded inert hardcore e.g. crushed limestone, granite, washed river gravel, clean and suitably graded concrete rubble, etc. maximum size not exceeding 100mm and free from organic materials, sulphates, or other deleterious matter. Do not use materials such as expanding colliery shales, slag, etc. Generally demolition materials should not be used unless specifically agreed by Compariqo.

A 1200g (300µm) polythene barrier should be placed between the blinded brick fill and the concrete slab.
Fill should be at least 100mm thick, laid in layers not exceeding 150mm and be fully consolidated by a mechanical compactor, e.g. 8 passes with a 65kg vibro tamper or 8 passes of a 2000kg/m2 vibrating plate. The total depth of compacted layers should not exceed 600mm.

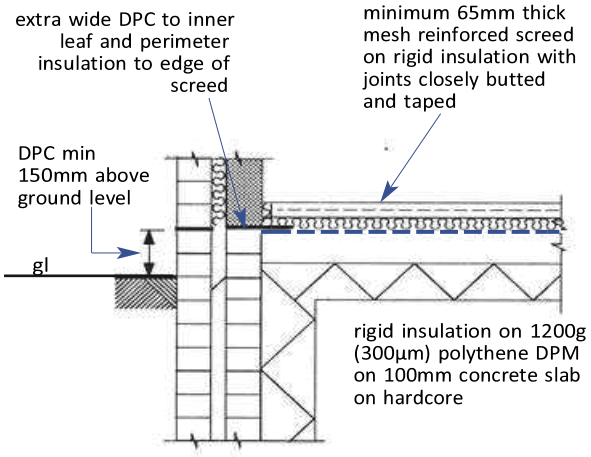

Diagram 5.02: Ground supported concrete slab with DPM above slab

Where the fill exceeds 600mm a suspended floor supported on load bearing walls is required.

To ensure optimum compaction, the fill should not be excessively wet.

The trench excavations located beneath slabs should be backfilled with hardcore and consolidated without damaging the brickwork below DPC level.
Unreinforced ground supported slabs should be minimum BS 5328/ST3 mix grade concrete at least 100mm thick. The concrete should be well tamped.
Avoid ingress of moisture at junction of DPC and DPM

Ensure that:

• Damp-proof membranes located below concrete floors are continued up the edge of the slab and lapped onto the wall DPC. Where the slab is power-floated, ensure that the projecting damp-proof membrane is not damaged
• In cases where a sheet type damp-proof membrane is laid after the construction of the walls, an extra wide damp-proof course should be provided in the wall and lapped onto the damp-proof membrane (e.g. where located between the screed and the concrete slab). (See diagram 4.03)

Avoid debonding and cracking of screeds

Prior to laying the screed ensure the floor slab is properly cleared of rubble and dust.

Use a 1:3 to 1:41/2 cement/sand mix for up to 50mm thickness (65mm thick with light reinforcing on insulation).
It is recommended that pipes are located in purpose made ducts.

Ensure that screeding is carried out in a frost-free environment and protect or cure screeds from rapid drying out e.g., floor areas adjacent to south facing patio doors. Additional guidance is available in this section.

Suspended Timber Floors

Avoid timber decay

Ensure that:

• Floor joists and any wall plates are located above DPC level in walls
• A minimum 150mm gap is provided between underside of joists and the oversite
• Air bricks are located at least one course above ground level
• Joists bear fully onto the inner leaf of a cavity wall without projecting into the cavity and that cut ends are preservative treated
• Ensure that the floor void below the joists is adequately cross ventilated. (See diagram 4.04)

Avoid build-up of gases and moisture in the floor void

Provide perimeter ventilation in two opposite external walls @ 1500mm2 per metre run of wall or 500mm2 per square metre of floor area (whichever is the greater) and maintain continuity of this ventilation through internal walls by honeycomb walling or air bricks. Any pipes carrying ventilating air should have a diameter of at least 100mm. See table 5.01 for net areas of airbricks and ventilators.

type	size (mm)	net area (mm^2)
squared holed clay air brick	225 x 75	1400
	225 x 150	4300
	225 x 225	6400
louvred clay air brick	225 x 150	2000
	225 x 225	6400
PVC (typical values)	225 x 75	4645

Table 5.01-

For guidance on ventilating in areas of radon, refer to BRE report 211 Radon: Guidance on protective measures for new dwellings.

Avoid ingress of ground moisture into the building

Provide beneath all suspended timber floors either:

• A 100mm BS 5328/STI mix concrete oversite on hardcore, or:

• A 50mm concrete oversite and minimum 1000g (250µm) damp-proof membrane on sand blinding

Avoid springing and unlevel floors Ensure that floor joists are:

• Dry/KD stamped

• Correctly sized, stress graded and laid at specified centres as indicated on the plans • Regularised

• Fully supported by supporting walls

• Securely nailed to timber wall plates where bearing onto sleeper walls

• Properly built-in to loadbearing walls without timber packing pieces

• Bedded in correct size joist hangers

• Adequately strutted.

NB: sleeper walls should be built off appropriate foundations and not on the concrete oversite unless a thickened slab is taken down to a suitable loadbearing strata is provided and its location clearly marked.

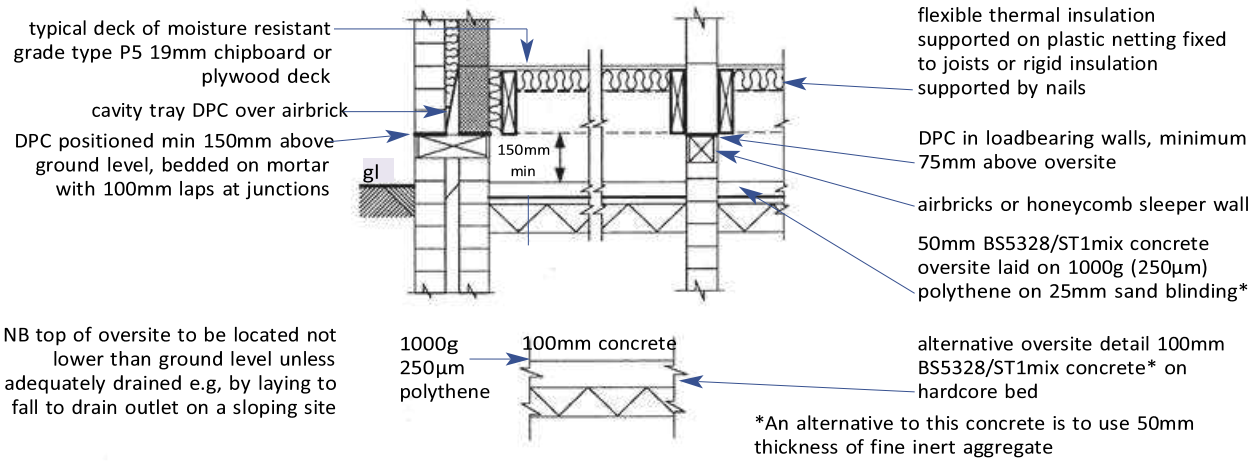

Diagram 5.03: Suspended timber ground floor

Avoid poor sound insulation through separating walls

Sound insulation performance is greatly reduced when timber joists are built into masonry separating walls. Even when joists are properly built-in, timber shrinkage can create air paths along which sound can travel.

Timber joists should be supported on joist hangers on masonry separating walls on at least one side.

Ventilation of subfloor voids

Voids beneath suspended ground floors should be ventilated by a through draught in order to:

- maintain an atmosphere in the void of sufficiently low moisture content so as to prevent damage to any timber or other susceptible materials in the floor,
- prevent the build-up of gases, whether natural or from leaking pipes, which could cause a risk of explosion, and
- prevent the build-up of gases of any kind which could penetrate the habitable areas of the building and cause a danger to health.

Continuity of underfloor ventilation should be maintained by providing internal sleeper walls and similar obstructions with the same degree of ventilation as provided to perimeter walls.

Precast Beam & Block Floor

Site Preparation

The ground beneath the floor should be free from topsoil and vegetable matter. Where necessary, ground level beneath the beam and block floor should be raised to that of the external ground to prevent water ponding (unless the ground is free draining and the perimeter wall is capable of acting as a retaining wall). Alternatively provide a suitable DPM linked to a DPC. In Scotland it is common practice to bring the solum area beneath all suspended floors up to ground level except where a damp-proof membrane is linked to a damp-proof course.

Avoid deflection of floors and cracking of screeds

Ensure that precast (PC) beam and block floors possess current independent third party certificates acceptable to Compariqo and are:

• Fully supported by loadbearing walls

• Laid as specified by the designer and independent third party certificates acceptable to Compariqo. Similar beams of the same size may have varying strength characteristics because of different size of reinforcement, therefore check the beam reference numbers

• Suitable infill bricks or blocks, properly bedded on mortar, are provided between PC beams where bearing onto supporting walls

• Beams and blocks are grouted together with a 1:6 cement/sand mix in accordance with the manufacturer's instructions

• Loadbearing walls continue through the beam and block floor

• Holes for service pipes are properly filled by laying non-timber form work between PC joists and gaps filled with good quality concrete (ST3 mix) prior to screeding

• Screeds in garages are reinforced with minimum A98 steel mesh to distribute car loads

Avoid ingress of ground moisture

There are two methods for preventing ground moisture in precast beam and block floors:

1. No damp proof membrane

Locate the beams and blocks above DPC level and provide 600mm2/m run of ventilation to the void under the floor. A minimum gap of 75mm should be maintained between the underside of the floor and solum area. (See diagram 5.04)

The void should be increased to 150mm when:

• Venting to remove gas
• In Scotland
• A risk of clay heave exits

Where a gas supply passes through this void or an occurrence of natural gas is possible (landfill, radon, etc.) the ventilation provided should be increased to 1500mm2/m run. Provide perimeter ventilation in two opposite external walls. Maintain continuity of ventilation through internal walls by honeycomb walling or airbricks.

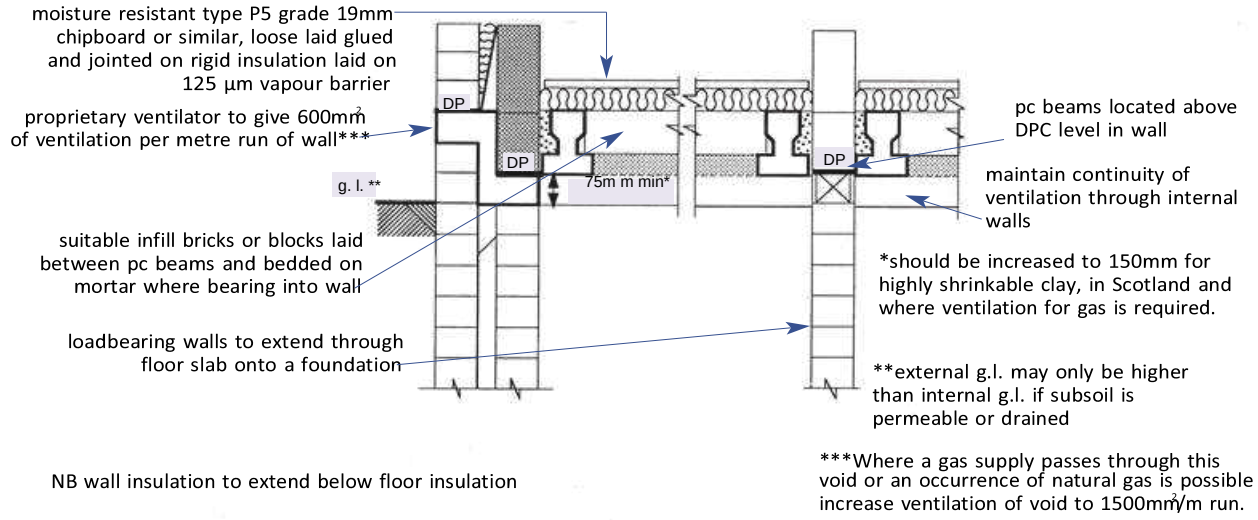

Diagram 5.04: Precast concrete ground floor

2. Damp-proof membrane required

Where beams and/or blocks are located below DPC level, provide a damp-proof membrane laid over the beams and blocks, lapped onto the DPC in the wall (A void below the floor is still required in this case in order to minimise the exposure condition of the precast concrete beams). The void should be ventilated where a gas supply passes through this void or the presence of naturally occurring gases are expected (i.e. Methane or Radon).

Damp-proof membranes should be either:

- Cold applied bitumen or coal tar, minimum 2/3 coats laid beneath screed
- Hot applied mastic asphalt (laid beneath or over screed)
- 300µm polythene.

All the above damp proof membranes should link to the damp proof course.

Ensure that PC beams bear fully onto the inner leaf of the cavity wall without projecting into and obstructing the cavity. The minimum bearing for precast beams should be 90mm.

Thermal Insulation of Floors

Provide an effective and durable layer of thermal insulation to ground floors. The diagrams in the previous section are for illustrative purposes only. Different arrangements for insulating floors are available. When considering different methods the design should take into account suitable damp proofing and the avoidance of cold bridging at junctions of elements.

Where required, thermal insulation should be provided to ground floors to achieve a U-value of not greater than 0.25w/m2K.

Insulation

Ground floor insulation should be installed in accordance with manufacturers instructions and the Agrément certificate. This is an authoritative document proving the fitness for the purpose of a construction product and its compliance or contribution to compliance with the various building regulations applying in the United Kingdom. Products without such certification are not authorised by Compariqo without prior approval.
Insulate water pipes located in voids below suspended floor slabs.
For all other types of ground floor construction a design with structural calculations must be submitted to Compariqo and be available for inspection prior to concrete pour.

Section 6 - Superstructure

General

Ways of achieving compliance with the requirements

The building should be designed and constructed in accordance with the guidance contained within the Building Regulations dependant on where the work is located.

Materials

Storage & Use

Position storage areas for maximum accessibility, ease of working and security. It is helpful to keep materials in delivery packaging until required, thereby reducing the risk of units being used in the wrong location or for the wrong purpose and to help keep them dry and secure.

Use mechanical off-loading where possible as this will reduce the risk of handling damage and enable units to remain protected in identifiable packs.

Facing quality bricks and blocks should be handled carefully to avoid damage. Damaged bricks or blocks should not be built into facing work since cracks, chips and other defects will detract from the final visual quality of the wall.

Torn or split damp-proof course (DPC) materials and cavity trays must not be used as water may be allowed into the construction causing problems of dampness and possibly affecting the durability of some components.

Ensure that:

• Materials are stored on a dry and firm level site and to a safe handling height
• Bricks and blocks are carefully stacked and covered to prevent them becoming saturated (diagram 5.00)
• Different types of cement, bricks and blocks are stored separately and are clearly identified
• The use of materials such as cement are rotated so that the 'oldest' bags are used first
• Sand is placed on polythene or a similar membrane to avoid contamination. Barrier boards can be used to limit wastage
• Sands are stored separately according to type and premixed lime-sand (coarse stuff) is clearly identified. Tarpaulin or polythene protection against rain is advised.

Avoid:

• Tipping units i.e. from a dump truck
• Stacking units on wet or uneven ground
• Breaking open protective wrappings prior to use.

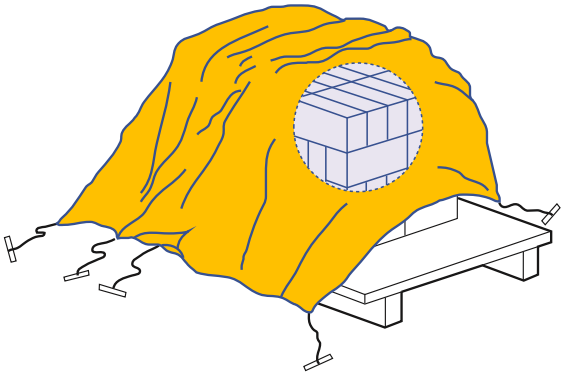

Diagram 6.00: Keep bricks and blocks dry by storing on a suitable base and covering them

Materials should be selected so that corrosive deterioration is minimised. If different metals are used in combination, particularly in humid locations, they should be chosen to be as near as possible in the electro-chemical series of metals so that galvanic action is unlikely to occur (not more than two metals apart in the list) e.g. use copper or galvanised nails with copper containing preservative treated timber. Some typical metals in the order they appear in the series are:

- Stainless steel
- Copper/Cupro-nickel
- Brass/Gunmetal
- Steel
- Aluminium
- Galvanized iron
- Zinc

If metals remote from each other in the series have to be used, adequate precautions should be taken to prevent their corrosive interaction.

All materials and equipment should be installed and commissioned as specified by the manufacturer.

Where indicated elsewhere in this Manual, materials and equipment should be type tested and approved by the mentioned independent authority.

Appliances and equipment should be selected that are suitable for the designed thermal loads, fluid flow rates and fluid pressures.

Bricks & Blocks

Selection

Bricks and blocks should be selected for their intended use, position and exposure depending upon:
- Durability
- Type
- Mortar

Sulphates

Sulphates can be present in the ground and carried to the construction by ground water or they can be present in certain types of brick.

The type of brick to be used will affect the specification of the mortar where there is a risk of saturation due to the lack of protection from roofs, copings, overhanging sills to openings and for elevations exposed to exceptionally severe wind driven rain.

Due to the presence of sulphates in designation N clay bricks to BS EN 771 (see table 5.00 for classification). Sulphate Resisting Portland Cement (SRPC) should be specified for the mortar when subject to saturation as described above.

See table 5.00 for selection of bricks and notes on mortar in sulphate bearing soils.

Designation S2 clay bricks have sufficiently limited sulphate content so that SRPC is not necessary.

Clay bricks are not affected by sulphate bearing soils.

Calcium silicate bricks and concrete bricks will not contribute to sulphate attack and Ordinary Portland Cement (OPC) is therefore satisfactory for the mortar above DPC level.

Durability	Frost resistance	Soluble salts content
FL FN	Frost resistance (F) Durable in all uses	Limits of soluble salts defined by test Low (L) Normal (N)
ML MN	Moderately frost resistant (M). Durable except when saturated and subject to repeated freezing and thawing.	
OL ON	Not frost resistant (O). Bricks liable to be damaged by repeated freezing and thawing. (internal use only)	
Note: calcium silicate and concrete bricks contain no soluble salts		

Table 6.00: Durability designations of clay bricks

Durability

See table 6.01 for selection of bricks for different uses.

Clay Bricks

BS EN 771 classifies clay bricks according to their frost resistance and soluble salt content (see table 6.0 for durability designation).
Use designation F2 clay bricks to BS EN 771 where brickwork may be saturated and subject to freezing and thawing. e.g.: parapets, sills and very exposed sites shown on table 2.02.
Use designation F1 clay bricks to BS EN 772 in the external wall providing measures, such as roof overhang or copings, have been taken into account by the designer to prevent saturation.

Do not use designation F0 clay bricks to BS EN 772 in external walls.

use	brick type			notes on mortar
	Clay	Calcium Silicate*	Concrete	(see table 2.04)
Foundation to	FL, FN, ML, MN**	Class 3	Strength > 20 N/mm2	
DPC Foundation to DPC Sulphates in Soils	FL, FN, ML, MN**	Class 3	Strength > 20 N/mm2 All Class 1 sulphates and some in Class 2 (Consult manufacturers). Engineering Quality Concrete bricks up to Class 3 sulphates.	Where sulphate levels are class 3 or higher use sulphate resisting Portland cement
Unrendered external walls protected from saturation	FL, FN, ML, MN	Class 3	Strength > 7 N/mm2	
Unrendered external walls not protected from saturation	FL, FN	Class 3	Strength > 15 N/mm2	Use sulphate resisting cement in mortar with Type N clay bricks
Rendered external walls	FL, FN, ML, MN	Class 3	Strength > 7 N/mm2	Use sulphate resisting cement in mortar and base coat of render with Type N clay bricks
Copings, cappings, sills etc.	FL, FN	Class 4	Strength > 30 N/mm2	
Internal	FL, FN, ML, MN, OL, ON	Class 3	All	

Notes: *Minimum Class indicated: a higher class (e.g. up to 7) is equally acceptable.
**If the site is wet or the masonry at or near ground level may be subject to saturation use designation FL bricks or FN bricks with sulphate resisting cement

Table 6.01: Selection of bricks

Concrete Bricks

The frost resistance of concrete bricks is related to their compressive strength. Concrete bricks of not less than 7N/mm2 may be used in external walling protected from saturation. Concrete bricks with a strength of not less than 15N/mm2 are required if the work is subjected to saturation and freezing.
A strength of not less than 20N/mm2 is required for concrete bricks used below DPC.

Concrete bricks of not less than 30N/mm2 should be specified for a capping course.

Calcium Silicate Bricks

Use Class 3 calcium silicate bricks in external walls except for sills and brick-on-edge copings, when a Class 4 or higher should be used.

Concrete Blocks

Where concrete blocks are to be used externally without a rendered finish or placed below DPC level reference should be made to the manufacturer for their suitability. Blocks should have been tested for their use in such locations.

Most blocks may also be used in the outer leaf above DPC when rendered – check with the manufacturer to ensure that the material is adequately durable. Low density aircrete units (usually less than 480 kg/m3) are not usually suitable for use in the external leaf.

Colour variation

Mix facing units from a minimum of three different packs to prevent colour banding of brickwork. On large schemes liaise with the manufacturer or supplier to ensure consistent colour/texture quality.

Use only fresh mortar mixed in the correct proportions and do not vary mix proportions as this will lead to incorrect strengths and colour variations. Changes in the supply of mortar materials may also lead to colour variation.

Avoid the use of pigments in mortar unless you are confident of consistent batching. As an alternative a coloured sand may avoid the need for pigments.

Ensure a consistent joint width is used – normally 10mm (nominal) and that the bed joints and cross joints (perps) are completely filled.

Joints

Perpends should be a minimum 5mm and a maximum 20mm. Bed joints a minimum 7mm and a maximum 13mm.

Frogs

Frogged bricks have a depression in the face of the brick. Normally they should be laid with the major depression or frog facing up so that it is fully filled with mortar during laying. This ensures optimum strength and helps to increase the mass of the wall (to give good sound insulation) and prevents the possibility of standing water within the structure which could freeze. Bricks with a directional surface texture are intended to be laid frog up. Bricks should only be laid frog down when specified and with the consent of Compariqo.

Perforated Bricks

Care should be taken with the use of perforated bricks where the exposure rating of the wall is high, as water retention/collection has been found to exist in the perforations.

Efflorescence

Efflorescence is a white deposit on the face of masonry brought about by water moving through the wall dissolving soluble salts and depositing them when the water evaporates during drying out.

Efflorescence is best prevented by:

• Keeping all units dry prior to use.
• Protecting the head of newly constructed work with some form of cover to prevent saturation

Protection during construction

All new masonry work should be protected during construction by covering, so that walls are not allowed to become saturated by rainwater, dry out too quickly in hot weather and to protect against frost attack. Unnecessary wetting will increase the risk of effloresence, line staining and movement problems. Care will need to be taken to ensure that any cover does not drape into fresh mortar or disturb the bond of the units.
It may be necessary to provide temporary propping to gable walls etc. prior to roof construction.

When a floor or roof slab of a building is used for the temporary storage of building materials the loading should not exceed the design loading for the element.

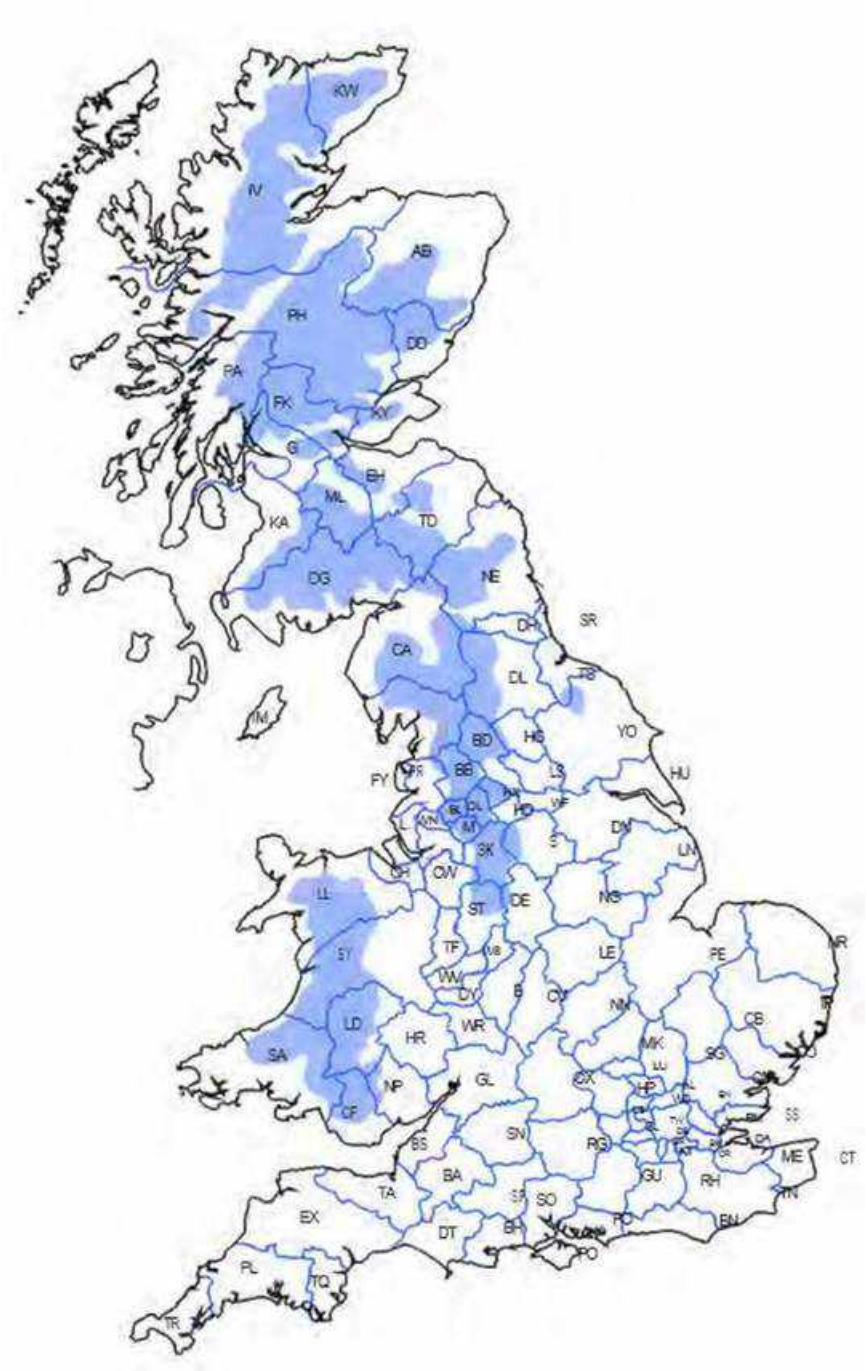

Diagram 5.01: Map showing areas where there is a risk of severe exposure to frost attack. Reproduced by permission of Hanson Brick Ltd.

The shaded areas meet the meteorological criteria for severe exposure. For identification of these areas by postcode district, see table 6.02 on the following page.

Buildings within these areas which are situated on top of, or on the slopes of, locally high ground or on a locally high plateau, and have an open aspect with no protection from adjacent trees, buildings or topographical features are subject to exceptionally severe exposure to frost conditions and require frost resistant brick work.

Note: Northern Ireland has been assessed as an area of normal exposure to frost attack. As such domestic buildings in Northern Ireland will not require frost restraint brickwork.

AB	BB	BD	BL	CA	CF	CH	DD	DE	DG	DH	DL	EH	FK	G	HD	HG	HR	HX	IV	KA
3	1	13	0	5	8	7	6	4	1	8	8	14	1	62	3	3	2	2	1	1
5	2	15	1	6	37		9	6	2		11	23	8	63	4		3	4	3	3
	3	20	2	7	39				3		12	26	11	64	7		5	6	4	4
	4	21	7	8	40				4		13	27	12	65	8			7	6	5
	5	22	8	9	41				6			28	13	72					7	6
	6	23	9	10	42				7			43	14	74					12	16
	7	24		11	43				8			44	15	75					13	17
	8			12	44				10			45	16	76					14	18
	9			13	45				11			46	17	77					15	19
	10			16	46				12			47	18	81					16	26
	11			17	47				13			48	19	82					17	
	12			19	48				14			55	20	83					18	
				20									21	84					19	
				22									47						22	
				23															23	
																			24	
																			25	
																			26	
																			27	
																			28	
																			40	
																			54	

partly within

wholly within

KW	KY	LA	LD	LL	MM	ML	NE	NP	OL	PA	PH	S	SA	SK	ST	SY	TD	TS	YO
3	13	2	1	11	24	1	19	1	1	23	1 30	6	9	6	10	10	1	9	6
5		6	2	15		2	46	2	2	24	2 31	10	10	10	13	16	2		7
6		8	3	16		3	47	3	3	25	3 32	11	11	11		17	5		18
7		9	4	20		6	48	4	4	26	4 33	30	13	12		18	8		21
8		10	5	21		7	49	5	5	27	5 34		19	13		19	11		22
9		12	6	22		8	66	6	6	32	6 35		20	14		20	71		
10		20	7	23		9	71	7	7	33	7 36		32	15		21			
11		21	8	24		10		8	8	34	8 37		33	16		22			
12		22		25		11		44	9	35	9 38		39	17		23			
13		23		26		12			10	36	10 39		40			24			
14				27					11	37	11 41		44			25			
				28					12	38	15		48						
				32					13	41	16								
				33					14		17								
				40					15		18								
				41					16		19								
				54							20								
				55							21								
				57							22								
											23								
											25								
											26								

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Table 6.02: Showing postcode districts wholly or partly within the severe Exposure from map on the previous page

Section 7 - External Walls - Masonry

Bricks & Blocks

Straightness on plan

± 10mm maximum deviation in any length of wall up to 5m

Level of bed joint

± 10mm maximum deviation for walls 5m long
± 15mm maximum deviation for walls 5-10m long
± 25mm for walls over 10m long

Thickness of bed joint

± 5mm (average over 8 joints)

Plumb of wall

Maximum 8mm out of plumb for walls up to 5m in height, limited to 8mm in a storey height (approx. 2.5m).
Maximum 12mm out of plumb for walls over 5m in height, limited to 8mm in a storey height (approx. 2.5m).

Straightness in section

± 8mm max deviation in any 2.5m height of wall

Mortar

Mortar type above DPC should be chosen in accordance with guidance given in table 7.00, or otherwise as recommended by the brick or block manufacturer.

The addition of lime and/or air entraining plasticizers to cement or the use of masonry cement produces mortars with the correct balance of workability, strength and durability. Cement and sand alone should not be used unless a strong mix is specifically required by the design.

Batching

Keep batching and mixing equipment clean to avoid contamination with materials used previously. Mortar should be mixed by machine (e.g. tilting drum mixer) or use ready-mixed retarded mortars. Accurately proportion materials using a gauge box or buckets.

Add water with care – start with about 1/4 of estimated quantity of water needed.

When mixing by machine load about 3/4 of the sand or premixed lime/sand and water. Continue mixing and gradually add cement and/or lime if appropriate. Then load the remainder of sand or premixed lime/sand and further water to achieve required workability.

Mixing of mortar

Mortar should be carefully and consistently proportioned then thoroughly mixed using a mechanical mixer, except for very small quantities. Accurately proportion materials using a gauge box or bucket. Do not use a shovel.

Ensure that mortar proportions are in accordance with the manufacturer's recommendations for the type of masonry unit to be laid and the degree of exposure.
Following initial production, nothing should be added to mortar except for clean water to maintain consistency.
Mortar should not be 'knocked up' after it has started to set.

Air-entraining or other admixtures should be used only when approved by the designer and then according to manufacturers instructions.
Do not use strong mortar for blockwork above DPC level (1:4 cement: sand or equivalent is too strong) (See table 2.04).
General purpose mortar (see BRE Digest 362) can be used internally and externally regardless of sand type. A mortar mix by volume of 1:1:51/2 (Portland cement/lime/sand) with an air-entraining plasticiser is deemed suitable. Sulphate resisting cement should be used where groundwater sulphate can reach the masonry or where clay bricks with a sulphate content (N designation BS EN 772) are used externally and are likely to be subject to a high risk of saturation.

Cold weather working

Precautions should be taken when necessary to maintain the temperature of bricks, blocks and mortar above 3° C. The use of anti-freeze as a frost resistant additive in mortar is not permitted.

Hot weather working

During prolonged periods of hot weather when masonry units can become very dry, absorbent clay bricks may be wetted to reduce suction. Low absorption bricks (i.e. engineering bricks) should not be wetted. For calcium silicate and concrete units the mortar specification may need to be changed in order to incorporate an admixture to assist with water retention. On no account should masonry units or completed work be saturated with water.

Use	Designation	Proportions by Volume			Minimum Compressive Strength of site-mixed mortars at 28 days in N/mm² (CEN standards in brackets)
		Portland cement:lime: sand	Air-entrained Portland cement:sand	Masonry cement:sand	
Mortar for internal and external use above dpc	(iii)	1:1:5-6	1:5-6	1:4-5	2.5 (M 2.5)
General Purpose Mortar to BRE Digest 362		Air entrained with plasticiser Portland cement: lime: sand 1:1:5½ by volume			2.5 (M 2.5)
High Durability Mortar for: **a** use below or near external ground level **b** in parapets & chimneys **c** external walls with a high risk of saturation due to severe exposure	(ii)**	1*:½:4-4½	1*:3-4	1*:2½ – 3½	5.0 (M 5)
	If Type N clay bricks are used, or for all chimneys, use sulphate-resisting cement				
Low Permeability Jointing Mortar for: **a** coping, cappings and sills **b** jointing impervious ceramic units in drainage systems	(i)***	1: ¼ :3 Use a Type S sand to BS 1200	–	–	10.0 (M)
Loadbearing Masonry designed to BS 5628:1		Air entrained with plasticiser Portland cement: lime: sand 1:1:5½ by volume			As specified

Notes: * Where soil or ground-water sulphate levels are appreciable (Class 3 or higher) use sulphate resisting Portland cement.
** For concrete or calcium silicate bricks use a designation (iii) mortar and refer to *.
*** For concrete or calcium silicate bricks use a designation (ii) mortar.

Table 7.00: Recommended mortars for different uses

Structural Design of External, Separating & Compartment Walls

The design of an external, separating or compartment wall depends upon a number of criteria, including the following:

- Construction
- Location
- Height
- Length
- Thickness
- Strength

Further guidance for wall design may be obtained from Approved Document A of Building Regulations and BS103:2. Any designs outside the scope of the approved document must be designed by a suitably qualified and competent structural engineer.

Wall Ties

Types

It is important to use ties to BS EN 845-1 or to provide independent third party certificates acceptable to Compariqo, so that the ties used have adequate durability. Normally it is the structural requirements of the cavity wall, the cavity width and any insulant to be used, which dictates the type of tie to be used. All ties should have a minimum embedment of 50mm, ensure that the drip is in the centre of any clear cavity and the tie is laid to a slight fall to the outer leaf.

Ties fitted with retained discs or rods are used to hold partial fill insulation in place within the cavity.

It is important to note that only BS EN 845-1 type wall ties or specifically manufactured (and tested) party wall ties are permitted in cavity separating walls between dwellings to reduce the transfer of sound.

Durability

Stainless steel wall ties should always be used.

Note: Proprietary ties should have independent third party certificates acceptable to Compariqo – some may be suitable for use with cavities up to 150mm.
BS EN 845-1 or proprietary party wall ties only, to be used in sound resisting walls

Spacing

For walls in which both leaves are 90mm or thicker, ties should be used at not less than 2.5 per square metre (900mm horizontal x 450mm vertical centres). This spacing may be varied when required by the Building Regulations. Ties should be evenly distributed over the wall area, except around openings, and should preferably be staggered.

At vertical edges of an opening, unreturned or unbonded edges, and vertical expansion joints, additional ties should be used at a rate of one per 300mm height, located not more than 225mm from the edge

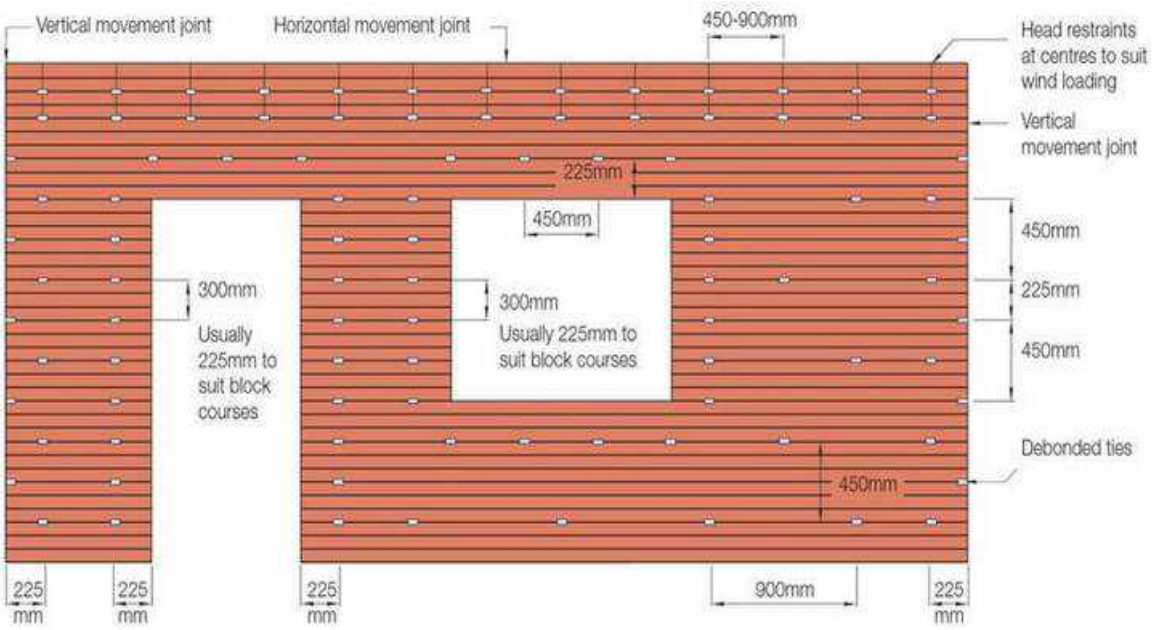


Diagram 7.00- Wall tie distribution

Restraint

Structural connections

Joist hangers should be appropriate for the strength of the masonry, the size of the joist and the load to be supported.

Joist hangers

Joist hangers may be either of the standard joint fixing type or of the restraint type

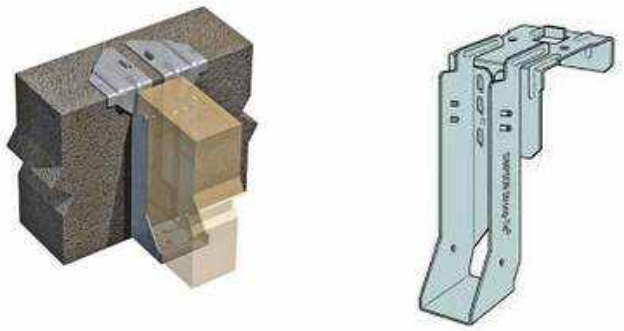


Diagram 7.01 -Joist hangers

Always support the hanger on a full masonry block not on a cut block.

Do not use hangers marked for use with a particular strength of block on a block of a lower strength. The joist width should be equal to the width of the hanger and not more than 10mm deeper than the hanger. Do not cut down the width of the joist to fit a hanger.

If the coursing requires adjustment to achieve the designed joist height make the adjustment at the course below the one supporting the hanger. The adjustment block must be of similar strength and thermal performance. Do not pack up between the joist and it's bearing surface on the hanger.
Ensure that:

• Ensure the correct hanger is used for its specific purpose intended by the manufacturer. The manufacturers instruction for usage should be followed in all instances
• The hanger is bedded directly on the masonry and there is no gap between the hanger back-plate and the face of the masonry
• At least 450mm of masonry should be provided above the hanger
• Hangers are spaced at centres of floor joists included in the design
• The hanger is suitable for the loadings and masonry strength.

Do not:

• Apply load while the mortar is still green and has not gained sufficient strength
• Use brick courses in block walls under joist hangers – the thermal insulation of the wall may be reduced unless similar units to the blocks are used

The guidance on connections given in this Manual relates to work on site and should be used in addition to guidance given in this section.
Floors including timber, block and beam, and roofs should provide lateral restraint to all walls running parallel to them, by means of 30 x 5mm galvanized or stainless steel restraint straps at 2.0m centres (See diagrams 2.24 and).

Straps need not be provided to floors at, or about, the same level on each side of a supported wall and at the following locations:
• Timber floors in 2 storey dwellings where:
• Joists are at maximum 1.2m centres and have at least 90mm bearing on supported walls or 75mm bearing on a timber wall plate
• Carried by the supported wall by restraint type joist hangers as described in BS 5268:7.1
• Concrete floors with minimum 90mm bearing on supported wall.

Joist hangers on steel beams - Use only heavy-duty hangers.

If standard or restraint hangers are to be used, there must be at least 450mm of masonry above. Joists can be hung up to half their depth below the beams lower flange provided they are packed as shown. Ensure shrinkage will not cause the packing to become dislodged.

Stirrup hangers can be used where the load on either side is approximately equal. Masonry above is not generally required.

Vertical strapping securely fixed to a suitable wall plate at least 1.0m in length should be provided at maximum 2.0m centres at eaves level to roofs except where the roof:

• has a pitch of 15° or more and

• is tiled or slated and
• is of a type known to resist wind gusts and
• has main timber members spanning on to it at maximum 1.2m centres.

Wall straps should be corrosion resistant, correctly positioned, blocked out and built into the masonry as the work proceeds.

Where a standard hangers are used and lateral restraint is required to this wall then a strap should be installed at max 2m centres (See diagram 5.04).

Where timber engineered joists are used then the strap should be fixed to the sides of the flanges

Straps that are only 1.2mm can be fitted to the top of joists without the need to notch

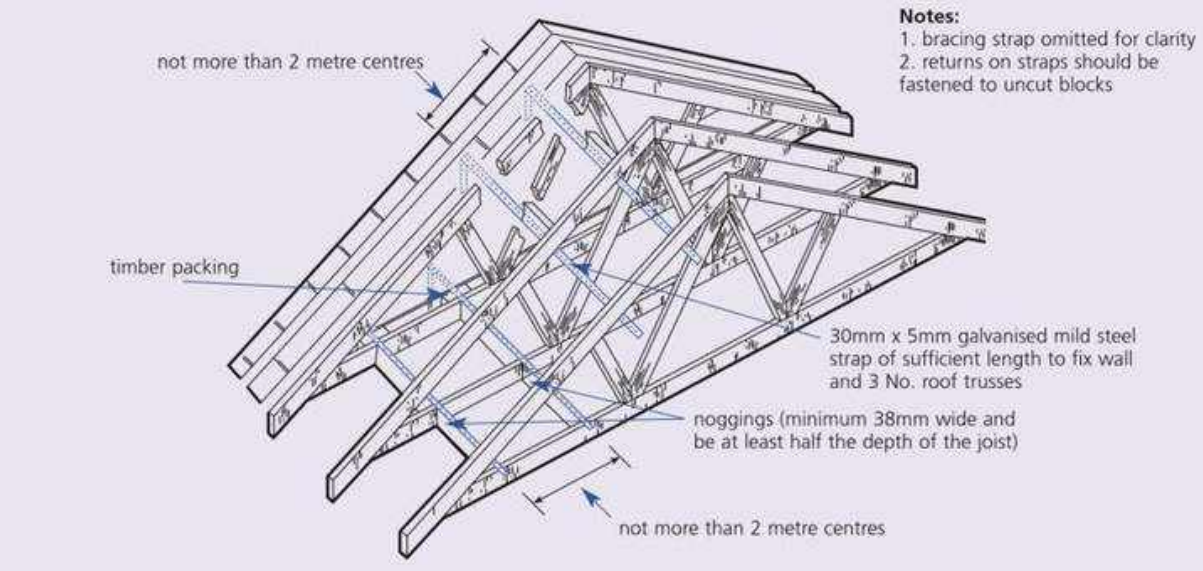


Diagram 7.02 Lateral restraint to gable and separating wall

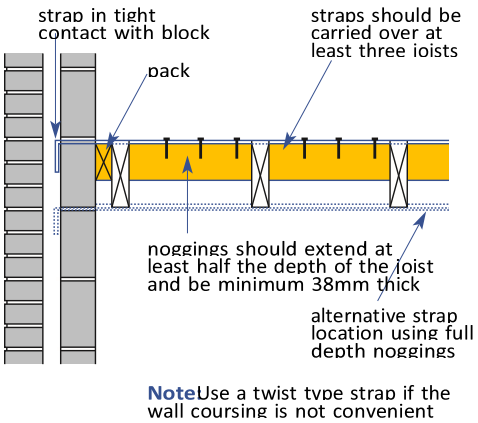


Diagram 7.03 Lateral restraint strap detail at floor or ceiling joist level

Movement Control

Vertical movement joints should be provided to the outer leaf of cavity walls as indicated in table 7.01. Where the finished ground level is 600mm or greater below the horizontal DPC then the movement joint should be continued within the external leaf of the substructure. The table below should be considered as a guide only. The requirement for all movement control both vertical and horizontal should be clearly stated within the design and confirmed by a qualified structural engineer.

Material	Normal spacing	Joint thickness
Clay brickwork	12m (spacing up to 15m may be possible if sufficient restraint is provided – consult designer)	15mm
Calcium Silicate & Concrete brickwork	7.5m – 9m	10mm
Concrete Blockwork (used in outer leaf)	6m	10mm
Stone* 12m 15mm		

Note: It is not normally necessary to provide movement joints to the internal leaf of cavity walls but should be considered where rooms occur with unbroken lengths of wall in excess of 6m.

The first joint from a return should be not more than half the dimension indicated in the table. Movement joints are not acceptable in solid party or separating walls, however where cavity wall construction is adopted offset movement joints with a solid rubber compressible strip, may be acceptable.

Table 7.01

Lintels & Beams

Bearing length

Use the correct length and width of lintel for the opening and cavity width. The bearing length should be at least 150mm (this may be reduced to 100mm with some concrete lintels – check with designer/manufacturer).

Ensure adequate end and intermediate (if applicable) support to hollow pressed steel lintels. This can be a problem where narrow or slender piers are proposed (See BS 5628:2 for further guidance).

Concrete prestressed lintels may need temporary strutting in the centre. Use correct size and type of padstones to spread the load if specified in the design.

Do not:

• Support lintels and beams on short lengths of cut block and make up pieces.

• Apply load to the lintels or beam before the masonry supporting it has hardened.

The use of timber lintels is not acceptable unless a structural lintel is provided above.

Cavity Trays

Cavity trays, associated weepholes and stop ends prevent the build up of water within a cavity wall thus allowing water to escape through the outer leaf. They are used in conjunction with lintels above openings, to protect the top surface of cavity insulation, at horizontal cavity barriers and where the cavity is bridged e.g. by projecting concrete floor units.

Cavity trays are to be provided at

• all interruptions which are likely to direct rainwater across the cavity, such as rectangular ducts, lintels and recessed meter boxes,

• above cavity insulation which is not taken to the top of the wall, unless that area of wall is protected by impervious cladding.

• above lintels in walls in exposure zones (exposure zones shown on diagram 2.03 in the previous section) 4 and 3 and in zones 2 and 1 where the lintel is not corrosion-resistant and not intended to function as its own cavity tray,

• continuously above lintels where openings are separated by short piers.

• above openings where the Lintel supports a brick soldier course.

• Cavity trays to rise at least 150 mm from the outer to the inner leaf, be self-supporting or fully supported, and have joints lapped and sealed. See diagram 2.32 and 2.37).

Weepholes

Weepholes to be installed at not more than 900 mm centres to drain water from cavity trays and from the concrete cavity infill at ground level. When the wall is to be cavity filled, it is advisable to reduce this spacing.

At least two weepholes to be provided to drain cavity trays above openings.

Provide means of restricting the entry of wind driven rain through weepholes in walls in exposure zones 3 and 4, including at ground level.

Stop ends

Cavity trays should have watertight stop ends to prevent water from running into the adjacent cavity (See diagrams 7.05).

Stop ends need to be bonded to the cavity tray material or clipped to the lintel such that a stop to the structural cavity of at least 75mm high is provided. Normally the stop-end is located to coincide with the perpend nearest to the end of the cavity tray. Stop ends can be formed by sufficiently turning up the end of a DPC tray into the perpend joint.
Surplus mortar should be removed from cavities and wall ties cleared of mortar droppings and debris as the work proceeds.

Ring beams or floor slabs which partially bridge the cavity (e.g. when dimensional accuracy cannot be guaranteed) should be protected by a continuous cavity tray, especially when full cavity insulation is used.

Stepped cavity trays are required at all pitched (stepped) roof abutments with external cavity walls e.g. attached garages or staggered terraces. The bottom (last) cavity tray must be supplied with two stop ends and an associated weephole, allowing all water to escape over the lower roof covering (See diagram 7.06).

For brickwork, blockwork and stonework, lead cover flashings should be linked into the cavity tray (lapped in below). Small gables should be constructed with a cavity. It may be impractical to build the inner leaf in masonry. In these cases it is acceptable to provide a "timber frame" construction (See diagram 2.38 for details). With blockwork, in particular rendered blockwork, and stonework this is more difficult and care must be taken in detailing and construction to avoid a path for water ingress.

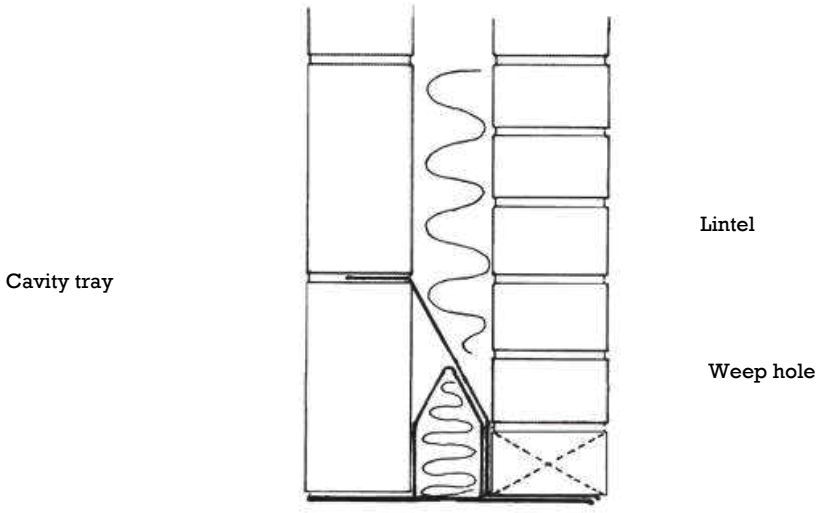


Diagram 7.04: Typical cavity tray installation

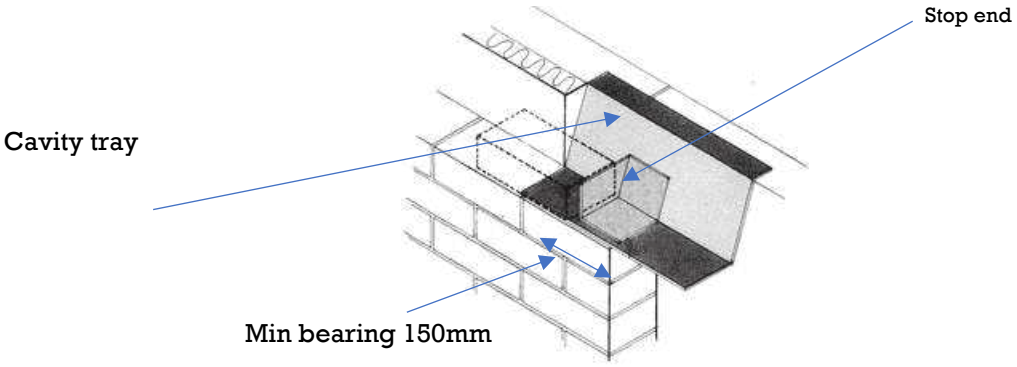


Diagram : Stop 7.05 stop end

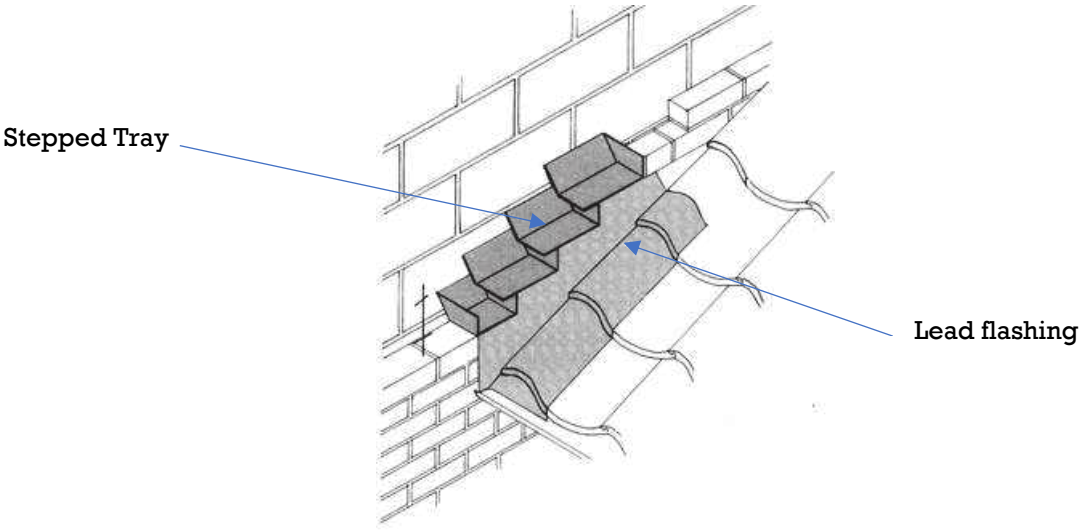


Diagram 7.06: Stepped cavity tray detail at roof/cavity wall abutment (brick/blockwork but equally applied to stone work)

Other perforations of the building envelope

Proprietary elements such as ventilators, soil pipes, etc. which perforate the building envelope should be installed and sealed to prevent ingress of moisture or vermin in accordance with the manufacturer's instructions.

External meter boxes should be of a type approved by the service supply authority and provided with a cavity tray and a vertical DPC between the back of the box and the wall.

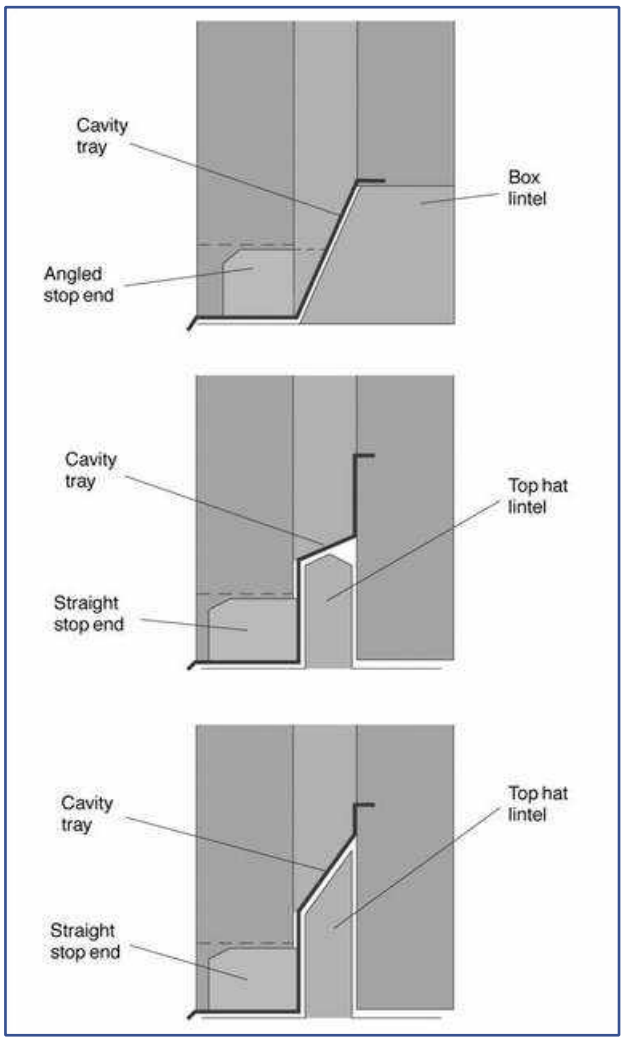


Diagram 7.07: Cavity tray and stop end profiles above lintels

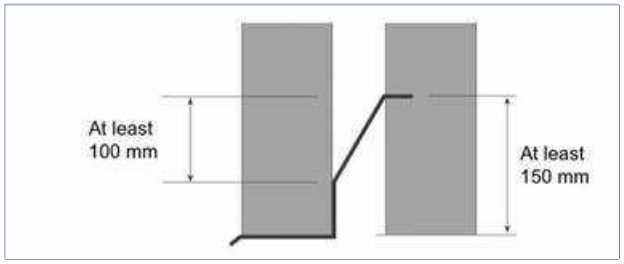
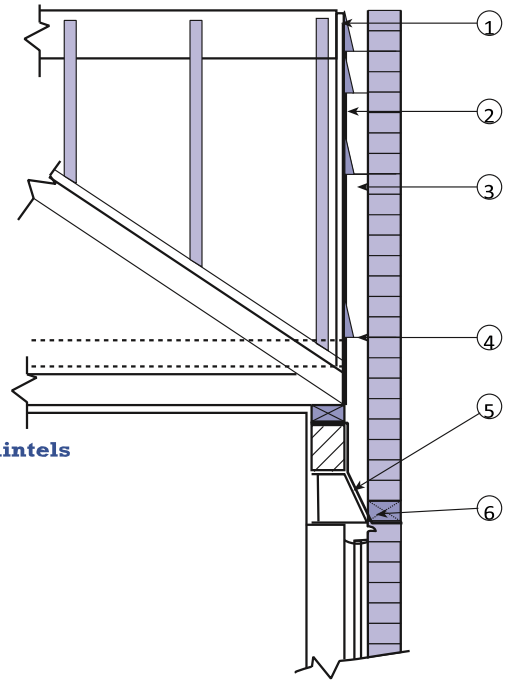


Diagram 7.08: Minimum dimensions for cavity trays



INDEX
1. Sheathing board fixed to rafters
2. Sarking felt or breathable membrane
3. Cavity
4. Timber frame, fix wall ties to studs and rafters
5. Cavity tray
6. Weepholes

Diagram 7.09: Small gable timber frame

External Wall - Chimneys

If a chimney is not provided with adequate support by ties or securely restrained, its height (measured to the top of the chimney) should not exceed 4.5 x its least horizontal dimension, when measured from the highest point of intersection with the roof surface (density of masonry must be minimum 1500kg/m3) - see diagram 2.45.

Chimneys and flues

Ensure that all gas flues terminate to the open air i.e. flue blocks must terminate at an appropriate ridge vent or similar even where no appliance is fitted prior to the sale/occupancy of the property. To demonstrate that flues comply with Building Regulations, reports showing flues have passed appropriate tests need to be drawn up and made available to the building control body and Compariqo surveyor. A suggested checklist for these reports is given in Appendix A of Approved Document J and detailed guidance on testing is given in Appendix E.

Special blocks are made to accommodate gas fire flues which tend to be slightly thicker than normal units. When used in external walls, care should be taken not to reduce the clear cavity width below 50mm.

Typical chimney positions, DPC and flashing details are shown in diagrams 7.10-

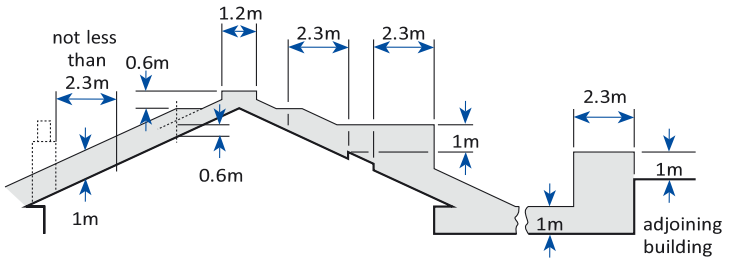
Ensure that:

• If the chimney is in a severe exposure zone the cavity should extend around the outside of the stack and be continuous up to roof level as per BS5628. Part 3: 2001. Where the chimney breast is gathered in, the lower projecting masonry should be protected with a suitable capping and cavity trays.
• A 50mm cavity at the back of the chimney breast is maintained to prevent rainwater penetration
• Flue liners are used as specified with sockets upper most and jointed with fire resisting mortar and flue liners should:
• be non-combustible o be reasonably smooth internally
• be correctly jointed with mortar with the space between the liners and the brickwork filled with weak insulating concrete unless the manufacturer recommends an alternative specification
• be properly jointed at the junctions with the starter block or lintel and outlet terminal
• A notice plate containing safety information about any hearths and flues should be securely fixed in an unobtrusive but obvious position within the home.
• Where a chimney forms part of a wall, the foundation should project at least 100mm wider than the chimney base and should be the same depth as the adjacent wall foundation.
• Factory made insulated chimneys should have a life of at least 30 years and be designed in accordance with BS4543, BS EN 1859 and installed in accordance with BS 7566.
• Where a chimney is not directly over an appliance or opening, a soot box accessible for emptying should be formed.
• Flue pipes should be equal to the cross section of the outlet of the appliance

- Flue pipes for solid fuel appliances should be vertical or inclined at 45° or less from vertical. A 150mm long horizontal section may be used to connect a back outlet appliance to a flue.

Combustible materials close to a chimney should be:

- At least 200mm from the inside surface of a flue, or
- In all areas except Scotland, 40mm from the face of the chimney. This does not apply to floorboard, dado rail, mantelshelf or architrave.
- Metal fixings in contact with combustible materials should be at least 50mm from a flue.



Note: The top of the chimney stack should terminate outside the shaded area and be not less than 2.3m horizontally from roof.

Diagram 7.10: Minimum chimney heights

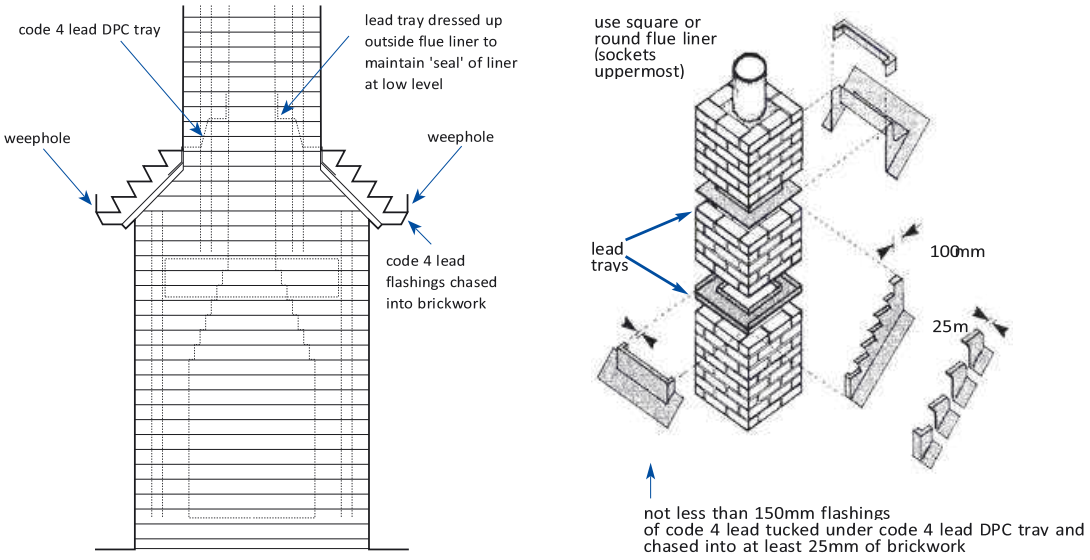


Diagram 7.11: Chimney Tray High and Low Level

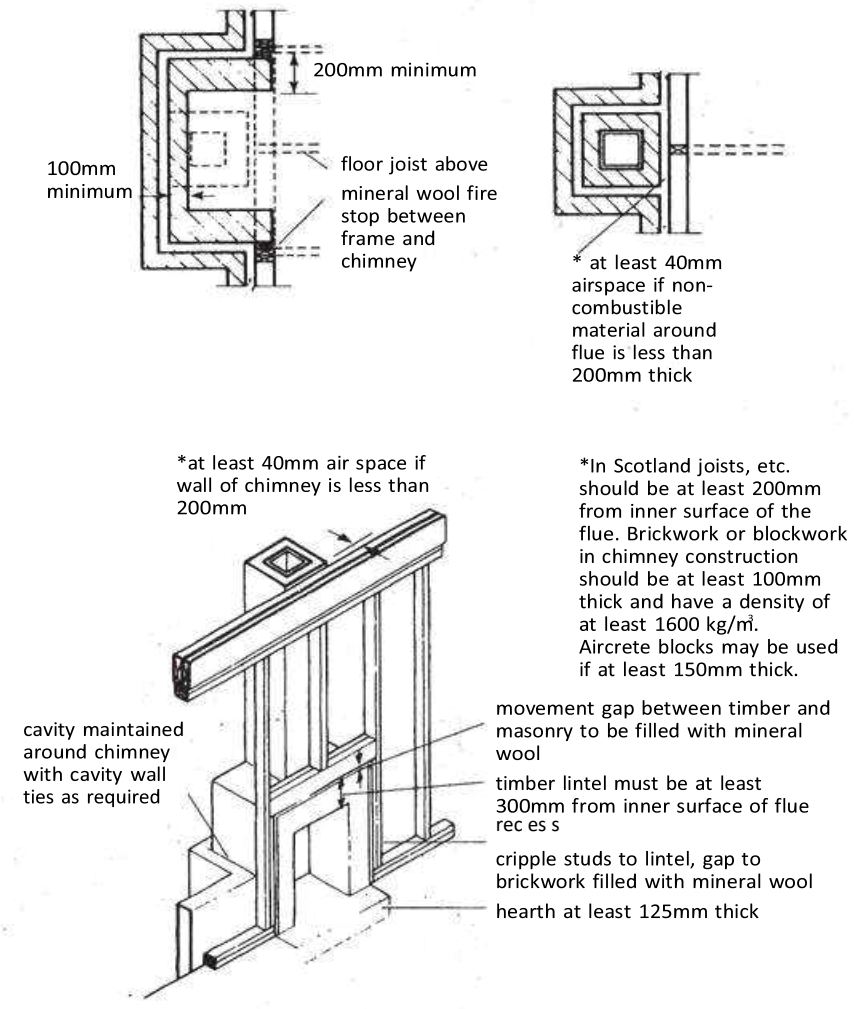


Diagram 7.12: Typical external fireplace recess and chimney -Timber frame construction

Corrosion of Lead Work

When free lime from mortar comes into contact with lead trays or flashings, (due mainly to the continual saturation of the brickwork) in areas such as chimneys, the lead should be protected from corrosion by the use of a thick coat of bitumen paint covering the faces likely to be in contact with the mortar. The protection against corrosion of lead work buried in mortar is suggested in guidance issued by the Lead Sheet Association. This treatment can also reduce staining of lead and brickwork. It is unnecessary to treat flashings buried only 40 – 50mm into mortar joints (cover flashings), as this close to the drying surface carbonation of free lime is rapid and there is no risk of corrosion in such circumstances.

Chimney Tray, Low Level

Required at low level where a cavity-walled chimney with brick shoulders is built on to an external wall; the tray prevents water which may enter the shoulders from penetrating to the inner leaf of the wall. Material: 1mm aluminium alloy sheet to BS EN 485-2: 1995 'Aluminium and aluminium alloys. Sheet strip and plate. Mechanical properties'. This has a higher melting point than lead, so is suitable for installation close to a heat source.

Chimney Tray, High Level

Required to prevent the entry of water at high level where a chimney rises through a pitched roof; suitable for newbuild or remedial work. Minimises disturbance to surrounding construction in remedial work.

Material: Lead sheet to BS 1178: 1982 'Specification for milled lead sheet for building purposes'. Code 4 as standard. Standard sizes: 800 x 800mm, 900 x 900mm, 950 x 950mm. To suit either 195mm square or 195mm diameter circular flue.

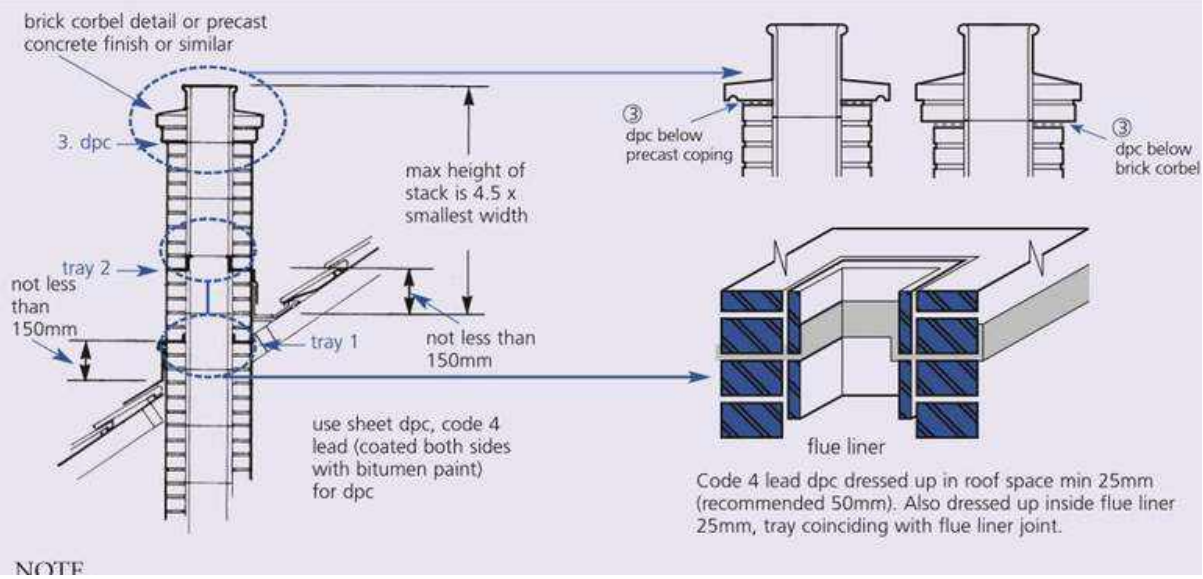


Diagram 7.13- Positions of DPC's in a chimney

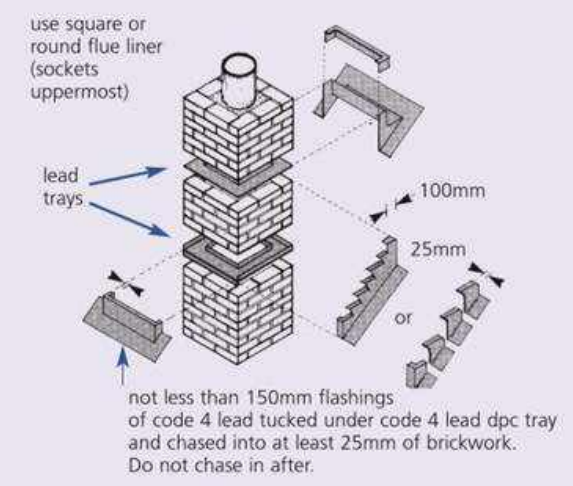


Diagram 7.14-Typical chimney flashing detail

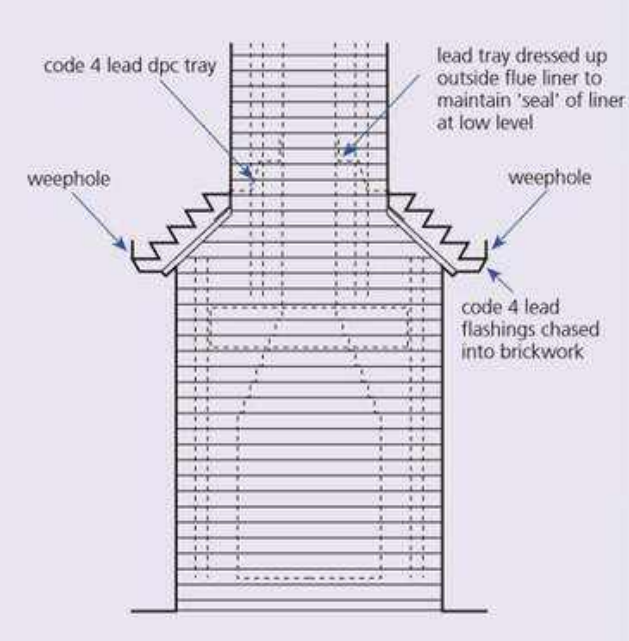


Diagram 7.15- Typical detail for external chimney breasts

External Walls

- Parapets

The minimum thickness and maximum height of parapet walls should be as given in diagram 7.16 and table 7.02.

Wall type	Thickness (mm)	Parapet height H to be not more than (mm)
Cavity wall	x + y equal or less than 200	
	x + y	600
	greater than 200 equal or less than 250	860
Solid wall		
w = 150		600
w = 190		760
w = 215		860
Note: w should be less than W		

Table 7.02 Parapet walls – height walls/height ratios

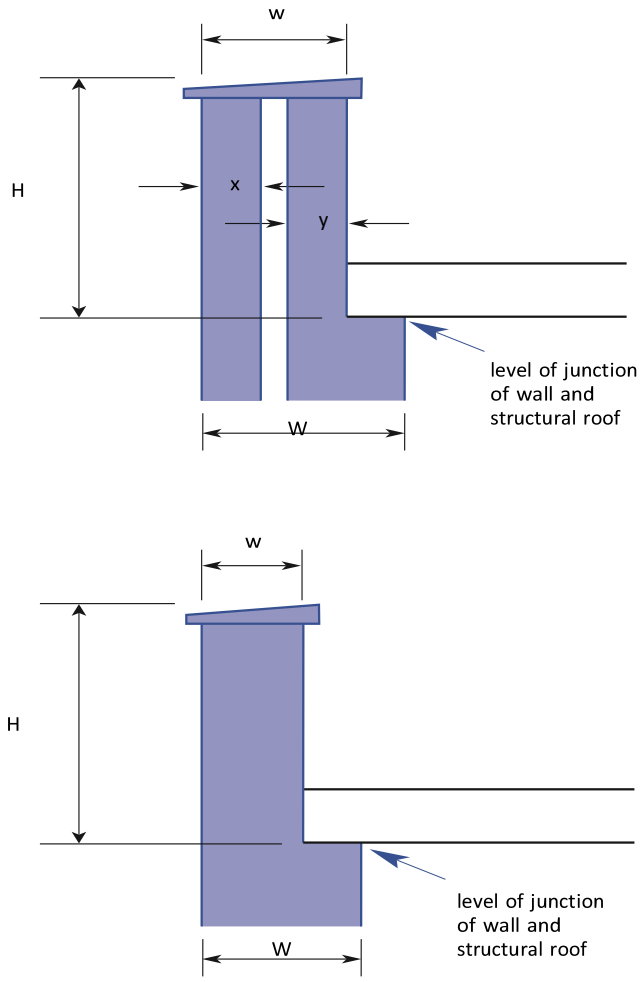


Diagram 7.16-Parapet walls – height walls/height ratios

The materials used in the construction of parapet details should be suitable for the location and exposure.

Where possible, the use of raking parapets should be avoided due to the need for high standards of detailing and workmanship required to prevent the ingress of moisture. In very severe exposure zones it is recommended that a parapet construction is avoided altogether. Where these details cannot be avoided it is essential to provide a high level of supervision and workmanship whilst following the general guidance given in diagrams 7.17 – 7.19.

It is recommended that in moderate and severe exposures any full fill cavity insulation should be stopped at the upper level of the ceiling insulation, providing a suitable cavity tray.

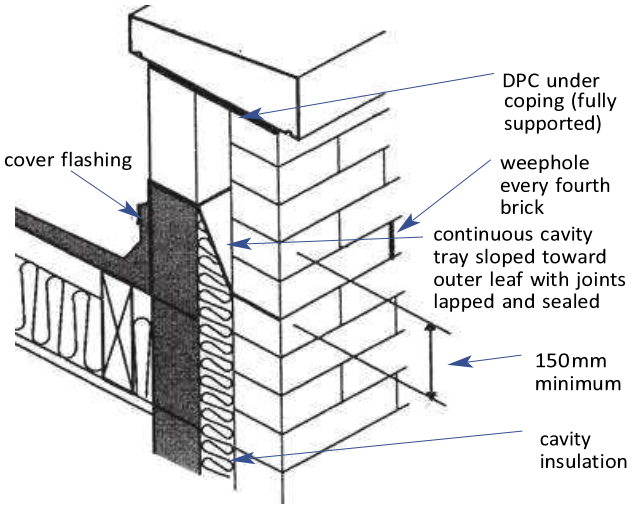
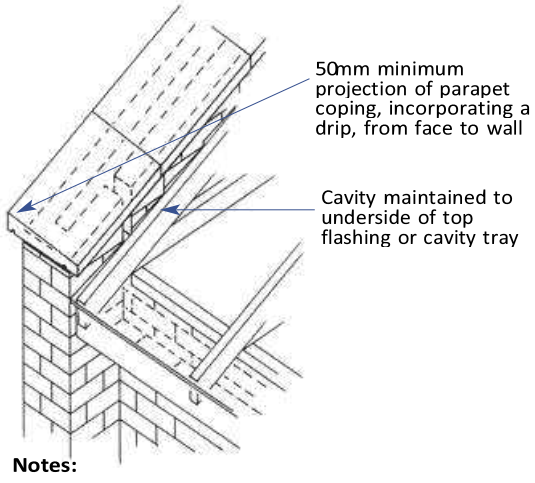
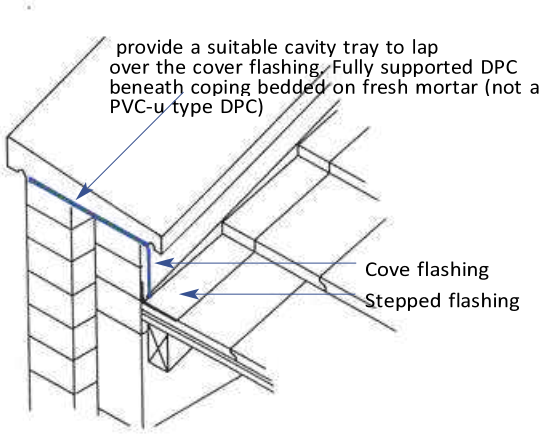


Diagram 7.17:Cavity Tray- Parapet



Notes:

Diagram 7.18: Raked parapet detail – coping



Note:

Diagram 7.19: Section of a raked parapet detail –

External Walls - Natural Stone

General

The following additional guidance for natural stone shall be used in conjunction with any other information in this manual.
When selecting stone for cavity wall house building it is important to consider the exposure rating for the area. Clearly it is not recommended to use a soft, porous type stone in a severe exposure zone.

Consideration should also be given to the compatibility of different stone to prevent staining and premature decay. Limestones and sandstones should not be mixed together. It is also advisable to use a stone that has been quarried within a reasonable location of the development thus ensuring both weathering qualities and the visual blending with existing buildings.

Natural stone has a grain or natural bed, which is determined during its formation in the strata of the quarry.
It is important that the stone is laid with the grain running horizontal to the bed. In the case of jambs and mullions the grain should be vertical.
Walls constructed with a cavity are essential where the location is likely to be of moderate exposure or worse.
A sawn bed of 100mm minimum thickness to be used as the outer leaf of a cavity wall although Compariqo recommends 150mm.
Where dressed stone is used and the bed falls below 90mm due to the irregularities of the stone, then the stone should be backed with either a brick or 50mm min thick block wall to maintain the structural stability.

It is not acceptable for the stone to be packed or wedged to maintain line and level without the backing wall being in place.

Mortar

The mortar for use with stone should comply with the relevant British Standards for sand, lime and cement as set out in BS 5390.
This can vary in strength from 1:1:6 to 1:3:12 depending on the softness of the stone. It is important to use correct mortar to allow for movement and associated shrinkage.

Wall ties

Ensure that the ties are stainless steel and of sufficient length to maintain a 50mm embedment. It may be necessary to double up the wall ties where the coursing is out of line due to the varying thickness of natural stone at the reveals i.e. every other course. Also ensure that wall ties do not slope inwards.

Insulation

Full fill cavity insulation should only be considered where the outer leaf is backed by brick/blockwork, although this is still dependent on exposure.
Either partial fill, leaving a residual cavity of 50mm or a clear cavity should always be the preferred option.

Movement control

Where sealants are used it is important to select a non-oil-based sealant to help to prevent any staining to the stone.

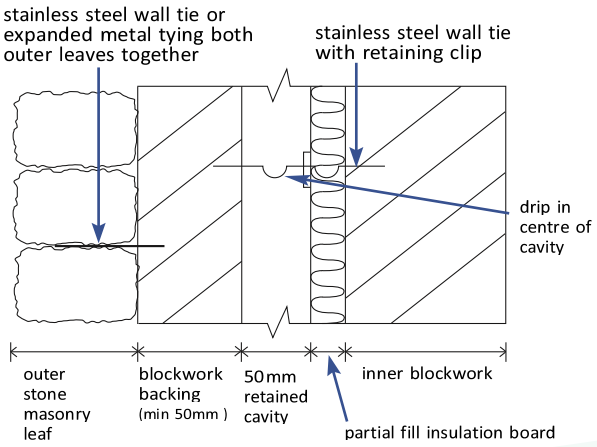
Cavity trays

In addition to the previous guidance for cavity trays the following shall apply:

• When stone heads are being used it is advisable to double up the cavity trays one below and one above the stone head.
• Provide stop ends and weep holes.

Jambs and mullions

Stone jambs and mullions should be fixed at the top and the bottom with stainless steel pins Stainless steel frame type cramps can also be used to give extra stability at jambs.



Note: wall tie spacings to be as per brick and block masonry

Diagram 7.20 Block backing to natural stone masonry

External Walls - Thermal Insulation

External walls should be designed to provide the required standard of thermal insulation and the correct use of insulation material to meet the requirements of the Building Regulations. Design should avoid cold bridging at openings and at junctions of external walls with roofs, floors and internal walls.

Full cavity insulation

In Northern Ireland, it is not permissible to fill cavities with pumped thermal insulants at the time of construction.

In Scotland, it is not permissible to fill the full width of the cavity with any thermal insulant at the time of construction.

Note: Render on an external leaf of clay bricks in Severe or Very Severe exposures is not permitted where the cavity is to be fully filled with insulation

SAP rating (SAP 2005)

The Approved Document sets out the Standard Assessment Procedure for calculating energy ratings. As well as producing guidance on the insulation values of the fabric, compliance with the following energy saving methods are required.

- The central heating programmer should control heating and hot water separately
- When both heating and hot water thermostats are satisfied the boiler should switch off (boiler interlock)
- All rooms shall be provided with a means of controlling heating output* The HWS cylinder shall be insulated and fitted with a thermostat
- All pipework outside the heated space including primary connections to the HWS cylinder for a distance of 1 metre should be insulated

Positive measures to prevent infiltration should include:

- all windows and doors to be draught stripped
- likewise loft hatches
- service entries and dry linings to external walls should all have continuous seals.

Care must also be taken to ensure that water pipes are adequately insulated

Provision must be made to prevent thermal bridging around windows and doors to avoid heat loss and condensation problems

When considering the energy efficiency of a dwelling care must be taken in the detailing at lintels, jambs and sills.

The Building Control Authority and Compariqo should be consulted at the design stage to agree variable design data such as the driving rain index for the site and be consulted if deviations from the approved plans are made during the course of the works.

Compliance with Compariqo Technical Requirements

The following provides guidance on the interpretation of the Requirements with regard to individual elements covered in this section and where appropriate, propose performance or specific standards which meet these Requirements.

Design of elements should be in accordance with BS 8104:1992 Code of practice for **assessing exposure of walls to wind-driven rain these are as defined in PD 6697:2019 and** should be determined by reference to the maps showing categories of exposure to wind driven rain. Where local knowledge or features dictate, a modification to the rating should be made.

Summary

External insulation

- External insulation systems, which incorporate 65mm or more of insulation or incorporate a 50mm clear cavity and an effective external cladding, are generally suitable in all exposure categories. However, they should only be installed in exposure categories as stated by suitable third party accreditation acceptable to Compariqo and in accordance with manufacturer's recommendations.

Cavities

- Cavities to be not less than the stated width and free of obstructions which may transmit water towards the inner leaf.

Solid masonry

- Internally insulated masonry walls to be at least 328mm thick if of brickwork, 250mm if of aggregate blockwork and 215mm if of autoclaved aerated concrete blockwork with a notional cavity between the masonry and the insulation.

Mortar and render

- A mortar mix whose strength is compatible with the strength and type of masonry unit must be specified to minimise cracking, especially for concrete and calcium silicate units.
- Tooled mortar joints, either bucket handle or weathered, to be used. Recessed or raked joints to be used only in exposure zone 1 with 50mm clear cavity, or zone 2 with 100mm clear cavity.
- Render to be appropriately specified and applied to the correct backing material to minimise cracking (See Render section for further guidance).

General (including cavity insulation and durability)

The following provisions apply when cavity fill insulation is used:

- Ensure that a clear cavity width of 50mm is maintained when partial cavity fill is used
- Full cavity fill should be the minimum thickness for the given exposure
- Full cavity fill insulation should not be used in walls of rendered clay bricks of N category soluble salts content, unless sulphate resisting cement is used in mortar for jointing and backing coat for render
- Full cavity fill should not be used in moderate exposure or worse where painted fair-face masonry is proposed unless the masonry outer leaf is frost resistant
- Full cavity fill insulation should not generally be used with random stonework unless backed up by a skin of brick or blockwork although this is still dependent on the exposure category.
- The two cavity leaves should be raised together, unless insulation comprising built-in batts is to be used, in which case it should be installed in accordance with the manufacturers instructions
- Wall ties should be positioned so as to support full or partial cavity insulation batts below the DPC where this is permitted by independent third party certificates acceptable to Compariqo. (See Wall Ties section.)

Third-party certification

- Built-in cavity fill must have third-party certification and be installed in accordance with manufacturers' instructions.
- Injected cavity fill must have third-party certification and be installed under an approved surveillance scheme.
- External insulation must have third-party certification for use on solid walls in specified exposure zones.

Ensure that:

- All batts butt closely
- Batts are kept free from mortar droppings
- The orientation of batts is retained, e.g. vertical laminations in mineral wool allow water to drain downwards not across the cavity
- Batts or injected fill are taken right up to the verge of a gable unless a cavity tray is fitted where the insulation finishes
- All vents are sleeved and all openings sealed when an injected insulation system is to be used
- No gaps are left – insulation materials can be cut to fit with a sharp knife or the edge of a trowel
- All new work is covered after construction
- Wall insulation is to be taken up high enough to link with loft insulation without blocking any cross ventilation provision.

Partial fill insulation

The insulation material must be designed and accredited as a partial fill type insulation.

Fixing the insulation against the inner leaf does not hinder the progress of any water draining down the cavity, allows air movement to dry out the outer leaf and keeps cold air in the residual air space outside of the insulation layer.

The minimum design width of the residual air space in the cavity is 50mm.

Wall ties need to be provided with an appropriate retaining disc or system to keep the insulation in place. Follow the installation procedure in the previous section. Mortar droppings should be cleaned off the top of batts before the next batt is placed.

Do not:

- Fix damaged boards
- Leave gaps in insulation (cut boards where required)
- Stop short of the verge in a gable wall without providing a cavity tray

It is recommended that cavity insulation is continued to the top of a gable wall. Where it is not, it should be protected by a cavity tray, unless otherwise permitted by independent third party certificates acceptable to Compariqo.

Cavity trays should be lapped and sealed at joints. A cavity tray should be provided immediately below parapets, being located above any insulation and with a step down towards the outer leaf. A DPC should also be provided beneath the coping. Cavity trays should be laid on a mortar bed of fresh mortar and extend across the full width of any opening including circular or arched openings.

Full fill cavity insulation

Always

• Fit wall ties so that the drips are in the centre of the cavity
• Fit insulation bats up to any insulated closure
• Install vertical DPC's where specified
• Cut bats to fit around extra ties etc. Never tear or impale
• Keep batts clean

Never

• Place cut edges of small off-cuts against the wall surface. The laminations should all be in the same direction to ensure moisture can travel down cavity

The following design points should be noted:

• stop ends should be provided to cavity trays or combined lintels
• weepholes should be provided at 450mm (maximum) centres with at least two per opening
• mortar should not be recessed
• paint finishes on brick or render are not acceptable if they are likely to cause frost damage or sulphate attack or other damage.

Partial fill cavity insulation

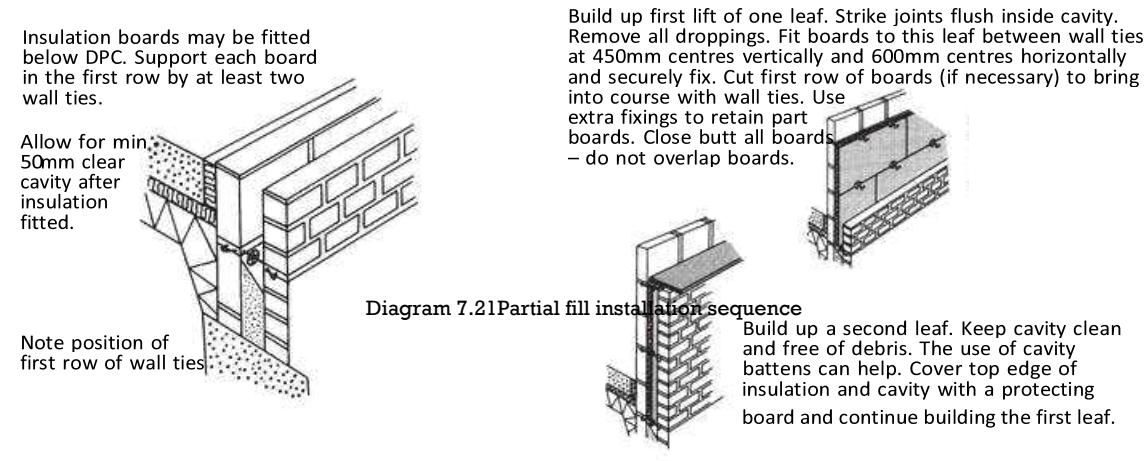
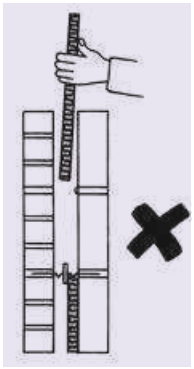
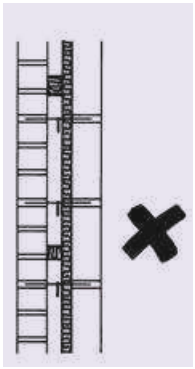


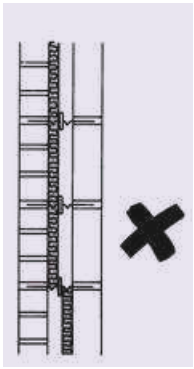
Diagram 7.21Partial fill installation sequence



Do not fix boards after construction of a second leaf

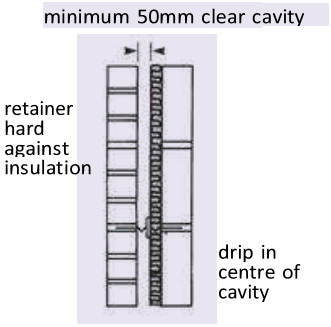


Do not Fix boards by unapproved methods, e.g. butterfly tie drips or wedges



Do not change fixing position from one leaf to the other

AVOID THESE PRACTICES



AS BUILT SECTION

Diagram 7.22- Partial fill bad practice

External Walls – Timber Frame

Design and Certification

All timber frames must be designed in accordance with BS EN 1995-1-1 and should be independently certified by either

• An industry recognised third party timber product approval scheme such as EXOVA BM TRADA Q-Mark Timber Frame Elements Certification Scheme - or
• A Suitably Qualified Structural Engineer with a minimum of three years experience in timber frame.

In either case the certifier should not be the designer of the timber frame and should provide a signed certificate confirming the structural assessment and adequacy of the design for the specific project.

Off site manufacturers of timber frame should belong to a suitable trade body such as the UK Timber Frame Association and employ a recognised quality management system.
Site manufactured timber frame should also provide an independently certified as built frame check for each property.

Design Information

Adequate design information should be available on site and also be provided to for their records and should include

• A full set of drawings
• Materials specifications
• Fixing and nailing schedules detailing size and type of fixings

Sole Plates

The moisture content of structural timber should not exceed 20% at the time of stress grading and at the time of erection. All structural timber for use within the building fabric should be stress graded marked ‘KD’ (Kiln Dry) or ‘DRY’.
Where elements are designed as stressed skin panels, notching, drilling and other perforations through the stressed skin should be designed by an Expert. All timber elements should be fixed with durable fixings or otherwise restrained in a manner capable of resisting excessive movement caused by drying out. Workmanship should comply with BS 8000-0:2014

Once timber frames have been erected, it is essential that the cladding and roof covering are installed as soon as possible. In no circumstances should the timber frame be left exposed for a period greater than specified by the manufacturers of either the frame or the breather membrane.

Setting out

It is essential that the accuracy of setting out of the foundations is checked well in advance of delivery of materials to site. Design changes should be approved by the designer.
Ensure sole plates are properly located and fixed to the substructure.

The sole plates or the lowermost timber plate should be set level, accurately set out, and fixed as specified in the design. Deviation in level should not be greater than 10 mm per 5m run. Particular care is required where the camber on a block and beam floor results in difficulties supporting the sole plate adequately.
Sole plates should not overhang the substructure by more than 12 mm, nor be set back from the edge of the substructure forming a ledge for mortar and debris to collect. Should a ledge be unavoidable then install a dampproof tray.

Packings where necessary should:

• Be non-compressible
• Be durable and corrosion resistant
• Not exceed 20 mm
• Be as wide as the timber frame
• Be located below the vertical studs positions

Sole plates with DPC under should be mechanically fixed to the substructure masonry. Holding down anchors, straps or shoes to be of either stainless steel, phosphor bronze, silicon bronze or galvanized mild steel (940 g/m2) at suitable centres. Mechanical fixing points are to be as specified in the design. It is preferable to use straps or shoes, but where specified care should be taken with shot fixings so as not to damage the supporting masonry or split timber members.

Green Timber/Ungraded Timbers

• The use of green timber/ungraded timbers are not permitted as structural members e.g. lintels, beams, joists, rafters, purlins etc., nor where they are aesthetic elements but are "fixed" to the structure, as the extent of their shrinkage is unknown and can lead to structural damage of the property.

Sole plates should not be fixed to infill blocks of proprietary masonry flooring systems i.e. block and beam floors. Suitable anchoring straps must be fixed to the substructure masonry to provide adequate fixings.
With masonry, special density nailable blockwork is required and generally with concrete the fixings should not be closer than 75mm from the edge of the slab.

Protect sole plates from damp

Sole plates should have a Hazard class 2 treatment in accordance with BS8417: 2003 or equivalent and be laid on a DPC which is lapped onto the slab DPM. Wall panels should be skew-nailed to sole plates without perforating the DPC.

Breather membrane should extend over the sole plate (See diagram 7.23).

It is recommended that the inner leaf DPC is turned up approximately 30mm above screed to protect sole plate and bottom rails from construction moisture and spillage.
Cavity fill should be ST1 concrete and terminate no closer than 225mm below the DPC (See diagram).
Drain cavities below DPC level at 1.35m centres. e.g. open perpend mortar joints.

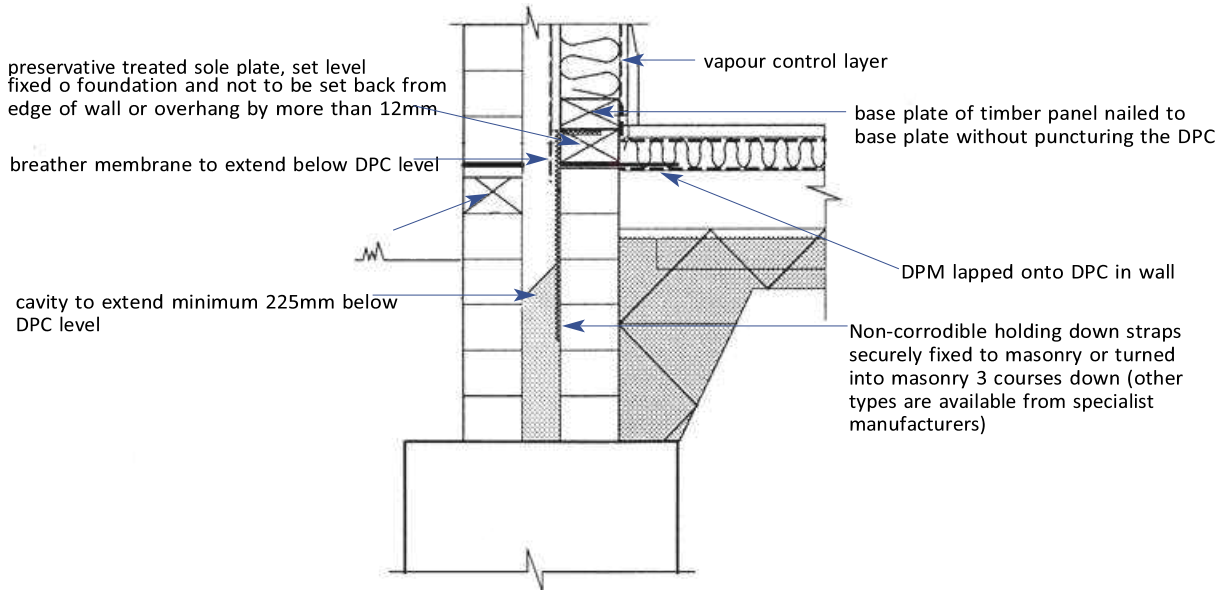


Diagram 7.23: Timber frame, typical ground floor detail

Timber stud framework

Avoid the following defects:

• Gaps between panels and nails missing at panel to panel connection
• Bottom rails not securely fixed to sole plates
• Plates, rails and studs cut away for services and holes drilled for electrical services near edge of stud
• Use of damaged wall panels
• Upper-deck wall panels nailed to floor decking only and not to joists
• Inadequate packing under upper storey panels
• Studs out of plumb
• Studs missing or overloaded
• Split timbers caused by nailing too close to edge of timber

Timber element	Process
Timber studs and rails header joists, lintels and binders, cavity barriers soleplates above screed including any timber or plywood packing pieces	Hazard Class 1in accordance with BS 8417:2011, or equivalent for a 60 year lifespan. See note 1
Sole plates below screed level	As above but vacuum process required

Note 1: The preservative treatment should conform to the treatment recommendations specified in BS8417:2011 CCA, organic solvent (O/S), micro-emulsions or copper-organic treatments according to the requirements for hazard class 2 for a 60 year anticipated service life. Treatments with micro-emulsion, those organic solvent preservatives not complying with BS 5707:1997 and copper organic preservatives should meet the recommendations in Table 9 of BS 8417 for treatments for which an appropriate critical value as described in BS EN 599-1 is available. The supplement to the BWPDA Manual lists preservatives for which an appropriate CV as described in BS EN599-1 has been audited. For other preservatives, interim critical values may have been declared by BSI. CCB and CC may also be used.

Note 2: From 30 June 2004, the use of CCA treated timber in the UK will be prohibited in residential or domestic constructions, whatever the purpose (this does not apply to CCA treated timber already in place). Its continued professional use will only be permitted in structural timber in public buildings, offices and industrial premises where human contact during service life is prevented provided skin contact by the general public during its service life is unlikely (Directive 1976/769/EEC, point 20).

Table 7.03: Treatment of external timber frame

Materials and fixings

Timber elements should be regularised, bear a stress grade stamp and the moisture content should not exceed 20% at time of erection. All structural timber to be used within dwellings must be clearly marked 'DRY' or 'KD'.

The moisture content of timber can be checked by the use of an electrical resistance moisture meter. The type with insulated probes is recommended which can be driven into the timber.
Timbers forming part of the external timber frame should be treated, see table 7.03.

Where elements are designed as stressed skin panels, notching, drilling and other perforations through the stressed skin should be designed by an Expert.
All timber elements should be fixed with durable fixings or otherwise restrained in a manner capable of resisting excessive movement caused by drying out.
Workmanship should comply with BS 8000:5.

Framed walls should be accurately aligned, plumb, level, without twist and securely fixed to adjacent elements using durable fixings suited to the location of the element.
Bedding under frames to accommodate variations in level should be made with a durable non-compressible material of full frame width. The maximum depth of the bedding should not exceed 20mm.

Lateral restraint

The gable panels of timber frame buildings need to be laterally restrained to the roof construction in the same way a masonry construction is restrained. Refer to this section for spacing etc.
It is acceptable to provide this lateral restraint by fixing the wind bracing of a trussed roof construction to the studs of the gable frame.
Unless designed by an Expert, holes for electrical services may only be drilled on the centre line of timber studs between 0.25 and 0.40 of height. Maximum hole size is 0.25 of stud depth (See diagram 7.24). Timber studs should not be notched.

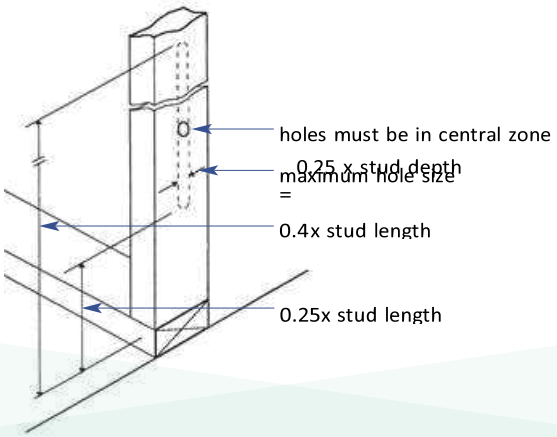


Diagram 7.24: Holes in studs or posts

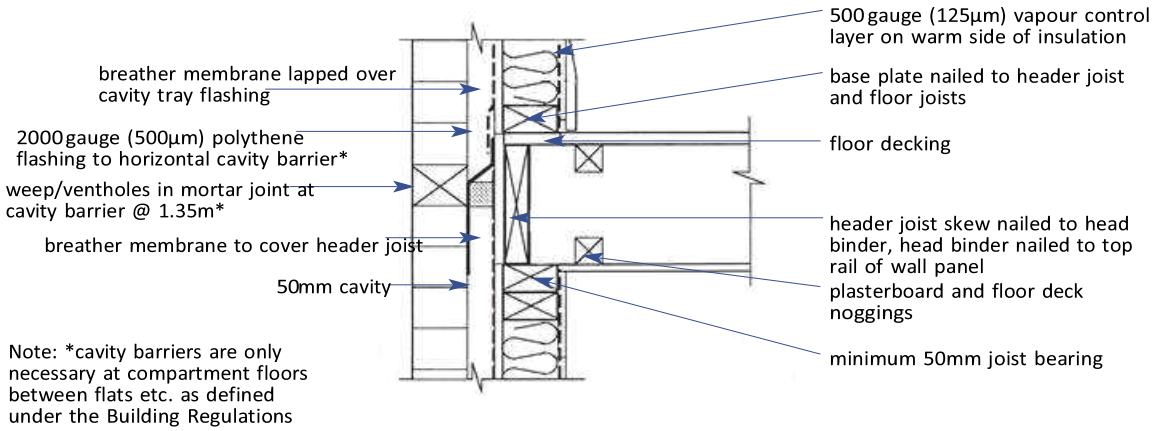


Diagram 7.25: Timber frame, first floor detail

Sheathing

Sheathing is usually provided to timber framed walls to provide increased strength to the structure or simply to protect the building from the elements prior to fixing the external cladding. Where sheathing provides racking resistance to wind and other lateral loads, the edge distance and spacing of the fixings are critical.
When fixed on site, sheathing should be nailed to stud members with galvanised, sherardised, stainless steel, phosphor or silicon bronze nails at centres as the approved design. Nails must not be overdriven.

Sheathing should achieve standard durability level and be of the type shown in table 7.04.

Standard Durability Sheathings
• Canadian Douglas fir and softwood plywood's, Finnish conifer plywood and Swedish softwood plywood as specified in BS 5268:2, which meet the BS 5268:6 requirements for plywood sheathing and have a WBP (weather and boil proof) bond as specified in BS EN 314 & 636. In addition, plywood's constructed • throughout of softwood, which meet the BS 5268:6.1 requirements for plywood sheathing and have a WBP bond as specified in BS EN 314 & 636. • Impregnated softboard type SBS which meets the requirements specified for sheathing in BS EN 622. • High-density medium board type HME which meets the requirements specified for sheathing in BS EN 622. • Wood chipboard of moisture-resistant types P5, P6 and P7which meet the requirements specified for sheathing in BS EN 312. • Oriented Strand Board (OSB) type OSB/3 and OSB/4 which meets the requirements specified in EN 300 and at least 8mm thick. • Any board (treated or untreated) that has been certified by independent third party certificates acceptable to Zurich Insurance Building Guarantee. as suitable for sheathing according to MOAT 26. • Any board included in table 2.14
Note : * These sheathings have a high moisture vapour resistance and designers should check that there is no risk of interstitial condensation in accordance with BS 5250.

Table 7.04-Standard sheathing

Sheathings for dwellings that are subject to extreme exposure conditions on sites located in areas defined as 'very severely exposed' should use either improved protection of standard or alternatively, an enhanced level of sheathing durability, Such dwellings would not be sheltered by local features, including surrounding buildings and trees, and therefore would not qualify for the reductions of exposure category permitted.

Breather Membrane

Avoid the following defects:

- Breather membrane torn at service entrance points
- Laps too small
- Breather membrane damaged by site work or wind
- Laps in breather membrane in wrong direction allowing ingress of water
- Breather membrane not extended to protect sole plate
- Marker tapes, or identification marks, for stud locations inaccurate or absent
- Breather membrane not lapped over lintels.

Suitable breather membranes

Breather membranes are normally provided to the face of sheathing as an additional waterproof barrier in cases where rainwater entering the cavity can come in contact with the timber frame construction (See diagram 7.23).

Suitable breather membranes can be identified by reference to BS 4016 noted on each roll and TRADA publication TBL 64: Test methods for breather membranes for timber frame walls. It should be noted that in areas designated as 'very severe', only 'high performance' breather membranes can be used. Impervious roofing felts are not suitable as breather membranes.

Where no breather membrane is required (e.g. where bitumen impregnated fibreboard is used) the joints between sheets should be taped to prevent draughts.

Fixing of breather membranes

Breather membranes are normally fixed with stainless steel staples and should be continuous, lap onto cavity trays and extend below sole plates and DPCs (See diagram).

Laps should be minimum 100mm horizontal and 150mm vertical (See diagram 7.26).

Breather membrane should be fixed in horizontal bands starting at the bottom of the building and working up so that upper layer overlaps the lower layer (See table 7.05).

Repair any damage to breather membrane before fixing of cladding

Fixing of breather membranes	
	Fixing centres (mm)
Vertical	
at stud position	300
at sides of opening	150
at vertical membrane joints	150
at end of panel*	150
Horizontal	
at eaves	300
at sole plate or bottom rail	150
at horizontal membrane joint	150
at head and base of openings	150
at head and base of panels`*	
* required when membrane is fixed to panels in the factory	

Table 7.05-Fixing of membranes

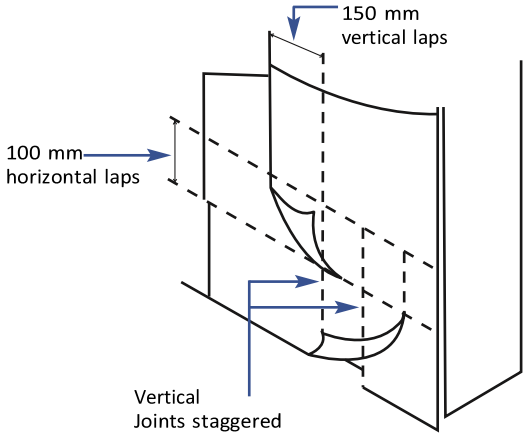


Diagram 7.26:Lapping of breather membranes

Thermal Insulation

Avoid the following defects:

• Thermal insulation quilt missing
• Thermal insulation not continuous above lintels and at junctions with other walls
• Paper backing on thermal insulation not stapled to studs
• Sagging thermal insulation (cold bridges)
• Thermal insulation squashed (reduced efficiency)

Fixing of thermal insulation

Generally flexible quilts should be mechanically fixed between studs to avoid sagging (e.g. by stapling).
Particular attention is required to avoid cold bridges at internal/external wall junctions where it is difficult to fix insulation between closely spaced studs.
Insulation should extend down to floor insulation (or provide perimeter insulation to slab edge).

Vapour control

Avoid the following defects:

• Vapour control layer with gaps at joints
• Holes in vapour check plasterboard and tears in polythene vapour control layer

Suitable vapour control layers

Suitable vapour control layers include 500 gauge (125µm) sheet polythene (manufactured from virgin polymer) or metalized polyester backed plasterboard (not foil backed plasterboard). Sheet polythene is preferred to plasterboard due to the problem of sealing board joints.

Where metalized polyester backed plasterboard is used as a vapour control layer, it should be fixed in strict accordance with the manufacturer's instructions, in particular ensuring that joints occur at studs and noggings, and are filled and taped.

Fixing of vapour control layers

Condensation can cause timber decay and reduced efficiency of thermal insulation.

The vapour control layer should have at least 5 times the vapour resistance of the breather membrane. Vapour control layers should be provided to timber framed external walls on the warm side of the insulation (See diagram 7.27).

"Warm wall" constructions (thermal insulation located outside sheathing) normally do not require a vapour control layer. Such systems need to be approved by an independent assessment authority (See diagram 7.28). The moisture content of the timber frame should be below 20% before the vapour control layer is fitted.

In practice it is very difficult to achieve a perfect vapour barrier and consequently a combination of vapour check and ventilation of the fabric is often used.

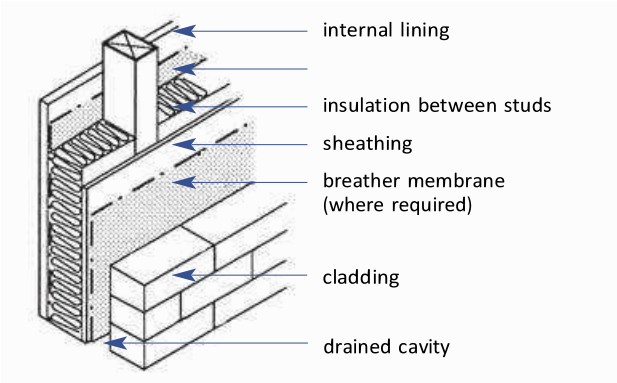
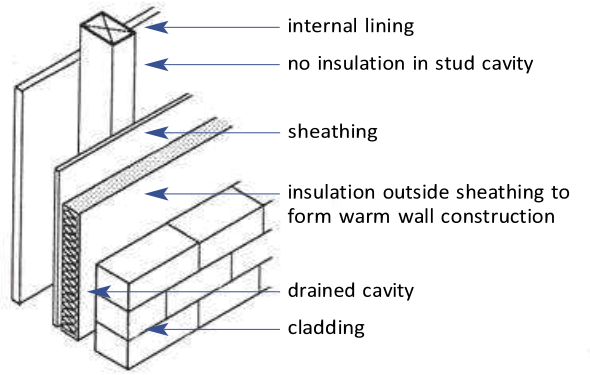


Diagram 7.27: Timber frame external wall construction



Note: warm wall system should be approved by an independent testing authority

Diagram 7.28: Timber frame warm wall construction

Fixing of frames

Make allowance for the shrinkage of the timber frame, see the following sections on movement control: Movement Control - Masonry and Movement Control - Timber Frame.
Support masonry over openings with lintels having minimum 150mm bearing, ensuring that no weight is transferred to timber frame structure.
Window and door frames should normally be screw fixed to the timber frame, unless specifically designed otherwise.
Provide vertical damp-proof courses to jambs which should be tacked to frames and dressed around cavity barriers. Ensure breather membrane laps over cavity trays over openings.

Vapour Control

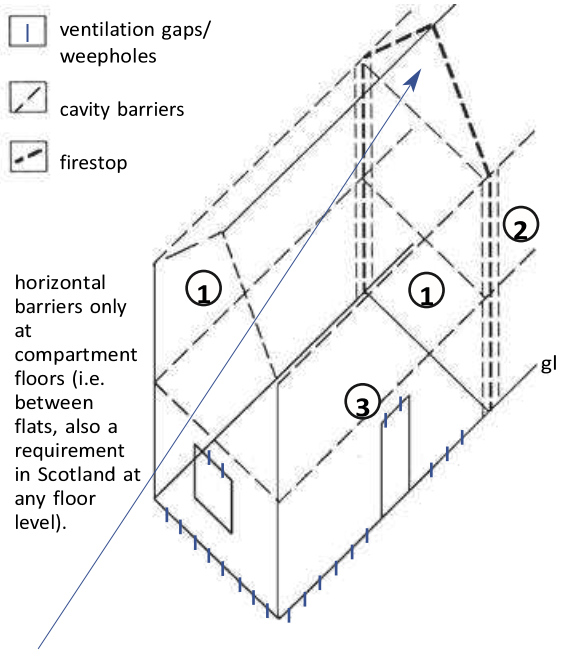
Venting of Cavities

It is considered unnecessary to provide weepholes to the base and head of a timber-framed building, provided an equilibrium of moisture and air within the cavity behind the external masonry cladding can be achieved.

Weepholes are therefore only required at the foot of the wall, usually at DPC level, therefore eliminating the need to vent the cavity (See diagram 7.29).
The exception to the provision of one set of weepholes is where the cavity is bridged by lintels etc. in the normal way or where a fire barrier is provided at a floor level in accordance with Approved Document B, in which case weepholes are required directly above the fire break to allow any moisture entering the cavity to be readily drained away.
The use of a vent/weephole ventilator incorporating an insect resistant grille is recommended.

Cavity widths should be:

- Masonry, 50mm
- Render, 25mm when the mesh or metal lathing is backed by a breather membrane
- Render, 50mm when the mesh or metal lathing is unbacked
- Other claddings, 19mm



firestop at junction between separating wall and external walls/roof

Note: cavity barriers to be provided at:
1 verge or ceiling level
2 external/separating walls
3 external wall/compartment floors between flats

ventilation gaps/weepholes to be provided at:
– DPC level
– compartment floors and above lintels in masonry walls

Note: In Scotland provide cavity barriers at:
– a junction between any floor and an external wall
– vertical and horizontal centres not exceeding 15m
– around openings

Diagram 7.29 Cavity barriers and venting of cavities

Wall Ties

Avoid the following defects:

- Wall ties nailed to sheathing only, instead of the studs
- Wall ties not sufficiently embedded in brickwork
- Prefixed wall ties not coinciding with masonry mortar joints
- Mortar droppings on cavity wall ties
- Wall ties sloping backwards to the internal wall
- Rigid wall ties used instead of flexible ties

Fixing of wall ties

Wall ties should be fixed to studs with stainless steel, phosphor bronze or silicon bronze nails.

Wall ties should be flexible stainless steel or equally durable.

Ties should be fixed to studs, not the sheathing, at the following spacing:
For studs at 600mm centres the vertical spacing is maximum 375mm
For studs at 450mm centres the vertical spacing is maximum 525mm.
In all cases the vertical spacing should be 300mm at reveals (See diagram 7.30).

Wall ties should be embedded in mortar joints to a minimum depth of 50mm with a slight fall towards the external brickwork.

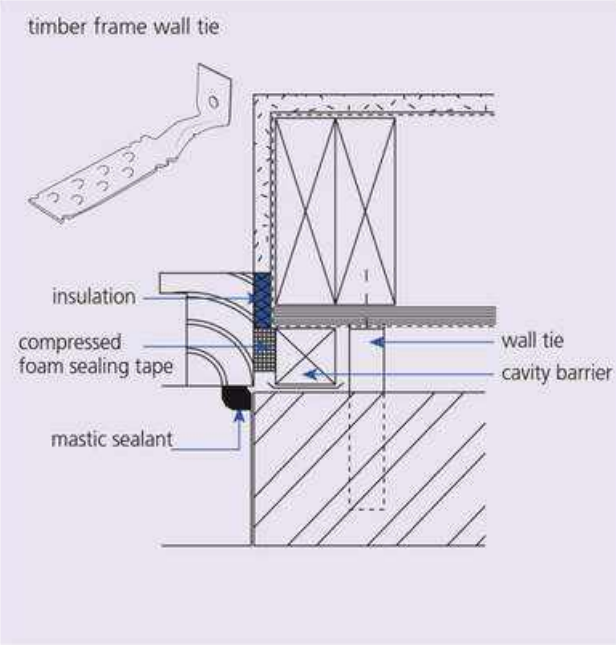


Diagram 7.30: Timber frame, window reveal detail

Movement Control

Avoid the following defects:

• Insufficient allowance for shrinkage of timber frame relative to masonry at eaves, verges, windows and door sills
• Cracking of cladding due to absence of a movement joint between different types of cladding
• Absence of movement joint where timber or render cladding bridges intermediate floor zones
• Failure of weather-tight joint at window jambs due to shear from movement

Masonry

Ensure that differential movement between timber frame and independently supported claddings such as masonry can take place, particularly at:

• Eaves and verges (See diagram 7.31)
• Window and door sills (See diagram 7.32)
• Balconies
• Service entries
• The junction of the timber frame and any other type of construction where cladding is fixed to the timber frame

Movement gaps should be in accordance with table 2.151 and should be constructed to provide a weather resistant Flexible joint

Make allowance for vertical sliding of masonry against side of openings by providing a flexible mastic joint between reveals and frames.

Where cladding horizontally abuts masonry, provide a movement joint to allow for differential movement (See diagram 7.33).

Where cladding vertically abuts masonry, provide a movement joint with drainage channel discharging onto a cavity tray DPC (See diagram 7.33).

Timber cladding

Where timber cladding spans across a floor zone, provide a movement joint to accommodate timber shrinkage (See diagram 7.34).

Cement render

Where cement render on lath fixed to the frame spans across an intermediate floor zone in timber frame construction, allow for differential movement due to timber shrinkage by incorporating a weather-tight movement joint using a proprietary render stop.

Vertical movement joints should also be provided at maximum 5m horizontal centres to render panels. A movement gap must be maintained below any horizontal render stop bead on masonry below.

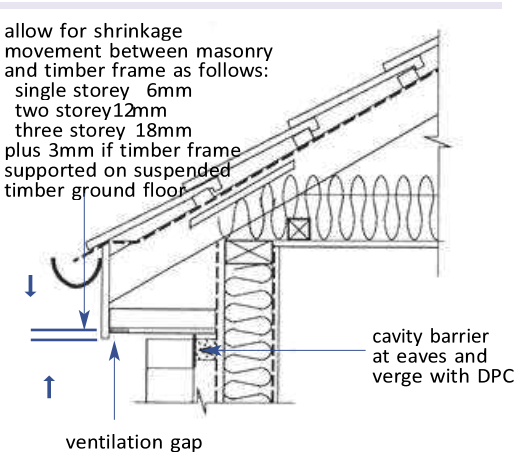


Diagram 7.31 Timber frame, movement control at eaves

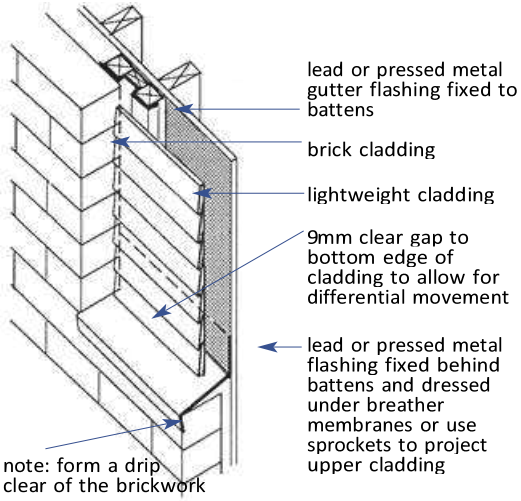
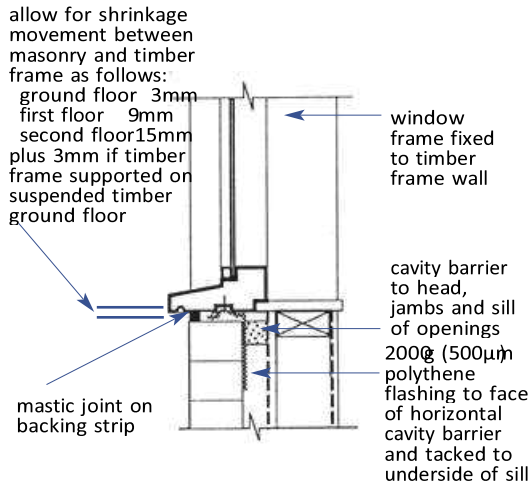


Diagram 7.33 : Typical movement joint between claddings at first floor



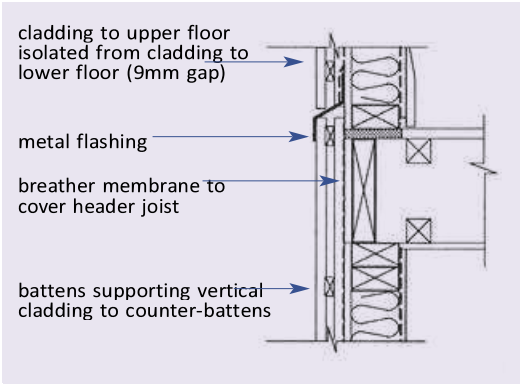


Diagram7.34: Timber frame, first floor movement

Diagram 7.32 : Timber frame, movement control at window sill

Shrinkage table

Gap Location		

Table 7

The gap sizes in Table 7 assume the following

• Timber components have a moisture content of less than 20%
• Timber joists have a maximum depth of 240mm
• Single binder plates at eaves and no more than double sole plates each with a maximum cross sectional depth of 45mm
• Ground floors are of concrete construction. For timber ground floors add 15mm for solid timber and 10mm for engineered I joists
• For light weight claddings fixed to the timber frame allow floor level joints of 15mm for solid timber and 10mm for engineered I joists

Cladding

Claddings fixed directly to frame

Avoid the following defects:

- Insufficient overhang of roof at verges to protect render
- Battens fixed directly to sheathing
- Mesh for render inadequately fixed to timber frame
- Mesh for render damaged or deformed
- Movement or slipping of timber cladding

Timber

Boarding to be preservative treated, minimum 16mm thick and sufficient tongues or overlaps provided to permit shrinkage and expansion of the timber. Timber boarding should be battened off the sheathing to provide a minimum 19mm cavity for draining and venting

Battens should be a minimum 38mm wide, preservative treated or equivalent hazard class 2 and at maximum 600mm
centres. Battens should be fixed to each stud (and not to sheathing) with annular ring nails of length at least twice the batten thickness plus the sheathing thickness or plain nails of length at least 2.5 times the batten thickness plus the sheathing thickness. All nails to be fixed at 600mm centres. Counter battens should be used for vertical cladding.
Boards should be fixed to battens by face or secret nailing with annular ring nails at least twice the board thickness or plain shank nails at least 2.5 times the board thickness. Butt joints at board ends should occur at battens. Nails should be either hot dipped galvanised, stainless steel or equally durable. Aluminium nails should not be used with copper containing preservative treated timber and galvanised nails should not be used with Western Red Cedar. Corners and reveals should be formed to provide a weather-tight construction Plywood sheets used as cladding should be pressure preservative treated, a minimum 12mm thick and bonded with WBP or equal quality exterior adhesive and marked accordingly. Battens should be vertical and treated. Joints between sheets should be made resistant to excessive water penetration by fixing cover battens or flashings.

Render

Battens should be either 25 x 38mm or 50 x 50mm, preservative treated.
Battens should be fixed to each stud with annular ring nails of length at least twice the batten thickness plus the sheathing thickness or plain nails of length at least 2.5 times the batten thickness plus the sheathing thickness. Horizontal battens must be drilled or notched to maintain ventilation requirements. Nails should be hot dipped galvanised, stainless steel or equally durable. Mesh or metal lathing should be stainless steel or assessed by an independent authority and fixed to vertical battens at maximum 600mm centres with stainless steel staples. Laps in the lathing should be wired together at 150mm centres. A damp-proof course should be provided between unbacked rendered lath and timber battens. Render should not bridge the dpc and should be finished onto a durable render stop.

Tile and slate cladding

Tile or slate cladding should be fixed in accordance with the manufacturer's recommendations. Battens should be a minimum 38 x 25mm for stud centres up to 600mm, and should be preservative treated (BS 8417, or equivalent, hazard class 2). 38 x 19mm counter battens should be provided on severely exposed sites.

Battens should be level and fixed to each stud (not to sheathing) with annular ring nails of length at least twice the batten thickness plus sheathing thickness or plain nails of length at least 2.5 times the batten thickness plus the sheathing thickness.
Battens should not normally be less than 1200mm in length and span across at least 3 supports. Nails should be either hot dipped galvanised, stainless steel or equally durable.
A breather membrane (not a roof underlay) should normally be fixed to the sheathing behind the battens. Edge of hanging tiles should be cloaked at the jambs of all openings with purpose made corner tiles or by butting against a timber reveal with drainage channel behind.

Other claddings

Other cladding should only be used if they either:

• Conform with a British Standard and, where appropriate, are detailed for use with timber frame construction by the manufacturer
• Approved as being suitable by an independent assessment authority
• In addition they should be approved by Compariqo

Cavity barriers & Fire-stops

Materials used for cavity barriers and fire-stops shall, be capable of providing adequate resistance to fire and smoke.

Cladding systems incorporating proprietary intumescent materials should follow the guidance provided by The Intumescent Fire Seals Association (IFSA) and the association for Specialist Fire Protection (ASFP).

Cavity barriers and fire-stops should be installed in positions detailed by the design and relevant Building regulations. Service penetrations in floors between dwellings should be fire-stopped. There should no holes or gaps for smoke to penetrate once the fire-stopping has been installed.

Installation of services Avoid the following defects:

• Insecurely fixed socket outlets, switches, cooker point boxes, etc
• Electric power cables not de-rated where they run in or beside thermal insulation
• Loadbearing studs cut away to accommodate meter boxes, flues, etc
• Holes in vapour barriers around service pipes not sealed
• Timber damaged by plumber's blow torch.
• Metal sleeves not provided to flues.
• External and internal load bearing studs drilled or notched excessively

Cables running in, or covered by, thermal insulation should be derated to reduce the risk of overheating. The current carrying capacity should be reduced by 50% when the cable is fully surrounded or by 25% when the insulation is on one side.

Provide noggings to support heavy fixtures and fittings.

Holes in vapour control layers for services should be cut close and neat and sealed around the pipe or cable.

Provide fire protection around flue pipes (e.g. metal sleeve extending through the wall thickness and a 25mm air gap between the pipe and sleeve).

Plumbing runs should not be located in external walls to avoid inaccessibility and the risk of condensation occurring on the pipes.

Holes in studs for services should be sized and positioned in accordance with diagram 2.105.

Compatibility of fixings

Structural timber in timber framed walls and cavity barriers should be preservative treated.

When copper containing preservative treated timber is used, aluminium fixings should not be used.

In order to avoid corrosion of ferrous fixings, timber treated with water borne preservative should not be fixed until the timber has dried out to its required moisture content.

External Walls - Cladding

General

Timber and boards for exterior use should be of a durable species, with sapwood excluded, or preservative treated by pressure impregnation using preservatives suitable for use in hazard class 3 in compliance with BS 8417:2011, or equivalent.

Ends cut on site should be dipped or liberally brushed with preservatives.

Where timber boarding or plywood spans across an intermediate floor zone in timber frame construction, allow for differential movement caused through timber shrinkage, by incorporating a movement joint.

Where cavity barriers are required they should be correctly fitted without gaps, fill the cavity and be fixed with stainless steel staples or equally durable fixings.
Abutments between cladding and other weather-resisting elements should be neatly made, be weather-tight and allow for differential movement.
Workmanship should comply with BS 8000:5.

Timber boarding

Timber boarding should be at least 16mm thick and allowance for moisture movement in boarding should be made by making tongues, joints or overlaps at least 10% of the board width.

Timber boarding should be battened off the supporting background to provide a minimum 19mm cavity for draining and venting. Battens should be a minimum 38mm wide, preservative treated and at maximum 600mm centres. A breather membrane should always be installed when horizontal battens are located against the sheathing.
Battens on timber frame should be fixed to each stud (and not to the sheathing) with annular ring nails of length at least twice the batten thickness plus the sheathing thickness (or plain shank nails of length 2.5 times the batten thickness plus the sheathing thickness).

Boards should be fixed to battens by face or secret nailing with annular ring nails at least twice the board thickness or plain shank nails at least 2.5 times the board thickness. Butt joints at board ends should occur at battens.

Nails should be either hot dipped galvanised, stainless steel or equally durable. Aluminium nails should not be used with copper containing preservative treated timber and galvanised nails should not be used with Western Red Cedar.

Tile and slate cladding

Tile and slate cladding should comply with BS 8000:6 and be fixed in accordance with the manufacturer's recommendations.
All battens should be minimum 38 x 25mm for double lap Clay or Concrete tiles or 50mm X 25mm for Single Lap Clay & Concrete tiles or Slates In accordance with BS 5534

Battens should be level and, if timber frame, fixed to each stud (not to sheathing) with annular ring nails of length at least twice the batten thickness plus sheathing thickness. Battens should not be less than 1200mm in length and span across at least 3 supports. Nails should be either hot dipped galvanised, stainless steel or equally durable.

A breather membrane (not a roof underlay) should always be fixed to sheathing behind the battens.

Other claddings

Other claddings should only be used if they conform with independent third party certificates acceptable to Compariqo

Flint, stone or cobble cladding must be a non-loadbearing element of the wall, backed up by a masonry skin and secured by stainless steel ties at 450mm centres horizontally and vertically. Expanded metal is recommended as it is easily adjusted to suit the stonework.

A minimum 50mm cavity and inner skin are then constructed in the usual way.

Section 8 - Upper Floors

Timber

Timber floors

The moisture content of structural timber should not exceed 20% at the time of stress grading and at the time of erection. All structural timber for use within the building fabric should be stress graded marked 'KD' (Kiln Dry) or 'DRY'.

Joists should be regularised to enable floor and ceiling finishes to be laid to a level and smooth finish. Notching and drilling of joists should be as shown in diagram 8.01, unless designed by an Expert.

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- Adjacent holes must not be closer than 3 times the diameter of the largest hole permitted
- A notch and a hole within the same joist must be at least 100mm apart measured horizontally along the centre of the joist
- Where the joist depth is greater than 250mm, then the dimensions of the shaded zones given in diagram 2.142 should be calculated using d = 250mm

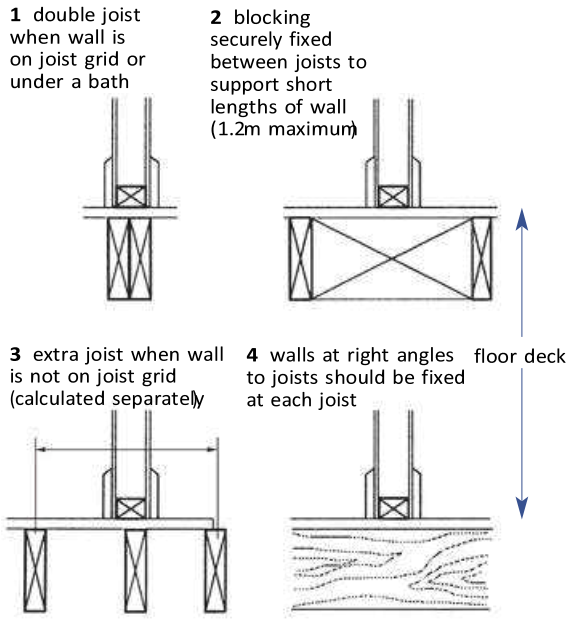


Diagram 8.00: Supporting of non loadbearing internal studwork and plasterboard wall

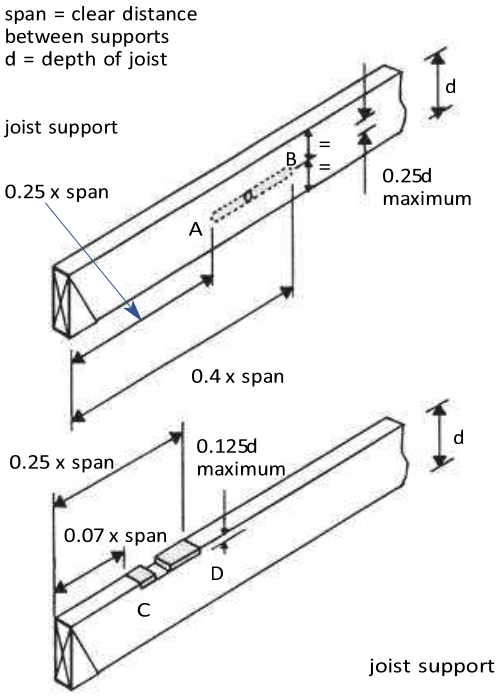


Diagram 8.01 Notching and drilling joists

Joists

Internal partitions should be supported so as not to cause excessive floor deflection. Non-loadbearing lightweight partitions (up to 0.7KN/m run) such as timber stud partitions or plasterboard lined honeycomb partitions may be supported by timber floors as shown in diagram 8.00.

To prevent cold bridging, reduce air leakage and avoid the risks of moisture penetration ends of joists should not be built into external masonry walls unless proprietary joist end caps are used, alternatively the use of suitable proprietary joist hangers are also recommended. Further information can be found in 'Robust Details' and BR262 "Thermal Insulation: avoiding the risks", 2002 edition.

To avoid distortion of finishes, joists should be prevented from twisting over supports and provision made to accommodate up to 10mm drying shrinkage in floor joists supported by steel beams (See diagram 8.02).

Joists should not be overloaded during construction. Joints in joists, rafters and purlins should only occur over a loadbearing support, or the joint be designed by an Expert.

Joists should be restrained at supports and along the span as shown in table 8.00, using tightly fitted strutting.

Joists should have a minimum end bearing of 90mm. Joists should have a minimum 35mm bearing onto joist hangers. Double joists should be pattern nailed at 450mm centres, nails maximum 20mm from top and bottom. Projecting nails ends should be bent over. Bolting of double joists recommended at 1m centres along centre line of joist – bolting should always be used on double stair trimmers.

Joist span	Rows of Noggins
Up to 2.5m	None
2.5m to 4.5m	1 (located at mid-span)
Over 4.5m2 (located at third points)	2

Notes:

Solid strutting should be used instead of herringbone strutting where the distance between joists is greater than three times the depth of the joists. In all other instances the use of herringbone strutting is recommended to reduce the risk of creaking floors due to shrinkage.

Timber for herringbone strutting should be at least 38 x 38mm.

Solid strutting should be at least 38mm thick and at least three quarters of the joist depth.

Strutting should be blocked solidly to perimeter walls.

Table 2.21: Strutting to joist

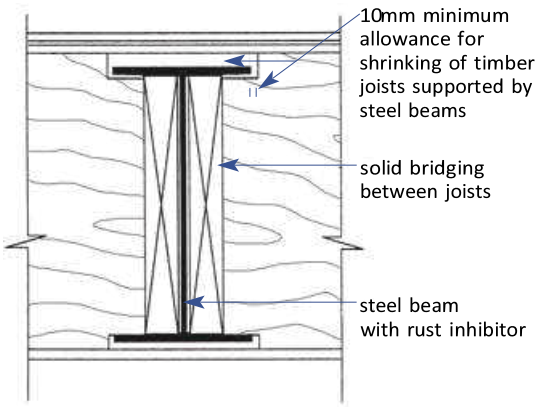


Diagram 8.02: Allowance for joist movement

Floor joist sizes should not be less than as shown within the Trada timber tables unless size and spacing are specifically designed by an Expert.

Decking

The type and thickness of floor decking should not be less than as set out in the manufacturer's instructions. Only decking designed for specific uses should be used. Other board types and thicknesses should be assessed as suitable by an independent testing authority and laid in accordance with the recommendations of the supplier or importer's association.

To achieve adequate sound resistance to internal floors the particleboard may need to be increased to 22mm to achieve the required density.
All square cut edges and all boards at room perimeters should have solid timber edge support, ensure that the short edge of tongued and grooved boards meet over a joist.

Deck fixings should be as set out as specified by the board manufacturer.

Floor decking should not generally be laid until the building is weather-tight, unless fully protected.

Engineered Timber I Joists

General

Engineered Timber I joists comprise a timber flange (typically solid timber or LVL – laminated veneer lumber) and a panel product web (usually OSB – oriented strand board). They are manufactured in a variety of depths and flange widths under carefully controlled factory conditions to low and uniform moisture contents.

Joists should be protected from the elements supported on suitable bearers over a free-draining surface. Levels of exposure that are more severe than those encountered during a normal continuous build programme should be avoided or addressed by the provision of suitable protection.

Large areas of floor joists can be assembled using these products due to their light weight and availability in long lengths. It is extremely important, though, that adequate safety bracing is provided to ensure that the joists remain stable during the construction phase. Joist manufacturers provide simple guide recommendations to allow the installer to facilitate this process quickly and easily.

Do not allow workers to walk on un-braced joist layouts. Ensure that floors do not become overloaded during construction.

Design

The design of these members should be undertaken in accordance with BS5268: Part 2 using design values obtained from the relevant third party product certification for service classes I and II only. These products are proprietary and cannot be substituted without design verification.

Notching and drilling

Notching and drilling of these products is restricted and should be undertaken in accordance with the reference charts and tables provided by the joist manufacturer.
Under no circumstances should the flanges of the I-joist be cut, notched or drilled.

Standard Details

Components are assembled using standard details, connectors and fixings. Two important details are shown below (See diagrams and) that illustrate the different approach that is utilised when detailing Engineered I-Joists.

Metal web joists

Consists of parallel stress graded timber flanges joined together with V-shaped galvanised steel webs. The webs are fixed to the flanges via nail plates. The open web design gives great flexibility in running through services. Metal web joists should be designed in accordance with BS EN 1995, Eurocode 5 design of Timber Structures. General: Common rules and rules for buildings. Metal web joists should be appropriately CE marked comply with ETAG 011 or hold independent third party certification. Metal web joists must be laid reasonably level and onto suitable solid and level bearings. It is essential that joists are not overloaded during construction. Joints in joists should only be in place over a load-bearing support, or the joint be designed by a qualified Structural Engineer. Joists should be restrained at supports using tightly fitted strutting. The minimum end bearing of the joists should be in accordance with the manufacturers instruction and the site specific design. Generally the minimum end bearing should be no less than 90mm, unless joist hangers are used, where the minimum bearing should be to the manufacturers specifications.

Building in of joists over internal walls

The mortar should be sufficiently dry to reduce the likelihood of shrinkage and should be solidly packed in but should not be packed up tight to the underside of the top flange. All continuous joists must be packed down to the intermediate bearing wall before the floor decking is fixed. (See diagram 8.05)

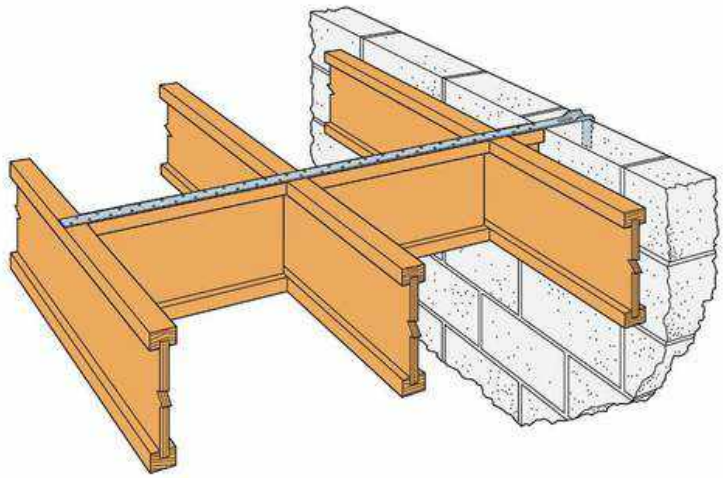


Diagram 8.03: Masonry wall restraint

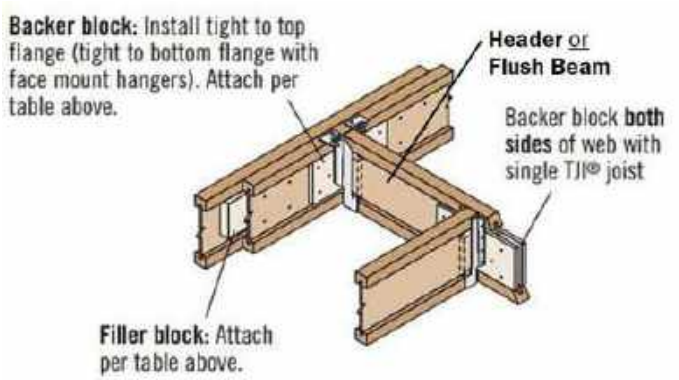


Diagram 8.04: Joist to joist connections

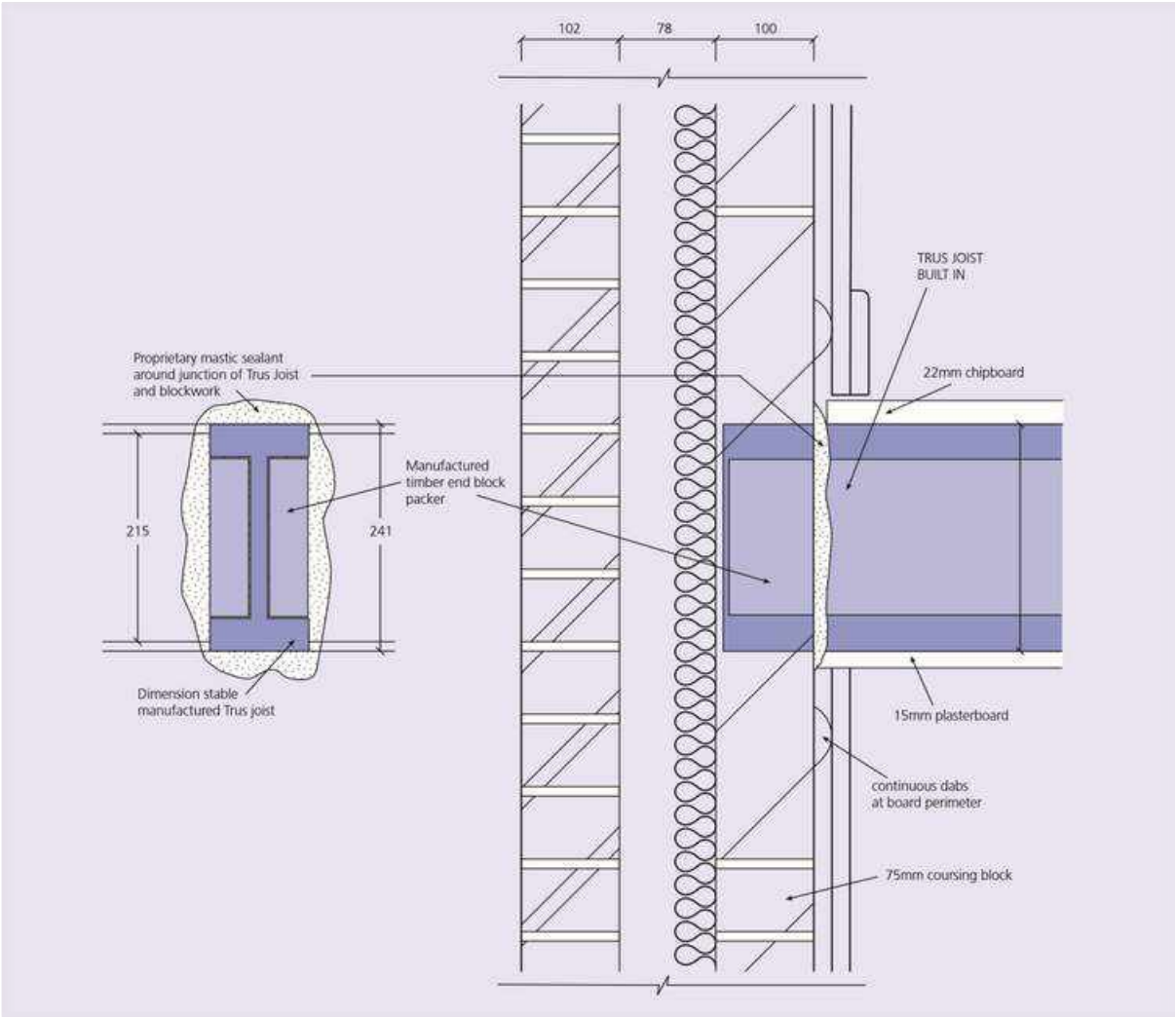


Diagram 8.05: Building in joists

Concrete

General

The quality and type of finish for in situ concrete should be to the standards as set out in BS 8110.

• class 1 finish should be used where surfaces are exposed to view

• class 2 finish should be used where surfaces are to be exposed to view but where appearance is not critical and

• special finish relates to the highest standards of finish where appearance is critical

Finishes for precast products are normally specified by reference to an agreed sample which should be kept on site for comparison with delivered items prior to acceptance.

In situ slabs and beams should be fully propped until the element has achieved its design strength.

Movement joints in large ground floor slabs should be provided in accordance with the recommendations of the British Cement Association publication, ‘‘Concrete Ground Floors’’.

Directly finished in situ concrete floor surfaces should be produced to a level and smooth finish, and to a porosity and texture appropriate for the specified covering.

The maximum permissible movement due to combined shrinkage, creep and deflection of concrete beams, floors and slabs should be as determined in accordance with BS 8110.

Columns, beams and slabs should be constructed level, square and plumb, and without excessive twist.

Precast concrete floor units

Precast or insitu concrete floors should be designed to BS 8110.

Proprietary concrete units of elements will be acceptable if supported by independent third party certificates acceptable to Compariqo or subject to appraisal by Compariqo.

Reinforced concrete upper floors should be constructed in accordance with the designers details without deviations unless specifically agreed with the designer.

Precast concrete units and infill blocks should be carefully stored and handled on site so as to avoid damage occurring before, during and after incorporation into the structure. Units should be lifted as near as possible to their ends.

The bearing surface of walls, beams and other supports to receive precast units should be smooth and level.

Infill blocks and slabs should fully bear onto supporting beams and walls.

Materials should be stored and protected so as to prevent damage by frost.

Reinforcement should be stored so as to keep it free from grease, oil, mud, excessive rust, loose concrete and ice.

Section 9 - External Walls - Doors, Windows & Roof Lights

General

Timber used for external joinery should be of a species classified as suitable in BS EN 942 and preservative treated if not a moderately durable species or better (with sapwood excluded). Guidance on selection is provided in BM TRADA Wood Information Sheets 3.10 and 4.16. Workmanship should follow the recommendations of BS 1186:2.
Preservative treated joinery which is cut or adjusted on site should be liberally brushed with an appropriate and coloured preservative. Where the colour of the preservative will adversely affect the final appearance of the joinery then an appropriate clear preservative should be used.
Bay, oriel and dormer windows require particular care in detailing and fitting so that they are stable, weather-tight and reasonably airtight.
Rooflights should be proprietary components, fixed within prepared openings in accordance with manufacturer's instructions, and have effective weather-sealing.
Non-timber components should comply with the following British Standards (as appropriate) and be installed and fixed in accordance with manufacturer's recommendations:

- BS 4873 Aluminium windows
- BS 5286 Specification for aluminium framed sliding glass doors
- BS 6510 Steel windows and doors
- BS 7412 PVC-u windows
- BS EN 514 PVC-u windows

Windows should comply with the current Building Regulations taking into consideration:

- Means of escape in the event of a fire
- Thermal insulation
- Ventilation
- Safety

Thresholds and sills should be at least 150mm above ground level. Where the top of a threshold is more than 225mm above ground level, steps are necessary.
Where level (threshold) access a high level of supervision and workmanship, together with the correct specification of materials, with consideration given to design, location and exposure.

Wherever possible locate the entrance door away from the prevailing weather and provide a storm porch.
It is recommended that a matwell be constructed within the entrance hall to accommodate the swing of the door without fouling the carpet and/or the proprietary door seal, thus maintaining the integrity of the seal.

External doors and opening lights to windows should be reasonably airtight by ensuring that effective draught seals are fitted.

External joinery should be designed and constructed in accordance with the requirements of the following British Standards:

- BS 4787:1 Internal and external wood door sets, door leaves and frames
- BS 6262 Code of practice for glazing for building
- BS 6375:1 Performance of windows
- BS 644:1 Wood windows
- BS 8213:1 Windows, doors and roof lights

Security

External door leaves should be of a robust construction. Timber doors should be not less than 44mm thick (or equivalent strength for other materials). Flush doors should be of solid core construction. Door stiles to which locks are fitted should be of sufficient width so as not to create a weak point in the general robustness of the door (119mm minimum width recommended for timber). Non-glazed panels should be sufficiently small to prevent access to within the dwelling. See diagram 2.83 in the following pages for hardware to main entrance door. The "throw" of the lock into the frame should be 20mm.

Additional security may be provided within the design and further guidance is given in this section.

Protection from falling

For houses and flats, the guidance in Approved Document K2 specifies a minimum guard height of 800mm to window openings in the external wall. This would normally be achieved by forming window openings at least 800mm above finished floor level. The wall beneath the opening is therefore considered to be the barrier to falling.

Where window openings are formed less than 900mm from the finished floor level permanent guarding should be provided to the opening in accordance with the design requirements specified in Approved Document K2, section 3, para 3.2 and 3.3.

The use of a restrictor stay in this situation is unlikely to be acceptable as guarding, because:

- It is unlikely to resist the loads of someone falling against the window
- It is releasable and therefore not considered to be permanent guarding
- The glazing, frame and fixings would need to be designed to provide containment.

Control of condensation

Minimise the effects of condensation on glazing and frames by:

- using insulated metal frames
- using details which prevent condensation running on to walls or floors
- housing window boards into frames to prevent condensation entering the joint and
- providing thermal insulation to walls at lintels, sills and jambs. Guidance on this subject is provided in BRE report, "Thermal Insulation: Avoiding Risks".

Security

Door frames should be securely fixed and the rebate formed preferably from a solid section. Where planted stops are used, they should be glued, screwed and pelleted.

Door and window frames should be fixed to vertical reveals with corrosion-resistant fixings at a minimum of 600mm centres, the end fixings being located within 150mm of the top and bottom of the frame.

External doors should be hung on 3no. 100mm hinges. A restraint arm or security chain should be provided to main entrance doors.

Main entrance doors should be provided with at least one security lock and keep. If a second lock is fitted it is suggested that this is positioned 600mm away.

A 5 lever deadlock should be provided to other external doors, including patio doors. The lock should comply with BS 8621 (and Euro Norm - 12209) or be of a similar performance standard. Locks to entrance doors of flats should not operate automatically and the deadlock mechanism on the dwelling side of the door should be non-key operated (this is a fire precaution requirement).

On the ground floor, with the exception of kitchens, all habitable rooms should either open directly onto a hall leading to the entrance or other suitable exit or be provided with a suitable window (or door).

External doors (except main entrance doors) and sliding patio doors should be provided with robust bolts at the top and bottom of the closing edge of the door (e.g. 100mm barrel bolts fixed with 30mm No. 8 screws. Where espagnolette multi locking points are provided the bolts can be omitted.

Sliding doors should be designed so that they cannot be lifted out of the frame from the outside.

Letter plates should comply with BS 2911 and either be located not closer than 400mm from the door lock or be fitted with a limited opening flap. Where fitted to a fire resistant door (e.g. flats), the letterplate should not adversely affect the fire resistance of the door.

Windows should be provided with a securing device which cannot be sprung by levering the casement or sash from the outside of the building when in a closed position. A key operated lock should also be provided to all ground floor windows and others which are readily accessible from the outside, either as part of the securing device or as a separate unit.

Rooflights should not be used on single storey or other accessible roofs unless they are specifically designed to provide a deterrent against forced entry and can be locked with a removable key.

Externally located hinge pins should be non-demountable (e.g. welded or disturbed ends).

Emergency Egress Windows in Two Storey Dwellings

With the exception of kitchens, all habitable rooms in the upper storey served by one stairway shall be provided with a window:
• Which has an unobstructed openable area of at least 0.33m²;
• Be at least 450 mm high x 450 mm wide in either width or height.
• The bottom of the openable area should not be more than 1100 mm above the floor.

Installation of doors and windows

Window and door frames should be installed so that:

• they do not carry loads unless designed to do so
• the face of the frame is set back at least 38mm from the masonry face. Masonry on the external side of a vertical DPC should not be in contact with internal finishes
• the window head is set back behind the edge of the cavity tray
• the frame to wall junction is weather-tight and reasonably airtight
• in areas of severe/very severe exposure checked rebates should be provided. The frame should be set back behind the outer leaf and should overlap it as shown in diagram 2.86. Alternatively an insulated finned cavity closer may be used that has third party accreditation for use in this location
• distortion is minimised by not locating radiators or other heaters close to doors.
• the water drip to window and door sills projects beyond the wall or subsill by at least 10mm and the sill edge by at least 25mm.

Fire safety

Fire resisting doors should be fitted with a positive self-closing device.

Any door between a dwelling and an attached or integral garage should be a half hour fire resisting door and frame.

Bay windows

The vertical DPC and cavity closer should be installed as shown in diagram 9.00.

Window and door frames should be installed either by building in tightly as work proceeds, or by fitting into preformed openings, suitably dimensioned to provide an accurate fit for the frame plus the perimeter weather-tight joint.

Timber frame windows and doors can be installed so they abut the masonry. Any gap provided should not exceed 10mm. For gaps less than 5mm the sealant must cover both the frame and the masonry by 6mm. For gaps greater than 5mm a backing strip should be provided behind the sealant. The sealant should have a minimum depth of 6mm.
PVC-U frame windows and doors should be installed with a gap of between 5mm and 10mm to allow for thermal expansion. For large framed units such as patio doors then the gap can be up to 15mm.

Frames should be fixed in accordance with the manufacturer's recommendations or, if no instructions are given, with the following guidance:

• fixings should be at 600mm maximum centres and within 150mm of corners of the frame
• frames should be fixed either by galvanized steel cramps or by non-corrodible screw fixings to the surrounding wall

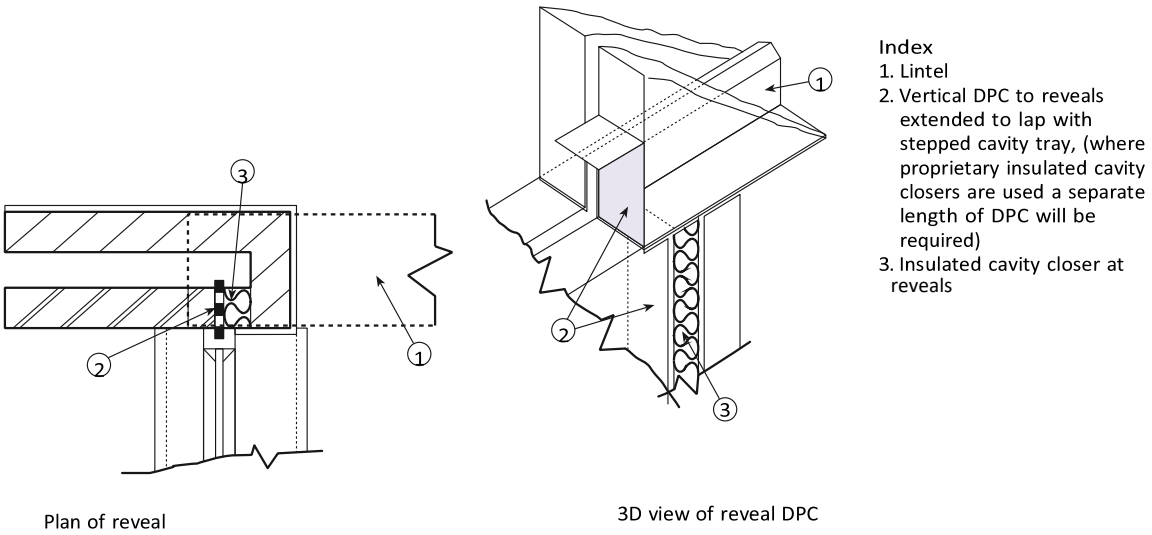


Diagram 9.00:Typical reveal detail showing vertical DPC and cavity closure at bay windows

Glazing

Proprietary materials, possessing third party accreditation acceptable to Comapriqo, should be used to close cavities at window and door openings. They should also be installed in accordance with the manufacturer's recommendations.

Critical Locations

Detailed guidance on this aspect of glazing can be found in Approved Document N to the Building Regulations.

Glazing

Glazing should be in accordance with BS 6262.

Insulated glass units should meet requirements of BS EN 1279-Glass in building-insulating glass units. IGU's should carry third party accreditation. This includes windows in possession of a BBA certificate and timber windows.

- they should have dual seals; single seal units are not acceptable
- desiccant should be provided to every spacer bar
- any glazing on site must have a drained and ventilated bottom bead
- any glazing with an area greater than 1m² must have a drained and ventilated bottom bead
- glazing with an area less than 1m² may be solid bedded
- all spacer bars should be stamped with BS EN 1279
- PVC-U frames and spacer bars should be stamped with BS 7412, 7413 & 7414

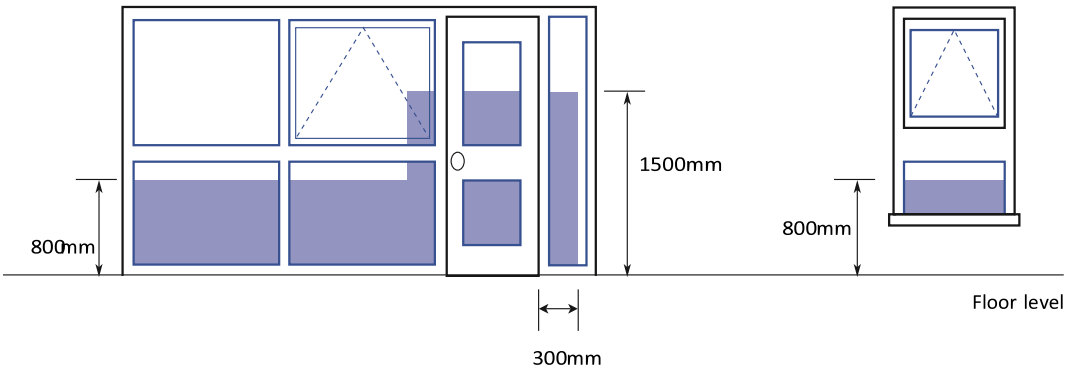
Linseed oil putty glazing should not be used when the joinery is finished with vapour permeable paint or stain, putty glazing should also not be used with organic solvent based stains. Putty should be neatly finished to receive a protective paint coat.

Putty is not suitable for double glazed units.

Workmanship should be in accordance with BS 8000:7.

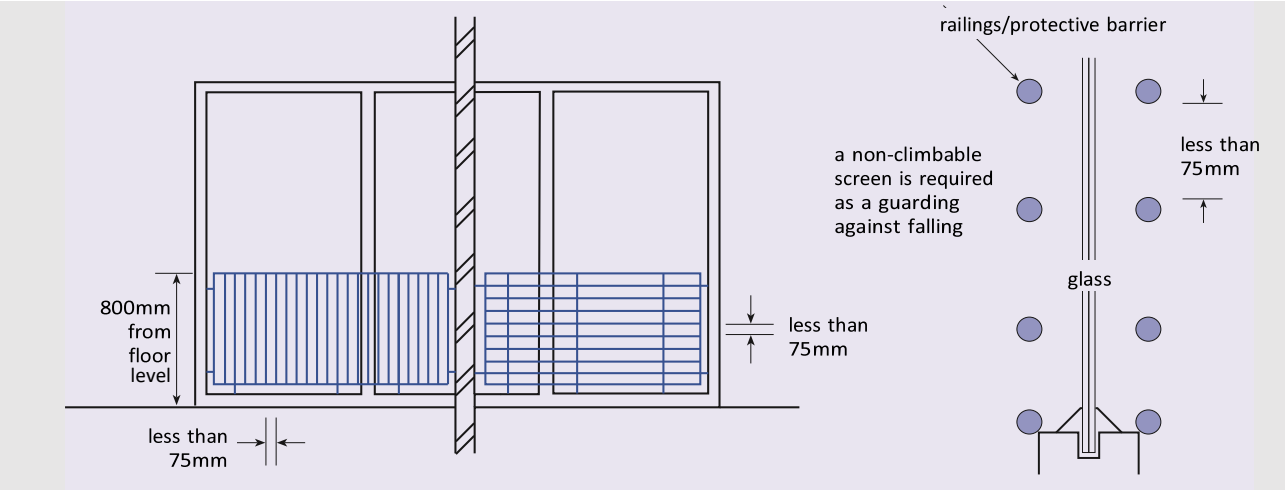
To ensure compatibility of the whole glazing system together with a high level of workmanship and control, it is recommended that factory pre-glazed systems be installed in all external openings.

External glazing beads should be fixed at maximum 150mm centres and the glazing bedded in a non-setting putty. Louvred windows should not be used. Double glazing should be fixed and bedded as recommended by the Glass and Glazing Federation.



Note any areas shaded indicates a critical area, all glazed units within those areas require safety glazing in accordance with BS 6206

Diagram : Critical locations for glazed panels



Section 10 - Pitched Roofs

General Requirements for Timber Pitched Roofs

Statutory Requirements

All structural timber used in a conventional cut roof (i.e. rafters, purlins, ceiling joists, binders and other timber elements) should be stress graded. All such timber must be either stamped as 'DRY' or 'KD' (Kiln Dry).

The use of ungraded or ''green'' timber is not acceptable.

Allowances for Wind Loading

The need for a roof to withstand wind pressure and suction will be met if the proposed roof is braced effectively as discussed elsewhere in this Manual and secured to the structure as detailed below with walls adequately restrained.

Securing of Roofs to the Supporting Structure

Roof timbers are normally supported on a timber wall plate or similar which should be levelled using a spirit level so that loadings from the roof are directed perpendicularly down the supporting wall. The wall plate may as good practice, be fixed to ensure correct positioning when roof timbers or trusses are being installed, by means of galvanised mild steel holding down straps (30mm x 5mm x 1000mm long at maximum 2.0 metres centres) nailed to the wall plate and securely fixed to the inner surface of the wall with compatible fixings. Ensure that holding down straps are provided in areas of severe wind exposure where required by the roof design.

Treatment of Timber

Preservative treatment of roof timbers is normally unnecessary except where specifically required under relevant standards and codes of practice, and in the following circumstances:

• Roof timbers should be preservative treated where the insulation and ceiling line follow the roof pitch (See diagram 2.166)

• The Approved Document of Regulation 7 of the Building Regulations for England and Wales requires that in certain geographical areas, all softwood roof timbers should be treated against attack by the House Longhorn Beetle. The areas at risk are:

• The District of Bracknell Forest
• The Borough of Elmbridge
• The Borough of Guildford (other than the area of the former borough of Guildford)
• The District of Hart (other than the area of the former urban district of Fleet)
• The District of Runnymede
• The Borough of Spelthorne
• The Borough of Surrey Heath
• In the Borough of Rushmoor, the area of the former district of Farnborough
• The District of Waverley (other than the parishes of Godalming and Haslemere)
• In the Royal Borough of Windsor and Maidenhead, the parishes of Old Windsor, Sunningdale and Sunninghill
• The Borough of Woking

The treatment should be impregnation with a preservative suitable for use in hazard class 2 in accordance with BS8417, or equivalent, for a 60 year anticipated service life. Cut ends must be liberally brushed or dipped with an end-grain preservative. It is strongly recommended that where punched metal fasteners are proposed to roof trusses, only micro-emulsion or organic solvent preservatives should be used for timber treatment to limit the possibility of corrosion of the fasteners and so as not to adversely affect glued joints.

Trussed Rafter Roofs

Information and design criteria necessary for ordering BS 5268:3 provides a comprehensive list of criteria that should be supplied by the building designer or site supervisor to the trussed rafter designer/fabricator to enable a design to be prepared. This includes:

• Span of the trussed rafter, wall plate to wall plate plus the width of wall plate at each end
• Pitch of the roof
• Method of support
• Position of support
• Anticipated loading of the roof structure, i.e. the weight of the roof tiles and the exposure of the site should it attract excessive wind loads (See diagram 2.174)
• Position and size of water tanks
• Position and size of openings (i.e. loft hatches, roof windows, chimneys)
• Due to the site locality, any particular preservative treatment necessary for the timber (e.g. to protect against House Longhorn Beetle)
• Eaves details (i.e. overhang required, etc.) (See diagram 2.166).

In return the trussed rafter designer should supply the following details for site use:

• Position, bearing and spacing of trussed rafters
• Position, fixings and sizes of lateral supports to prevent buckling of compression members such as rafters and struts
• Deviations from standard spacings, etc. to accommodate openings
• Support details for water tanks
• •Any special handling equipment.

Site storage

The delivery of trussed rafters should be planned so as to minimise the period of storage necessary on site. When delivered, the trusses should, at all times, be kept clear of the ground and vegetation and be supported by level bearers sited under or adjacent to the points of support assumed by the design.

Erection

It is essential when erecting a trussed rafter roof to ensure that the first trussed rafter is erected and braced rigidly in the correct vertical position so that it provides a base model against which all the other trusses can be set out .Any temporary bracing should not be removed until permanent bracing has been installed. Immediately prior to the fixing of permanent bracing the trussed rafters should be checked again for alignment and verticality.

Fixing

To achieve a stable and wind resistant roof and gable wall structure, the roof must be secured to the gable wall, if applicable, and fully braced by 100 x 25mm timber twice nailed to roof timbers using 65mm long, 3.35mm diameter galvanised wire nails. Where nail guns are used 3.1mm x 75mm long annular ring-shank nails are allowed. They do not need to be galvanised.

Limitations

The details given relate to standard bracing for trussed rafters.

Types of bracing

There are three main types of wind bracing, which should be fixed:

• Diagonal rafter bracing
• Longitudinal bracing
• Chevron bracing (only necessary on trussed rafter spans over eight metres).

Diagonal and longitudinal bracing are required in all trussed rafter roofs and will be provided in accordance with the design
Bracing for wind loads can also be enhanced by adequately fixed tiling battens and/or sarking boards. The ceiling plasterboard (12.5mm thickness) or a similar rigid material will also contribute to the bracing process.

Sarking boards such as moisture resistant plywood (minimum thickness 9mm) and moisture resistant chipboard (minimum thickness 12mm) may provide adequate bracing without the need for additional wind bracing to the roof. Sarking boards should be laid with staggered joints and nailed at 200mm centres on every truss with 50mm long x 3mm diameter galvanised round wire nails.

Sarking boards are commonly used in Scotland.

Diagonal bracing

Diagonal braces should be fixed at an angle of about 45° (but not less than 35° or greater than 50°) to the plane of the rafters (See diagram 2.176). There are other forms of diagonal bracing. BS 5268:3 requires that narrow fronted houses (where frontage does not exceed 6.6 m) adopt a ‘cross’ approach to diagonal bracing. Diagonal bracing is taken up from the wall plate at either end of the roof and cross over in the approximate centre of the roof slope. The crossover should be arranged as in diagram .

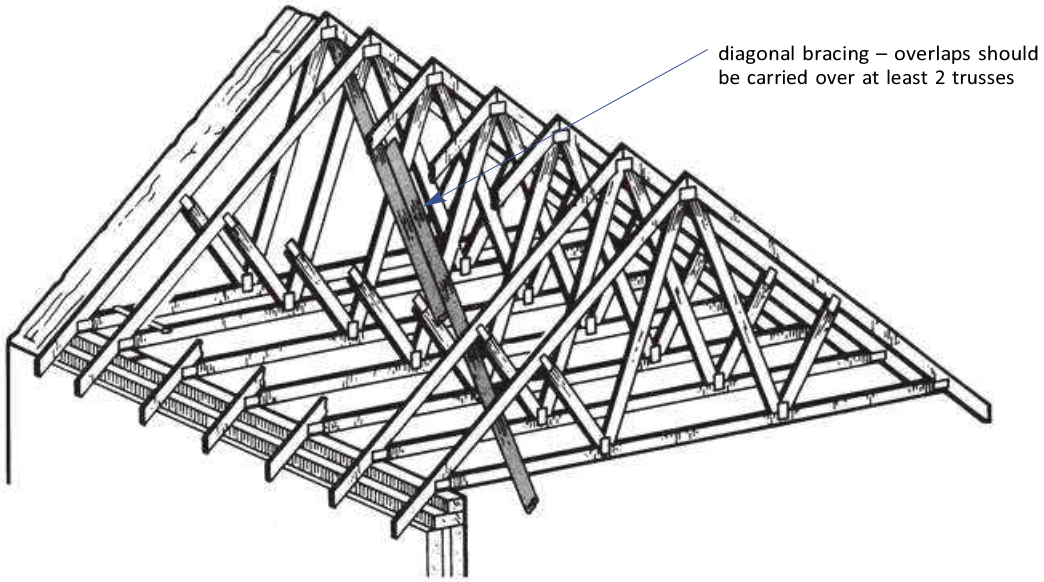


Diagram 10.00- Diagonal Bracing

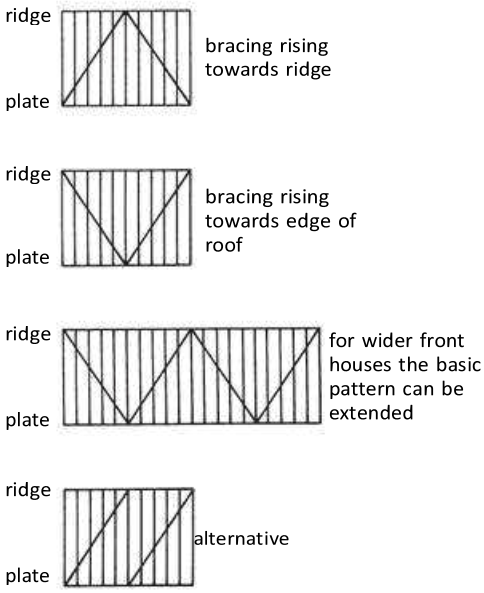


Diagram 10.01

Longitudinal bracing

Longitudinal bracing should be positioned tightly to abut separating and gable walls. In timber frame construction you should ensure that longitudinal braces are fixed to timber frame gables/separating walls to provide additional lateral restraint. Diagram 10.02

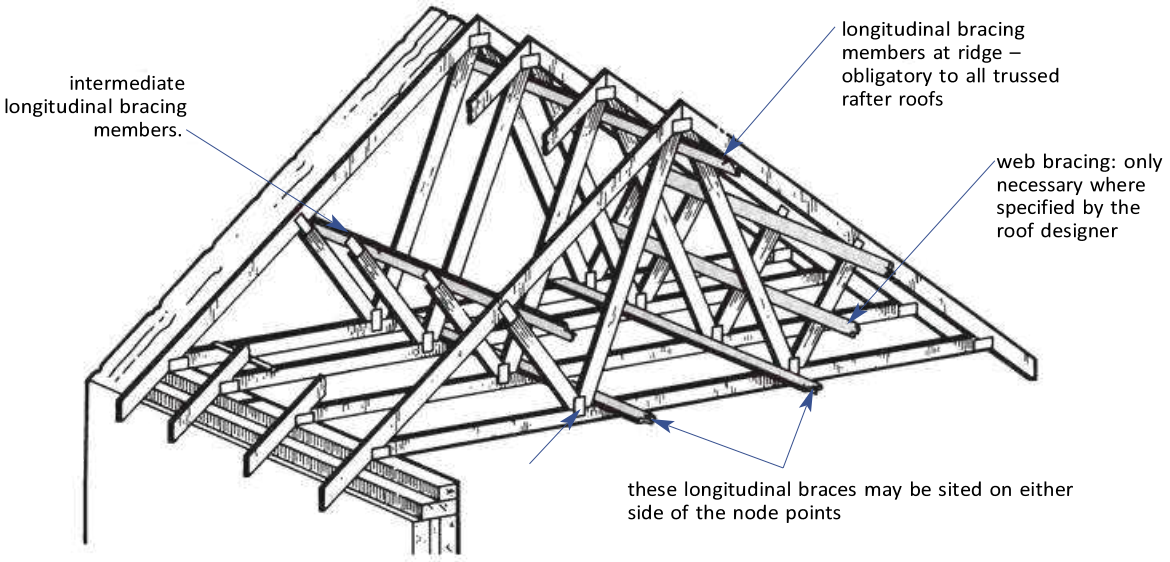


Diagram 10.02: Longitudinal bracing

Chevron bracing is only required for roof spans exceeding 8 metres. Chevron bracing can be identified as diagonal bracing to the web members of the roof truss.

For spans of between 8 and 11 metres such bracing may only be required to a single web member on either side of the roof. For spans exceeding 11 metres more extensive chevron bracing may be necessary.

Chevron bracing is required to the webs in roofs exceeding 5 metres span and also to upright members where inadequate lateral restraint is provided at the apex of the roof. i.e. not connected to a masonry wall or rigid frame cladding. (See diagram 2.180).

Trussed rafters should never be cut, altered or repaired for use without the full agreement of the trussed rafter designer. Remedies for defects to erected trusses can be found in BS 5268:3, but the roof designer's advice should be sought prior to repairs being carried out.

Combined trussed rafter and traditionally framed roofs

Extra care is necessary where the two principal timber pitched roof types are being used in conjunction. The trussed rafters should be specifically designed to accept any additional loadings imposed by an adjacent traditional roof. Similarly, account should be taken of any loadings imposed by trusses on traditional roofs where only nominal loadings have been allowed for. If in doubt consult the roof designer.

Traditionally Framed Roofs

The moisture content of structural timber should not exceed 20% at the time of stress grading and at the time of erection. All structural timber for use within the building fabric should be stress graded marked 'KD' (Kiln Dry) or 'DRY'.

An example of a traditionally framed roof is shown in diagram 2.189. The arrangement illustrated shows the various timber members that make up the roof but the internal configuration of members may vary from roof to roof. Short span roofs can be constructed using rafters and ceiling joists. Ceiling ties or collars are necessary to relieve horizontal thrust from the roof pushing out the walls.

In longer spanning roofs, purlins and binders are used to reduce the effective span of the rafter/joist and avoid the necessity for uneconomic larger dimension timbers.
Purlins and binders should be located at mid-rafter/joist span. Purlins may be located higher in the roof where attic rooms are desired and the roof is to be designed by an Expert.
The purlins/binders should be adequately supported to contribute fully to the roof structure. For example, they could be built into the inner leaf of a gable end wall and supported by struts onto the load-bearing structure at centres specified in the design.

Always ensure that the correct strength class of timber is both ordered and used. Structural timbers are allocated a strength class by BS 5268:2.

The timber supplier will require the following information before supplying timber:

- Type and strength class of timber required.
- Required sizes of timber
- Any treatment required.

The dimensions of rafter, ceiling joist and binder timbers for use in traditionally framed roofs can be found in span Tables for solid timber members in floors, ceilings and roofs for dwellings (3rd edition)'. The section sizes are based on regularised ALS or CLS timber. (England & Wales) with live loadings of 0.75 kN/m2 (snow loading). For other loading situations further guidance can be taken from Approved Document A (E&W), Section 1, Scotland and Part D-N, N. Ireland.

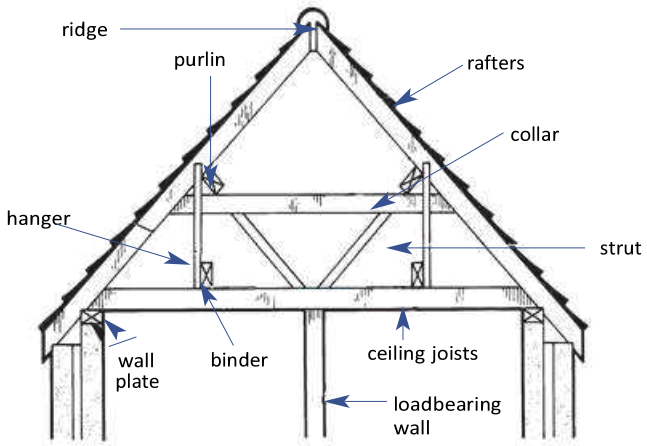


Diagram 10.04: Traditionally framed roof

Weather-tightness

The roof underlay to a pitched roof should be fixed in accordance with the underlay or tile manufacturer's recommendations, with care taken to ensure that water will run off into the gutter, e.g. by use of a tilting fillet where required.

A type 5U quality felt should be used at eaves (above the tilting fillet) and drop into the gutter to prevent solar degradation.

Roofing felt should be fixed with non-corrodible clout nails. Horizontal laps should be not less than 150mm for roof pitches below 35˚, and 100mm for pitches greater than 35˚. Vertical laps should not be less than 100mm and occur only over rafters, to which they should be securely fixed. The underlay should extend into the gutter and the bottom row of tiles should overhang to the centre of the gutter.

Particular care should be taken in ensuring weather-tightness at eaves, verges and valleys. Movement joints should, where required, extend through the roof covering and be adequately weather-proof, or the roof covering should be of a flexible type and designed to accommodate any movement.

Ensure that roof insulation extends fully to perimeter walls in order to avoid cold bridging and that roof ventilators are not obstructed.

Tiling

Since 2014, it has been a requirement of BS 5534: the British Standard Code of practice for slating and tiling, that all single lap roof tiles are mechanically fixed; It is no longer acceptable to have unfixed tiles on any roof.

Tile fixing
All tiles must be fixed. As a minimum, this means that all tiles must be nailed. In addition, a fixing calculation should be run to determine if any extra fixings, such as clips, are required. This will depend on the shape, size and exposure of the building.

Note: It is important to use the correct clips as specified by the tile manufacturer, otherwise, the fixings may not comply with BS 5534.

Perimeter tiles

perimeters are verges, abutments, valleys, hips, first courses at eaves and ridge and edge tiles around roof windows and chimneys etc. All edge tiles at roof perimeters must have at least two fixings. At eaves and ridges, this could be a nail and clip. At verges, it could be a nail and dry verge unit,

Cut tiles

It is always best to set out to avoid small cut pieces. But where these are unavoidable, particularly at hips and valleys, suitable adhesive can be used and will count as one of the two fixings.

Ridge and hip tiles

All ridge and hip tiles must be mechanically fixed, even if they are mortar-bedded. In practice, the best way to comply is to use dry fix systems, such as Sandtoft profile or roll ridge and roll hip.

Double lapped plain tiles

The rules for fixing plain tiles remain largely unchanged. The minimum requirement is for each tile in every fifth course to be twice nailed, with all tiles at perimeters being twice nailed, including the first two courses at eaves and the last two courses at ridge. to determine if any extra fixings are required.

Battens

Battens should be spaced so as to ensure adequate laps at each course and provide a neatly aligned and uniform gauge of tiling over the whole area. While the gauge may be reduced, it should not be increased.

Battens should be preservative treated, (BS 8417, or equivalent, hazard class 2), at least 1200mm in length and span across at least three supports. Sizes for battens are given in table 10.00

Type of slate or tile	450mm span		600mm span	
Slates (double lap)	Width mm	Depth mm	Width mm	Depth mm
Natural: sized or random	50	25	50	25
Fibre cement or concrete	38	25	50	25
Clay and concrete tiles				
Double lap	38	25	38	25
Single lap	38	25	50	25

Table 10.00: Batten sizes

Eaves tiles should be supported by a fascia board or by a batten on a tilting fillet.

Dry verge systems should be fixed in accordance with the manufacturer's recommendations.

Plain tiles should have a tile under course at the eaves.

Verges should be built so as to provide an upward cant and project beyond the supporting wall or barge-board by a minimum of 38mm.
Under cloak courses of fibre cement board, slate or tile should be neatly bedded in cement based mortar, and neatly jointed in line with the face of the verge.

Valleys should be made with purpose made tiles or formed in metal, pvc or other durable sheet materials so as to provide a continuous channel. The junction between tiles and valleys should be neatly jointed with a cement-based mortar. Valley tiles should not be laid below the minimum pitch recommended by the manufacturer.
Hips and ridges should be formed with purpose made tiles of appropriate section, securely bedded and jointed in cement based mortar to true line and level.
Flashings should be fixed in accordance with the recommendations of the Lead Sheet Association and not less than the following:

- soakers in Code 3 lead
- flashings in Code 4 lead
- saddles in Code 4 lead
- valley gutters in Code 4/5 lead
- gutters in Code 5 lead

Generally the length of each piece should not exceed 1.5m.

In timber frame construction, flashings should allow for up to 30mm in vertical differential movement between the roof surface and abutments such as chimneys, parapets and around pipes.

Mortar for roofing work should be 1:3 cement: sand.

Workmanship should comply with BS 8000:6.

Fixing materials

Non-corrosive nails should be used for fixing slating and tiling e.g. stainless steel, aluminium, copper or bronze. Nb. galvanised nails do not have sufficient durability. Aluminium nails should not be used with timber treated with Copper Chrome Arsenic (CCA).

It is common practice to fix roofing battens with ordinary wire nails. However in coastal areas or other regions having an aggressive atmosphere, corrosion resistant nails should be used (e.g. galvanised wire nails).

Where parapet detailing cannot be avoided, the guidance given in the previous section must be followed.

Avoid leaking valley gutters

Valleys are also a common source of roof leaks. Ensure that proprietary gutter linings are fixed in accordance with manufacturer's recommendations. Where valleys are formed by roof pitches that differ by more than 5 degrees the use of preformed valley systems are not generally acceptable. Lead valleys should be used and that lead-lined gutters are

- Made with code 4 or 5 lead sheets 1.5m long with minimum 150mm lap joints
- Fully supported on boarding
- Dressed a minimum of 200mm under tiles and sarking felt and dressed over an upstand fillet
- Have geotextile matting under lead.

Box or hidden gutters

Box gutters should constructed in accordance with the recommendations of the Lead Development Association.
Tiles adjacent to valleys should be secured by neatly bedding in mortar or using a proprietary dry fixing system.

Avoid wind blown rain and snow entering into the roof structure Falls to pitched roofs are dependent on the type of tile and its profile.
The manufacturer's minimum pitch and lap recommendations should be followed in order to prevent ingress of wind driven rain or snow. Larger head laps are often required for falls of less than 25° and smooth finish tiles are often necessary.

Condensation control in roof spaces

Avoid build up of condensation in roof voids

Excessive condensation in roof spaces can cause decay of damp susceptible materials such as timber, plaster, etc. and reduce the efficiency of thermal insulation.
Cold bridges should be avoided at roof/wall junctions by ensuring continuity of thermal insulation (See diagrams 10.05 and 10.06).

All extraction fans should terminate to the outside of the building and not within the roof void.

Venting Pitched Roofs
Ensure that roof spaces to pitched roofs are vented on two opposite faces by a 10mm continuous ventilation gap (25mm if roof pitch is less than 15 degrees). A proprietary tray should also be provided to ensure that the ventilation is maintained where the roof insulation abuts the eaves (See diagram 10.05).

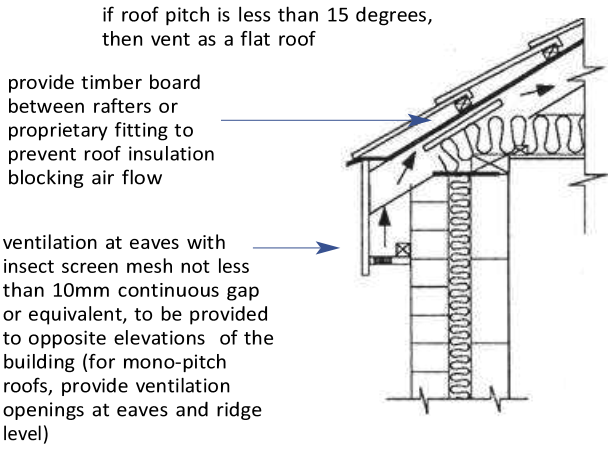


Diagram 10.05: Venting of pitched roof

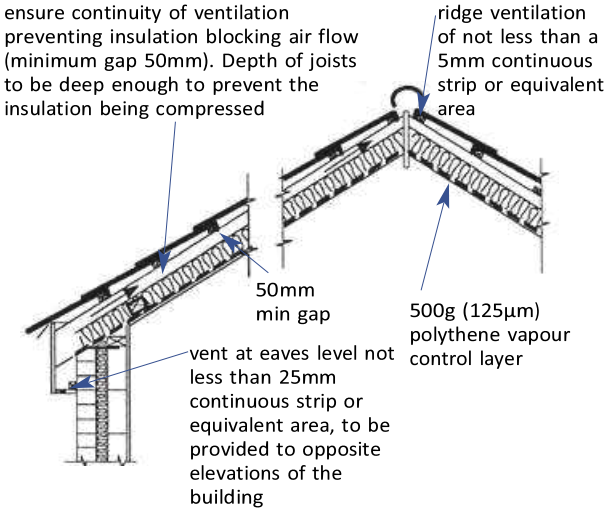


Diagram 10.06: Venting of cold pitched roof

Ceiling following pitch of roof

Provide a 25mm continuous ventilation gap along two opposite eaves and provide additional proprietary ridge or tile vents along ridge line to provide additional ventilation area of 5,000mm2 per metre run (See diagram 10.05).

Should the air flow be blocked, for example by a roof light, the use of tile vents above and below the blockage should be considered to maintain an air flow.

Pitched roof timbers should be preservative treated where the insulation and ceiling line follow the roof pitch (referred to as a cold pitched roof).

Ensure continuity of the ventilation by preventing the insulation blocking the air flow and maintaining a 50mm air gap between the insulation and the felt. This could be achieved by:

- the use of board fixed to battens between the rafters
- the use of rigid insulation fixed to the sides of the rafters

Lean-to roofs

Examples are:

• Mono pitched roofs and situations where a party wall is located parallel to the ridge

• Provide 10mm continuous gap at eaves (25mm if roof pitch is less than 15°) and ventilation of 5,000mm2 per metre run at ridge level using proprietary ridge or tile vents (10,000mm2 run if the roof pitch is less than 15°)

• Small insulated cold pitched roofs (less than 3m2) do not normally need to be provided with cross ventilation.

• Cross ventilation must be provided to insulated flat roofs or where the ceiling follows the pitch of the roof irrespective of its size. In these cases it may be better to consider an alternative design such as a warm roof or the use of a breathable membrane.

Warm Pitched Roofs

Even with the use of vapour impermeable insulant it is necessary to provide means to allow vapour to exit the system. The use of a third party accredited vapour permeable membrane, when used in accordance with the manufacturers' guidance, negates the need to ventilate above the insulation, which may be difficult in roofs with hips, valleys, roof lights and other roofline interruptions

Further guidance on the control of condensation in roof spaces can be found in BS 5250 and BRE publication BR 262 "Thermal Insulation: avoiding the risks" 2002 edition.

Additional guidance for the use of vapour permeable membranes

Alternatively, condensation in warm and cold pitched roofs may be controlled by the use of a Third Party accredited vapour permeable membrane as the underlay in a non-ventilated system. This approach allows for the escape of water vapour through the membrane and exit freely to atmosphere, via laps in the tiles/slates. This method does not require ventilation at eaves, ridges or mid-slope when used in accordance with the manufacturer's guidance.

When using Third Party accredited vapour permeable membranes to control condensation in roof spaces, it is important that the manufacturer's recommendations are followed:

Ridge or high-level ventilation (at the highest point of each roof slope) equivalent to a continuous opening of 5mm should be provided in accordance with BS 5250 where "unventilated cold roofs have insulation placed over a horizontal ceiling and a vapour-permeable underlay (type LR) is used

Particular attention should be given to the fitting of eaves carriers to prevent UV light degradation of the membrane. This will also reduce noise by vibration or 'flapping' of the membrane in the gutter.

The type of roof covering may require the use of ventilation to the batten/counter batten area. Man-made slates and sheet metal profile roof coverings are of particular concern. The use of vapour permeable membranes over sarking boards may require the use of ventilation to the batten/counter batten area.

For guidance refer to diagrams 10.07 and 10.08. A service is usually offered by manufacturers to perform dew point calculations. This will confirm the suitability of the system and compliance with the recommendations in BS 5250.

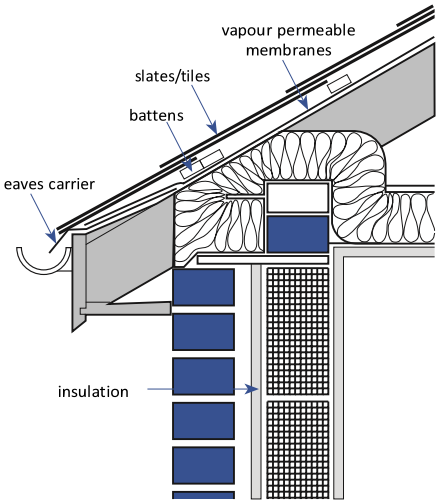


Diagram 10.07 Vapour permeable membrane at eaves

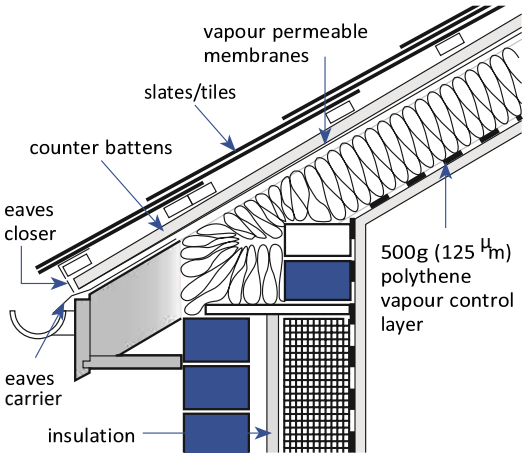


Diagram 10.08: Vapour permeable membrane at eaves with sloped ceiling

Roof void Access

Ensure that roof spaces are accessible and that the access hatch or door is located in a safe place e.g. not over a staircase. The access hatch should be not less than 520mm in either direction, located between structural members, a proprietary hatch is recommended and fitted with an effective draught seal, insulated and sealed to the surrounding construction in accordance with the manufacturers instructions.

Workmanship should be in accordance with BS 8000:8.

Flat Roofs

Please note: Flat roof coverings require an Insurance backed guarantee covering both materials and workmanship.

General

The moisture content of structural timber should not exceed 20% at the time of stress grading and at the time of erection. All structural timber for use within the building fabric should be stress graded marked 'KD' (Kiln Dry) or 'DRY'.

Flat roofs should be designed as either:

• warm deck roofs,
• inverted roofs or
• ventilated cold deck roofs.
• A flat roof should be regarded as having a maximum
• slope of 10° from the horizontal
• "Decking" or "deck" is the substrate of a flat roof or
• the upper surface of a balcony

Flat roofs should be laid to a minimum fall of 1 in 40 or to a fall in accordance with manufacturers details

Where a cold deck roof is used, ensure that a vapour control layer and minimum ventilation is provided in accordance with BS6229. The vapour control layer should be carefully fitted with lapped joints and no perforations (See diagram 10.11).

Glass fibre Reinforced Plastic (GRP) roof systems are acceptable where designed and installed to the manufacturer's recommendations.

Flat roof construction should comply with the following:

• All roof timbers (with the exception of inverted warm deck roof timbers) to be preservative treated to BS5268:5 with all site cut ends treated
• Weatherproof covering
• Chipboard should not be used as a decking material (exterior quality WBP plywood is recommended)
• The design, workmanship and selection of materials should comply with Model Specification Sheet P.L.1 Built-Up Roofing: Plywood Deck, published by the British Flat Roofing Council.

• Work on site should comply with BS8000:4.

Flat roofing systems should not be laid during wet weather or when the roof deck has not fully dried out.

Metallic roof trims should be of a non-corrodible material and resistant to sunlight. In addition to the manufacturers recommended fixings, roof trims should be fixed within 30mm from any joint.

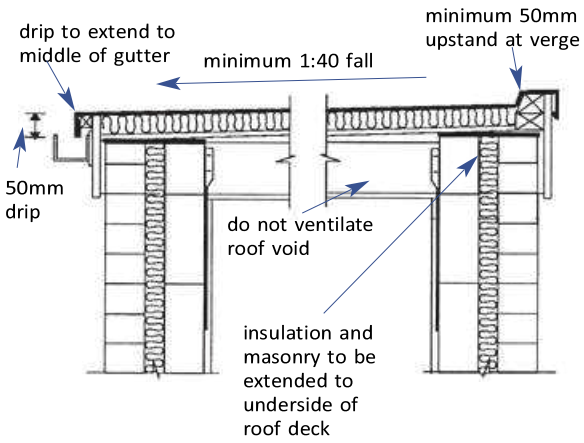


Diagram 10.09: warm deck flat roofs – details at eaves and verge.

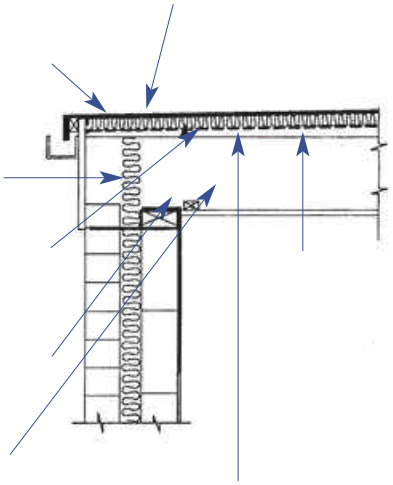


Diagram 10.10: Typical warm deck flat roof

Venting Flat Roofs

Warm deck flat roofs should be used in preference to cold deck flat roofs (See diagrams 10.09 and 10.10Cold deck flat roofs are not permitted in Scotland.

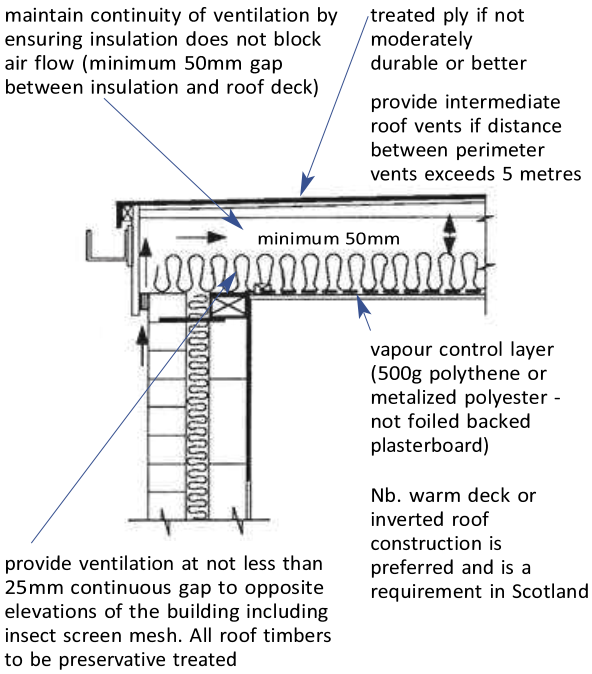


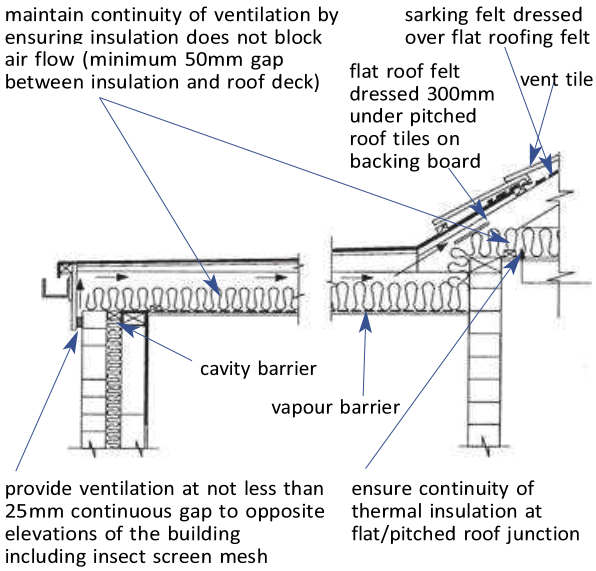
Diagram 10.11 Venting of cold deck flat roof

Where cold deck flat roofs are used, the roof void should be vented along two opposite faces by a 25mm continuous gap and a vapour control layer provided to the warm side of the insulation (See diagram 2.204).

Where the span of cold deck flat roofs exceeds 5m, additional provision for ventilation should be made at mid-span using proprietary roof ventilators providing a ventilation area of not less than 50% of the required rate for perimeter ventilation.

Venting junctions at pitched and flat roofs

Provide 25mm ventilation to eaves of cold deck flat roof and 10mm to eaves of pitched roof, ensuring continuity of ventilation at the flat roof/pitched roof junction (See diagram 10.12). In the case of a warm deck flat roof (which is not ventilated) abutting a pitched roof, provide tile vents adjacent to the roof junction to give a ventilation area of 10,000mm2 per metre run (See diagram 10.12).



Nb. warm deck roof construction is preferred and a cold deck is not permitted in Scotland

Diagram 10.12 : Venting of pitched/cold deck flat roof junction

Rainwater gutters and downpipes

Ensure downpipes discharge directly to a drain

Rainwater downpipes should not discharge directly onto adjacent flat roofs or gutters as this can cause dampness and staining of walls and early failure of flat roof surfaces. Downpipes should discharge directly to a drain or gully (gullies must be trapped), not on to gardens or highways.

During construction downpipes should be connected as early as possible to a drain in order to avoid rainwater discharge weakening the strength of the foundation subsoil

Avoid overflowing rainwater gutters

Where appropriate, rainwater gutters and downpipes can be sized in accordance with the Building Regulations or BS 6367/BS EN 12056.

Advice can also be obtained from product manufacturers.

200mm

Downpipes to be located a minimum of 200mm from the building corner

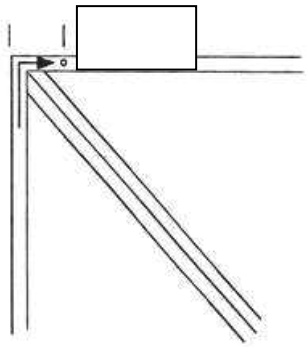


Diagram 10.13: Location of downpipes - corners

Provision of gutters and downpipes

Roofs greater than 6m2 in area should be provided with rainwater gutters and downpipes. Consideration should also be given to the provision of rainwater drainage to roof areas less than 6m2, e.g. dormer and porch roofs.

Discharge of gutters into downpipes can be substantially improved by careful location of downpipes e.g.:

- Where more than one downpipe is required, locating downpipes at end quarter positions will double the flow capacity.
- Where changes in the line of the gutter occur, the downpipe should be located within 200mm of the change in direction in order to maintain the flow capacity of the gutter (See diagram 10.13).

type of surface	Effective design area (m2)
paved areas	plan area
flat roof	plan area of roof
30° roof pitch	plan area x 1.29
45° roof pitch	plan area x 1.50
60° roof pitch	plan area x 1.87
70° roof pitch	elevational area x 0.5

Table 10.01: Calculation of roof area

Guidance for design of Gutters

First calculate the area of roof to be drained (See table 10.01).

Next decide which gutter size is appropriate for the designed roof plan area (See table 10.02).

Max effective roof area (m2)	Gutter size (mm dia)	RWP. outlet size (mm dia)	Flow capacity (litres/sec)
6.0	-	-	-
18.0	75	50	0.38
37.0	100	63	0.78
53.0	115	63	1.11
65.0	125	75	1.37
103.0	150	89	2.16

Diagram 10.02: Gutter Size

Avoid deformed gutters and downpipes

Gutters should not have a backfall and should preferably slope to downpipes at a 1 in 350 fall.

Gutters and downpipes should be fixed at centres as recommended by the manufacturer. Typically gutters require brackets at 800 – 1000mm centres and downpipes at 1800 – 2000mm centres.

Downpipes should not be located closer than 300mm to balanced flue outlets.

Avoid leaking internal gutters

Internal gutters and associated gutter outlets are common sources of roof leaks. Wherever possible, rainwater should drain to the outer edge of the roof and discharge into an external rainwater gutter.

Avoid ponding on flat roof surfaces

Rainwater should efficiently discharge to a gutter without causing ponding of the roof surface. If ponding occurs, the life of the weatherproof membrane may be reduced.

Provide a minimum 1:40 fall for flat roof decking

Although slopes as low as 1:80 provide flat roofs with an adequate self-draining fall, in practice greater falls are necessary in order to accommodate inaccuracies in levels of supporting walls and the permanent deflection of the roof structure under its own weight.

Ensure that rainwater discharges effectively into roof gutters

Flat roof drips should extend to the middle of the rainwater gutter and a minimum 50mm turndown provided.

Verges to flat roofs should be provided with a minimum 50mm upstand in order to prevent blown water spilling over non draining edges.

Balconies

Balconies should comply with the following:

• Balconies functioning as roofs shall have adequate rainwater disposal to a suitable outfall.
• Balconies and flat roofs to which persons have regular access other than for maintenance shall be guarded adequately.
• Balconies and flat roofs including associated elements such as support and guarding shall be designed to resist the applied loading and should be calculated in accordance with BS 6399 and have adequate durability.
• Structural design shall be undertaken to a recognised standard to ensure that loads are transmitted to the supporting structure without undue movement and should be in accordance with BS 5268 and BS 8103 for timber and BS 8110 for concrete.
• The durability of the structure should be 60 years.

The use of timber in balconies should be limited to secondary elements which are in turn are supported by materials other than timber. Timber can be used in the following circumstances:

• Cantilevered solid timber joist balconies with a waterproof membrane above the joist
• Open balcony constructions with timber decking.
• The decking may be supported on solid timber joists which are supported by materials or components other than timber
• Balustrading.

Timber should not be used for:

• Gallows brackets supporting a balcony
• Posts or columns supporting a balcony
• Guard rails or their support

Guarding to Balconies

Guarding should be provided to the perimeter of all balconies, unless the drop is less than 600mm. The minimum height of guarding should be 1100mm and should be designed as follows:

• The balustrade should not be easily climbed
• No opening in the balustrade should be large enough for a 100mm diameter sphere to pass through
• Any glazing should be toughened or laminated glass or glass blocks. Wired glass is not safety glass and should not be used
• Balustrading should not be fixed through the weatherproofing unless special precautions are taken

Falls

Balconies should be designed to have a fall of not less than 1:40. To ensure that balconies and flat roofs have an adequate finished fall of 1:80, twice this figure (1:40) should be used for design purposes unless a detailed analysis of the roof is carried out, including overall and local deflections.
Falls should be away from and parallel to the dwelling.

Suitably drained decking may be incorporated above the waterproofing but less than 150mm below the sill.

Where a balcony or flat roof has an upstand on all sides, an overflow outlet should be provided through the parapet walls or perimeter upstands to prevent build-up of water. The size of the overflow should be the same size as the outlets. (See diagram 10.14).

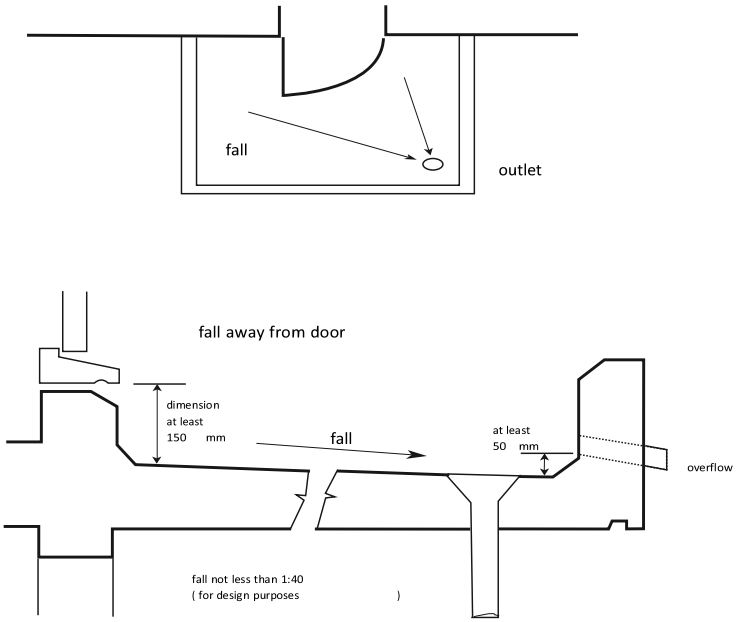


Diagram 10.14: Balcony Falls

Section 11 - Internal Works - Floors

General

Fire resistance

All floors should have the fire resistance required by the relevant Building Regulations.

I-Joists and metal web joists may require a different specification for the ceiling than that for solid timber joists to achieve the same fire resistance.
Ceilings should not be perforated (e.g. for downlighters) unless it can be shown that the floor construction achieves the required fire resistance.

Fire stopping

Penetrations in floors between dwellings shall be fire stopped. There should be no holes or gaps for smoke to penetrate once the fire stopping has been installed. Where downlighters are incorporated in a ceiling they should be incorporated in accordance with the manufacturer's instructions.

Thermal insulation of ground floors

Provide an effective and durable layer of thermal insulation to ground floors (this includes floors to habitable basements).

Where required, thermal insulation should be provided to ground floors to achieve a U value of not greater than 0.25W/m2K.

Thermal insulation materials subject to load (e.g. where located below slab, screed or boarding) should possess current independent third party certificates acceptable to Compariqo be laid in strict accordance with the manufacturers instructions. The design should take into account DPC and DPM positions to prevent moisture transfer and the avoidance of thermal bridging with element junctions.

Other points to remember:

• The floor slab must be smooth and level prior to laying the insulation
• Irregularities up to 10mm may be removed by lean mix screed adequately compacted
• Concrete slabs should be left as long as possible to dry out prior to laying of the insulation
• Non T&G board joints should be screw fixed to battens eg. at door openings
• Protect thermal insulation from damage whilst laying floor screed or deck
• Special care should be taken to ensure that where timber boarding is used as a finish it is laid in dry conditions in a weather-tight building after all wet site operations have been completed • Insulate water pipes located in voids below suspended floor slabs.

Screeds

General

• The dwelling should be made weather-tight before finishing materials are stored or fixed within the dwelling
• Finishes should be compatible with the supporting surface
• Exposed corners and edges of surfaces which do not have sufficient impact or wear resistance should be provided with a suitable strengthening bead or edging strip
• Movement joints should be provided where required in order to minimize cracking or warping due to expansion, moisture or other causes
• Movement joints should also be provided to finished surfaces to coincide with movement joints which occur in the structure where required.

Screeds to sheet and tile flooring should comply with BS 8203. Care is needed when choosing adhesives. They must be compatible with screed.
Monolithic screeds should be laid within 3 hours of the subfloor being laid and be no less than 12mm and no greater than 25mm thick (See diagram 11.00).

Unbonded screeds should be a minimum 50mm thick (See diagram 11.00).

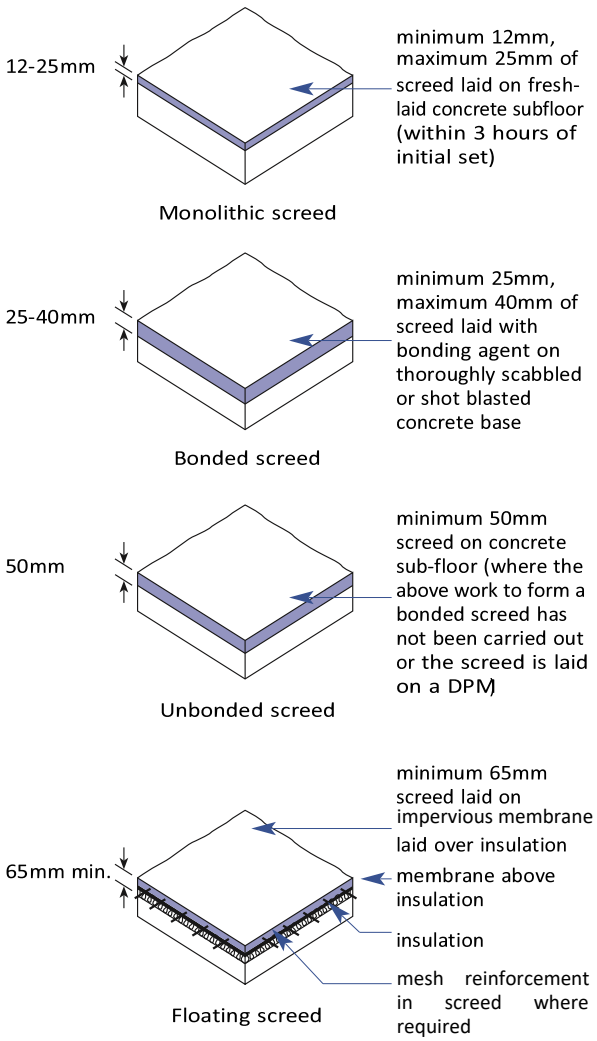


Diagram11.00: Types of screed

Bonded screeds should be laid on a thoroughly scabbled or shot-blasted concrete base. The screed thickness should be between 25mm and 40mm (See diagram 11.00). An allowance should be made for deviations in the level of the concrete base. To achieve a minimum thickness of 25mm overall, a design thickness of 40mm may be required.

Floating screeds (screeds laid over an insulating material) should be a minimum 65mm thick.

A layer of D49 or D98 mesh reinforcement should be placed centrally in the depth of the screed if the room size is more than 15m2. A layer of impervious sheeting should be provided over open cell or other porous insulating material (See diagram 11.00)

Screeds in excess of 30m2 should be provided with shrinkage joints.

For screeds, a cement and sand mix of 1: 3 to 4 1/2 by weight should be used. For screeds exceeding 50mm, a concrete mix of 1: 11/2 : 3 (10mm aggregate) can be used.

Before laying a screed or applying a damp-proof membrane, the surface of the supporting slab should be thoroughly cleaned of plaster, dust, loose debris, oil, etc. Concrete subfloors should not be contaminated with any substances that may have a harmful effect on the screed finish.

Screeds should be fully cured and protected against damage prior to laying of the floor covering.

Proprietary screeds should be laid in accordance with the manufacturer's instructions.
Ensure that PC beam and block floors possess current independent third party certificates acceptable to Compariqo and are:

- Fully supported by loadbearing walls
- Not damaged in any way

Laid as specified by the designer and the independent third party certificates acceptable to Compariqo.

Ensure that:

Beams and blocks are grouted together with a 1:6 cement/sand mix or in accordance with the manufacturer's instructions.
Screeds in garages are reinforced with minimum A98 steel mesh to distribute car loads alternatively are to the manufacturer's/engineer's requirements.

Mixing

Materials should be thoroughly mixed in correct proportions on a clean surface.

Materials should be frost-free at the time of mixing.

Screed materials should be mixed in force-action mixers.

Free fall drum mixers should not be used.

Flexible Floor Coverings

Sheet and tile flooring should comply with BS 8203:2017.

Floor finishes should not be laid until the slab/screed has dried out.

Where it is necessary to use a self-levelling compound to achieve the required quality of finish for the support, the manufacturer's recommendations should be followed.
Where sheet or tiled vinyl is laid on timber floorboards, a sheeting such as 6mm conditioned hardboard, or 4mm plywood should be laid first to give a smooth finish (unless T&G chipboard or a similar level surface is already provided). The sheeting should be securely fixed to the floor.
Floor coverings should always be fitted in accordance with the manufacturer's instructions.

Joints between floor coverings should be even and regular as is appropriate to the material.
Cutting and trimming should be carried out neatly.
Floor finishes should be cleaned and adequately protected until the dwelling is handed over.

Floor tiling

Rigid tile flooring should comply with BS 5385.

Adhesives are to comply with BS 5980.

Mortar for fixing floor tiles should be as recommended by the tile manufacturer and must be compatible with the subfloor.
Surfaces should be dry, clean and free from any substances that may adversely affect the bonding.
Tile grouting should be selected to suit a particular location. Joints should be thoroughly filled and surplus grout removed. Flexible watertight joints should be provided between sanitary or fixed kitchen units and a tiled surface.

Tiles should be laid reasonably square and to the designed pattern.

Work on site to be in accordance with BS 8000:11.

Floor surfaces that are exposed to rainwater should be laid to self-draining falls connected to a rainwater outlet.

Internal Works - Walls

Timber Partitions

Loadbearing and bracing internal walls should be designed by an Expert and should not be modified without approval.
Partitions should be:

• Adequately supported so as not to be subjected to excessive vertical movement
• Constructed so as not to support any loadbearing elements unless specifically designed otherwise
• Accurately set out and aligned so as to produce a level, plumb and plane surface, ready to receive the wall lining
• Located parallel or perpendicular to the main structural walls unless specifically designed otherwise.

Partitions bearing onto ground supported slabs should be provided with a damp proof course where required by the Building Control Authority.

General

• Partitions should be robust and form a smooth, stable, plane surface to receive decoration
• Supporting members should be accurately spaced, aligned and levelled
• The tolerance of horizontal straightness of a partition should be ±10mm over a 5 m length
• The deviation in vertical alignment of a partition in any storey height should be ±10mm
• Timbers supporting plasterboard should be regularised and have a moisture content not greater than 20% at the time of erection. (Lower moisture contents can reduce the incidents of nail popping and other effects of shrinkage)
• Additional guidance can be found in BS 8000:8 and BS 8212.
•

Studs should be not less than 38mm wide and not less than 63mm thick (up to a maximum partition height of 2.4m) and 89mm thick (up to a maximum partition height of 3.0m). However, in order to accommodate tolerances for plasterboard fixing, a minimum width of 44mm is recommended.

Head and sole plates should consist of single length members fixed to the building structure at not less than 600mm centres (See diagram 11.01).

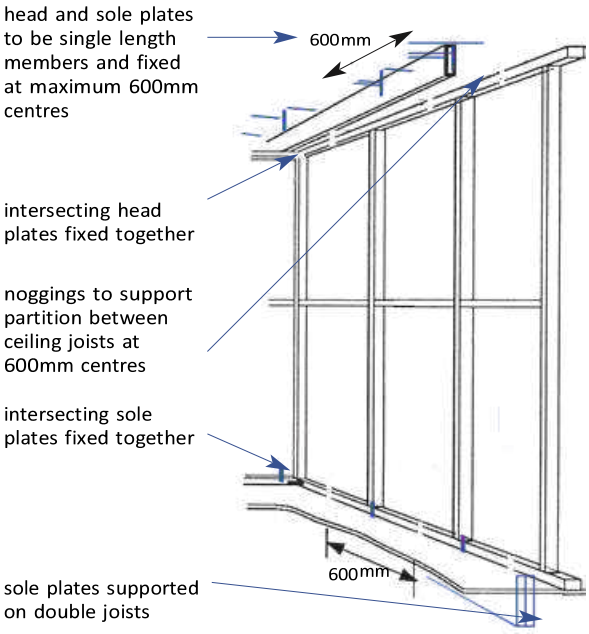


Diagram 11.01: Head and sole plates

Partitions should be located on double joists when parallel to floor joist span and nailed to 50 x 50mm noggins fixed between ceiling joists at 600mm centres when parallel to ceiling joist span. For short lengths of partitions (1.2 m maximum) blocking between joists at 600mm centres may be used. Intersecting head and sole plates should be skew nailed together (See diagram 11.01and 11.02).

Timber members should be fixed together with minimum 2 No. 75mm long x 2.65mm diameter nails.

Partitions which support wall tiles should be constructed with 12.5mm plasterboard fixed to studs at 450mm maximum centres. Where studs are at greater centres, provide noggings at 600mm centres

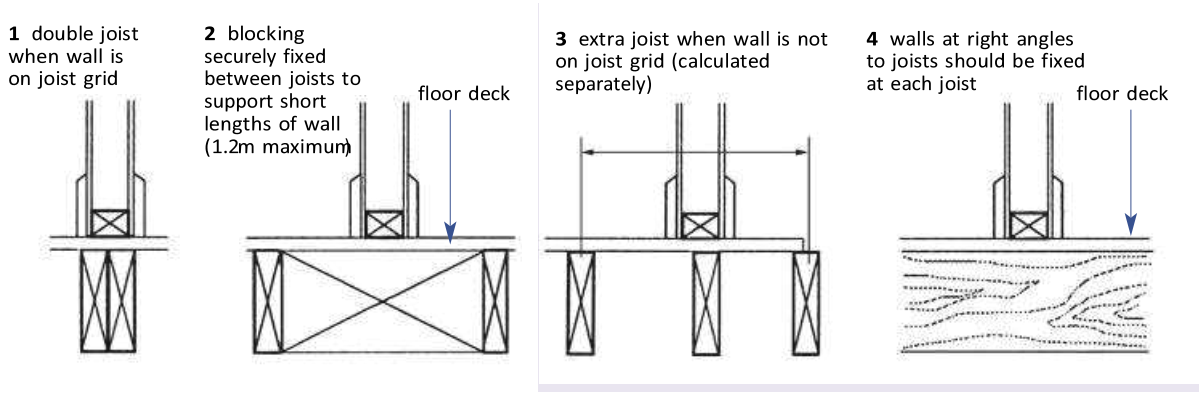


Diagram 11.02: Supporting of non loadbearing internal studwork partitions

Avoid horizontal joints in plasterboard. Where this is unavoidable (e.g. excessive floor to ceiling heights), provide noggings at joint locations and stagger the joints.

Stud members should be nailed or screwed to abutting walls and partitions at maximum 600mm centres.

Unless designed by an Expert, holes for electrical services may only be drilled on the centre line of timber studs between 0.25 and 0.40 of the stud height. Maximum hole size is 0.25 of the stud depth.

Timber studs should not be notched.

All plasterboard edges to partitions (including bound edges) should be supported by noggings.

Openings should be trimmed with minimum 38mm wide noggings.

In the case of full height boards, noggings should be provided at mid-height in order to prevent studs from twisting and provide additional rigidity.

Fixings

Additional reinforcement framing should be provided to support medium to heavy fixtures, e.g. radiators, wall cupboards, etc. Lightweight fixtures should be supported using proprietary fixings.

Many proprietary fixings for dry wall linings i.e. stud walls are readily available for fixing wall shelves and pictures. Any system used should be suitable for the wall type and the end use loadings applied. All installations should be in accordance with the manufacturers instructions.

Fixing of plasterboard

- All cut and bound edges of partitions should be provided with noggings
- Perimeters of all boards should be provided with noggings. However, when 15mm plasterboard is fixed at right angles to timber framing at centres not exceeding 600mm then noggins are not required
- Manufacturers' recommendations should be followed. Table 3.02 is provided for fixing guidance
- Fixings should be positioned not closer than 13mm to unbound edges (10mm from bound edges) or 6mm to edges of timber supports. (See diagram 11.03)
- Partition boards should be fixed with at least 8 nails per metre along each supporting member or spaced at approximately 150mm centres (See diagram 3.13). Screw fixings are recommended at 230mm centres for ceilings and 300mm for walls.

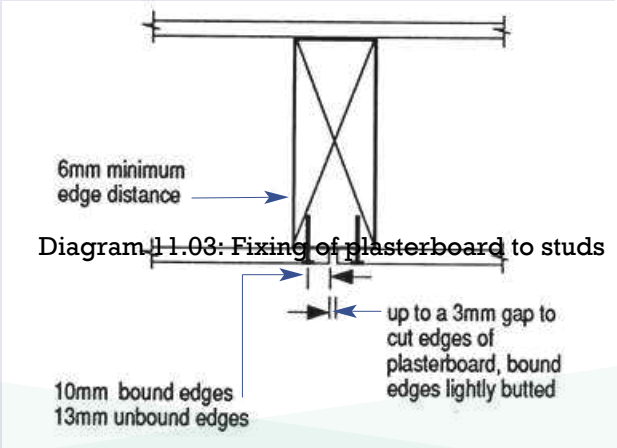


Diagram 11.03: Fixing of plasterboard to studs

Nail popping

Unsightly nail protrusion can be reduced by:

• Lowering moisture content of timber to that recommended by BS 5286: Part2.
• Nailing or preferably screwing plasterboard tightly to the timber framework.
• Avoiding overdriven or skewed nails puncturing the paper of the board.
• Not forcing boards to fit. They will bow and prevent secure contact with the frame.
• Avoiding fixing to twisted or misaligned framework.
• Driving home nails that are not securely driven into framing and re-fix in new ones.

board board width maximum thickness spacing of studs	
9.5mm	900mm 450mm
9.5mm	1200mm 400mm
12.5mm	900mm 450mm
12.5mm	1200mm 600mm

Table 11.00-Thickness of plasterboard

Where the partition separates a bedroom from a bathroom area it may be necessary to increase the thickness/weight of the plasterboard to achieve the required sound insulation.

non-timber partitions

Metal studs system

There are a number of proprietary systems on the market. Generally they consist of "U" shaped channels which act as ceiling (head), base plates (tracks) and the vertical studs. These systems are lightweight, versatile and quick to erect.

Installation should always be carried out in accordance with the manufacturer's instructions. Plasterboard coverings are screw fixed to the metal studs, with, generally, the perimeter studs/tracks being mechanically fixed to the surrounding walls, ceilings and floors.

It may be necessary to provide earth-bonding to the metal stud system. Please refer to your NEIC registered contractor

Other systems

Other proprietary internal non-loading bearing walling systems are available. Systems such as plasterboard walls with solid or hollow cores are commonplace and are generally accepted by Q, provided it can be shown that they are rigid enough to accommodate the predicted working and impact loads, and are designed to be suitable in performance for the environment in which they will be used.

Masonry partitions

Masonry partitions should not be supported on timber floors or beams unless designed by an Expert and the timber can be proven to be sufficiently dry and/or the masonry is reinforced. Generally, they should be supported by suitably designed steel beams or be built off ground floor masonry partitions provided with a foundation.

Dry lining

Fixing plasterboard direct to masonry can be achieved either by a proprietary mechanical system (in accordance with the manufacturer's instructions) or by plaster dabs (See diagram 11.04), the latter being the most commonly used form of dry lining for masonry construction. When using plaster dabs it is important to use a proprietary bonding (adhesive) plaster compatible with both the board and the background masonry.

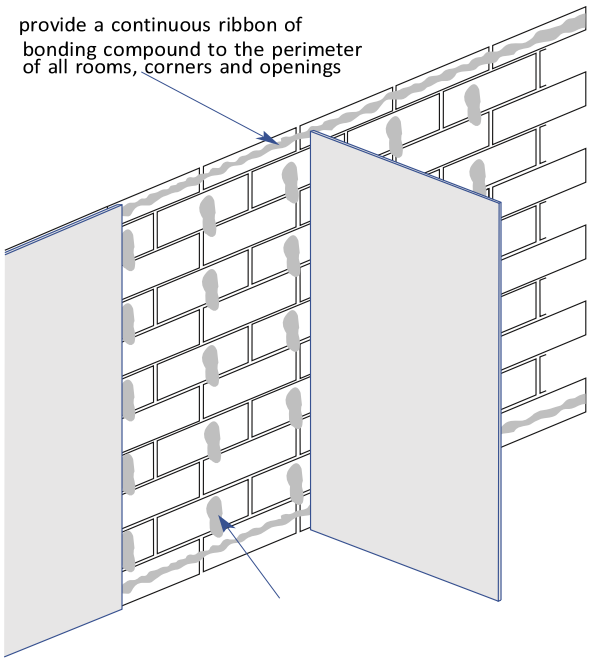


Diagram 11.04

It is also necessary to provide sufficient dabs (adhesive) together with a continuous ribbon to all room perimeters (floor, ceilings, corners and all openings). This prevents air movement (heat loss) behind the lining, it also assists in sound attenuation.

Finishes

General

• The dwelling should be made weather-tight before finishing materials are stored or fixed within the dwelling
• Wall linings should have a resistance to impact loads not inferior to that obtained from 9.5mm plasterboard continuously supported at 400mm centres
• Finishes should be compatible with the supporting surface
• Exposed corners and edges of surfaces which do not have sufficient impact or wear resistance should be provided with a suitable strengthening bead or edging strip
• Precautions should be taken at the junction between different surfaces to minimize cracking or warping occurring in linings due to expansion, moisture or other movement
• Movement joints should be provided to finished surfaces to coincide with movement joints which occur in the structure, where required
• Linings should not extend below any DPC or DPM.
• Wall linings should meet an appropriate British Standard or be assessed as suitable by an independent testing authority and be installed in accordance with the manufacturers instructions
• Plasterboard linings should be fixed plumb
• Moisture resistant boards should used in bathrooms and shower rooms

Direct decoration finish

Jointing should be carried out in accordance with the manufacturer's instructions.

Gaps greater than 3mm should be filled with jointing compound and allowed to set.

For joints and internal corners, apply a continuous thin layer of compound with tape pressed firmly into the joint ensuring no air bubbles remain. Immediately, apply a layer of joint compound flush with the surface. Once set, a final layer of feather-edged joint finish should be applied.
Galvanised metal beading or better should be provided to external corners firmly bedded in jointing compound and allowed to set.

Plastered finish

Gaps between boards and all nail holes should be filled with plaster. A nominal 50mm paper tape or glass fibre mesh tape (or other suitable joint reinforcement material) should be bedded over all joints and internal corners.

Galvanised metal beading trim should be provided to all external corners. The trim should be fixed to the plasterboard with corrosion-resistant nails or dabs of finish plaster at 600mm centres.

Internal Plastering

Internal plastering should comply with BS 5492.

Wall paper and fabric finishes

Surfaces to be papered should be dry, thoroughly cleaned and prepared to provide a flat even surface. Where necessary, surfaces should be sealed or sized to reduce their porosity. Adhesives should be as recommended by the paper or fabric manufacturer. Surplus adhesive should be removed from the finish and any surrounding surfaces. Work on site should be in accordance with BS8000:12.

Fire Resistance

Typically in dwellings only a half hour or one hour fire resistance is required to satisfy the Building Regulations, with regard to fire separation between dwellings and/or compartments within dwellings.

Table 11.01 provides typical examples of how these ratings can be readily achieved.

Material	1/2 hour FR 1 hour FR
Brick	90mm thickness 90mm thickness
Block	90mm thickness 90mm thickness
Plasterboard on sides of timber	12.5mm board board on both on both sides of framing OR framing Proprietary fire boards (typically 12.5 – 15mm) on both sides of framing
Plasterboard laminated wall	12.5 mm laminated on both sides of 19mm board

Two layers of 12.5mm

N/A

Not es :
All masonry joints should be properly filled with mortar.
All junctions with floors, walls, ceilings and roof coverings should be adequately fire stopped with a suitable non-combustible material.
2. All plasterboard layouts should aim to achieve staggered joints, with all joints being taped and filled.
3. All plasterboard layers should be fully fixed in accordance with manufacturer's recommendations to achieve the appropriate fire rating (see table 3.02 for fixing guidance) 5. Ceiling/wall junction layers should be alternated to form a 'Z' joint.

Table 11.01: Typical examples of achieving adequate fire ratings on walls

Internal Works – Ceiling

Linings to Ceilings

General

The building should be made weather-tight before damp susceptible materials are stored or fixed within the building.
Exposed corners and edges of linings which do not have sufficient impact or wear resistance should be provided with a suitable strengthening bead or edging strip.
Precautions should be taken at the junction between different surfaces to minimize cracking or warping occurring in linings due to expansion, moisture or other movement.
Voids behind linings and duct-casings should not connect with the exterior of the dwelling or with a ventilated roof space, floor space or other ventilated void.
Ensure that roof spaces are accessible and that the access hatch or door is located in a safe place e.g. not over a staircase. The access hatch should be not less than 520mm in either direction, located between structural members, a proprietary hatch is recommended and fitted with an effective draught seal, insulated and sealed to the surrounding construction in accordance with the manufacturers instructions.

Workmanship should be in accordance with BS 8000:8.

Plasterboard linings

Gypsum plasterboards should comply with BS 1230:1.

Plastered ceilings with plasterboard backing should follow the manufacturer's recommendations
Plasterboard nails should comply with BS 1202:1.

Plasterboard thickness, board size, size and type of fixings for each location should be in accordance with the manufacturer's instructions or not less than as set out in tables 11.00-11.01

board thickness	board widths	ceilings* (preferred)	ceilings* (maximum)
9.5	900	400	450
9.5	1200	400	450
12.5	900	450	600
12.5	1200	450	600

* all dry and skim finish ceiling board edges to be supported.

Table 11.01: Dry finish and skimmed plasterboard ceilings

Cracks in ceilings can be largely avoided by following the guidance set out below:

Ceilings should be robust and form a smooth stable plane surface to receive decoration
Supporting members should be accurately spaced, aligned and levelled
The tolerance of horizontal surface planeness should be ±10mm over a 5m length
Timbers supporting plasterboard should be regularised and have a moisture content not greater than 20% at the time of erection
Additional detailed guidance can be found in BS 8000:8 & BS 8212.

Plasterboard Ceilings

Timber ceiling joists and noggings
Ceiling joists should be not less than 38mm wide (35mm for trussed rafters). In order to accommodate tolerances, a minimum width of 44mm is generally recommended.

Noggings or joists should be provided at wall/ceiling junctions to support the perimeter edges and located not more than 50mm from the wall.
All cut edges should be supported by noggins or joists.

In direct decoration ceilings all joints should be provided with noggins unless the joist spacing is reduced in accordance with manufacturer's requirements. Openings should be trimmed with minimum 38mm wide noggins.

Fire resistance to domestic floors/ceilings

Within low rise dwellings (up to 3 storey) fire separation between floors and/or separate units will range from a modified half hour fire resistance (ground to first floor of a two storey house) to one hour between flats.

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Holes in ceilings

Downlighters and other flush fitting attachments should not be installed through a ceiling if the ceiling is providing part of the required sound insulation or fire resistant properties to the dwelling. An additional suspended ceiling, light box or proprietary fittings must be installed to maintain the integrity of the ceiling construction.

Fixing of plasterboard

Ceiling boards should be staggered to minimise cracking and fixed across the supporting members.
Joints between plasterboards and adjacent walls, ceilings, openings and fittings should be neatly made.

Finishes – General

The dwelling should be made weather-tight before finishing materials are stored or fixed within the dwelling.
Finishes should be compatible with the supporting surface.

Exposed corners and edges of surfaces which do not have sufficient impact or wear resistance should be provided with a suitable strengthening bead or edging strip.
Movement joints should also be provided to finished surfaces to coincide with movement joints which occur in the structure where required

Plastered finish

Gaps between boards and all nail holes should be filled with plaster. A nominal 50mm paper tape or glass fibre mesh tape (or other suitable joint reinforcement materials) should be bedded over all joints and internal corners.

Final plastering should take place as soon as possible after fixing of boards.

Direct decoration finish

Jointing should be carried out in accordance with manufacturer's instructions and as previously detailed for partitions.

Suspended ceilings

• Should comply with BS 8290.

• Should be fixed securely to the main structure in accordance with the manufacturer's instructions.

• Ceiling systems should be set out to provide a visually acceptable finish, i.e. level framework, straight joint lines and located parallel to adjacent walls unless specifically designed otherwise.

• Allowance should be made for thermal expansion as recommended by the manufacturer.

• Fire stopping should be installed as necessary to comply with the Building Regulations.

Where a suspended ceiling is continuous over adjoining rooms, provision should be made to maintain an adequate degree of sound insulation between WCs and other parts of a dwelling.

Internal Works - Fireplaces

Please refer to the relevant building regulations

Internal Works - Carpentry

General

Internal joinery and fittings

Joinery items should, where appropriate, comply with the requirements of the following British Standards:

BS 585:1 Wood stairs

BS 4787:1 Internal and external wood door sets, door leaves and frames BS EN 942 Timber for and workmanship in joinery

Internal joinery should not be installed until the building is weather-tight. The moisture content of the timber should generally not exceed 15% at the time of installation.

Materials and workmanship should follow the recommendations of BS 1186 and BS EN 942.

• Where metal stud partitions have been specified it is particularly important that adequate consideration is given, at the design stage, as to where joinery items are required to ensure that the requisite fittings to support such items have been provided.

All joinery items should be fixed reasonably plumb, level and square.

If fixing battens for curtain rails are required within hollow lintels by manufacturers, the location of the batten should be clearly indicated on the finished surface.

Kitchen units, wardrobes, cupboards and other fittings should be securely fixed, in accordance with manufacturer's recommendations.

Access panels should be of a durable material and screw fixed.

Frames, linings and screens should be located so that they:

• Fit openings
• Do not carry load unless designed to do so
• Are securely fixed at 600mm maximum centres and within 150mm of the corner of a frame.

Doors should fit frames or linings with even margins not exceeding 6mm. Latches or locks should engage easily.

Airing cupboard doors should be hung on 3 No. hinges. Other internal doors should be hung on minimum 2 No. hinges.

Latches, locks and other ironmongery should be securely and neatly fixed using matching screws. Locks to bathrooms and WCs should be releasable from outside in emergencies.

Joints between the wall and frames or linings of fire resisting doors should be sealed to maintain the required fire resistance

Fire Doors

Fire doors shall be in accordance with BS 8214 and tested to BS 476. Fire resisting doors should be fitted with a positive self-closing device.

Fire doors can be ordered in sets i.e. a complete fire resisting door and purpose made frame.

However, for half hour fire doors between a garage and the dwelling, either a 30minute fire door set should be installed or, alternatively, a fire door tested to an FD20 standard installed with intumescent strips fitted, normally, to rebates within the doorframe.

There should be a minimum 100mm threshold between a garage and a dwelling

Where fire doors are required they should fit tightly with a margin of 3mm (top and sides) and be fitted with an appropriate self closing device.

Fire doors should be hung on a minimum of 3 hinges.

Skirtings, architraves and other trim finishes

Timber trim should be selected in accordance with BS EN 942 & BS 1186 and should be correctly sized to cover joints and allow for any shrinkage.

Trims and panelling should be securely fixed.

Internal panelling of timber or wood based boards should be fixed on suitable timber battens, to give a smooth, flat surface.

Proprietary panels and trims should be fixed in accordance with the manufacturer's recommendations.

Timber trim should have a primer or stain base coat applied prior to the finishing coat.

Timber window boards should be fitted to timber frames with a tongue rebated into the frame.

Stairways

Ensure that staircases, newels, balustrades and handrails are adequately fixed to avoid excessive deflection. Staircases should be supported by strings securely fixed to a supporting wall and not by the top tread.
There is no longer guidance given for a minimum width of a staircase unless it is a means of ingress/egress from a communal type building. In these circumstances the width and pitch etc. will be determined by the use of the building.
For staircases serving individual properties the need is that a safe means of access between different levels is provided.
In both circumstances consideration should always be given to the practicality of a staircase design for those that may have a disability and to the moving of furniture etc.
All staircases within domestic units should have a maximum rise of 220mm with a minimum going of 220mm, however the stair pitch which is a line connecting all nosing's should not exceed 42˚.

The minimum width of the tread (winder) should be no less than 50mm at its narrowest point.

The minimum headroom over the flight and landing should be 2.0m.

Handrails and guarding over the flight and landing should be set at a height of between 900mm and 1000mm. It should be non-climbable and any gap within a riser or guarding should not exceed 100mm.

Where the staircase is greater than or equal to 1000mm a handrail should be provided to both sides of the staircase.

Safety

When designing buildings, full consideration should be given to all factors that affect safety in the home, including: • Spatial layout, e.g. circulation spaces, kitchen layout and location of steps

• Minimizing obstructions, e.g. arrangement of opening doors and windows, and the ease of access of opening lights, switches, meters, etc.
• Locks to WCs and bathroom doors to be openable from the outside in an emergency
• Provision of non-slip surfaces particularly in kitchens, bathrooms, etc.

Provide adequate storage space to dwellings
Adequate general storage space should be provided at each floor level within a dwelling.

Typical guidance on the level of storage suggested is given in table 11.02

size of dwellings	storage space
1 bedroom	1.6m3
2 – 4 bedrooms	2.8m3
More than 4 bedrooms	3.6m3

11.02 Total storage space for dwellings

At least 25% of the storage accommodation with one robust shelf should be located in a heated airing cupboard if provided.

A minimum 1.75m3 of the storage accommodation (0.75m3 for one bedroom dwellings) should be located in the kitchen and be available for food storage. Part of this accommodation should consist of a space reserved for a refrigerator and have a 13 amp fused electricity supply.

The remainder of the storage accommodation should be arranged such that a degree of storage accommodation is provided at each floor level.

Painting

Paint systems should be used as recommended by the manufacturer and comply with BS 6150.

Surfaces should as appropriate be knotted, stopped up, rubbed down, sealed and primed prior to painting.

Keep surfaces to be decorated clean while work is proceeding.

A minimum of two coats of paint should be provided in all cases, with each coat of paint being left to dry fully before application of a subsequent coat.

The use of materials from more than one manufacturer in any one system may result in failure due to incompatibility. It is therefore recommended that all paints are obtained from the same manufacturer to avoid such occurrences.

Remove from site any materials that, on opening are found to be incorrectly labelled or defective. If materials are found to be defective when in use, set them aside.

Work on site should be in accordance with BS 8000:12.

Do not apply painting materials if:

• The moisture content of the background exceeds 18%
• Surfaces are affected by damp or frost
• The air or substrate temperature is below or likely to fall below 5°C
• Condensation is likely to occur before the paint is touch dry
• Rain or snow is likely to occur before the paint is touch dry
• Heat is likely to cause faults to develop
• Airborne dust is likely to spoil wet paint
• The light is insufficient
- Substrates have not adequately dried out e.g. plaster
- It interferes with the proper functioning of components such as radiator valves, stop valves or other service components.

Ensure good ventilation is provided as this is necessary:

• To remove unpleasant, toxic and flammable vapours arising from painting materials
• To ensure that paints dry and harden.

Services

System Design

Service supplies and installations should be designed by an Expert. Service installations should be designed according to the methods and data published by the Chartered Institution of Building Services Engineers.

Building elements supporting service installations

Walls, floors, ceilings and the like should be specifically designed to carry any supported service appliance or equipment.
Full account should also be taken of the added mass of water contained in the appliances and equipment during their normal use. (This is particularly applicable to cold water storage cisterns, hot water storage cylinders and boilers).

Gas and water services should not generally be run in timber frame external wall panels unless the design specifically allows for this.

Precautions against frost, entry of gas and vermin

All water services, including those for space heating, should comply with BS 6700. Any part of a water pipe or appliance liable to freezing should be located within the heated thermal envelope of the building.

Where pipes, ducts or cables pass through the building envelope, holes and floor perimeters should be sealed and made watertight with a flexible, vermin-proof and gas- tight compound.

Appliances – Safety and location

Exposed surfaces of accessible appliances should have no sharp edges which could cause injury to persons. All appliances and components which are heated in normal operation should be located so that movement and shrinkage of structural and other timber is minimized.

Flue outlets to gas and oil appliances should be protected with a suitable guard where people can come into contact with them, or where they could be subject to damage i.e. vehicular access. Balanced flue outlets should be located 300mm and 600mm minimum respectively away from any opening into the dwelling, including roof voids.

In certain circumstances a minimum of 1200mm is required. For further details refer to Approved Document J (Technical Standards for Scotland: Part F).

Selection of appliances and equipment

Materials and equipment should, wherever possible, either bear the British Standard 'Kitemark' symbol and be manufactured by firms registered under the BSI 'Kitemark' scheme, or should comply with the relevant British Standard and be manufactured by a firm operating a BS EN ISO 9001-9004 Quality Assurance System which is regularly assessed by a recognised independent third party.

Materials should be selected so that corrosive deterioration is minimised. If different metals are used in combination, particularly in humid locations, they should be chosen to be as near as possible in the electro-chemical series of metals so that galvanic action is unlikely to occur (i.e. not more than two metals apart in the list). Some typical metals in the order they appear in the series are:

- Stainless steel
- Copper/Cupro-nickel
- Brass/Gunmetal
- Steel
- Aluminium
- Galvanised iron
- Zinc

If metals remote from each other in the series have to be used, adequate precautions should be taken to prevent their corrosive interaction.

All materials and equipment should be installed and commissioned as specified by the manufacturer.

Appliances and equipment should be selected so that they are suitable for the designed thermal loads, fluid flow rates and fluid pressures.

Installation of pipes, ducts and cables

• Pipes, ducts and cables should be securely fixed to walls within floor zones etc. at suitable intervals to prevent sagging, using purpose made proprietary support brackets or clips
• All joints in pipework should be carefully made to eliminate leaks
• Pipes should be laid to falls away from high points in the installation to aid being drained and provision made for air venting at the high points where required
• Pipework should be arranged to prevent contact with electric cables
• Provision should be made for expansion of water service installations where required
• Pipework and cables should have a neat appearance where visible, with all bends being neatly made using the correct tools
• Appliances shall be installed level unless specifically designed otherwise, using durable fixings
• Workmanship should comply with BS 8000:13/15.
• Installation of electrical cables and gas pipework shall be undertaken by qualified tradesman registered by NICEIC – National Inspection Council for Electrical Installation & Contracting / Registered Gas Safe Installers.
• Gas pipework in the proximity of electrical cables should follow the Gas Safe requirement guidance – see this section.

Services embedded in floors and walls and positioned beneath floor slabs
Service pipes and cables should not be laid within a structural element unless approved by the designer of the building. Where permitted, they should not be solidly embedded.

Service pipes and cables should be sleeved, isolated and sealed when passing through a structural element. Where passing through joists, it is recommended that hessian or similar is provided to prevent expansion noise.

Pipes should not be cast into walls and floors, the use of a proprietary accessible ducting system being strongly recommended. (See diagram 3.30). Pipes behind dry lining should be placed either horizontally below the valves, vertically within the radiator width from ceiling to floor level or within 150mm of a wall junction or a door frame. If located outside these zones, then mechanical protection should be provided.

Appliances should be so located and positioned as to allow reasonable access for operation, inspection, maintenance and removal.

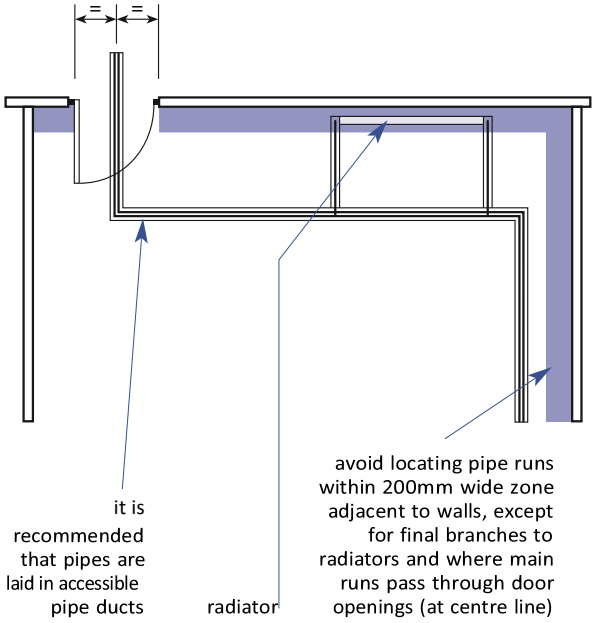

Diagram 11.03: Recommended positioning of pipes in screeds

In order to avoid subsequent damage during the laying of floor coverings, it is recommended that principal pipework runs in screeds are not located within 200mm of walls and should pass through door openings at the centre line (See diagram 11.03).

Only pipework forming part of a closed circuit system of under floor space heating or above ground central heating may be laid in floor screeds and should be laid as follows:

- A clear minimum thickness of screed of 25mm is required over and above the thickness of any pipework buried in the screed or insulation
- Where the screed is to be laid upon insulation, the required nominal reinforcement to the screed should be continuous over the pipework. D49 or D98 mesh reinforcement should also be provided over multiple pipes laid together in normal screeds
- Allowances for thermal and other types of movement must be made
- Pipes bedded in screeds should be tested to twice the designed operating pressure of the system and joined with the minimum number of capillary joints
- It is advisable to check that pipes bedded in screeds will meet the requirements of the local supply company.

Conduits and ducts should be located in such a manner as to allow reasonable access for inspection and maintenance without major disruption to the structure.

Flexible connections should be provided to services, conduits and ducts at their entry point into the structure. Raft foundation design details should show such service arrangements in relation to the reinforcement details.

Warm air ducts below ground floors should be constructed and positioned to avoid ingress of moisture into the duct or surrounding insulation.

Warm air ducts located beneath the ground floor of a dwelling which sits on clay soil should be positioned and insulated so as to prevent heat drying the clay, which may cause subsidence of the structure.

Services in walls

When installing services i.e. cables in walls or behind dry lining care should be taken to avoid back to back chasing which could affect the stability of the wall.

Isolation, draining down and maintenance of service installations

Installations designed to hold water should be capable of being drained. Drain cocks, or similar, should be located at the lowest point of the system. In some circumstances there may be short lengths of pipe at low level, such as when passing under a door, that may not be practical to drain. However if a substantial amount of pipework is run in a screed then arrangements should be made for complete drainage (See diagram 11.03)

Wet systems serving more than one dwelling should be capable of being drained down separately.

Isolation valves and switches should be provided to services serving separate dwellings within the same building and should be accessible and clearly identified.

Telephone

A conduit should be provided from the telephone position to the communications company's duct or overhead terminal. A draw wire should be left in the conduit.

The conduit entry from outside to inside the building should be sealed to prevent moisture ingress.

Television

A single, unbroken length of cable suitable for frequencies currently in use for television should be provided between an aerial point in the loft and a co-axial socket outlet in the main living room. A 'tail' of approximately 4m should be left in the loft. The cable from the loft to the living room should be installed to comply with BS 6330.

Fire-stopping

Fire-stopping should be provided around any services which penetrate fire- resisting floors, walls or partitions.

Where a proprietary system, such as an intumescent seal, is used it should be installed in accordance with the manufacturer's instructions.

Electrical Installations

System design

Electrical installations will be subject to the requirements of Approved Document P Electrical Safety and the electric installation should comply with the Wiring Regulations of the Institute of Electrical Engineers (IEE) and BS 7671.

Part P applies to electrical installations in buildings or parts of buildings comprising:

• Dwelling houses and flats;
• Dwellings and business premises where there is a common supply;
• Common access areas in blocks of flats such as corridors and staircases;
• Shared amenities of blocks of flats such as laundries and gymnasiums.

Part P also applies to parts of the above electrical installations:

• In or on land associated with the buildings – for example fixed lighting and pond pumps in gardens;
• In outbuildings such as sheds, detached garages and greenhouses.
• Where there is a relevant material change of use.

Certification

The installation should be designed and installed to provide appropriate protection against mechanical damage, and so that they do not present electric shock and fire hazards to people.

The installation must be suitably inspected and tested to verify that they meet the relevant equipment and installation standards. A way of demonstrating this compliance would be to follow the procedures in Chapter 74 of BS 7671 and to supply:

• To the person ordering the work copies of the forms called for, signed by a person competent to do so; and
• In the case of a competent person registered with an electrical self-certification scheme, to the building control body a declaration that compliance with the Building Regulations has been achieved.
• Certificate showing compliance must be shown to Compariqo at Final Inspection.

To be able to complete the relevant forms it is necessary to ensure that work has been inspected both during erection and on completion. The work must comply with the appropriate British Standards or harmonised European Standards, selected and installed in accordance with BS 7671 have not been visibly damaged or defective so as to be unsafe.

Smoke detectors

Mains operated self-contained smoke detectors shall be provided in all dwellings.

• There shall be at least one detector on each floor of a dwelling. Where more than one is provided they shall be interconnecting to operate the alarm signal simultaneously in all of them.
• There shall be a smoke detector in the circulation space within 7.5m of the door to every habitable room.
• Where the kitchen area is not separated from the stairway or circulation space by a door, a heat detector must be fitted in the kitchen in addition to the smoke detector fitted in the circulation space.

Self-contained detectors should be permanently wired to a separately fused circuit at the dwelling's electricity consumer unit..
A test should always be carried out on completion to ensure that all units are interconnecting and are operational, where the system is reliant on a battery back up the power should be disconnected during the test.

Above Ground Drainage

Waste disposal

All above ground plumbing systems should be designed to allow the unobstructed flow of waste water from an appliance to the underground drainage system. To achieve this the following points should be noted at the design and installation stages:

• Provide rodding access facilities at all changes of direction
• Avoid bends and changes of direction in the wet part of the above ground drainage system
• 75mm deep seal traps should always be used except on a WC
• where an appliance on the ground floor discharges directly into a trapped gully
• Pipe sizes should not exceed the dimensions for diameter against pipe length
• Pipe should be laid at a gradient of 1/80 or better
• Any admittance valve fitted to the system should be located above the highest flood level of any appliance connected to that stack pipe
• Enclosures to air admittance valves should be adequately ventilated
• The highest point of a drainage system (head of run) should always be vented to the external air.

Ventilation

General

System design

The system should comply with the following:

• BS 5250: Code of Practice for control of condensation in buildings
• BS 5720 Code of Practice for mechanical ventilation and air conditioning in buildings
• BRE Digest 398.

Where ductwork from extractor fans pass through unheated spaces such as roof voids the following action should be taken to reduce the possibility of condensation forming within the ducting and any consequential damage caused to finishes and the fan unit:

• Ensure ducting discharges to the outside air
• Provide insulation to the outside of the ductwork and lay to a fall away from the fan.

The system should provide the rates of change with the external air as set out in:

• Approved Document F (E&W)
• Technical Standards: K (Scotland).
• Part K: Ventilation (Northern Ireland)

It is a requirement that all habitable and service rooms within dwellings have some form of ventilation, whether it be permanent background ventilation, mechanical ventilation or an openable window. provides guidance as the provisions of ventilation to rooms.

Minimum extract ventilation rates for intermittent extract systems are:

• Kitchen: 30 l/s adjacent to the hob or 60 l/s elsewhere
• Utility room: 30l/s
• Bathroom (including shower room or ensuite): 15l/s
• Sanitary accommodation: 6 l/s

Minimum extract ventilation rates for continuous extract systems are:

• Kitchen: 13l/s
• Utility room: 8l/s
• Bathroom (including shower room or ensuite): 8l/s
• Sanitary accommodation: 6l/s
• For internal rooms (non-habitable), provide either 15 minutes overrun to the mechanical extraction unit, provide PSV or an open flued heating appliance may be acceptable. In all cases some form of air inlet is required.

Whole Building Ventilation

Whole building ventilation rate for the supply of air to the habitable rooms in a dwelling should be no less than specified in Table 11.03

Ventilation	Number of bedrooms in d w elling				
	1	2	3	4	5
Whole building ventilation rates (l/s)	13	17	21	25	29

Notes:
In addition, the minimum ventilation rate should be not less than 0.31l/s per m internal floor area (this includes each floor, e.g. for a two-storey building, add the ground and first floor areas.
b. This is based on two occupants in the main bedroom and a single occupant in all other bedrooms. This should be used as the default value. If a greater level of occupancy is expected, then add 4l/s per occupant.

Table 11.03: Whole building ventilation rates

Passive Stack Ventilation

The system should comply with the recommendations contained within BRE information paper 13/94 or hold an appropriate third party certification such as a BBA Certificate.

Section 12 - External Works

Introduction

General

Fixings

Fixings should:

Be corrosion resistant where located externally
Resist or accommodate movement of the fixed element during the course of its normal life
Be chemically compatible with the element they support and adjacent elements.

Control of building movement

In determining whether adequate precautions have been taken to minimize or accommodate whole and differential movement of elements, consideration must be given to the following causes of movement which occur within a building:

- Settlement and heave
- Deflection (lateral and vertical)
- Drying shrinkage
- Cyclical changes in moisture content and humidity
- Thermal movement
- Differential movement of adjacent dissimilar materials
- Chemical action.

Treatment of materials susceptible to premature decay or decomposition

In determining whether materials should be treated against premature decay or decomposition, consideration must be given to the resistance of the material to attack from the following:

- Frost
- Moisture
- Fungal growth
- Insects
- Sunlight
- Oxidation
- Atmospheric pollution
- Acid and alkaline attack
- Other chemical attack

Timber based materials should not be incorporated into the structure unless precautions have been taken to prevent the occurrence of dry rot, due account being taken of the location of the element. In particular, attention should be given to materials located within the external fabric of the building envelope, permanent shuttering, perimeter insulation and filling of movement joints.

Storage and protection of materials

Materials susceptible to damp, dust and frost should be stored in a clean and dry place.
Those which have a limited storage life should be used in date rotation and before the use-by date.

Manufactured units should be clearly identified and kept in their protective wrappings until incorporation into the construction.
Materials should be stored in such a manner that damage does not occur during the period of storage and individual elements may be withdrawn from storage without being damaged or causing damage to other elements.

Materials which are withdrawn from storage for incorporation into the construction should be transferred directly to the work and temporarily stored in such a manner as to avoid damage occurring. Damp susceptible materials should not be incorporated into the construction until the building is weather-tight.
Where appropriate, uncompleted construction work should be provided with temporary protection and support.
After incorporation into the construction, all work should be protected from damage until handover of the dwelling.

External Works – Retaining / Boundary Walls

Retaining Walls

Where retaining walls are provided they should be designed and constructed of materials suitable for the ground conditions. Retaining walls should be designed to resist vertical movement, overturning, sliding, rotation, and thermal and moisture movement.

The findings and recommendations of the site investigation report should be taken into account.
Retaining walls constructed of proprietary precast concrete units or timber cradles are to be used in accordance with the manufacturer's recommendations.
Retaining walls should be designed by an Expert and constructed in accordance with BS 8110 or BS 5628 as appropriate.

Boundary Walls

Walls should be constructed on a concrete foundation capable of safely transmitting all loads into the ground without causing excessive movement.
The recommendations of the site investigation report should be taken into account for the design and construction of walls.
Generally, free standing walls should be designed and constructed in accordance with BS 5628:1 and of materials as specified in BS 5628:3

Walls should be provided with a two course engineering brick damp-proof course situated not less than 150mm above the adjacent finished ground level. A precast concrete coping or other durable capping should also be provided in order to prevent ingress of rainwater into the top of the wall.

Section External Works - Garage and Small Outbuildings

General

Garages and small outbuildings including carports and other single storey outbuildings etc., should be designed and constructed to adequately resist lateral and vertical loads such as wind (including uplift), self-weight, snow and other live loads. Refer to Substructure and Superstructure pages within this manual.

In particular, foundations for garages, conservatories or any other permanent outbuilding should be designed and constructed to suit the ground conditions and loadings relevant to the particular site.

Floor construction should be a minimum 100mm float finished grade ST4 or GEN3 concrete laid on a minimum 100mm consolidated and blinded hardcore. If a perimeter toe-beam is provided it shall extend to 350mm below ground level and be a minimum of 350mm wide.

It is recommended that a DPM be incorporated under garage slabs to resist the ingress of ground moisture.

In severe/very severe exposure zones set frame well back to provide further protection (it is recommended to provide a storm porch or canopy whenever using level thresholds) It is recommended to provide a proprietary Matwell projecting beyond the swing of the door.

Avoid ponding of paths & drives

Paths and drives should be properly drained in order to ensure that rainwater is evacuated and that ponding does not occur adjacent to the dwelling.

Areas of particular concern include paved areas that provide:

• access for the disabled
• access for solid waste disposal
• passage giving access to the building where this is intended to be used in common by the occupiers of one or more other buildings.

Impervious surfaces should be laid to falls away from buildings to a trapped gully or a permeable part of the garden provided that it is free draining. Rainwater should not discharge onto a highway or adjacent property.

No part of the surface should be less than 150mm below a DPC. with exception of provision for level access detailing at entrance doors.

Surfaces should be laid to cross falls of not less than 1.25% (1:80) and not greater than 8.3% (1:12) Drainage channels should be laid to longitudinal falls of not less than 1% (1:100).

Gullies should be trapped when a drain discharges to a soakaway (in order to prevent long term silting of the soakaway).

Trapped gullies are also required when Local Authority approval has been granted to permit rainwater to discharge into a foul sewer.

A gully should be provided for every 50m2 of impervious drained area and should be centrally located particularly in the case of enclosed courtyards.

Standing water

One hour after rain has stopped isolated areas of temporary standing water up to 1m2 and no deeper than 7mm are considered to be reasonable.

Variations in surface finish

The surface should not exceed ± 10mm deviation from a 2m straight edge with equal offsets.

Reinstatement of Garden Areas

Redundant foundations, masonry structures and the like occurring within 300mm of the finished ground level should be cleared from the site. Garden levels and top soil should be reinstated to uniform levels appropriate to the level of the building, adjacent roads and other properties.

Where the ground levels need to be raised by site fill, any excessive thickness of existing topsoil should first be removed and subsequently reinstated.

Where slopes exceed the natural angle of repose for the soil material, retaining walls should be provided or other soil stabilization methods used.

Trees and large bushes should not be planted adjacent to any building unless considered fully in the foundation, drain or underground service design. As a general rule, a distance equal to the mature height of the tree or bush should be taken as the closest permissible distance.

Avoid flooding of garden areas

Subsoil drainage may be necessary in garden areas in cases where:

Site works have affected the natural flow of ground water within 4m of the dwelling (e.g. exposing of underground springs)
Ground water table rises to within 250mm of the finished ground within 4m of the dwelling
Subsoil is poor draining and the ground contours make the site prone to waterlogging within 4m of the dwelling.

External Works - Security

Design – General

From the 1st of October 2015 the building regulations Approved Document Q has been in force and this requires that new dwellings should make reasonable provision to resist the unauthorised entry into the property. Compliance is largely shown to have been achieved if the Industry specification PAS 24:2012 has been complied with.

Section 13 - Conversions

General

Depending on the condition of the original building, an Experts survey is usually required for the elements below. If the Report concludes that any of these elements are unable to meet the life expectancy of 30 years for structure and 15 years for non-structural elements, they should be systematically replaced or repaired. The main report may be made up of several individual reports, such as an Engineer's report on foundations and a specialist company report on rising damp and/or timber treatment.

Additional guidance on Compariqo's Requirements

- The project must achieve compliance with Compariqo technical requirements and the Building Regulations.
- All conversions must be registered with Compariqo at least 15 working days prior to any works commencing on site.
- Your Compariqo surveyor is unable to inspect the development until we have received all of the reports, plans, specifications etc. and carried out a desktop appraisal.
- Testing of reclaimed materials such as bricks, timbers, tiles, slates etc. may be subject to a third party test to show suitability
- All new structural timber must be stamped KD or DRY timber
- Additional information and guidance regarding the registration of a conversion is available, please contact our office.

Retained elements:

1. Foundations and load-bearing structures, including floors, walls and roof
2. Damp-proof courses and membranes*
3. Timber treatment against insect and fungal attack*
4. Roof coverings*
5. Weather resistance of walls including claddings, render, re-pointing etc.
6. External doors and windows. Existing single glazed windows must be replaced with suitable double glazed units or an endorsement will be added to the policy to exclude them from cover.
7. External and internal services
8. Drainage

Retained timber

- They are free from any rot / decay/ insect infestation. If appropriate they should be treated and an insured certificate of guarantee provided
- They must be stress graded by an Expert prior to them being used
- A structural engineer must provide calculations to justify their adequacy.

Green Timber/ Ungraded timbers

• The use of green timber/ ungraded timbers are not permitted as structural members e.g. lintels, beams, joists, rafters, purlins etc, nor where they are aesthetic elements but are "fixed" to the structure, as the extent of their shrinkage is unknown and can lead to structural damage of the property.

• They can be used as lintels providing the detail within diagram 4.29 is followed and allowance is made for any possible shrinkage and / or swelling of the timber.

In addition to the installer guarantee, the Builder is required to provide a 10 year insured certificate/guarantee:

• for chemical damp-proof course and basement tanking

• timber treatment against insect and fungal attack,
• specialist roofing systems
• proprietary externally applied weather-proofing and/or insulation systems.

Where some of the timber elements are new and replaced as part of the conversion/refurbishment no report is necessary.

The treatment should be:

• Carried out by a specialist contractor and supervised by a CSRT or ASRT qualified surveyor. All BWPDA contractors meet this specification.

• Be the subject of a suitable insured guarantee. An insured guarantee will meet the following minimum requirements:

- A certificate of insurance (not a warranty or guarantee or (insurance backed 'guarantee') will be issued specifying the insured property.
-This insurance certificate shall be issued by a UK registered and regulated insurance company.

The guarantee itself should:

• Cover failure of the work and consequent opening up and making good.
• Remain valid for a period of 20 years and be automatically transferred to subsequent purchasers/ successors in title.
• Provide cover against the specialist contractor's insolvency.
• An insured guarantee must meet the following minimum requirements.
• The report should identify those parts of the building that have not been fully inspected at the time of the survey.

Suitable Experts, with relevant experience, normally include:

• Registered Architects
• Chartered Civil
• Structural Engineers
• Chartered Building Surveyors
• Members of the Chartered Institute of Building Members of the Association of Building Engineers.

More detailed guidance on conversions is contained in the following section of this manual.

For conversion properties, we will always need to carry out a technical assessment of your conversion project before we can agree to offer a warranty/policy cover under our warranty policy scheme. The assessment process is not just a desktop overview of your proposals and specification of the project, but will also include a site visit. We understand that you need to make quick progress on site, in order to help you do this we set out below how we can help each other to streamline the assessment process.

The flow chart on the pages to follow shows you the stages, from notification of the project to our decision to accept, or, unfortunately, on some occasions to decline.

Ensuring Our Quick Assessment

General

What are we looking for?

In order to understand your project, we need to know as much as possible about it as soon as possible. In particular we need to see your

• Project specification – remedial proposals, plans and specifications .
• Structural engineer's report – to comment on structural adequacy of retained elements and confirm life expectancy of at least 30 years
• Experts reports – these will be in addition to the structural engineer's report and should include specialist reports on rising damp, timber infestation and fungal attack (see guidance on reports later in this document). By providing us with the information when you notify us of the site we will be able to complete our desktop overview and arrange a site visit without delay.

Ideally the inspections for all of the expert/specialist reports should be carried out when all the relevant parts of the building are opened up. Existing plaster and other redundant elements should have been removed e.g. at the "SOFT STRIP" stage. This will enable us to confirm our initial acceptance of the scheme. However, on larger projects it may be more practical for reports to be received by us on later stages of the building as work proceeds. If this is the case please mention it when you first register the project. This will save unnecessary questions and delay later.

What remedial works we expect

• Any roof covering that is not in sound condition should be replaced. If you propose to retain any roof coverings we will need safe access so we can inspect both above and below the covering. This safe access will also be needed by your expert for their report.
• All external walls must prevent moisture penetration to the inside and be insulated to building regulation requirements. This can be achieved where walls are "drylined" with a suitable independent system, which will both insulate the fabric and prevent moisture ingress, or by the provision of an externally applied render/insulation system.
• Any habitable areas either below or partially below ground level must be provided with a minimum grade 3 tanking system or equivalent.
• All repairs and treatments identified in the expert's and engineer's reports.
• In addition to the contractors guarantee, min 10 year insured guarantees are required for chemical DPCs, timber treatments for insect and fungal attack, specialist roofing systems and proprietary externally applied weather proofing/insulation systems. Rising damp and timber treatments must be carried out by a BWPDA member.
• Windows, doors and internal services should be replaced to modern standards.
• All cavity walls must have a borescope inspection and the report passed to the Compariqo Surveyor to determine the condition of the cavity wall ties and any possible defects that exist.

Such insured guarantees are available from the Guarantee Protection Administration Limited.

In addition to the guarantees, certified copies of invoices, reports & plans indicating the areas treated must be supplied.

• Guidance on experts reports for retained elements

• A full structural report of the existing building as described in BRE Digest 366 including:
• Foundations
• Any basements
• Suspended timber floors, including joist ends, wall plates and ventilation
• Ground bearing slabs
• External and internal walls, including lintels and any built-in timber
• Intermediate floor, including, for timber, the condition of any built-in joist ends, wall plates and floor coverings
• Any structural concrete (incl. carbonation) / steel frame
• Roof structures, including wall plates, joist ends, valley/parapet gutters
• Chimneys and parapets
• Report on investigations regarding rising damp, insect infestation and fungal decay. The report should be compiled by a suitably qualified expert (e.g. Certified Surveyor for Remedial Treatment).
• Weather resistance of walls including claddings, render, re-pointing, parapets and chimneys etc. • Report on any retained roof coverings, including adequacy of fixings from above and below
• External doors and windows

External and Internal services

If the elements are to be replaced no report is necessary.

More detailed guidance on conversions is contained in the following chapter.

Substructure

Foundations

An appraisal of the existing building and its foundations should be carried out by a Structural Engineer or similarly approved expert by Compariqo.
This appraisal should address such items as settlement, heave, foundation depth and type, soil type, radon and contamination, basement walls and floors and trees adjacent to buildings. When carrying out the appraisal the person should take into account the proposed increased loading on the structure and foundations, alterations to existing load paths and any alterations to the existing stability of the building.

Proposals for underpinning should be prepared by an Expert and be in accordance with BS 8004 or a proprietary underpinning system.
The decision as to which system should be used depends on a number of factors, including the type of existing foundation, depth of suitable strata, position of water table.

Tanking – Basement Space

If the building has an existing basement or it is proposed to build a new basement it is important that Compariqo Insurance are consulted at the design stage to discuss and agree the proposals. The designer should identify the intended use of the basement as this has a bearing on its design and construction.
Where it is intended that any accommodation below ground level is to be habitable, then the design should be such that no moisture/damp should enter this area. There are a number of possible solutions to tanking existing basements and a guidance is given in BRE Good Building Guide 3 – Damp Proofing Existing Basements.
Additional information is provided in Approved Document – Basements Design, which although covers design of new basements, identifies a number of key points which are applicable to the design of all basements. This includes:

• Determine the position of water table
• Assess the drainage characteristics of soil

Select an acceptable construction type, this will probably be one of the following:

• Mastic asphalt
• Cementitious render
• Self adhesive membranes
• Liquid applied membrane

Products which are used should have independent third party certificates acceptable to Compariqo and, where required, should be installed by an approved installer.

• BRE Good Building Guide 3 – Damp proofing existing basements
• Approved Document – Basements for dwellings
• BS8102 Code of Practice for Protection of Structures against water from the ground
• British Cement Association Basement Waterproofing Design Guide
• British Cement Association Basement Waterproofing Site Guide

Damp Proofing

Damp Proofing

An minimum 10 year insured guarantee for all injected chemical damp proof courses.

A suitable damp proof course should be provided to existing walls, and be placed at least 150mm above external ground level to ensure that ground moisture does not enter the inside of the building.

An existing damp proof course may be acceptable to Compariqo, if a specialist's survey report confirms it's adequacy.

Where a damp proof course needs to be installed in an existing wall there are two options available:

• Injected chemical damp proof courses
• Physically cutting in a new damp-proof course.

Injected chemical damp proof courses shall be installed by a registered member of the British Wood Preserving & Damp proofing Association (who will provide a 10 year underwritten guarantee) and be in accordance with BS 6576 Code of Practice for Installation of Chemical Damp-proof Courses.

www.bwpda.co.uk

Most types of wall are suitable for treatment by a remedial damp-proof course system. There are exceptions to this and these include:

• Walls of exceptional thickness, i.e. greater than 600mm
• Rubble filled walls
• Random flint/granite walls or other similar impermeable materials
• Mud walls (cob), wattle and daub
• Rat trap bond

Advice should be sought from the specialist installer as to the suitability of their products/system. Products used in chemically injected systems shall always hold current independent third party certificates acceptable to Compariqo

Provision can be made for physically cutting in a new damp-proof course. The drawback is that they have to be mechanically inserted into brickwork or coursed stonework. Random flint walls, rubble infilled or unusually thick walls may therefore require some rebuilding. When cutting into the walls to install the DPC it is essential to ensure that all pipes and wiring have been moved out of the way. The new DPC should be linked to any membrane beneath a solid concrete floor, or turned down the wall to protect timber and joist ends.

Location of damp proof courses and membranes

It is essential that any new damp-proof courses are continuous with other damp-proof courses and membranes so as to provide an effective barrier against rising damp

Damp-proof courses should be located in a manner that damp susceptible materials such as suspended timber floors, joist ends and wall plates are located within a dry zone of the wall construction.

Continuity of injected damp proof courses should be maintained at changes in floor levels, around chimneys and fireplaces, within recesses, alcoves, party walls, garden walls, etc.

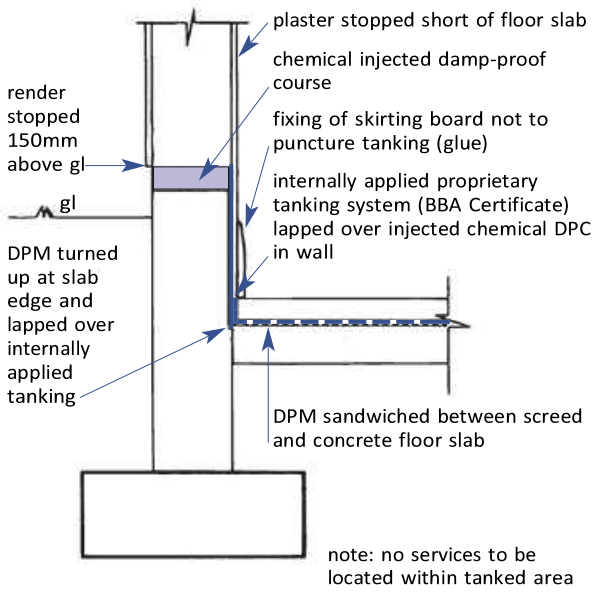

Diagram 13.00: Continuity of damp-proofing system when not subject to hydrostatic pressure

Often in refurbishment work it is not possible to lower ground levels adjacent to walls as this will reduce the depth or cover to foundations and footings. In cases where the ground level is higher than the adjacent floor level special attention is required to maintain continuity of the damp proofing system (See diagram 13.00)

Further guidance on damp-proofing is available:

• BRE Digest 245 Rising Damp in Walls
• BRE Good Repair Guide 5: Diagnosing the causes of damp
• British Wood Preserving and Damp proofing Association
• Independent third party certificates acceptable to Compariqo

Treatment of timbers – Rot/Insects

An minimum 10 year insured guarantee to the satisfaction of Compariqo shall be provided for all remedial timber treatment.

Any remedial treatment shall be carried out by registered members of the British Wood Preserving and Damp- proofing Association in accordance with their Code of Practice for Remedial Treatment and associated technical leaflets.

In order to obtain insurance it is necessary to undertake a detailed investigation of all timber members to identify the presence of any insect or fungal decay and treat the affected areas as appropriate. It is essential that the type of fungal attack is correctly identified as treatment methods vary for dry rot and wet rot.

Alternatively it may be acceptable to Compariqo to use a specialist building pathologist who will provide reports and designs which will design out the cause of damp, rot or infestation in older buildings and will provide a guarantee backed by their professional indemnity insurance. This approach may be more suitable for historic and listed buildings examples of such companies include

Fungal attack covers wet rot and dry rot. Wood rotting fungi can be divided into two categories according to their effects on the wood:

• Brown Rot – causes the wood to become darker in colour and crack along and across the grain when dry.
• Badly decayed wood will crumble to dust, and the majority of wet rots and dry rot fall within this group.
• White Rot – the wood becomes lighter in colour, the wood cracks along the grain. All white rots are wet rot
• Insects attack includes Common Furniture, Death Watch, House Longhorn and Powder Post Beetle

The root cause of fungal attack is dampness. For example, dampness may be caused by the following:

• Rain penetration
• Condensation
• Hygroscopic salts
• Defective rainwater goods and roofs
• Bridging of existing DPC's, or no DPC
• Defective renders
• Direct penetration of rainwater through solid walls, particularly those facing prevailing winds
• Leaking drains and internal plumbing

Fungal attack is controlled by two sets of measures: primary and secondary.

Areas which have not been inspected should be clearly identified to enable a subsequent inspection to be carried out when the structure has been fully exposed, this could include rafter feet and wall plates which are particularly prone to rot.

Primary measures consist of locating and eliminating sources of dampness and promoting the rapid drying out of the structure. Where the timber becomes wet and remains wet e.g. the moisture content exceeds 20%, then it is likely to decay, and by eliminating the source of dampness and drying of timbers below 20%, the fungus will normally stop growing and will eventually die.

Secondary measures consist of determining the full extent of the outbreak then either:

• Removing all decayed timbers
• Treating of walls so to contain fungi within the wall (only applicable to dry rot)
• Treating of sound timbers with preservative on a localised basis where required
• Using preservative-treated replacement timbers (pre- treated)
• Introducing support measures such as isolating timbers from walls and provision of ventilation between timbers and the walls or:
• Appoint a specialist company who are able to provide an automatic building monitoring system.

Timber identified as being at risk of decay such as lintels, joist ends, flat roof timbers, rafter feet, etc., can be monitored and any changes in moisture content recorded by a central computer and the appropriate action taken before serious damage occurs

Dry rot commonly occurs when timber is in contact with damp brickwork and where ventilation and heating are inadequate. Therefore, particular attention should be paid to cellars, basements and sub-floors and also behind panelling. (see table 4.01 for ventilation of cellars and voids)

Floors

Existing Concrete Floors

Guidance on this subject matter is available in BRE Good Building Guide 28 domestic floors.

Where it can be shown that the existing ground floor is structurally adequate but does not incorporate a damp proof membrane, remedial measures will be required. In such cases a damp proof membrane may be laid over the existing slab e.g. 2/3 coat bitumen paint or 1200 gauge (300μm) polythene over which a minimum 50mm 1:3 screed should be laid (65mm minimum thickness in the case of floating screeds and incorporating D49, chicken wire mesh reinforcement). The damp proof membrane should lap with the damp proof course.

Existing Suspended Timber Floors

Where it is proposed to keep the existing ground floor, the following guidance should be followed:

• The existing floorboards/finish should be lifted to ascertain the condition of the timber joists, wall plates and a report carried out by a specialist relating to insect infestation and fungal attack.

When deciding if an existing ground floor is adequate, there are a number of areas which should be addressed, these include:

• An adequate DPC to walls/sleeper walls
• Are all timbers free from rot, insect infestation, and particular attention should be given to the ends of the joists and wall plates
• Adequate ventilation to the sub-floor. (1500mm2 of free opening in air bricks per metre run of wall, in older properties where there is no oversite (sub floor) this figure should be doubled.)
• Adequate foundations supporting sleeper walls
• Joists are of sufficient size and span
• Are any load-bearing internal walls built off floor joists
• Have joists been weakened by excessive notching or drilling
• Adequate trimming to hearth
• Strutting of joist with spans in excess of 2.5m

The surface of the oversite covering should be above the highest level of adjoining ground or laid to a fall with a drainage outlet above the lowest level of the adjoining ground and the outlet screened against rodent entry.

All sub-floor voids should be cleared of all timber/builders rubble as this can provide a ready source of food for dry rots and insects.

Timber joists which are previously built into walls and the joist ends have decayed can be isolated from the damp walls by cutting back the joist and supporting on joist hangers. If the decay extends beyond the proposed cuts for the joist hangers, then the timber will be replaced.

There are also proprietary methods of splicing new timbers to existing joists with galvanised plates, these systems are an acceptable method of repairing rotten or damaged joists.

Radon and Contamination

The aim is to improve the resistance to contaminants and moisture as much as possible but it has been recognised that this is not always practical. In arriving at an appropriate balance between historic building conservation and improving resistance to contaminants and moisture the advice of the Local Planning authority's conservation officer should be sought at an early stage in the design process.

Further information can be found within the following documents:

- BS 7913 Guide to the principles of the conservation of historic buildings
- SPAB Information Sheet 4 1986 The need for old buildings to breathe.
- BRE Report BR 267 Major alterations and conversions
- BRE GBG 25 Buildings and radon.

New Concrete Floors

Replacement ground floor slabs should:

- Be minimum 100 mm thick and preferably located 150mm above the adjacent ground levels
- Incorporate a damp-proof membrane located immediately below the screed and lapped so as to form an integral barrier with the adjacent wall DPC
- Be laid on minimum 100mm consolidated and well graded non-organic hardcore. Hardcore which is used must be free from water soluble sulphates and other deleterious materials. Outbreaks of dry rot have been recorded and attributed to hardcore containing pieces of wood infected with dry rot

Drainage

In cases where the finished slab level is substantially higher than the damp-proof course level in the wall, special attention is needed to ensure that damp does not bridge the DPC..

Drainage

Where it is intended to use the existing below ground foul drainage system a CCTV survey should be carried out to ascertain the condition of the drains and manholes. The survey should cover size, type of drain, falls and its adequacy to take the proposed discharge. An air or water test could also be carried out.

The use of existing surface water drainage may be acceptable providing that it can be shown to be carrying the water away from the building i.e. to a soakaway located 5m away, public sewer etc.

Drainage and ground services

Excavations for new drains and below ground services should not extend below the spread load line of foundations unless special precautions are taken such as protecting the drains/service installations from damage by backfilling trenches with concrete whilst maintaining flexibility of the drainage system to accommodate movement.

Often with refurbishment work it is necessary to extend the drainage system to connect to additional sanitary accommodation. Slab levels and drain inverts are fixed and consequently insufficient cover may be provided to the extended drain. The manufacturer's recommendations for protection should be followed.

Structural Repairs

General

Prior to undertaking structural repairs, it is essential that the root cause of the structural defect has been remedied e.g. by underpinning, addition of adequate lateral restraint, buttressing etc. Strengthening works to the structure may also be necessary to accommodate increased or modified loads.

Masonry Walls

When damage has occurred to walls, the cause needs to be investigated. Likely reasons for the damage include:

• Ground Movement – foundation failure, settlement, subsidence, chemical attack
• Thermal Movement – thermal expansion of wall due to temperature changes
• Roof Spread – pitched roofs not properly tied, spreading at eaves
• External and internal walls not bonded together
• Wall tie corrosion
• Lintels inadequate over openings
• Sulphate attack – water soluble sulphates attack cement based mortar, normally in a wet environment, i.e. below ground level and parapet walls
• Frost attack

- Bonding timbers present and subject to rot and shrinkage
- Ineffective or no lateral support at floor and roof level
- Moisture ingress

Cracking in Masonry Walls

Minor cracking can be defined as cracking which occurs in the mortar joints and which does not extend through the masonry components. Providing that the crack is no wider than 4mm and there has been no lateral displacement of the wall, the wall can be repointed. Minor cracking does not usually affect the structural integrity of the wall and may be remedied by raking out mortar joints to a minimum depth of 15mm and repoint with a mix 1:2:9 cement: lime: sand. If the existing mortar is very weak use a 1:3:12 mix.

Major cracking affects the structural integrity of the wall and investigation should be undertaken to find the cause of the problem. If it is necessary, cut out the brickwork either side of the crack (minimum 225mm) and replace, ensuring that adequate bonding is maintained between new and existing brickwork. It is recommended that brickwork reinforcement is used within the new mortar joints.

Avoid strong mortar mixes and use a well graded sand to minimise shrinkage. The use of gun-applied mortar pointing systems should be considered, as they are able to match strength and colour of the existing wall.

Where repointing a wall or building a new wall, jointing should be 'bucket handle' or 'weathered' in preference to flush jointing. Recessed pointing is not acceptable

Walls out of plumb/bulging

Where walls are more than 25mm out of plumb or bulge more than 10mm within a storey height a Structural Engineer should comment on the stability. The wall may need to be rebuilt or strengthening works undertaken.

Where it is intended to provide buttressing walls to support out of plumb and/or bulging walls, they should be designed by an engineer.
In raised tie roofs (where no ceiling ties are provided at eaves level) lateral spread of the brickwork just below eaves level may have occurred because the roof has deflected. In such cases it is necessary to prop the roof and to rebuild the affected part of the wall.

Lateral Support at Floor and Roof Level

Buildings may show signs of insufficient lateral support through bulging of walls. Many older houses are built with the floors spanning between the front and back walls with a load bearing spine wall and there is no lateral support to the flank walls at floor or roof level.

To overcome this it will be necessary to retrofit restraint designed by a qualified structural engineer.

Lateral Restraint at Roof Level

The solution is to use a retro-strap system, fitting solid noggins between the first three rafters and mechanically or resin bonding the strap to the wall and screwing it to the noggins. Further guidance is available within the BRE Good Building Guide 29: Connecting walls to floors

Bonding Timbers

These are common in Georgian buildings and were laid in the internal skin of the wall to reinforce it and to provide fixings for paneling etc. With the low compressive strength of lime mortar and general timber decay, the bond timber compresses under load. As the timber is on the inner skin, the compression causes bulging outwards. This may be apparent on the external face. Normally bond timbers should be exposed during the conversion and removed in short lengths and replaced with bonded masonry.

External and Internal Walls not bonded together

A common defect in properties up to the 1920s is the lack of bonding/tie of party walls to the external wall. Different bricks and bricklayers were often used, with the poorer quality materials and labour being used on the party walls. This junction should be exposed when undertaking a conversion and if the bond is inadequate a suitable stitching detail incorporated.

Arches and Lintels

Where existing timber lintels support structural walls and it can be shown that the lintel is adequate for its purpose, i.e. there is no sign of any structural movement, loads will not be increased and the timbers are free from rot and insect infestation, this lintel can be retained. In order to ensure that a lintel is free from rot, a percentage of all lintels should be exposed at both ends and on the outer face for openings in external walls. Compariqo should be consulted to determine a suitable percentage of lintels to be exposed.
Where movement has occurred and the timber lintel is inadequate, the lintel should be replaced with either a concrete or steel lintel and have the appropriate bearing. Consideration may be given to replacing timber with timber and calculations should be provided to justify this. One solution to this, is where new timber lintels are provided over openings, additional structural support can be provided by a concealed steel angle so that the timber lintel acts as a non-structural element
Where cracking has occurred in masonry arches (openings not supported by a lintel), then it will be necessary to prop the wall and rebuild the arched construction. In cases where failure has occurred due to the low pitch of the arch, it may be necessary to incorporate a lintel.

Wall Tie Corrosion

Cavity walls have been constructed since 1850, but it was not until 1920 that this form of construction was widely adopted. It is important when undertaking a conversion to confirm the construction of the external wall. Care should be taken, where headers are incorporated into the bond of the external brickwork, you should investigate the wall construction, as many properties in the Victorian period were built with either a 215mm outer leaf and cavity behind, or a 215mm inner leaf, cavity and a half brick outer leaf with snapped headers.
Where the wall is of cavity form, a survey of the wall ties on a percentage of the development should be carried out.
An initial survey can involve cutting out bricks to inspect the condition and predict (remaining) life span of the ties. During opening up works the ties can be inspected for their suitability and acceptance by Compariqo.

The report should cover:

- Age of property
- Condition of wall ties – evidence of rust or corrosion
- Are there enough wall ties – at least 2.5 ties/m2
- Ties should have at least 50mm embedment into each leaf
- Do ties slope towards the internal leaf
- Is the cavity bridged by mortar ?

Initial evidence of cavity wall failure can include cracking of bed joints in mortar (typically every sixth course). This is due to the expansion of the wall tie as it corrodes.

Bulging of the external leaf could indicate that the ties have failed.

Where there is wall tie corrosion or inadequate ties, a specialist company should be employed to provide a report which includes measures to overcome these defects.
Where wall ties have corroded to an extent that it is serious enough to threaten the stability of the wall or building, a structural engineer should be appointed to determine the necessary remedial works.

Further guidance is contained in:

- BRE Digest 329: Installing Wall Ties in Existing Constructions.
- BRE Digest 401: Replacing Wall Ties
- BRE Good Repair Guide 4: Replacing Masonry Wall Ties

Internal Walls

New Masonry

Masonry walls should be built off a suitable foundation, incorporate a DPC and be in accordance with Approved Document A (E&W) and Regulation 11(Scotland) (up to three storeys). When a wall is outside the scope of these documents, a qualified Structural Engineer should design the element.

Existing Masonry

Where a wall is adequately founded or supported on a beam which shows no signs of distress, it can remain providing there is no increase in load onto the wall. Any increase in load should be justified by calculation. However, masonry supported on timber beams should be avoided.
In older properties it is possible that Flitch beams and Bressummers may be supporting masonry walls and these should be examined by an appropriate Expert to ascertain its capability to carry the load. (An appraisal by a qualified engineer may not be necessary in all cases, it is suggested that your Compariqo surveyor be involved at the early stages to establish whether clarification by an engineer is actually necessary)

Existing External Walls

Weather Resistance

Existing solid brick or stone walls may be acceptable as a weather resisting wall subject to the exposure category of the building (see exposure to wind driven rain map above) and the porosity of the masonry. It is anticipated that all buildings located in severe or very severe locations will require at least one of the additional treatments noted below. However, all solid masonry wall situations will require a specialist's report to identify the extent of any necessary remedial treatment.

The specialist report including the proposed design and / or the manufacturer's details must be forwarded to Compariqo for approval along with other requested reports that form part of the conditions placed on the warranty.

If the above situations cannot be satisfied, then a new external cladding or render system will need to be installed alternatively an independent metal or timber lining system should be used.

Independent metal or timber framed systems.

These should not be fixed to the existing masonry walls, but fixed at the "head and base" to avoid direct contact.
Ventilation should be provided to avoid build-up of condensation between the masonry and the inner lining system. For timber/metal lining systems with insulation between the studs these should also incorporate a vapour barrier on the warm side of the insulation.

Impervious sheet and drained sheet systems.

Systems to prevent water penetration should be installed in accordance with the manufacture's recommendations and shall possess third party accreditation acceptable to Compariqo.

Timber Walls

New Studwork

Studwork should be in accordance with the previous section regarding Timber Walls.

Existing Studwork

Many properties before 1880, have trussed internal partitions, usually located approximately halfway back in the depth of the property. Often these walls are load bearing and continue up through the building and carry floor and roof loads on to the foundations.

If a timber partition is load bearing, provided it is adequate and the loads are not being increased and the timber is free from rot and insect infestation, the partition can remain. Where there are defects i.e. the floor sags on the line of the partition and there is distortion of door heads then additional strengthening works should be undertaken.
New door openings cut into an existing trussed partition should be overseen by a qualified structural engineer, as it can adversely affect the triangulation of the truss.

Timber Floors

Timber Floors above Ground Level

Existing timber floor joists can be retained within the building providing that they are adequate for their purpose. The following points should be considered (please refer to the previous section for further details):

• joists are of sufficient size for the span
• load on the floor is not being increased
• have joists been weakened by excessive notching and/or drilling (refer to previous section)
• are ends of joists are free from rot
• all timbers to be treated for insect infestation and wood rot
• no masonry walls are built off timber joists
• adequate trimming to hearth
• solid strutting or herringbone as per previous section

A common defect in floor joists is that the ends which are built into solid external walls have often rotted. A percentage of all existing joists should be examined to ascertain if there is any rot in these timbers. (Compariqo should be consulted to determine a suitable percentage of floor joists to be exposed.) Where timber rot is identified in these joists, then further investigation should be undertaken on a further percentage of the joists.

• Before carrying out this type of work, you should consult a qualified structural engineer to ensure the structural integrity of the building is not compromised
• Proprietary methods of splicing new timbers to existing joists with galvanised plates is also an acceptable method of repair
• Where joists have been previously excessively notched to accommodate services then they should be replaced or the joists strengthened, e.g. by the addition of steel plates securely connected to joists

Differential Movement

Movement joints between new and existing construction

In order to avoid the damage resulting from differential movement between new and existing work, it is necessary to isolate the new extension from the existing construction whilst at the same time maintaining lateral support to the new construction and ensuring a weather-tight joint. The isolation joint should extend through to the foundations (See diagram 4.32 for typical solution).

Walls of special construction

If it is intended to retain walls of special construction such as wattle and daub, Tudor, mud walls (cob) etc., they should be altered so as to form a non-structural element e.g. by the incorporation of an additional load bearing wall or framing which provides lateral support to the wall and supports all structural loads previously supported by the wall. It is also necessary to ensure that the wall provides an adequate barrier to the passage of rainwater into the fabric or the inside of the building. This may be achieved by e.g. the formation of cavity construction whereby the special wall forms the external leaf and the cavity

construction provides the required resistance to rainwater penetration. It is recommended that Expert advice is obtained for these types of construction

Imperial Brickwork – Metric Blockwork

Where it is intended to use this construction particular attention should be made to ensure that the wall ties do not slope inwards towards the inner leaf. Conventional coursing of 450mm centres vertically will not match as imperial bricks are bigger than metric. The use of proprietary walls ties should be considered.

Chimney Removal

Chimneys

When removing chimney stacks, they should be taken down to below roof level and capped. Chimneys located on external walls should be ventilated to the external air at roof and base level.

Where it is intended to re-use existing flues they should be tested for airtightness.

Adequate support should be provided to chimneys after removal of chimney breasts. Cantilever slabs built into existing walls or corbelling should not be used.
The design of any support should be justified by calculation.

Sound Insulation

Pre completion sound testing - Conversions
Sound testing is needed in accordance with Compariqo's requirements and Building Regulations Approved Document E. Resistance to the passage of Sound.

If the building is deemed "historical" and it is not practical to improve the sound insulation to the standards set out in Tables 1a & 1b of Approved Document E, see further guidance in the next paragraph.

Historic buildings

The aim is to improve the sound insulation as much as possible but it has been recognised that this is not always practical. Where the performance standards cannot be met due to maintaining the character of the building it is acceptable to "test and declare" and provide a fixed notice in the building to show the sound insulation values achieved. For further information on testing, please refer to this section.

Historic buildings include:

• Listed buildings
• Buildings situated within conservation areas
• Buildings which are of architectural and historic interest and which are referred to as a material consideration in a Local Authority's development plan
• Buildings of architectural and historic interest within national parks, areas of outstanding natural beauty and world heritage sites
• Vernacular buildings of traditional form and construction

Further guidance on the principles that should be applied when proposing work on Historic Buildings can be found in: BS 7913 -The principles of the conservation of Historic Buildings.

Party walls and floors

Where the conversion, refurbishment of the building does not constitute a "material change of use" there is no requirement under the Building Regulations to upgrade existing party floors and walls i.e. if the building is already sub-divided into flats and these are remaining, there is no need to upgrade sound resistance.

In this instance Compariqo will normally require any existing party floors and walls to be upgraded to achieve the decibel reduction given in Tables 2.30 & 2.31. However, in special circumstances, such as a listed building, this requirement may be waived.

Air Pressure Testing

Historic Buildings

To do nothing to existing windows is not an option unless keeping is specific condition of listed building consent.

Historic buildings are not by right exempt from improving energy efficiency.

Only exempt where change would unacceptably alter character or increase risk of long term deterioration of fabric.

Other buildings other than Historic are to be tested as described within the previous sections of this manual, relating to Insulation and Pressure Testing.

Concrete/Steel frames

Where the scheme involves converting a concrete or steel framed building into dwellings the following guidance is given.

An appraisal of the existing building should be carried out by a qualified Structural Engineer taking into account the proposals for the change of use, this will include:

- condition of the structural frame including joints
- proposals to increase loadings on the structure and foundations
- alterations to existing load paths
- alterations to stability systems
- changes in environmental exposure
- recommendations to cover additional reports, testing by specialists.

The floor loads on the building may decrease as they will now be for domestic use only, where previously they were for example, offices. Q will accept a statement from a qualified Structural Engineer confirming, where appropriate, that the existing foundation design is acceptable for the new loads subject to the building showing no signs of distress i.e. movement, cracking etc.

Where the intention is to increase the load on the existing structure e.g. by the introduction of an additional floor, then structural calculations should be provided to prove the adequacy of the building and foundations.

Concrete Framed Buildings

Where the building is of concrete construction additional reports are needed for:

• Carbonation
• Chlorination

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It is important that a second stage survey incorporates the following:

• Chemical tests on the concrete structure to ascertain if corrosion of the steelwork is or is likely to occur
• Depth of carbonation can be assessed either on site or in the laboratory and the depth of the reinforcement measured. This allows those areas of risk to be identified
• Chloride ion content can be taken by analysis of a drilled dust sample from the concrete.

Where concrete repairs are necessary they should be carried out by a specialist contractor.

High Alumina Cement Concrete (HACC)

Where High Alumina Cement Concrete has been used in a building and the intentions are to keep the existing structure, Q may consider the property for warranty subject to:

• The structure being free from obvious signs of deterioration
• The building being weather-tight
• Structural calculations being provided to show that the floors and roof can solely carry the loads imposed on them.

Typically HACC precast concrete beams were cast as "X" or "I" shaped beams.

Steel Framed Buildings

In addition to any structural reports a visual inspection of the steel frame should be carried out to assess the extent of any corrosion of the framework.

Where corrosion is present accurate measurements can be made using an ultrasonic gauge.

Data collected can then compare the thickness of steel sections against the original steelwork drawings, British Standards and Historical Structural Steelwork Handbook to ascertain if the structural frame is adequate for the proposed loads.

When corrosion is apparent, what appears is a thick layer of rust e.g. 10mm only actually indicates a loss of between 1.0mm and 1.6mm of steel and it is therefore important to take readings.

Exterior Steelwork should be inspected. Where corrosion is visible, the steel can be grit blasted cleaned and recoated.

Perimeter Steelwork in direct contact with the outerleaf of the building can be prone to corrosion particularly in older properties. A sign indicating that this has happened is the

displacement of the external masonry due to the expansion of the steelwork caused by corrosion.

Corroded steelwork occupies between 6 and 10 times the original volume of the steel.

Perimeter steelwork can normally be inspected during the conversion process and the appropriate repairs/ replacement carried out.

Interior Steelwork - normally corrosion of unprotected steelwork within the interior of a building is low with only superficial rusting.
Providing a visual inspection confirms this and the environment intends to remain dry no further treatment of the steel will be required.
Where the proposals involve the steelwork in a "wet" environment such as kitchens and bathrooms it should be be adequately protected.

Bimetallic Corrosion

This should be considered in the existing and proposed structure. Bimetallic corrosion occurs where two different metals are in electrical contact and are also bridged by water or water containing other chemicals to form an electrolyte, a current passes through the solution from the base metal to the noble metal. As a consequence the noble metal remains protected and the base metal suffers increased corrosion.

Where there is a possibility of this occurring or if it has already occurred advice should be taken from a specialist on how to deal with it.

Cast Iron, Wrought Iron and Mild Steel Structures

Many older buildings which are converted into dwellings e.g. warehouses, cotton mills etc. were built using cast iron, wrought iron or mild steel. Typical beams are shown in diagram 4.34.

Cast and wrought iron were first introduced in 1800s followed by the use of steel around 1890. With the onset of steel the use of cast and wrought iron declined.
When the intention is to keep the existing structural elements, an appraisal of the existing building is necessary and guidance is given (See previous section, Introduction to Conversions).

In addition to this the engineer should comment on the following:

- determine age of the building and materials used
- assess how its construction has faired
- justify the loadings by calculation
- identify areas where additional testing and/or opening up is necessary.

If the proposed loads remain unchanged or are reduced, as will probably be the case, and it can be shown that the existing structure has not suffered any deterioration due to corrosion, deflection of structural members etc., the building may only require localised structural alterations.

When the intention is to increase loads, carry out major structural alterations, or the existing building is under designed, a structural engineer should comment on this and provide calculations to justify the proposals.

Filler Joist Floors

Many buildings of late Victorian and Edwardian period were built with floors constructed of clinker concrete supported by embedded iron or steel joists. The concrete produced with clinker aggregate was porous and therefore provided poor corrosion protection to the metal (See diagram 4.

The clinker also contains particles of unburnt or partially burnt coke or coal which contain substantial proportions of sulphur. As the concrete is porous the sulphur oxidises to form Sulphur Dioxide (SO2) and if moisture is present this then forms Sulphuric Acid (H2SO4). Where floors have been subject to the weather for any length of time severe corrosion of the embedded iron or steelwork is likely to have occurred.

When considering a conversion in a building which has filler joist floors it is important to firstly investigate to ascertain if the floors have been subject to damp conditions and whether any significant corrosion has taken place.

Existing claddings can be retained if it can be shown that:

• the system is maintaining the integrity of the building
• it is adequately fixed and the expected life span of the fixings where appropriate is in excess of 15 years
• the cladding material is free from any defects
• adequate provision for movement has been allowed.

If the above situations cannot be satisfied, then a new external cladding or render system will need to be installed.

Internal Treatments

An alternative to preventing moisture penetration by using externally applied claddings and renders is internally applied methods.

Systems are available that are installed on the inside of existing walls to prevent moisture penetration reaching the internal accommodation. These include:

• Independent metal or timber framed systems.

• These should not be fixed to the existing masonry walls, but fixed at the "head and base" to avoid direct contact. Ventilation should be provided to avoid build-up of condensation between the masonry and the inner lining system.
• Impervious sheet and drained sheet systems.
• Systems to prevent water penetration should be installed in accordance with the manufacturer's recommendations and shall possess third party accreditation.

Interstitial condensation

Vapour control layers may need to be incorporated on the warm side of the thermal insulation. Voids and cavities may also need to be ventilated.

Surface condensation

Measures should be taken to prevent surface condensation, this can be based on guidance contained in BS 5250.

Summer Condensation

Under certain conditions the warmth from sunlight falling onto a damp solid masonry wall can drive moisture inwards and form condensation on the outside of a vapour barrier. Diagrams 4.39 and 4.40 indicate two methods of upgrading the thermal properties of existing solid walls whilst attempting to limit the risk of summer condensation.

Control of damp penetration

Measures should be taken to ensure that thermal insulation in cavities does not encourage the passage of damp from the ground or from the exterior of the building to the inside of the building.

Various methods exist to upgrade the thermal insulation of existing walls and floors. Regardless of the methods adopted, it is essential that risks associated with increased thermal insulation are minimised, including:

- Surface condensation caused by improvements to draught proofing of the building.
- Interstitial condensation caused by moisture-laden air passing from the dwelling to within the fabric of the structure and condensing on cooler surfaces.
- Increased risk of damp penetration caused by filling of cavities with insulation.
- Maintaining the robustness of the external and internal wall surfaces by the provision of adequate mechanical protection over insulation materials, e.g. externally applied insulation systems with render coat mechanical protection.
- Avoidance of cold bridges around openings and where structural elements extend through thickness of the building envelope.
- Where planning restrictions prevent the thermal upgrade of the building then Q may deem it appropriate to add an endorsement to the policy regarding the risk of condensation.

Approved Documents

Building Regulations (England & Wales) – Approved Documents
Approved Document A - Structure

Approved Document B – Fire safety

BR E&W AD C:
Approved Document C - Site preparation and resistance to moisture
BR E&W AD D: A1
Approved Document D - Toxic substances.
BR E&W AD E:
Approved Document E - Resistance to the passage of sound
BR E&W AD F:
Approved Document F1 - Means of Ventilation
BR E&W AD G:
Approved Document G - Hygiene
BR E&W AD H: A1
Approved Document H - Drainage and waste disposal
BR E&W AD J:
Approved Document J - Combustion appliances and fuel storage systems
AD J Edition – Guidance and Supplementary Information on the UK Implementation of European Standards for
Chimneys and Flues

BR E&W AD K:
Approved Document K - Protection from falling, collision and impact.
BR E&W AD L1A, L1B, L2A and L2B
Approved Document L - Conservation of fuel and power
BR E&W AD M:
Approved Document M - Access facilities for disabled people.
BR E&W AD N:
Approved Document N - Glazing - safety in relation to impact, opening and cleaning.
BR E &W AD P:
Approved Document P-Electrical safety.
BR E&W AD 7:
Materials and workmanship - Approved Document to support Regulation 7. BR E&W Amendments: Amendments to the Approved Documents

Scottish Regulations-

Part A - S of the Scottish building regulations have been replaced by six numbered sections based on the European

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