TECHNICAL MANUAL

PART 7

INTERNAL WORKS
7.1 General

Part 7 – Internal Works

7.1 General

WAYS OF ACHIEVING COMPLIANCE WITH THE REQUIREMENTS

The building should be designed and constructed in accordance with the guidance contained in the following appropriate documents:

**England & Wales**

Approved Document A - Structure
Approved Document B – Fire safety
Approved Document D – Toxic substances
Approved Document E – Resistance to passage of sound
Approved Document F - Ventilation
Approved Document G - Hygiene
Approved Document H – Drainage
Approved Document J – Combustion appliances and fuel storage systems
Approved Document K - Protection from falling, collision & impact
Approved Document L – Conservation of fuel and Power
Approved Document M - Access facilities for disabled people
Approved Document N – Glazing
Approved Document P – Electrical safety
Approved Document 7 – Materials and workmanship

**Scotland**

Section 0: General
Section 1: Structure
Section 2: Fire
Section 3: Environment
Section 4: Safety
Section 5: Noise
Section 6: Energy

**Northern Ireland**

Part A: Interpretation and general
Part B: Materials and workmanship
Part F: Conservation of fuel and power
Part G: Sound insulation of dwellings
Part J: Solid waste in buildings
Part K: Ventilation
Part L: Combustion appliances and fuel storage systems
Part N: Drainage
Part P: Unvented hot water storage systems
Part R: Access to and use of buildings
Part V: Glazing

**Building Control (Amendment) Regulations 2014 (Ireland)**

Technical Guidance Document A - Structure
Technical Guidance Document B – Fire Safety
Technical Guidance Document C – Site preparation and resistance to moisture
Technical Guidance Document D – Materials and Workmanship
Technical Guidance Document E - Sound
Technical Guidance Document F – Ventilation
Technical Guidance Document G – Hygiene
Technical Guidance Document J – Heat producing Appliances
Technical Guidance Document K – Stairways, Ladders, Ramps & Guards
Technical Guidance Document M – Parts 1,2,3 & 4
7.2 Floors

GENERAL

Fire Resistance

All floors should have the minimum fire resistance required by the relevant Building Regulation. 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 down lighters) unless it can be shown that the floor construction achieves the required fire resistance.

FIRE STOPPING

Penetrations in floors between dwellings must be fire stopped. There should be no holes or gaps for smoke to penetrate once the fire stopping has been installed. Where down lighters are incorporated in a ceiling they should be incorporated in accordance with the manufacturer’s instructions.

Thermal Insulation

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. Any thermal insulation material subject to load (e.g. where located below slab, screed or boarding) should possess a current independent Third Party certificate acceptable to Build-Zone and be laid in strict accordance with its recommendations.

TIMBER BOARD LOOSE LAID SYSTEM

A loose laid system is where tongue and grooved (T&G) panels of particleboard or plywood and rigid insulation are laid separately. The damp-proof membrane should be laid above the floor slab linked to the DPC. Pressure impregnated timber battens are used at door openings to support non T&G board joints and elsewhere to support heavy partitions. A 500 gauge polythene (125μm) vapour barrier is then laid over the insulation with 150mm lapped and taped joints continued up the walls to 25mm minimum above the insulation (see diagram 7.01).

Type P5 or P7 particleboard or similar, with all joints glued with PVA adhesive or similar is then laid over the vapour barrier. Allow for a 10mm gap or 2mm gap per metre run of floor (whichever is the greater) at all abutments between walls and floors to accommodate possible expansion of the floor decking. Temporary wedges should be used to facilitate fixing and gluing the boards, which must be removed prior to fixing the skirting board.

TIMBER BOARD/INSULATION COMPOSITE SYSTEM

A composite system is where the board and insulation are one element and laid together. The damp-proof membrane must be laid above the slab and lapped to the DPC (this is to prevent any residual moisture in the slab affecting the particle board). See diagram 7.02.

The jointing and expansion gaps at walls are as the loose laid system. (See diagram 7.01).

Diagram 7.01: Ground supported concrete slab finished with separate timber boarding and loose laid insulation system

Diagram 7.02: Ground supported concrete slab finished with composite board/decking system
INSULATION

Insulation Located above a Ground Bearing Slab – Screed Finish

A damp-proof membrane (DPM) should be located above the slab linked to the DPC. 1200 gauge (300μm) polythene DPM is recommended in this situation linked to an extra wide DPC. The joints of the rigid insulation should be closely butted and taped or the insulation should be protected by a separating layer e.g. 500 gauge (125μm) polythene or building paper to prevent the wet screed penetrating the joints between the boards.

The insulation should be turned up at the edges to prevent cold bridging through the screed/wall junction.

Screeds laid over insulation should be at least 65mm thick and incorporate a layer of either D49, D98 or chicken mesh reinforcement located centrally in the screed (see diagram 7.03), if the floor area of the room exceeds 15m².

Insulation Located above a Precast Concrete Suspended Floor – Screed Finish

Providing the precast concrete floor is located above the damp-proof course and has a ventilated void, a damp-proof membrane is not usually required. If there is a high water table or the possibility of water ponding under the floor a DPM should be installed. The insulation and finish should be constructed as shown for insulation located above a ground bearing slab. A 500g (125μm) polythene vapour barrier located beneath the timber boarding should be provided (see diagram 7.04).

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 e.g. at door openings.
- Protect thermal insulation from damage whilst laying floor screed or deck and where applicable an additional DPM should be laid to protect acid attack to the insulation from cementitious screeds.
- 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.

Diagram 7.03: Ground supported concrete slab with insulation located below screed
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.
- Additional DPM's should be laid to protect the insulation from acid attack by cementitious screeds.

Screeds to sheet and tile flooring should comply with BS 8203:2001+A1:2009. Care is needed when choosing adhesives. They must be compatible with the 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 7.05). Unbonded screeds should be a minimum 50mm thick (see diagram 7.05).

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 7.05). 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, D98 mesh or other fibre 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 7.05).

Screeds in excess of 30m² should be provided with shrinkage joints. For screeds, a cement and sand mix of 1:3 to 4:2 by weight should be used. For screeds exceeding 50mm, a concrete mix of 1:1 to 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 Build-Zone 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 Build-Zone.
Ensure that beams and blocks are grouted together with a 1:6 cement/sand mix or in accordance with the manufacturer’s instructions.

Ensure that screeds in garages are reinforced with minimum A98 steel mesh to distribute car loads or are to the manufacturer’s/engineer’s requirements and are laid to the correct fall.

![Diagram 7.05: Types of screed](image)

**Diagram 7.05: Types of screed**

**Mixing**

Materials should be thoroughly mixed in correct proportions on a clean surface and to manufacturer’s instructions.

Materials should be frost-free at the time of mixing and should be laid in accordance with the manufacturer’s instructions and at the correct ambient temperature.

Screed materials should be mixed in force-action mixers. Free fall drum mixers should not be used.

**FLEXIBLE FLOOR COVERINGS**


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 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.
7.2 Floors

FLOOR TILING

Rigid tile flooring should comply with BS 5385-1:2009. Adhesives are to comply with BS EN 120004:2001. Mortar for fixing floor tiles should be as recommended by the tile manufacturer and must be compatible with the subfloor. (see table 7.06).

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 8000-11.1:1989.

Floor surfaces that are exposed to rainwater should be laid to self-draining falls connected to a rainwater outlet.

<table>
<thead>
<tr>
<th>base</th>
<th>Cement:sand &amp; mortar &amp; cement/lime:sand mortar bonded to base</th>
<th>Cement:sand semi dry mix</th>
<th>adhesive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>bonded</td>
<td>Unbonded*</td>
<td>bonded</td>
</tr>
<tr>
<td>New concrete (less than 6 weeks old)</td>
<td>U</td>
<td>S</td>
<td>U</td>
</tr>
<tr>
<td>New screed (less than 3 weeks old)</td>
<td>U</td>
<td>S</td>
<td>U</td>
</tr>
<tr>
<td>Mature concrete</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Mature screed</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Screed over suspended floor or underfloor heating</td>
<td>U</td>
<td>[U]</td>
<td>S</td>
</tr>
<tr>
<td>Suspended concrete:</td>
<td></td>
<td></td>
<td>U</td>
</tr>
<tr>
<td>Rridged and new (less than 6 weeks old)</td>
<td>U</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Rridged and mature</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>With significant deflection</td>
<td>U</td>
<td>U</td>
<td>S</td>
</tr>
<tr>
<td>Timber</td>
<td>U</td>
<td>U</td>
<td>U</td>
</tr>
<tr>
<td>Asphalt</td>
<td>U</td>
<td>U</td>
<td>S</td>
</tr>
<tr>
<td>Existing hard floor finishes after preparation</td>
<td></td>
<td></td>
<td>U</td>
</tr>
<tr>
<td>Terrazzo</td>
<td>S</td>
<td>U</td>
<td>S</td>
</tr>
<tr>
<td>Unglazed ceramic tile</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Glazed ceramic tile</td>
<td>S</td>
<td>U</td>
<td>S</td>
</tr>
<tr>
<td>Granolithic topping</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Natural stone</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>

Key: S Suitable  C confirm suitability with tile manufacturer or supplier  
* unbonded beds are unsuitable for heavy traffic conditions

Table 7.06: Suitability of flooring beds for different bases
7.3 Walls

TIMBER PARTITIONS

Load bearing and bracing internal walls should be designed by an Expert and should not be modified without the approval of the Expert. 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 to do so
- 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
- Formed over adequately constructed floors so as to reduce or eliminate the floor’s deflection
- Provided with a damp proof course where required by the Building Control Authority where partitions bear onto ground supported slabs.

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 8000:8:1994 and BS 8212:1995.

Timber 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 timber members fixed to the building structure at not less than 600mm centres (see diagram 7.07).

For good practice, partitions should be located on double joists when parallel to floor joist spans and nailed to 50 x 50mm noggins fixed between ceiling joists at 600mm centres when parallel to ceiling joist spans. 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 7.07 and 7.08).

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 noggins at 600mm centres.
Where possible, avoid horizontal joints in plasterboard. Where this is unavoidable (e.g. excessive floor to ceiling heights), provide noggins at joint locations and stagger the joints.

Stud members should be nailed or screwed to abutting walls and partitions at maximum 600mm centres (see diagram 7.09).

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 (see diagram 7.10).

**Timber studs should not be notched.**

All plasterboard edges to partitions (including bound edges) should be supported by noggins. Openings should be trimmed with minimum 38mm wide noggins.
7.3 Walls

Diagram 7.09: Studs and noggins

Diagram 7.10: Holes in studs or posts

In the case of full height boards, noggins should be provided at mid-height in order to prevent studs from twisting and provide additional rigidity (see diagram 7.11).

Diagram 7.11: Ceiling height boards

Fixings

Additional reinforcement with regard to the framing should be provided to support medium to heavy fixtures, e.g. radiators, wall cupboards, etc. (see diagram 7.12). Lightweight fixtures should be supported using proprietary fixings.

Many proprietary fixings for dry wall linings e.g 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 manufacturer’s instructions.
7.3 Walls

FIXING OF PLASTERBOARD

- All cut and bound edges of partitions should be provided with noggins.
- Perimeters of all boards should be provided with noggins. However, when 15 mm plasterboard is fixed at right angles to timber framing at centres not exceeding 600 mm then noggins are not required.
- Manufacturer’s recommendations should be followed. Table 7.15 is provided for fixing guidance.
- Fixings should be positioned not closer than 13 mm to unbound edges (10 mm from bound edges) or 6 mm to edges of timber supports (see diagram 7.13).
- Partition boards should be fixed with at least 8 nails per metre along each supporting member or spaced at approximately 150 mm centres (see diagram 7.14).
- Screw fixings are recommended at 230mm centres for ceilings and 300mm for walls.

NAIL POPPING

Unsightly nail protrusion can be reduced by:

- Lowering moisture content of timber to that recommended by relevant British Standard
- Nailing or preferably screwing plasterboard tightly to the timber framework. Plaster board screws should be used where possible.
- 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-fixing with new nails before the plaster board is offered up

Diagram 7.12: Support of heavy fixtures

Diagram 7.13: Fixing of plasterboard to studs

Diagram 7.14: Fixing of plaster board to partitions

Table 7.15: Nail fixings for plasterboard
7.3 Walls

NON-TIMBER PARTITIONS

Metal Studs System

There are a number of proprietary systems on the market. These 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. Guidance should be sought from an NICEIC registered contractor and the system must comply with the relevant sections of the Building Regulations.

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 Build-Zone, 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 suitable to take such loadings 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 an adequate 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 7.16), 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. 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.

Diagram 7.17: Dry lining
7.3 Walls

TIMBER & NON-TIMBER PARTITIONS

Thickness of Plasterboard

The thickness of plasterboard required depends upon the stud spacing and the board width (see Table 7.17).

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.

<table>
<thead>
<tr>
<th>Board thickness</th>
<th>Board width</th>
<th>Max. spacing of studs</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.5mm</td>
<td>900mm</td>
<td>450mm</td>
</tr>
<tr>
<td>9.5mm</td>
<td>1200mm</td>
<td>400mm</td>
</tr>
<tr>
<td>2.5mm</td>
<td>900mm</td>
<td>450mm</td>
</tr>
<tr>
<td>12.5mm</td>
<td>1200mm</td>
<td>600mm</td>
</tr>
</tbody>
</table>

Table 7.17: Dry finish and skimmed plasterboard partitions

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 manufacturer’s instructions.
- Plasterboard linings should be fixed plumb.
- Moisture resistant boards should be 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/scrim tape (or other suitable joint reinforcement material) should be bedded over all joints and internal corners.

Galvanised preformed metal or plastic beading trim should be provided to all external corners. The trim should be fixed to the plasterboard with appropriate corrosion-resistant nails or dabs of finish plaster at 600mm centres. It is noted that some forms of preformed beading include their own fixing systems.

The final plastering should take place as soon as possible after fixing of boards.
7.3 Walls

DIRECT PLASTERING TO MASONRY

Mixing

Materials should be thoroughly mixed in correct proportions on a clean surface as per the manufacturer’s instructions.

Materials should be frost-free at the time of mixing.

Additionally the background should be frost-free, at least until the plaster is substantially dry. Admixtures are acceptable but must be suitable to the environment and conditions where they are being applied and should be in accordance to the manufacturer’s instruction/detail.

INTERNAL PLASTERING

Internal plastering should comply with BS 8481:2006, BS PD CEN/TR 15123:2005 & BS EN 13914-2:2005. Table 7.18 provides details of the minimum number of coats and total thickness of plaster suitable for various types of supporting surfaces.

Wallpaper 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 BS8000:12:1989.

<table>
<thead>
<tr>
<th>Supporting surface</th>
<th>No of coats</th>
<th>Av. Total thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>1</td>
<td>2mm</td>
</tr>
<tr>
<td>Brickwork</td>
<td>2</td>
<td>13mm</td>
</tr>
<tr>
<td>Blockwork</td>
<td>2</td>
<td>13mm</td>
</tr>
<tr>
<td>Metal lathe</td>
<td>3</td>
<td>13mm</td>
</tr>
<tr>
<td>Gypsum on plasterboard</td>
<td>1</td>
<td>2mm</td>
</tr>
</tbody>
</table>

Table 7.18: Internal plastering
7.3 Walls

**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 7.19 provides typical examples of how these ratings can be readily achieved.

<table>
<thead>
<tr>
<th>Material</th>
<th>½ hour FR</th>
<th>1 hour FR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brick</td>
<td>90mm thickness</td>
<td>90mm thickness</td>
</tr>
<tr>
<td>Block</td>
<td>90mm thickness</td>
<td>90mm thickness</td>
</tr>
<tr>
<td>Plasterboard on timber</td>
<td>12.5mm board on both sides of framing</td>
<td>Two layers of 12.5mm board on both sides of framing OR proprietary fire boards (typically 12.5-15mm) on both sides of framing</td>
</tr>
<tr>
<td>Plasterboard laminated wall</td>
<td>12.5mm laminated on both sides of 19mm board</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Notes:
1. All masonry joints should be properly filled with mortar.
2. All junctions with floors, walls, ceilings and roof coverings should be adequately fire stopped with a non-combustible material.
3. All plasterboard layouts should aim to achieve staggered joints with all joints being taped and filled.
4. All plasterboard layers should be fully fixed in accordance with manufacturers recommendations to achieve the appropriate fire rating (see table 7.15 for fixing guidance).
5. Ceiling/wall junction layers should be alternated to form a “Z” joint

Table 7.05: Typical examples of achieving adequate fire ratings on walls

**SOUND INSULATION**

For information and guidance on sound insulation for floors and walls please refer to Part 6: Superstructure.
7.4 Ceilings

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 (see diagram 7.20).

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, fitted with an effective draught seal and insulated.

Workmanship should be in accordance with BS 8000-8:1994.

Diagram 7.20: Draught sealing of service ducts at ceiling level

<table>
<thead>
<tr>
<th>Board thickness</th>
<th>Board width</th>
<th>Ceilings * preferred</th>
<th>Ceilings * maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.5</td>
<td>900</td>
<td>400</td>
<td>450</td>
</tr>
<tr>
<td>9.5</td>
<td>1200</td>
<td>400</td>
<td>450</td>
</tr>
<tr>
<td>12</td>
<td>900</td>
<td>450</td>
<td>600</td>
</tr>
<tr>
<td>12</td>
<td>1200</td>
<td>450</td>
<td>600</td>
</tr>
</tbody>
</table>

* All dry and skim finish ceiling board edges to be supported

Table 7.21: Dry finish and skimmed plasterboard ceilings
7.4 Ceilings

**Plasterboard Linings**


Plasterboard nails should comply with BS 1202-1:2002.

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 7.15, 7.17 and 7.21.

**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 5 m 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 8000:8:1994 & BS 8212:1995.
- The use of appropriate plaster board screws is an alternative fixing method and is preferred by Build-Zone.

**PLASTERBOARD CEILINGS**

**Timber Ceiling Joists and Noggins**

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.

Noggins or joists should be provided at wall/ceiling junctions to support the perimeter edges and located not more than 50mm from the wall (see diagram 7.23).

All cut edges should be supported by noggins or joists.

In “direct decoration” ceilings all joints should be provided with noggins (see diagram 7.24) 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.

Tables 7.22 and 7.27 provide guidance on how typical floor/ceiling construction details can achieve the required fire resistance.

<table>
<thead>
<tr>
<th>Fire resistance</th>
<th>Floor decking</th>
<th>min joist width</th>
<th>max joist spacing</th>
<th>Ceiling finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 mins (modified)</td>
<td>squared edge board (structurally adequate)</td>
<td>38mm</td>
<td>600mm</td>
<td>12.5mm plasterboard</td>
</tr>
<tr>
<td></td>
<td>15mm T&amp;G floor grade board</td>
<td>38mm</td>
<td>600mm</td>
<td>12.5mm plasterboard</td>
</tr>
<tr>
<td>30 mins</td>
<td>squared edge board (structurally adequate)</td>
<td>38mm</td>
<td>600mm</td>
<td>2 layers plasterboard (joints staggered)</td>
</tr>
<tr>
<td></td>
<td>21mm s.w T&amp;G boarding or 15mm T&amp;G plywood or chipboard</td>
<td>38mm</td>
<td>600mm</td>
<td>12.5mm plasterboard</td>
</tr>
<tr>
<td>60 mins</td>
<td>15mm T&amp;G plywood or chipboard</td>
<td>47mm</td>
<td>600mm</td>
<td>At least 30mm plasterboard with joists staggered</td>
</tr>
</tbody>
</table>

Notes:
1. All joints to plasterboard to be taped and filled. Where two layers of board are used joints should be staggered.
2. All plasterboard layers should be fully fixed in accordance with manufacturers recommendations (see table 7.15).
3. Ceiling/wall junction layers should be alternated to form a “Z” joint.
4. The thickness of floor decking and ceiling finish may need to be increased to provide sufficient sound insulation.

Table 7.22: Fire resistance to ceilings/floors in dwellings

Diagram 7.23: Plasterboard ceilings with 2 coat plaster finish

Diagram 7.24: Plasterboard ceiling for direct finish

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 (See diagrams 7.25 and 7.26).
Nail Popping

Unsightly nail protrusion can be reduced by:

- Lowering moisture content of timber to that recommended by the relevant British Standard
- Nailing or preferably screwing plasterboard tightly to the timber framework. Plaster board screws should be used where possible.
- 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-fixing with new nails before the plaster board is offered up

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.
The information on plasterboards is correct as at 23 March 2017 but it is the user’s responsibility to ensure it remains current prior to use. Approved Document E generally requires 10kg/m² per layer.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Plasterboard Type</th>
<th>6.0mm</th>
<th>9.5mm</th>
<th>12.5mm</th>
<th>15mm</th>
<th>19mm</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Gypsum</td>
<td>WallBoard</td>
<td>6.3 kg/m²</td>
<td>8 kg/m²</td>
<td>9.8 kg/m²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>WallBoard Duplex</td>
<td>8 kg/m²</td>
<td>9.8 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>Plank (TE/SE)</td>
<td></td>
<td></td>
<td>15 kg/m²</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Gyproc</td>
<td>HandiBoard</td>
<td>6.3 kg/m²</td>
<td>8 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>Moisture Resistant</td>
<td>8.6kg/m²</td>
<td>10.1 kg/m²</td>
<td>Green face and reverse</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>Fireline</td>
<td>9.8 kg/m²</td>
<td>11.7 kg/m²</td>
<td>Pink faced</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>Fireline Duplex</td>
<td>9.8 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>Fireline MR</td>
<td>9.5 kg/m²</td>
<td>11.5 kg/m²</td>
<td>Pink faced/moisture resistant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>Core Board</td>
<td></td>
<td></td>
<td>16 kg/m²</td>
<td>Green faced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glascroc</td>
<td>Multiboard F</td>
<td>6 kg/m²</td>
<td>8.5 kg/m²</td>
<td>10.6 kg/m²</td>
<td>White faced/glass reinforced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>Moisture Resistant</td>
<td>8.6 kg/m²</td>
<td>10.1 kg/m²</td>
<td>Green face</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>SoundBloc</td>
<td>10.6 kg/m²</td>
<td>12.6 kg/m²</td>
<td>Blue face</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>SoundBloc F</td>
<td>13.5 kg/m²</td>
<td>Blue face/water repellent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>SoundBloc MR</td>
<td>10.6 kg/m²</td>
<td>12.6 kg/m²</td>
<td>Blue faced</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>SoundBloc Rapid</td>
<td>12.6 kg/m²</td>
<td>Blue faced</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>SoundBloc Rapid MR</td>
<td>10.5 kg/m²</td>
<td>12.5 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>DuraLine</td>
<td>13.9 kg/m²</td>
<td>Ivory face</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>DuraLine MR</td>
<td>13.9 kg/m²</td>
<td>Green faced</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knauf</td>
<td>Wall board</td>
<td>6.2 kg/m²</td>
<td>8.3 kg/m²</td>
<td>10.2 kg/m²</td>
<td>Ivory face</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vapour Panel</td>
<td>8.3 kg/m²</td>
<td>10.2 kg/m²</td>
<td>Grey face/polyester foil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plank</td>
<td></td>
<td></td>
<td></td>
<td>14 kg/m²</td>
<td>Ivory face</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact Panel</td>
<td></td>
<td></td>
<td></td>
<td>12.8 kg/m²</td>
<td>Yellow faced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire Panel</td>
<td>10 kg/m²</td>
<td>12 kg/m²</td>
<td>Pink face</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture Panel</td>
<td>9.5 kg/m²</td>
<td>10.2 kg/m²</td>
<td>Green face</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sound Panel</td>
<td>10 kg/m²</td>
<td></td>
<td></td>
<td>Blue face</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance Plus</td>
<td>11.5 kg/m²</td>
<td>12.8 kg/m²</td>
<td>Grey face</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soundshield plus</td>
<td>11.5 kg/m²</td>
<td>12.8 kg/m²</td>
<td>Blue face</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Core board</td>
<td></td>
<td></td>
<td></td>
<td>16.3 kg/m²</td>
<td>Green face</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7.27: Plasterboard type/weights

**SUSPENDED CEILINGS**

- Suspended ceilings should comply with BS EN 13964:2004 & BS EN 13964+A1:2006-8290.
- Suspended ceilings 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 Approved Document B (Technical Standards for Scotland: Section 2 and Part E for N. Ireland).

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.
7.5 Carpentry

INTERNAL JOINERY AND FITTINGS

Joinery items should, where appropriate, comply with the requirements of the following British Standards:

- BS 585-1:1989 Wood stairs
- BS 4787-1:1980 Internal and external wood door sets, door leaves and frames
- BS EN 942:2007 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 EN 942:2007.

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 (see diagram 7.28).

FIRE DOORS

Fire doors shall be in accordance with BS 8214:2008 and tested to BS 476-10:2009. Fire resisting doors should be fitted with positive self-closing devices.

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 30 minute 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 3 mm (top and sides) and be fitted with an appropriate self-closing device. Rising butts are acceptable within a dwelling house but not in flats or maisonettes.

Fire doors should be hung on a minimum of 3 hinges.

Further guidance on the type of hardware suitable for fire doors should be obtained from a suitable professional. BM TRADA operates ‘Q-Mark’ certification schemes for fire door manufacture, fabrication and installation.

Q-Marked fire doors are marked as being accredited by BM TRADA using colour-coded plastic plugs. Further details can be found on the BM TRADA website – www.bmtrada.com.
Diagram 7.28: Maintaining fire resistance of frames to fire doors

<table>
<thead>
<tr>
<th>Fire Rating of Door</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FD30</td>
<td>White tree in yellow circle</td>
</tr>
<tr>
<td>FD60</td>
<td>White tree in blue circle</td>
</tr>
<tr>
<td>FD90</td>
<td>White tree in brown circle</td>
</tr>
<tr>
<td>FD120</td>
<td>White tree in black circle</td>
</tr>
</tbody>
</table>

Table 7.29: Identification of fire rating on doors

SKIRTINGS, ARCHITRAVES AND OTHER TRIM FINISHES

Timber trim should be selected in accordance with BS EN 942:2007 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 for 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 nosings 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 width of 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.

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 7.30.

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.

<table>
<thead>
<tr>
<th>Size of Dwelling</th>
<th>Storage Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Bedroom</td>
<td>1.63m³</td>
</tr>
<tr>
<td>2 – 4 Bedrooms</td>
<td>2.8m³</td>
</tr>
<tr>
<td>More than 4 Bedrooms</td>
<td>3.6m³</td>
</tr>
</tbody>
</table>

Table 7.30: Total storage space for dwellings
7.6 Painting

GENERAL

Paint systems should be used as recommended by the manufacturer and should comply with BS 6150:2006.

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 8000-12:1989.

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.