

FUNCTIONAL REQUIREMENTS

7.2 STEEL FRAME

Workmanship

- i. All workmanship must be within the tolerances defined in Chapter 1 of this Manual.
- ii. All work is to be carried out by a technically competent person in a workmanlike manner.

Materials

- i. All materials should be stored correctly in a manner that will not cause damage or deterioration of the product.
- ii. All materials, products and building systems shall be appropriate and suitable for their intended purpose.
- iii. Steel frames should be appropriately treated to prevent corrosion.
- iv. The structure shall, unless specifically agreed otherwise with the Warranty provider, have a life of not less than 60 years. Individual components and assemblies, not integral to the structure, may have a lesser durability, but not in any circumstances less than 15 years.

Design

- i. The design and specifications shall provide a clear indication of the design intent and demonstrate a satisfactory level of performance.
- ii. The design of the steel frame must be supported by structural calculations completed by a suitably qualified engineer. The design and construction must meet the relevant Building Regulations, British Standards, Eurocodes and other statutory requirements.

7.2.1 Steel frame

Galvanised strip steel should be designated either grade S280GD or 350GD to BS EN 10326. The structural design should be in accordance with BS 5950–5: 1998, and imposed loads should be calculated in accordance with BS EN 1991, including:

- Dead loads
- Imposed loads
- Wind loads

Steel and fixings should be suitable for the design and adequately protected against corrosion. Load-bearing walls should be designed to support and transfer loads to foundations safely and without undue movement.

Wall panels may provide resistance to racking forces using one or more of the following techniques:

- Internal bracing
- Cross flat bracing
- External sheathing board
- Internal sheathing board
- Rigid frame action

The design should detail how joints between the wall panels and other elements are to be securely fixed:

- To the structure
- To adjacent panels
- To the floor and roof

The design should ensure that the structure is adequately protected from the effects of moisture. Exterior claddings should be compatible with the steel frame. Suspended floors should be designed to support and transmit loads safely to the supporting structure without undue deflection.

Services should be adequately protected from damage. Walls and floors should resist the spread of fire. Internal walls and floors should be designed to resist the passage of sound adequately.

7.2.2 Site tolerances

It is essential that the accuracy of setting out foundations and ground beams are checked well in advance of materials being delivered to site.

For accurate erection of the frame, the following tolerances are required at the level of the base of the wall frame:

- Length of wall frame: +/-10mm in 10m.
- Line of wall frame: +/-5mm from outer face of plate.
- Level of base of wall frame: +/-5mm over complete wall line.

Some packing may be needed to achieve the required tolerances:

- Less than 10mm; pack under each steel with pre-galvanised steel shims.
- 10mm–20mm; pack under each steel with steel shims and grout over length of sole plate.
- Over 20mm; refer to Frame Designer.

7.2.3 Fixing of frames to substructures

The oversite DPM should be attached to the side of the slab and returned under the DPC on which the frame is placed. The DPC/DPM detail requires careful attention to prevent the cavity being bridged and providing a ledge for mortar droppings.

Holding down anchors may be galvanised, or preferably stainless steel straps that are fixed to the stud wall and attached to masonry supports or concrete foundation, or holding down bolts fixed to the concrete slab.

7.2.4 Walls

If stainless steel straps are used, they should be grade 1.4301 steel to BS EN 10088 and isolated from the studs with neoprene gaskets or similar. Non-stainless connections should be isolated from the straps with suitable grommets and washers.

Resin or expanding anchors should be used in an in-situ concrete raft of a minimum C20/GEN3 grade concrete. If required, steel frames can be fixed to timber sole plates.

For guidance on fixing sole plates, refer to the timber frame section in this Manual. The metal frame should be located entirely above DPC level. Where this is not possible, Z460 galvanising or equivalent, or a suitable bituminous coating, should be applied to all components below DPC level. It is recommended that the inner leaf DPC is turned up approximately 30mm above the screed to protect the bottom of the studs from

construction moisture and spillage, and weep-holes are provided at 900mm centres to drain cavities at ground level.

7.2.5 Metal stud framework

The wall panel usually consists of a head rail, base rail (sole plate) and possibly horizontal noggins at mid-height, together with vertical wall studs:

- Recommended site connections include self-drilling, self-tapping screws or 10mm–12mm diameter grade 4.6 bolts. Welding is not recommended on-site.
- Workmanship should comply with BS 8000: 5
- Framed walls should be accurately aligned, plumb, level without twist and securely fixed to adjacent elements

Vertical tolerances are:

- +/-15mm in overall height of wall 3 storey or;
- +/-10mm in overall height of wall 2 storey or;
- +/-5mm in storey height (approx. 2.5m).

A lintel should be provided where one or more studs is cut or displaced to form an opening. A lintel is not required where an opening falls between studs. Non-load bearing walls should have adequate strength and support.

Non-load bearing walls should not bridge movement joints in the main structure. A movement joint should be constructed between the frame and any chimney flue lift shaft to prevent load transfer. Cavity barriers and fire stops should be provided in accordance with relevant Building

Regulations, and steel joists should be spaced at centres no greater than 600mm.

Cutting holes for services on-site is not recommended, but where essential should be carried out with specialist tools. The maximum size of rectangular holes should not exceed 40% of the overall section, and length should not exceed 60% of the overall section or be the depth of the section apart. No holes should be closer than 1.5 times the depth of the section to the end of the member. Notches are not acceptable.

7.2.6 Thermal insulation

Rigid thermal insulation material should be fixed to the outside face of the steel studs to create a 'warm frame' construction.

Where the condensation risk has been assessed and shown to be negligible, additional insulation may be placed between the studs. The additional insulation should be placed in contact with the studs to minimise air gaps and prevent local condensation.

The following are acceptable:

- Mineral wool to BS EN 13162
- FR (flame retardant) grade expanded polystyrene to BS EN 13163
- FR (flame retardant) grade extruded polystyrene to BS EN 13164
- Rigid polyurethane foam and polyisocyanurate to BS EN 13166
- Cellular glass to BS EN 13167

7.2.7 Breather membranes

Breather membranes should be capable of allowing water vapour from within the frame to pass out into the cavity and protect the sheathing and frame from external moisture. These should be:

- Vapour-resistant to less than 0.6MNs/g when calculated from the results of tests carried out in accordance with BS 3177 at 25°C, and with a relative humidity of 75%.
- Capable of resisting water penetration.
- Self-extinguishing.
- Durable.
- Adequately strong when wet to resist site damage.
- Type 1 to BS 4016 in areas of very severe exposure to wind-driven rain.

If foil faced insulation is not used, then an independent breather membrane should be provided to the 'cold side' of the insulation.

7.2.8 Vapour Control Layers

VCL resist the passage of water vapour from within the dwelling and should be a minimum of 500-gauge polyethylene sheet or vapour control plasterboard. The vapour resistance (not resistivity) of the vapour control material should not be less than 250 MN.s/g or 0.25 Pa/m².

Installation

A sheet membrane Vapour Control Layer (VCL) should be:

- Lapped and sealed by at least 100mm at joints.
- Lapped over studs, rails or noggins.
- Sealed around service penetrations.
- Lapped and sealed fully into window and door reveals.
- Lapped and sealed with DPM/DPC at the junction with the ground floor/foundation.
- Able to accommodate differential movements.

Small holes in the VCL should be sealed with a suitable self-adhesive tape. Larger holes should be re-covered with new laps located over adjacent studs and rails.

7.2.9 Plasterboard

Plasterboard should be to BS 1230 and not less than:

- 9.5mm for stud spacing up to 450mm or;
- 12.5mm for stud spacing up to 600mm.

To provide fire resistance, fire rated boards should be used and installed in accordance with the manufacturer's instructions.

7.2.10 Masonry cladding

- Cavity trays must be provided above all cavity barriers, windows and door openings, etc.
- Cavity trays should extend 150mm either side of the door or window openings and have stopped-ends.
- A continuous cavity tray should be provided where intermediate floors meet the external wall.
- External skin of brickwork should be attached to the metal frame with either epoxy coated galvanised ties or austenitic stainless steel ties (to DD 140, BS 1243, BS 5268, BS 8200).
- Ties are normally fixed in vertical channels. These channels are then fixed directly to sheathing boards or attached through insulation boards with stand-off screws (screws should be isolated from the channels with neoprene or similar washers).
- Ties should be spaced at jambs of openings, a maximum of 300mm vertically within 225mm of the masonry reveal.

Additional studs may be needed to achieve this:

- Ties should be inclined away from the frame.
- Ties should be fixed to the studs, not the sheathing.
- Ties should accommodate differential movement between the frame and the cladding.
- Soft joints should be provided to allow for differential movement. A gap of 1mm per metre of masonry should be provided at openings and soffits.

- All brick support angles should be installed by the manufacturer or Specialist Contractor.

7.2.11 Claddings

More traditional claddings can include, amongst others, timber boarding, plywood and tile hanging. These types of cladding should be fixed to battens and suitably attached at stud positions. For further details, refer to the timber frame section of this Manual and the manufacturer's recommendations.

Render on metal lath combined with a breather membrane should also be fixed to battens attached to studs.

Breather membranes should be provided in areas of severe exposure or worse

Other claddings should only be used if they are provided with an acceptable third-party accreditation certificate.