Technical performance and principles of system design

Robustness

Legislation and guidance

BS 5234: 1992 – Partition (including matching linings)

BS 5234 comprises two parts – *Part 1 code of practice for the design and installation*, and *Part 2 Specification for performance requirements for strength and robustness including methods of test* in relation to end-use categories. The standard covers performance aspects such as stiffness, crowd pressure, impact resistance, anchorages and door slamming resistance.

BS 6399-1: Part 1:1996 – Loading for buildings: – Code of practice for dead and imposed loads

This code of practice gives dead and minimum recommended imposed loads for use in designing buildings. Whilst our GypWall partition systems are non-loadbearing, they are able to provide resistance to levels of horizontal uniformly distributed loads (UDL) applied at a height of 1.1m as detailed within this standard for parapets, barriers and balustrades, etc. Refer to examples in table 8.

BS EN 13964: 2014 – Suspended ceiling – Requirements and test methods

Includes performance requirements for ceiling tiles and suspended ceiling grid systems (concealed and exposed). The standard covers issues such as the load span performance of grids.

Principles of robust design

Partition Duty Ratings

All our partition systems have a Duty Rating established in accordance with all the full requirements of *BS 5234*. This rating relates to the strength and robustness characteristics of the partition system against specific end-use applications. Table 9 gives details of the four duty categories.

A series of tests are used to assess the resistance to damage, both aesthetic and structural, from a range of impacts and load applications.

The tests are conducted at the maximum height for the partition system. *BS 5234* itself does not have a method for establishing an acceptable maximum height, and the partition height must be established using a separate method. It is suggested within *BS 5234* that the crowd pressure test may be suitable for evaluating heights up to 4200mm, but we would strongly advise against using this inconsistent approach and would never rely solely on *BS 5234* for evaluating heights, especially above 4200mm.

Table 8 – *BS 6399-1 – Loading for buildings: – Code of practice for dead and imposed loads*

Gyproc GypWall partitions comprising double layer 12.5mm Gyproc plasterboard or specialist board each side						
Gypframe AcouStuds at 600mm centres	146 AS 50	146 AS 50	92 AS 50	92 AS 50	70 AS 50	70 AS 50
Gypframe Deep Flange Floor & Ceiling Channel	148 EDC 80	148 EDC 80	94 EDC 70	94 EDC 70	72 EDC 80	72 EDC 80
Partition height	7.8m	6m	5.8m	4.9m	4.7m	3.1m
Maximum horizontal UDL as per BS 6399-1, applied at a height of 1.1m	1.5 kN/m	3 kN/m	0.74 kN/m	1.5 kN/m	0.74 kN/m	1.5 kN/m

Table 9 – *BS 5234* Duty Ratings

Partition Duty Rating	Category	Examples
Light	Adjacent space only accessible to persons with high incentive to exercise care. Small chance of accident occurring or misuse.	Domestic accommodation
Medium	Adjacent space moderately used, primarily by persons with some incentive to exercise care. Some chance of accident occurring or misuse.	Office accommodation
Heavy	Adjacent space frequently used by the public and others with little incentive to exercise care. Chance of accident occurring or misuse.	Public circulation areas, industrial areas
Severe	Adjacent space intensively used by the public and others with little incentive to exercise care. Prone to vandalism and abnormally rough use.	Major circulation areas, heavy industrial areas

Technical performance and principles of system design

Robustness (continued)

Tests within *BS 5234* include:

- Partition stiffness
- Resistance to damage from a small hard body impactor
- Resistance to damage from a large soft body impactor
- Resistance to perforation from a small hard body impactor
- Resistance to structural damage from a large soft body impactor
- Resistance to damage from door slamming

BS 5234 does not identify specific points of contact on a partition that should be impacted. However, we understand that there are limiting points in terms of impact resistance. These are then subjected to the impact tests to ensure that the most onerous situation is assessed.

Optional tests are also detailed within the standard, but these are not used in the partition grading. These include:

- Resistance to damage from a crowd pressure load
- Lightweight anchorages pull down
- Lightweight anchorages pull out
- Heavyweight anchorages wall cupboard
- Heavyweight anchorages wash basin

▶ Refer to Service installations within this section, for more information on fixing to drywall systems.

Important design considerations

To achieve Heavy Duty Rating or Severe Duty Rating, the door detail needs to be reinforced otherwise the door opening will undergo too much deflection and damage during the onerous door slamming test.

Important information

To claim a partition Duty Rating, all tests must achieve the designated performance level. It is not possible, for example, for a partition lined with a single layer of Gyproc WallBoard (12.5mm) to achieve a Duty Rating better than medium, because of the board's performance in the hard body perforation test. In the majority of cases, the type of board used will determine the maximum partition Duty Rating. Table 10 shows the maximum rating available based on a single layer board lining. In all cases, a double layer lining achieves Severe Duty Rating.

Table 10 – Board type required to achieve a given Duty Rating (single layer) solutions

Board type	Maximum rating
Gyproc WallBoard 12.5mm	Medium
Gyproc WallBoard 15mm	Medium
Gyproc SoundBloc 12.5mm	Medium
Gyproc SoundBloc 15mm	Medium
Gyproc FireLine 12.5mm	Medium
Glasroc H TILEBACKER 12.5mm	Medium
Gyproc FireLine 15mm	Heavy
Gyproc SoundBloc 15mm	Heavy[1]
Glasroc F MULTIBOARD 10mm	Heavy
Gyproc Habito 12.5mm	Severe
Glasroc F MULTIBOARD 12.5mm	Severe
Gyproc DuraLine 15mm	Severe
Rigidur 12.5mm / 15mm	Severe

[1] Minimum Gypframe 70mm Stud for Heavy Duty Rating.

The level of deflection and strength performance required to achieve Light Duty Rating within *BS 5234* is, in our opinion, unsuitable for any application. We do not offer any systems with a rating less than Medium Duty Rating.

Maximum partition heights

As stated previously, *BS 5234: Part 2* does not contain a consistent methodology for establishing the performance of a partition in terms of height. To date the UK and Ireland has adopted a methodology, which is based on the level of lateral deflection under a given uniformly distributed load (UDL). The criterion is that the maximum lateral deflection of the partition should not exceed L/240 (where L is the partition height) when the partition is uniformly loaded to 200Pa.

We utilise a UKAS accredited test laboratory to evaluate partition system heights against this performance criteria. The test evidence comes from a full-scale test procedure where the test specimen is subjected to a UDL and the induced lateral deflection recorded. From this procedure, it is possible to establish the maximum height for a range of partition systems.

When cutting Gypframe studs to suit the partition height, it is not good practice to cut the stud through the location of a service cut-out.

Technical performance and principles of system design

Robustness (continued)

Assessing acoustic performance of GypWall with reduced stud centres

Reducing the centres of the metal studs within GypWall partition systems can have a detrimental effect on the sound insulation performance of the system. We have estimated the performance reductions for GypWall:

- When there is no insulation within the partition cavity and studs are closed down to 400mm centres, this results in an estimated 2dB loss in *Rw* compared to studs at 600mm centres with no insulation
- When there is no insulation within the partition cavity and studs are closed down to 300mm centres, this results in an estimated 3dB loss in *Rw* compared to studs at 600mm centres with no insulation
- When there is a minimum 25mm Isover Acoustic Roll within the partition cavity and studs are closed down to 400mm centres, this results in no loss in *Rw* compared to studs at 600mm centres with 25mm Isover Acoustic Roll
- When there is a minimum 25mm Isover Acoustic Roll within the partition cavity and studs are closed down to 300mm centres, this results in an estimated 2dB loss in *Rw* compared to studs at 600mm centres with 25mm Isover Acoustic Roll

Where Gyproc Finish Plasters are specified to obtain a 1 or 2 dB uplift, this will be negated when closing down stud centres or changing stud profile.

If the partition system is also performing a fire compartmentation function to EN standards, the partition height in the fire state also needs to be established for the required duration. It should not be assumed that the cold state height is still valid in the fire state.

Movement

Deflection of upper floor and roof slabs can cause appreciable stress in partitions. Where such deflection is likely to occur, the partition to structural soffit junction detail must be designed to accommodate movement, whilst still complying with any fire or acoustic performance requirements. Typical deflection head details for fire-rated GypWall partition systems are given in the relevant partition and wall system sections within this book. Additional attention to detailing will be required to optimise sound insulation performance. The detail included in GypWall STAGGERED shows a good practice solution incorporating steel angles, either side of the head and sealed to the structure. Refer to figures 2 and 3 earlier in this section for more information.

Where linings (partitions, wall linings and ceilings) cross a movement joint in a structural wall, floor or roof slab, they should be provided with a movement joint at the same point, and be capable of the same range of movement as the wall, floor or roof joint. Gyproc Control Joint provides a suitable solution for movement up to 7mm. Gyproc Control Joint may also be required to relieve stresses induced by extreme environmental conditions. For example, consideration could be given to installing control joints at 10m centres in linings that are subjected to either extreme or variable temperatures.

▶ **Refer to C07. S05. P501 detail 7 and 8 – Control joint detail.**

Environmental conditions

Temperature

Gyproc plasterboards, Glasroc F specialist boards and Gyproc plasters should not be used where the temperature will exceed 49°C. Prolonged exposure to high temperature, and/or multiple exposure for short periods, results in the gradual continued calcination of the gypsum and loss of its inherent properties. Gyproc plasterboards, Glasroc F specialist boards and Gyproc plasters (once fully dried) can be subjected to freezing conditions without risk of damage.

Moisture

Our products should not be used in continuously damp conditions or in buildings that are not weather tight. However, our Gyproc moisture resistant grade plasterboards and Glasroc F specialist boards are suitable for use in intermittently damp conditions or sheltered external situations in conjunction with an appropriate decorative finish. This should take the form of ceramic tiling or other suitable moisture impervious coating by others. Glasroc H TILEBACKER can be used as a tiling substrate in high moisture applications.

Relative humidity (RH)

In moderate humidity situations, i.e. 40% to 70% RH, no special precautions need to be taken when using Gyproc plasterboards, other than those necessary to prevent interstitial condensation. However, whenever the building's heating system is turned off a rapid increase in the relative humidity can occur as the building cools down. This could lead to the occurrence of potentially harmful surface condensation. Precautions to avoid this problem should be taken, e.g. by continuing to run the ventilation system after the heating is turned off.

Low humidity does not affect the plasterboards, but may lead to distortion of timber framing members as they dry to below their usual moisture content. Intermittently high relative humidity, i.e. above 70% RH, requires special treatment to the face of the plasterboards, and only moisture resistant grade plasterboards or Glasroc F specialist boards should be used. Suitable surface treatments include ceramic tiling and water vapour resistant paint systems. Gyproc plasterboards are not considered suitable in continuously high humidity conditions. Certain Gyproc ceiling products are suitable for use in environments above 70% RH.

Technical performance and principles of system design

Robustness (continued)

Special environments – swimming pools and similar environments

Ceiling lining

Our products and systems are regularly specified for ceilings in and around swimming pool halls and similar areas. With regard to ceiling specifications attention to detail is critical. The following guidance should be considered:

- The boards to be used should be moisture resistant grade or Glasroc F specialist boards. They should be screw-fixed to a framed system at their recommended centres
- The surface of the board should be finished using our recommended methods, and they must be set and dry before applying decoration. Gyproc Finish Plasters are not recommended for this type of environment
- The decoration should take the form of a suitable moisture impervious finish supplied by other manufacturers
- Penetrations in the ceiling linings and perimeters should be avoided where possible. All service penetrations must be sealed using a moisture resistant sealant (even though the recommended plasterboards are moisture resistant it is unwise to allow moisture to gain access to the core of the board)
- The air in the pool area should be conditioned such that condensation will not form on the surface of the boards
- In situations where there is a risk of condensation occurring within the ceiling cavity, it must be mechanically ventilated or the decorative finish must be impervious to water vapour. This will minimise the risk of condensation forming on 'cold' surfaces in the cavity, which could then come in to contact with the unprotected back face of the plasterboard lining
- It is good practice to protect the cut ends of Gypframe metal components using suitable material to prevent corrosion
- Ensure that the Gypframe metal frame is totally encapsulated by suitable Gyproc board and waterproof finishing system (by others).

Wall lining

Offering enhanced levels of moisture resistance performance, Glasroc H TILEBACKER is suitable as a tiling substrate in high moisture environments including domestic shower enclosures and bathrooms, commercial kitchens and changing areas.

Gyproc moisture resistant grade boards and Glasroc F specialist boards are not suitable to be used in those areas, but can be considered for use in adjacent areas of wall lining and in most domestic situations. Attention to detail is critical and, in addition to the guidance given above for ceiling linings, the following additional guidance should be considered:

- The lining boards must be lifted clear from any floor where free water is possible and a suitable skirting detail must be employed which will not allow water penetration
- In extreme moisture environments, Glasroc H TILEBACKER must be used in conjunction with a tanking system
- Important guidance is given within *BS 5385-1: 2009* and *BS 5385-4: 2009*, within which gypsum plasterboard and gypsum plaster are deemed unsuitable backgrounds for tiling in 'frequently wetted' areas. These areas include communal showers and pool halls

Ceilings

EN 13964: 2014 includes class definition relating to exposure conditions and maximum deflection. The standard **CasoLine MF** ceiling layout is capable of complying with deflection Class 2 and exposure Class A, however the system can be modified to meet Classes 1 and B. Contact the Gyproc Technical Department for further guidance.