

3.4 Robustness

3.4.1 Legislation and guidance

BS 5234: Part 2: 1992 - Partition Grading

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.

HTM 60 - Ceilings in Healthcare Environments

HTM 60 sets out six performance categories. These categories relate user requirements to the physical and performance characteristics of different ceilings. See the British Gypsum **WHITE BOOK Health sector guide** for more information, available to download from www.british-gypsum.com

BS EN 13964: 2004 - 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.

3.4.2 Principles of robust design

Partition Duty ratings

All British Gypsum partition systems have a duty rating established in accordance with all the full requirements of BS 5234. This rating relates the strength and robustness characteristics of the partition system against specific end-use applications. Table 13 gives details of the four duty categories.

Table 13 - Duty ratings

Partition Duty	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

The series of tests are designed to test the resistance to damage, both aesthetic and structural, from a range of impacts and load applications.

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 - see maximum partition

heights later. It is suggested within BS 5234 that the crowd pressure test may be suitable for evaluating heights up to 4200mm, but British Gypsum would strongly advise against using this inconsistent approach and would never rely solely on BS 5234 for evaluating heights, especially above 4200mm.

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, British Gypsum understands there are limiting points in terms of impact resistance. These are then subjected to the impact tests to ensure that the most onerous situation are 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 section 3.5 – Service Installations, for information on fixing to drywall systems.

Important considerations

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

To claim a partition duty, 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 14 shows the maximum rating available based on a single layer board lining. In all cases, a double layer lining achieves Severe Duty.

Table 14 - Board type required to achieve a given duty rating

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
Gyproc FireLine 15mm	Heavy
Gyproc SoundBloc 15mm	Heavy ¹
Glasroc F MULTIBOARD 10mm	Heavy
Glasroc F MULTIBOARD 12.5mm	Severe
Gyproc DuraLine 15mm	Severe
Rigidur H 12.5mm / 15mm	Severe

¹ Minimum Gypframe 70mm Stud for Heavy Duty.

The level of deflection and strength performance required to achieve Light Duty within BS 5234 is, in British Gypsum's opinion, unsuitable for any application. British Gypsum does not offer any systems with a rating less than Medium Duty.

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. The UK has therefore 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 200 Pa.

British Gypsum utilises 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.

Table 15 - GypWall classic metal stud partition recommended maximum heights (mm) - based on a limiting deflection of L/240 at 200 Pa
Applicable to non fire-rated or BS 476: Part 22 fire-rated constructions only (not applicable to EN 1364-1: 1999)

Stud	Boarding each side	600mm centres	600mm boxed	400mm centres	400mm boxed	300mm centres	300mm boxed
48 S 50	1 x 12.5mm	2500	2800	2900	3200	3100	3500
	1 x 15mm	2800	3000	3100	3300	3300	3600
	2 x 12.5mm	3400	3600	3600	3800	3800	4000
	2 x 15mm	3700	3800	3900	4000	4000	4200
48 I 50	1 x 12.5mm	2900	-	3400	-	3700	-
	1 x 15mm	3100	-	3500	-	3800	-
	2 x 12.5mm	3700	-	3900	-	4200	-
	2 x 15mm	3900	-	4200	-	4400	-
60 S 50	1 x 12.5mm	3200	3400	3500	3800	3800	4200
	1 x 15mm	3400	3600	3700	4000	4000	4300
	2 x 12.5mm	4100	4300	4300	4600	4600	4800
	2 x 15mm	4400	4500	4600	4800	4800	5000
60 I 50	1 x 12.5mm	3600	-	4000	-	4400	-
	1 x 15mm	3800	-	4200	-	4500	-
	2 x 12.5mm	4400	-	4700	-	5000	-
	2 x 15mm	4600	-	4900	-	5200	-
60 I 70	1 x 12.5mm	4100	-	4600	-	5000	-
	1 x 15mm	4200	-	4700	-	5100	-
	2 x 12.5mm	4700	-	5100	-	5500	-
	2 x 15mm	4900	-	5300	-	5600	-
70 S 50	1 x 12.5mm	3600	3900	4000	4300	4300	4700
	1 x 15mm	3800	4100	4200	4500	4500	4900
	2 x 12.5mm	4600	4800	4900	5100	5100	5400
	2 x 15mm	4900	5100	5100	5300	5300	5600
70 S 60 or 70 AS 50	1 x 12.5mm	3800	4100	4200	4600	4500	5000
	1 x 15mm	4000	4300	4400	4700	4700	5100
	2 x 12.5mm	4700	4900	5000	5300	5200	5600
	2 x 15mm	5000	5200	5200	5500	5500	5800
70 I 50	1 x 12.5mm	4100	-	4600	-	5000	-
	1 x 15mm	4300	-	4700	-	5100	-
	2 x 12.5mm	4900	-	5300	-	5600	-
	2 x 15mm	5200	-	5500	-	5800	-
70 I 70	1 x 12.5mm	4600	-	5100	-	5600	-
	1 x 15mm	4700	-	5300	-	5700	-
	2 x 12.5mm	5300	-	5700	-	6100	-
	2 x 15mm	5500	-	5900	-	6300	-

Table 15 (continued) - GypWall classic metal stud partition recommended maximum heights (mm) - based on a limiting deflection of L/240 at 200 Pa. Applicable to non fire-rated or BS 476: Part 22 fire-rated constructions only (not applicable to EN 1364-1: 1999)

Stud	Boarding each side	600mm	600mm	400mm	400mm	300mm	300mm
		centres	boxed	centres	boxed	centres	boxed
92 S 50	1 x 12.5mm	4500	4800	4900	5400	5300	5800
	1 x 15mm	4700	5000	5200	5600	5500	6000
	2 x 12.5mm	5700	5900	6000	6300	6200	6600
	2 x 15mm	5900	6100	6200	6500	6400	6800
92 S 60 or 92 AS 50	1 x 12.5mm	4700	5000	5200	5600	5600	6100
	1 x 15mm	4900	5300	5400	5800	5800	6300
	2 x 12.5mm	5800	6000	6100	6500	6500	6900
	2 x 15mm	6000	6200	6300	6700	6600	7000
92 S 10	1 x 12.5mm	5300	5800	6000	6600	6500	7200
	1 x 15mm	5500	6000	6100	6700	6600	7300
	2 x 12.5mm	6200	6600	6700	7200	7200	7700
	2 x 15mm	6400	6800	6900	7400	7300	7800
92 I 90	1 x 12.5mm	6000	-	6800	-	7400	-
	1 x 15mm	6100	-	6900	-	7500	-
	2 x 12.5mm	6800	-	7400	-	7900	-
	2 x 15mm	6900	-	7500	-	8000	-
146 S 50	1 x 12.5mm	6200	6800	6900	7600	7500	8300
	1 x 15mm	6500	7000	7200	7800	7700	8400
	2 x 12.5mm	7600	8000	8100	8600	8500	9100
	2 x 15mm	7900	8200	8300	8800	8700	9300
146 AS 50	1 x 12.5mm	6500	7100	7300	8000	7900	8700
	1 x 15mm	6800	7400	7500	8200	8100	8900
	2 x 12.5mm	7800	8200	8400	8900	8900	9500
	2 x 15mm	8100	8500	8600	9100	9100	9700
146 I 80	1 x 12.5mm	7900	-	8900	-	9700	-
	1 x 15mm	8100	-	9000	-	9800	-
	2 x 12.5mm	8800	-	9600	-	10400	-
	2 x 15mm	9000	-	9800	-	10500	-
146 TI 90	1 x 12.5mm	8400	-	9500	-	10400	-
	1 x 15mm	8500	-	9600	-	10500	-
	2 x 12.5mm	9100	-	10100	-	10900	-
	2 x 15mm	9400	-	10300	-	11100	-

In all systems, for heights below 4200mm, the appropriate Gypframe Standard Floor & Ceiling Channel can be used. It is recommended that for heights between 4200mm and 8000mm, the Gypframe Deep Flange Floor & Ceiling Channel is used. Gypframe Extra Deep Flange Floor & Ceiling Channel is used for heights above 8000mm. Additional consideration needs to be given if there is a deflection head requirement.

Assessing acoustic performance of GypWall classic 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. British Gypsum has estimated the performance reductions for GypWall classic:

- When there is no insulation within the partition cavity and studs are closed down to 400mm centres, this results in an estimated 2 dB loss in R_w 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 3 dB loss in R_w compared to studs at 600mm centres with no insulation.
- When there is a minimum 25mm Isover insulation within the partition cavity and studs are closed down to 400mm centres, this results in an estimated 0 dB loss in R_w compared to studs at 600mm centres with 25mm Isover insulation.
- When there is a minimum 25mm Isover insulation within the partition cavity and studs are closed down to 300mm centres, this results in an estimated 2 dB loss in R_w compared to studs at 600mm centres with 25mm Isover insulation.

Please see Table 15 for example using GypWall classic.

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, which results in only a 1 dB - 2 dB loss in performance.

Where partitions cross a movement joint in a structural 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 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.

Environmental conditions**Temperature**

Gyproc plasterboards, British Gypsum specialist boards and Thistle 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, British Gypsum specialist boards and Thistle plasters can be subjected to freezing conditions without risk of damage.

Moisture

Gyproc plasterboards should not be used in continuously damp conditions nor in buildings that are not weathertight. However, Gyproc Moisture Resistant board, Gyproc SoundBloc MR, Gyproc DuraLine MR, Gyproc FireLine MR, Gyproc CoreBoard and British Gypsum specialist boards are all 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.

Two coats of Gyproc Drywall Sealer applied to the face of standard grade plasterboards, with the edges adequately protected from moisture may also be suitable to receive a tile finish. The application of Gyproc Drywall Sealer provides surface water absorption resistance only, and does not meet the performance requirements for moisture resistant grade boards as defined in *BS EN 520, type H1*.

Glasroc F specialist boards are also suitable for use in sheltered external situations.

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 British Gypsum 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 British Gypsum ceiling products are suitable for use in environments above 70% RH.

Special environments - swimming pools and similar environments**Ceiling lining**

British Gypsum 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 British Gypsum's recommended methods, and they must be set and dry before applying decoration. Thistle finish coat plasters are not recommended for this type of environment.
- The decoration should take the form of a suitable moisture impervious finish supplied by others.
- 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.

Wall lining

British Gypsum boards (including MR grade) are not suitable for use as wall linings in areas such as communal showers and public pool halls. Moisture Resistant grade board and Glasroc F specialist boards can be considered for use in adjacent areas of wall lining

and in most domestic situations but 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.
- Thistle plasters are not recommended for this type of environment with the exception of Thistle Dri-Coat undercoat which could be considered in conjunction with a completely sealed, impervious, tiling 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. 'Frequently wetted' areas include communal showers and pool halls.

X-ray protection

Thistle X-Ray plaster provides X-ray protection and has been tested by the National Radiological Protection Board (NRPB) for use in hospitals and other healthcare environments. Contact the British Gypsum Drywall Academy for guidance on plaster application. The NRPB, now the Radiation Protection Division of the Health Protection Agency, can be contacted via their website: www.hpa.org.uk

Ceilings

EN 13964: 2004 includes class definition relating to exposure conditions and maximum deflection. The standard **CasoLine MF** ceiling lay-out 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 British Gypsum Drywall Academy for further guidance.