

News to Use

Design Requirements Manual

The formulae $\frac{\partial U_i}{\partial x_i} + \frac{\partial}{\partial x_i}(\rho U_i) = -\frac{\partial p}{\partial x_i} + \frac{\partial}{\partial x_i}(\mu \frac{\partial U_i}{\partial x_i}) + s_i(\rho - \rho_0)$ for building $\frac{\partial}{\partial x_i}(\rho U_i) = -\frac{\partial p}{\partial x_i} + \frac{\partial}{\partial x_i}(\mu \frac{\partial U_i}{\partial x_i} - \rho U_i^2) + s_i(\rho - \rho_0)$ state of the art $\frac{\partial}{\partial x_i}(\rho U_i) = \frac{\partial}{\partial x_i}(\lambda \frac{\partial T}{\partial x_i} - \rho U_i^2)$ biomedical research facilities.

'Design Requirements Manual (DRM) News to Use' is a monthly ORF publication featuring salient technical information that should be applied to the design of NIH biomedical research laboratories and animal facilities. NIH Project Officers, A/E's and other consultants to the NIH, who develop intramural, extramural and American Recovery and Reinvestment Act (ARRA) projects will benefit from 'News to Use'.

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Interior Gypsum Board

Gypsum board is one of the most frequently used construction materials and makes up most of the interior wall surfaces and many of the ceiling surfaces in laboratories and other common building types. There is a wide variety of gypsum board available, and these products must be specified and detailed appropriately to perform as required.

Primary advantages of gypsum board are the low cost and ease of installation. Gypsum board arrives in large sheets, up to 14' (4.2M) long and is cut, installed and finished using common tools. Typical gypsum board is 5/8" (16mm) thick, but is available in thicknesses from 1/4" (6mm) to 1" (25mm). Gypsum board consists of gypsum plaster (calcium sulfate dihydrate) pressed between two layers of paper or fiberglass mat.

Applications: Gypsum board is available from a number of manufacturers which have proprietary brand names with unique characteristics and specifications. In addition to standard gypsum board, most manufacturers provide products for specialty applications to address specific performance requirements in buildings.

Fire Resistance: Type X gypsum board can provide fire ratings of up to 4 hours when installed as part of an Underwriters Laboratories (UL) rated wall assembly. To meet fire ratings, all components, including gypsum board type and thickness, framing assembly components, fasteners and fastener spacing, must be in strict conformance with the UL design specification.

Durability: Standard gypsum board has sufficient durability for offices and other moderate-duty use. It can be damaged by impact and abrasion, so impact-resistant or abuse-resistant gypsum panels must be used in areas subject to impact, wheeled traffic and excessive wear. When abuse resistant gypsum board is used, wall protection should be considered in high traffic areas like corridors, vivariums and loading docks. Both abuse and impact resistant gypsum board are tested per ASTM C1629.

Water and Moisture Resistance: When exposed to water or high humidity standard gypsum board will absorb water, degrade and become a growth medium for mold. Water resistant gypsum board is resistant to water, but is not waterproof and not appropriate for locations subject to repeated or prolonged water exposure. Mold-resistant gypsum board surface consists of fiberglass instead of paper, preventing the growth of mold on the surface. Mold-resistant gypsum board is appropriate for humid conditions but not for direct water exposure. Because of these inherent limitations, alternative materials such as concrete masonry units (CMU) or fiberglass reinforced plastic (FRP) should be used in wet locations. Cement board, though not a gypsum board, is a related product that is appropriate for use as a backer for tile in showers, or as a

backer for integral wall bases with monolithic floors and other wet locations.

Sag Resistance: Gypsum board is rigid but will sag if not adequately supported, especially in horizontal applications. Sag resistant gypsum board should be used in humid conditions and on ceilings and other horizontal surfaces where support spacing exceeds 16" (410mm), where gypsum board thickness is less than 5/8" (16mm).

Sound Isolation: Gypsum board assemblies typically do not have good acoustical properties because gypsum board is a light weight material installed on a lightweight framing system. Assemblies can be designed for acoustic performance if detailed appropriately. Acoustic gypsum board, along with double-row of framing, resilient channels, sound insulation, acoustical sealants and other wall assembly details, can be used to obtain a high sound transmission coefficient (STC). STC ratings are tested per ASTM standard E90 and rated per ASTM standard E413.

Other Considerations

Jobsite conditions: Gypsum board can be damaged by impact, bending or exposure to water. Therefore, gypsum board must be handled and stored properly on the jobsite. Manufacturer's recommendations, including support and environmental conditions, should be followed.

Expansion: Gypsum board assemblies expand like other construction materials, so expansion must be accommodated with expansion joints.

Holding Capacity: Gypsum board has negligible holding capacity for screws and other fasteners, so strapping must be installed where shelving, cabinets, wall protection rails and other wall-mounted equipment will be installed. Strapping requirements, as specified in DRM Section 4-3.B Interior Partitions, shall be followed in all laboratory applications.

Resources:

The Gypsum Association (www.gypsum.org) is the governing industry association for the Gypsum Board industry. The Gypsum Association publishes a number of design and technical manuals which are valuable resources for detailing and specifications.

ASTM C1396 Standard Specification for Gypsum Board covers most common gypsum board installation, physical properties specifications, water resistance, absorption, strength, deflection and other important characteristics.

ASTM C840 Standard Specification for Application and Finishing of Gypsum Board covers requirements for the methods of application and finishing of gypsum board.

Further details on this month's topic are available on the DRM website

<http://orf.od.nih.gov/PoliciesAndGuidelines/BiomedicalandAnimalResearchFacilitiesDesignPoliciesandGuidelines/Pages/DesignRequirementsManualPDF.aspx>

DRM Chapter 4 Section 3 Interior Architectural Elements