



## GYPSUM CONSTRUCTION TROUBLESHOOTING GUIDE

### GYPSUM BOARD

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#### 1. SCOPE

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The purpose of this document is to serve as a guide for identifying common interior wall construction and finishing problems, list probable causes, typical corrective actions and tips for prevention.

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#### 2. TERMINOLOGY

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The following definitions are applicable to this document.

**coat (n):** Paint varnish or lacquer applied to a surface in a single application (one layer) to form a properly distributed film when dry. - **ASTM**

**critical lighting (adj):** A condition whereby interior surfaces are flooded by natural or artificial lighting at an oblique angle; such as lighting from large expanses of windows, glass curtain walls, skylights, or surface-mounted light fixtures. - **ASTM**

**gloss (adj):** A subjective term used to describe the relative amount and nature of mirror like (specular) reflection. - **FSCT**

**gypsum board (n):** The generic name for a family of sheet products consisting of a noncombustible core primarily of gypsum, with paper surfacing. – **ASTM C11**

**gypsum panel products (n):** The general name for a family of sheet products consisting essentially of gypsum. – **ASTM C11**

**inspection lighting:** Inspection lighting shall be representative of normal lighting conditions in intensity and location.

**joint photographing (n):** The shadowing of the finished joint areas through the surface decoration. Syn telegraphing. - **GA-214-07**

**normal lighting conditions:** Normal lighting conditions are described as those in place when the project is finished. This includes, but not limited to, design lighting (e.g. wall washers, spots and floods, etc) and natural lighting." - **PDCA**

**normal viewing position:** The normal viewing position shall be at any angle provided it is established at a minimum distance of five feet perpendicular from the surface to be viewed.

**paint (n):** Any pigmented liquid, liquefiable, or mastic composition designed for application to a substrate as a thin layer which is converted to an opaque solid film after application. Used for protection, decoration or identification, or to serve some functional purpose, such as filling or concealing surface irregularities. – **FSCT**

**primer (n):** First complete coat of paint applied in a painting system to an uncoated surface prior to application of an intermediate coat or topcoat. Note: A primer used in gypsum board construction is typically a paint material specifically formulated to fill the pores and minimize suction differences between gypsum-board surface paper, texture and/or the compound used on finished joints, angles, fastener heads, accessories, and over skim coatings.



**properly painted surface (n):** A surface that is uniform in appearance, color, and sheen. It is one that is free of foreign material, lumps, skins, runs, sags, holidays, misses, strike-through, or insufficient coverage. It is a surface that is free of drips, spatters, spills, or overspray which a contractor's workforce may cause. Compliance to meeting the criteria of a "Properly painted surface" shall be determined when viewed without magnification at a distance of five feet or more under normal lighting conditions and from a normal viewing position. Note: A surface uniform in appearance, color, and sheen may not be achieved with a coat of primer or a single coat of topcoat. - **PDCA**

**topcoat (n):** The finish coat(s) of a coating system, formulated for appearance and/or environmental resistance. - **PDCA**

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### 3. DESCRIPTION OF PROBLEM

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#### **DRYWALL CONSTRUCTION**

Irregularities during the drywall construction and finishing process can occur. Invariably, unsatisfactory results show up first in the areas over joints or fastener heads. Improper application of either the board or joint treatment may be at fault, but other conditions existing on the job can be equally responsible for reducing the quality of the finished gypsum board surface.

*To help identify a particular imperfection, what follows is a physical description of each problem along with a discussion of the common factors related to the unsatisfactory result(s). Also provided is a list that identifies possible causes for the irregularity, as well as some common remedies and preventions.*

**Fastener Imperfections** - A common problem, which takes on many forms. May appear as darkening, localized cracking; a depression over fastener heads; pop or protrusion of the fastener or the surface area immediately surrounding the fastener. In new construction, fastener imperfections are usually caused by improper framing, wall movement, or improper fastener installation.

**Joint Problems** - Generally occur in a straight-line pattern and appear as ridges, depressions or blisters at the joints, or darkening over the joints or in adjacent panel areas. Imperfections may result from incorrect framing or joint treatment application, or fluctuating / changing environmental conditions during or after construction if remedial action has not been taken.

**Loose Panels** - Board does not have tight contact with framing, rattles when impacted or moves when pressure is applied to the surface. Typically caused by improper installation of panels, framing out of alignment or improper fastening.

**Joint Cracking** - Appears either directly over the long edge or butt ends of boards, or may appear along the edge of taped joints. Often caused by structural movement and/or hygrometric and thermal expansion and contraction, or by excessively fast drying of joint compounds.

**Field Cracking** - Usually appears as diagonal crack originating from a corner of a partition or intersection with structural elements. Also seen directly over a structural element in center of a partition. May originate from corners of doors, light fixtures and other weak areas in the surface created by penetration. Caused by movement described previously.

**Angle Cracking** - Appears directly in the apex of wall-ceiling or interior angles where partitions intersect. Also can appear as cracking at edge of joint reinforcing tape near surface intersections.



Can be caused by structural movement, improper application of joint compound in corner angle or excessive build-up of paint.

**Bead Cracking** - Shows up along edge of flange. Caused by improper bead attachment, faulty bead or joint compound application.

**Wavy Surfaces** - Boards are not flat but have a bowed or undulating surface. Caused by improper board fit, misaligned framing, hygrometric or thermal expansion due to fluctuating / changing environmental conditions during or after construction.

**Board Sag** - Occurs in ceilings, usually under high-humidity conditions. Caused by insufficient framing support for board; board too thin for span; poor job conditions; improperly installed or mislocated vapor retarder; use of unsupported insulation directly on ceiling panels; or improperly fitted panels.

**Surface Problems** - Fractured, damaged or crushed boards after installation may be caused by abuse or lumber shrinkage. Also, see Discoloration below.

**Discoloration** - Board surface has slight difference in color over joints, supports or fasteners. Caused by improper paint finishing, uneven soiling and darkening from aging or ultraviolet light.

**Water Damage** - Stains, paper bond failure, softness in board core or mildew growth are caused by sustained high humidity, standing water and improper protection from water leakage during transit and storage.



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### 3.1 Damaged Edges



Fig. 1

**Cause:** Paper-bound edges have been damaged or abused; may result in ply separation along edge or in loosening of paper from gypsum core, or may fracture or powder the core itself. Damaged edges are more susceptible to ridging after joint treatment (Fig. 1).

**Correction:** Cut back any severely damaged edges to sound board before application.

**Prevention:** Avoid using board with damaged edges that may easily be compressed or can swell upon contact with moisture. Handle gypsum panels with reasonable care.

### 3.2 Water Damaged

**Cause:** During transit or storage, water has damaged panels from heavy rain, floods, broken pipes, etc. Water-damaged panels may be subject to scuffing and may develop paper bond failure or paper delamination from the gypsum core after application. They also may easily warp and deform. Dissolved glue from bundling tapes may damage board faces and cause them to stick together. If stored wet, may be subject to mildew. Prolonged soaking or exposure to water can soften gypsum core and destroy bond of the paper to the core.

**Remedy:** The amount of water exposure and the length of time exposed are both critical factors in preventing excessive losses. As soon as possible, dry wet board completely before using. Moisture damage delamination should not be present after thorough drying. Paper that is not totally bonded when the panel is moist often will reestablish its bond when panel is completely dry. If delamination exists after thorough drying, remove loose paper and patch area with a setting-type joint compound. Replace board if there is extensive loose paper. Handle board cautiously and re-pile with bundles separated by spacer strips of gypsum board. Check incoming board for water stains or dampness. Protect carefully during shipment and storage. Do not erect damp panels; this may result in paper bond failure. Replace boards that have soft cores.

**Prevention:** Protect from high moisture conditions of any kind.

### 3.3 Paper Delamination

**Cause:** Manufacturing conditions, water damage.

**Remedy:** Manufacturing conditions or water damage causing delamination often can be treated as above. If board is received on job with paper delaminating, inspect delivery to determine extent of damage. Do not install or finish prior to contacting the gypsum board manufacturer. If delamination



is minor, peel back paper to where it soundly bonds to board and treat with joint compound (ready-mix or setting-type).

**Prevention:** Protect from water damage.

## 3.4 Mildew

**Cause:** Mildew can occur on almost any surface depending on heat and humidity conditions. Gypsum panels that have become wet for any reason are susceptible to mildew growth.

**Remedy:** Ordinary soap and water may be used to clean moderately affected surfaces. Proper ventilation and/or heat should be used to thoroughly dry the affected area. Mildew growth may occur again if proper conditions are not maintained.

**Prevention:** Keep gypsum panels and the job site area as dry as possible to prevent mildew spores from blooming.

## 3.5 Improperly Fitted

**Cause:** Forcibly wedging an oversize panel into place bows the panel and builds in stresses preventing it from contacting the framing. The result: following fastening, a high percentage of fasteners on the central studs probably will puncture the paper. May also cause joint deformation.

**Remedy:** Remove panel, cut to fit properly and replace. Fasten panels so that the board hangs flat against framing without binding against previously installed panels or framing. Apply pressure to hold panel tightly against framing while driving fasteners.

**Prevention:** Properly cut and check fit prior to fastening.

## 3.6 Surface Fractured After Application

**Cause A:** Heavy blows or other abuse has fractured finished wall surface; too large a break for repair with joint compound.

**Correction 1:** Cut a square-shaped section around damaged area with a utility knife or keyhole saw, (Fig. 2) then cut a plug of the same dimensions from a sound gypsum panel. Use a drywall repair kit with drywall repair clips onto all four edges of the prepared hole and screw attach. Mount replacement section and screw attach to clips. Remove repair clip tabs and finish all four sides with joint tape and compound. Apply and feather out second and third coats, sand and prime. Meets requirements of ASTM E-119 for repairing one-hour fire-rated wall. All patching components—except drywall—available in most drywall repair kits.

**Correction 2:** Cut a square-shaped or triangular section around damaged area, with a utility knife or keyhole saw; use a rasp or sanding block to slope edges inward at 45°. Cut corresponding plug from sound gypsum panel, sand edges to exact fit. Butter edges and finish as a butt joint with joint compound.

**Correction 3:** An alternate repair technique - sometimes referred to as a “butterfly patch”, “California patch”, or “hot patch” - involves cutting a corresponding plug approximately 1-1/2” wider and longer than the cutout in the wall. Next, score through the back paper and core, snap the core and then peel the core away from the face paper so that an overlapping section remains around the perimeter of the plug. The plug is then edged with joint compound and inserted into the damaged area, and the overlapping face paper is used in lieu of tape for finishing with joint compound. Although this may be an acceptable method for certain applications, it provides a repair which is weaker and more difficult to finish than the methods noted above, because the patch will



remain above the existing plane of the wall or ceiling. Also, this technique should not be used to repair fire-rated walls.

**Prevention:** Minimize forceful impacts and/or any abuse to surface.

**Cause B:** Attaching panel directly to flat grain of wide-dimensional wood framing members such as floor joists and headers. Shrinkage of wood causes fracture of board.

**Correction:** As above, where appropriate, or repair as for joint ridging.

**Prevention:** To provide a flexible base to allow for movement of framing, attach RC-1 resilient channel to framing members and apply panels. Allow 1/2" space at bottom edges of board for movement. Or attach board directly to studs but allow 1/4" separation between panels, and install zinc control joint.

**Cause C:** Knife scoring beyond corner of cutout for electrical boxes, light fixtures and door and window openings produces cracks in panel surface.

**Correction:** Repair cuts with joint compound and tape before finishing.

**Prevention:** Stop score marks at corners, cut openings accurately.

**Cause D:** Abnormal stress buildup resulting from structural deflection or racking discussed previously.

**Correction:** Relieve stress, provide adequate isolation and re-tape, feathering joint compound over board area to disguise buildup.

**Prevention:** Provide proper isolation from structure to prevent stress buildup.

**Cause E:** Excessive stresses resulting from hygrometric and/or thermal expansion and contraction discussed previously.

**Correction:** Correct unsatisfactory environmental conditions, provide sufficient relief. Retape, feathering joint compound over board area.

**Prevention:** Correct improper job conditions and install control joints for relief in long partition runs and large ceiling areas.

## 3.7 Ceiling Sag After Installation

**Cause A:** Too much weight from overlaid insulation; exposure to sustained high humidity; vapor retarder improperly installed or wetting causes ceiling panels to sag after installation. Also caused by installing board that is too thin for framing space.

**Correction:** Remove sagged board or fur out the ceiling using RC-1 resilient channel; apply another layer of board. (Leveling of surface with joint compound, will not correct problems resulting from improper framing, unusual weight loads or recurring high moisture conditions.)

**Prevention:** Follow recommended frame spacing and attachment procedures and use recommended products only. Use interior gypsum ceiling board, where available.

**Cause B:** Water-based textures wet face paper and weaken gypsum core, causing ceiling panels to sag after installation.



**Correction:** Same as above.

**Prevention:** Check with gypsum board manufacturer for proper frame spacing and application procedures.

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## 4. COMMENTS

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**Application** - Industry experience demonstrates that an effective method for achieving a visually uniform surface for both the primer and topcoat is spray application immediately followed by back rolling or roller application using good roller techniques, such as finishing in one direction and using roller types and naps recommended by the paint manufacturer.

**Environmental Conditions** - Refer to Drywall Finishing Council recommendations in document titled, "Interior Job Condition Specifications for The Application of Drywall Joint Compounds, Drywall Textures, and Paint/Coatings".

**Environmental Control** - Temperature, humidity, and airflow should remain constant, and as close to occupancy conditions as possible. The potential for finishing and decorating problems is minimal when job environmental conditions match occupancy environmental conditions. Controlling and maintaining environmental conditions is key. Changes and/or fluctuations in temperature, humidity, and airflow can have a profound adverse effect.

**Environmental Limitations / Considerations** – All products shall be applied and maintained in accordance with manufacturers recommendations.

**Gypsum-Board Preparation** - To achieve the desired effect of texture finish over gypsum wallboard, the gypsum board substrate must be finished appropriately. Refer to Gypsum Association GA-214-07 titled "Recommended Levels of Gypsum Board Finish", NWCB "Recommended Levels For Finishing Of Gypsum Board", and/or equivalent.

**Job Standard Specification** - To improve communication, a job standard of the approved paint system shall be established to provide for a visual sample, constructed and finished in accordance with applicable project specifications. As a guideline, refer to PDCA P5-94 titled "Benchmark Sample Procedures for Paint and Other Coating Systems" for a detailed description.

**Paint Selection** - Manufacturers produce various paint grades and types. When the level of finish is selected, consult with the paint suppliers to determine the products that will produce the desired finish.

**Project Standard Specification** - A project standard of the approved wall and/or ceiling configurations shall be established to provide a visual sample constructed, finished, and decorated in accordance with applicable project specifications. As a guideline, refer to PDCA P5-94 titled, "Benchmark Sample Procedures For Paint and Other Coating Systems".

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## 5. RESOURCES

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**ASTM.** C11 Standard Terminology Relating to Gypsum and Related Building Materials and Systems, American Society for Testing and Materials, West Conshohocken PA

**ASTM.** C840-06 Standard Specifications for Application and Finishing of Gypsum Board. American Society for Testing and Materials, West Conshohocken, PA



**DWFC.** Interior Job Condition Specifications For The Application of Drywall Joint Compounds, Drywall Textures, and Paint/Coatings". Drywall Finishing Council, Incorporated. [www.dwfc.org](http://www.dwfc.org)

**DWFC.** Method for Inspecting Joint Treated Gypsum Panel Surfaces, Drywall Finishing Council, Incorporated. [www.dwfc.org](http://www.dwfc.org)

**DWFC.** Recommended Specification for Preparations of Gypsum Board Surfaces Prior To Texture Application, Drywall Finishing Council, Incorporated. [www.dwfc.org](http://www.dwfc.org)

**FSCT.** Coatings Encyclopedic Dictionary. Federation of Societies for Coatings Technology, Blue Bell, PA

**GA.** GA-214-07 Recommended Levels of Gypsum Board Finish. Gypsum Association, Washington DC

**GA.** GA-216-07 Application and Finishing of Gypsum Panel Products. Gypsum Association, Washington DC

**National Gypsum Company.** ProForm Brand Drywall Finishing Products Construction Guide, National Gypsum Company, 2001 Rexford Road, Charlotte, NC, 28211, [www.nationalgypsum.com](http://www.nationalgypsum.com)

**National Gypsum Company.** National Gypsum Construction Guide, National Gypsum Company, 2001 Rexford Road, Charlotte, NC, 28211, [www.nationalgypsum.com](http://www.nationalgypsum.com)

**PDCA.** Glossary of Terms, Painting and Decorating Contractors of America, Fairfax VA

**PDCA.** Standard P4-94 Responsibilities for Inspection and Acceptance of Surface Prior to Painting and Decorating. Paint and Decorating Contractors of America.

**PDCA.** Standard P5-94. Benchmark Sample Procedures for Paint and Other Coating Systems. Painting and Decorating Contractors of America, Fairfax VA

**USG.** The Gypsum Construction Handbook H-17. USG Corporation, 550 West Adams Street, Chicago, IL, 60661, [www.usg.com](http://www.usg.com)

**USG.** SA927 Gypsum Products – Panels and Accessories System Catalog, USG Corporation, 550 West Adams Street, Chicago, IL, 60661, [www.usg.com](http://www.usg.com)

**USG.** USG SHEETROCK Brand Products - Installation and Application Guides, USG Corporation, 550 West Adams Street, Chicago, IL, 60661, [www.usg.com](http://www.usg.com)

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