

UNITED STATES GYPSUM COMPANY

Gypsum Drywall Construction

4th edition Handbook

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... ABOUT THIS HANDBOOK

This Handbook of Gypsum Drywall Construction presents complete data on products and systems developed to simplify and speed construction, enhance appearance, and increase the use of gypsum drywall construction. It contains new data on partition, ceiling and fireproofing systems, and revised up-to-date information on tools, products, methods of installation and good construction practices. It is a complete and authoritative guide, valuable for both those with limited knowledge and those with broad experience in gypsum drywall construction.

HOW IT SERVES YOU

This handbook will serve as a quick and comprehensive reference for any drywall information you want:

Architects and Builders—Complete information on drywall systems, including descriptions, advantages, limitations and detail drawings.

Contractors and Dealers—Full data on all aspects of drywall products, tools, methods, including estimating and planning.

Applicators, experienced or beginners—Clear, concise illustrated instructions on all phases of drywall application from framing to finish.

TO FIND THE INFORMATION YOU WANT:

Use the fully cross-referenced index at the back. Or—check Table of Contents on page 5 to find the applicable chapter, then use the detailed table on the first page of that chapter to find the right page.

For example, if you want information on metal trim, it's in the index both as "Metal trim" and "Trim, metal." Also, the facing Table of Contents shows "Products" as Chapter 2 and the table of contents on page 21 shows metal accessories to begin on page 32.

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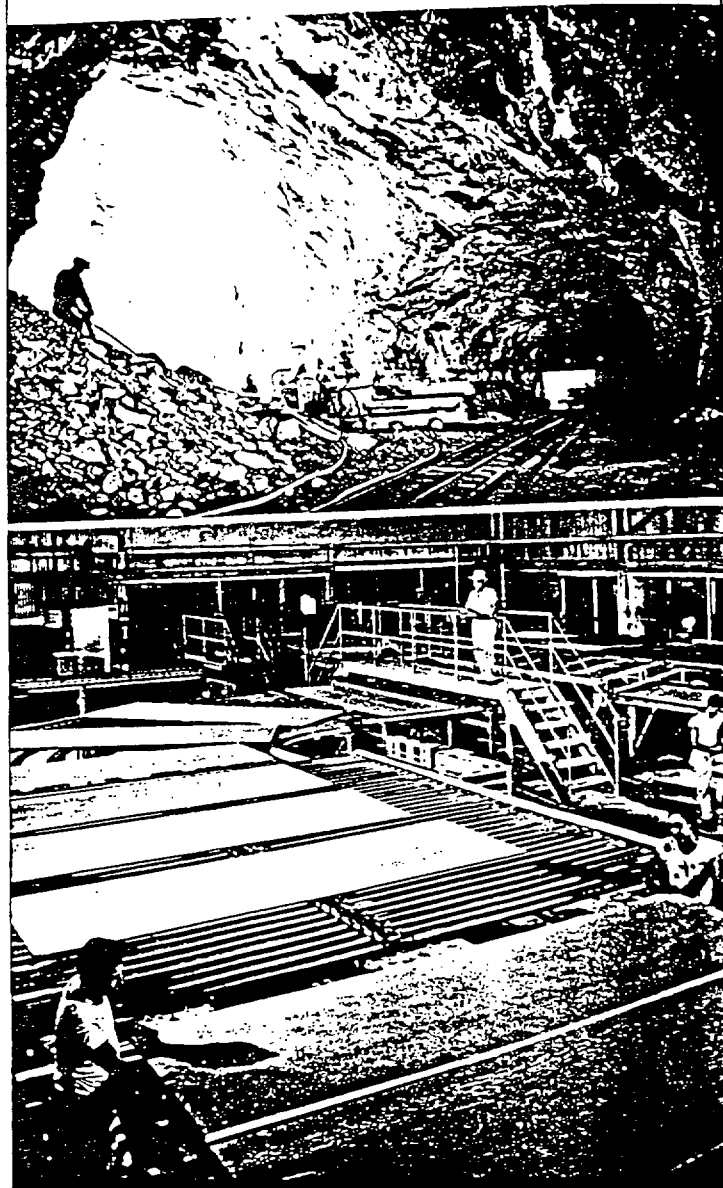
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/CHARACTERISTICS AND PRACTICES
GYPSUM DRYWALL CONSTRUCTION

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CHAPTER

1

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THE DRYWALL REVOLUTION

In the last decade, gypsum drywall construction has revolutionized the building industry. A dynamic expansion is taking place—to the point that today more than 75% of all new residential buildings have sturdy, beautiful walls and ceilings of fire-resistant gypsum wallboard.

In the last five years, through leadership in research and development, United States Gypsum has introduced many new products and systems for drywall construction. These systems offer specialized sound control and fire resistance together with speed of installation, strength and low cost. Their wide acceptance in commercial, industrial and institutional construction follows the same pattern of drywall's dominance in residential work.

The key product in this revolution is SHEETROCK®, the first and most widely used brand of gypsum wallboard, now available in various types to meet every wall and ceiling requirement.

SHEETROCK has its beginning in the ground as a gray to white-colored rock called gypsum. The basic ingredient of fireproof wallboards, gypsum is a non-metallic mineral composed of calcium sulphate chemically combined with water of crystallization. This "dry" water makes up approximately 20% of the weight of gypsum rock. It is this feature which gives gypsum its fire-resistive qualities and makes it so adaptable to the manufacture of wallboard.

After gypsum ore is mined or quarried (illustrated, Page 6), it is crushed, dried, ground to flour fineness, and heated or calcined to drive off the greater part of the chemically combined water as steam. This calcined gypsum, or plaster of Paris, is then mixed with water and other ingredients and sandwiched between two sheets of specially treated paper to form a ribbon of SHEETROCK, as illustrated on Page 6. After the gypsum core has set, the wallboard is cut to length, dried, pre-finished as required and packaged for shipment. The entire process is conducted in strict accordance with specifications to meet carefully controlled high quality standards.

Success and continued expansion in gypsum drywall construction depends on keeping standards of quality and appearance high while cutting construction time and costs to a minimum. U.S.G. has consistently been in the forefront of this effort, providing new materials to increase utility and lower cost; new systems with improved fire resistance and sound control; advisory services to promote better materials handling, market analysis and business management; specification and application information as a guide to good construction practices.

Advantages of Gypsum Drywall Construction

Fire Resistant—Gypsum will not support combustion. Gypsum when exposed to fire behaves like a cake of ice when the flame from a blow torch is applied. The ice melts on the surface in contact with the flame while the opposite side remains cool. Similarly, the surface of gypsum wallboard opposite the flame remains at a relatively low temperature until the gypsum core is completely calcined.

Smooth Unbroken Surfaces—PERF-A-TAPE® Joint System reinforces and conceals the joints between SHEETROCK panels and provides an uninterrupted wall or ceiling surface.

Decoration—The strong, highly calendered face paper on SHEETROCK Wallboard is suitable for any type of decorative treatment such as paint, texture or wallpaper and permits repeated redecoration during the life of the building.

Pre-finished panels are available which require no painting or joint finishing. Walls are complete as soon as panels are installed. These fire-resistant panels have a durable finish that is easily maintained.

Minimum Moisture—SHEETROCK Gypsum Wallboard eliminates the use of tons of water on the job. Since excess moisture is not put into the building, the possibility of moisture damage is minimized.

Crack Resistance—Bonded together by PERF-A-TAPE Joint System, SHEETROCK panels form walls and ceilings that are exceptionally resistant to cracks caused by minor structural movement, vibrations or settlement.

Uniform Quality—SHEETROCK Gypsum Wallboard panels are factory-made products. The raw materials and the manufacture are carefully controlled.

Speed of Erection—The use of SHEETROCK Gypsum Wallboard permits earlier completion of construction—and earlier building occupancy.

Snug-Fitting Trim—The uniform thickness of each panel permits installation of wood or metal trim snug to wall surfaces.

Warp-Resistance—Expansion or contraction of SHEETROCK under normal temperature and humidity changes and resulting deformation are negligible.

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Good Construction Practices

Two ingredients are required for a *quality drywall job*—quality products and skilled craftsmen correctly employing good construction practices. SHEETROCK Gypsum Wallboard, the PERF-A-TAPE Joint System and drywall accessories are top quality products designed to *work together*, job-proven and constantly improved. But without proper planning and correct installation by the applicator, the products by themselves cannot be expected to produce the desired quality results.

This section deals with the basic recommendations that should be followed in planning and completing the best possible job. These good construction practices can give the applicator greater profit through fewer callbacks, less waste and lower job costs, and quality results that produce quicker sales, higher prestige and an enduring business reputation.

Framing Requirements

The framing that will receive SHEETROCK Wallboard should be thoroughly inspected to be certain that all previous work has been completed in good order. Good framing is essential regardless of the type of wall surfacing materials used.

Minimum requirements for wood framing include the following:

1. Framework must meet minimum requirements of F.H.A., V.A. and/or local building code regulations.
2. Framing and bridging members must be adequate to carry the design and code loading requirements.
3. Lumber must be of the proper grade for the intended use, and 2"x4" nominal size or larger must bear the grade mark of a recognized inspection agency using grading rules recommended by the American Lumber Standards Committee.



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Framing requirements/Good practices

Although the moisture content of grade marked lumber is low enough for most framing uses, it may exceed 15% which is the maximum recommended for gypsum wallboard application. At the time of wallboard application the moisture content should be as close as practical to the amounts recommended in the U.S. Department of Agriculture publication, Wood Handbook No. 72: 7% to 12% for dry Southwestern areas and 9% to 14% for the remainder of the United States. If the framing moisture content exceeds 15%, delay the wallboard application until the requirement is met. Drying can be speeded by heating the building to 55° to 70°F. and providing ventilation.

4. Framing lumber should be straight, true, and of uniform dimension.

5. Extremely soft framing members should not be used for attachment of gypsum wallboard.

6. Studs, plates, joists and headers should be checked for accurate spacing and alignment (illustrated, left). Spacing of framing should not exceed the maximum allowable for the thickness of SHEETROCK to be used. If framing is out of alignment, the surface of the wallboard applied to it will be correspondingly out of plane.

7. Horizontal load bearing members should be of sufficient dimension, and trusses should be fabricated in such a manner that when the full design load is applied the deflection should not exceed 1/360 of their span.

8. Studs or back-up members should be provided at all interior corners for both support and end or edge nailing of SHEETROCK Wallboard. Nails may be omitted when Floating Interior Angle attachment is used (see page 75 for details).

9. All joists must be level and correctly bridged in spans over 6'. Bridging should be securely nailed and should not extend below the bottom of the joists.

10. Exterior door and window openings should be properly framed with double studs and headers.

11. If joists, rafters or trusses do not fall directly over studs, top plate must be of sufficient dimension to transfer the load from these members to the studs. Single plate may be used in non-load bearing partitions.

12. Adequate headers should be provided to support fixtures such as sinks, cabinets, towel rods, soap dishes, etc.

13. Frames at all openings in gypsum wallboard surfaces should be set for thickness of wallboard to be used.

14. Electrical outlets, switch boxes, all concealed heating ducts and rough plumbing work should be set to receive the thickness of the SHEETROCK Wallboard to be used on the job so that none will cause the board to be held away from the framing. Rough plumbing work and heating ducts should be tested before SHEETROCK application.

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FRAMING CORRECTIONS

If joists are out of alignment, 2"x6" leveling plates attached perpendicular to and across top of ceiling joists may be used. Toe nailing into joists pulls framing into true horizontal alignment and insures a smooth level ceiling construction.

Bowed or warped studs may be straightened by sawing the hollow sides at the middle of the bow and driving a wedge into the saw kerf until the stud is in line. Reinforcement of the stud is accomplished by securely nailing 1"x4" wood strips or "scabs" on each side of the cut (see photo).

**Job Storage**

If possible, SHEETROCK Wallboard should be ordered for delivery a day in advance of drywall application. Materials stored on the job for a long period of time are subject to excessive abuse. Wallboard, like millwork, is a finish material to be handled with care to avoid damage.

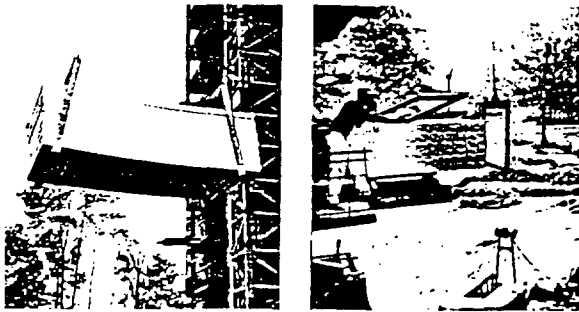
The SHEETROCK should be placed inside under cover and stacked flat on a clean floor in the centers of the largest rooms. It is often desirable to place the necessary number of pieces of SHEETROCK Wallboard in the location where they will be used. All materials used on the job should remain in their wrappings or containers until ready for actual use.

SHEETROCK planned for use on ceilings should be placed on top of pile for removal first. Avoid stacking long lengths on short lengths, as the weight of overhang of the longer board is apt to break the boards.

If flat storage space is not available an alternate method of short-term, on-the-job storage is placing the wallboard vertically against the framing with the long edge of the board horizontal. This method should not be used for long periods since vertical storage may deform the board. With this type of storage, some jobs cannot be stocked until electrical and plumbing installations are made.

Caution should be exercised not to overload the framing members acting as a brace for this manner of storage, and not to overload floor space in a storage area when board is piled flat. There are so many variable conditions that, in general, outside storage of SHEETROCK Wallboard is not recommended.

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Mechanical Handling

When drywall construction moved into high-rise buildings, it brought with it the new challenge of moving large wallboard panels from the ground to the point of use many stories up. Materials handling on the job site can add cost and whittle away profit while the contractor scarcely knows where his money has gone. Time and money savings can be substantial when correct handling procedures are used. Job conditions vary so widely that it is impossible to establish universal materials handling procedures. However, there is much to be learned from inspecting methods used in various job situations and from reviewing resulting costs.

Case studies with photos and step-by-step procedures of material handling methods used by contractors around the country are found in the free booklet "Better Ways to Get Gypsum Wallboard Upstairs." This booklet, No. X-351, available from your U.S.G. representative, will help in determining on-site handling costs and methods best suited to particular job conditions.

Temperature and Humidity Conditions

In cold weather (outdoor temperatures less than 55° F.), controlled heat in the range of 55° to 70° F. must be provided. This heat must be maintained both day and night 24 hours before, during and after entire gypsum wallboard and joint treatment application and until permanent heating system is in operation or the building is occupied. Ventilation should be provided to eliminate excessive moisture. In glazed buildings, this may be accomplished by keeping windows open approximately 2" top and bottom (or side-pivoted windows approximately 4") to provide air circulation. In enclosed areas lacking in natural ventilation, temporary circulators should be used. Under slow drying conditions, allow additional drying time between coats of joint compound. Avoid drafts during hot, dry weather to prevent too rapid drying of joint compound. Also see "Cold Weather Tips — PERF-A-TAPE Joint System Application," page 97.

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General Recommendations for Applying SHEETROCK Wallboard

- Ceiling panels should be installed first.
- SHEETROCK Wallboard panels should be cut so as to slip easily into place.
- All joints should be loosely butted together. Boards should never be forced into position.
- Tapered edges, except at angles, should always be placed next to one another.
- Butt ends should never be placed next to a tapered edge. (SHEETROCK Wallboard is tapered and wrapped along the long dimension to facilitate joint treatment. Exposed ends (butts) along the short dimension are not tapered.) Wherever possible, SHEETROCK should be applied horizontally and in lengths to span ceilings and walls without end (butt) joints. If butt joints occur, they should be staggered and located as far from the center of walls and ceilings as possible.
- All ends and edges of SHEETROCK Wallboard must be supported on framing members, except face layer of Double Layer application and where end joints are to be back-blocked and floated. For description of Back-Blocking see page 76.
- If metal trim is to be installed around edges, doors, or windows, determine if trim is to be installed on framing prior to application of wallboard. Refer to Chapter 2 for description of products and to Chapter 3 for description of installations.

Measuring—All measurements must be accurate. They should be taken at approximate wall location of each edge or end of the board, whichever the case may be. Two measurements should be made as a check, one on the other. In addition, this procedure will usually warn applicator of partitions or door frames that are out of plumb so that allowances in cutting may be made. A 12-foot steel tape rule is recommended. All tools for measuring and cutting are illustrated and described in detail in Chapter 7—Tools.

Cutting—Straight line cuts across full width or length of board are made by scoring face paper, snapping core of board, and then cutting back paper. The common tool used to score and cut gypsum wallboard is a Stanley wallboard trimming knife. Regardless of type used, blade should always be kept sharp so that score will be made through paper into core of gypsum wallboard.

Use of a straight edge is recommended. An aluminum 4-foot T-square, ruled on both sides, facilitates clean, straight cuts.

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Measuring & cutting/Good practices



Score paper on face of board with cutting knife, using a straight edge as a guide.



Break the gypsum core of SHEETROCK by snapping and bending away from the scored paper side. Complete cutting by running knife through back paper from above or below.



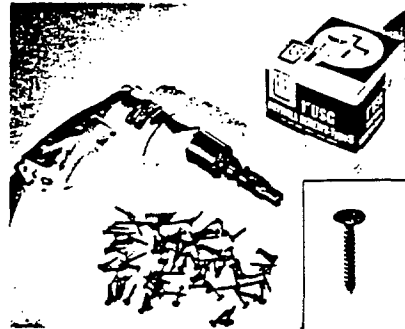
Smooth cut edges with a rasp, coarse sandpaper or metal lath wrapped around a block of wood, or trim with a cutting knife.

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Fastening—SHEETROCK Wallboard is fastened to wood framing with either nails or screws. Traditionally, nails have been the sole fastening means for wallboard constructions, but use of the USG Drywall Screw—Type W is the best known insurance against fastener pops caused by loosely attached board. 1¼" USG Drywall Screws—Type W are applied with a positive-clutch electric power-driven screwdriver equipped with an adjustable screw depth control head and a Phillips bit.

Extensive comparison tests have shown the superiority of the screw over the GWB-54 annular ring nail, itself the most effective of nail fasteners. Compared to the nail, the screw offers:

- Over 100% greater withdrawal resistance.
- Over 100% greater "push-off" resistance.
- Reduced incidence of loose board.
- Increased coating protection against rust.
- Reduced fastener head defects, resulting in fewer call-backs.
- Tighter attachment of SHEETROCK Wallboard to framing.
- Fewer fasteners, less spotting and joint compound needed.
- Elimination of paper tearing and core fracturing associated with nailing.

Two alternate methods for fastening wallboard are available:

1. Double Nailing System—for minimizing defects due to loosely nailed wallboard by placing second nails within 2" of first nails.

2. Adhesive Nail-on System—A continuous bead of SHEETROCK Brand DWA-14 or DWA-10 Adhesive is applied to framing plus supplementary nailing; improves bond strength by 50% to 100%, greatly reduces face nailing needed.

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Specifications for recommended nails and drywall screws are given in Chapter 2—Products. The spacing of fasteners is included in the description of each type of wallboard application in Chapter 3. For fastener specifications used in specific drywall systems, see Chapter 4 or consult the official test report.

General Recommendations for Joint Treatment

The growth of drywall construction in the building industry is due largely to the development of quality joint finishing. U.S.G., the originator and developer of modern joint treatment, has perfected products with overall qualities that provide the best, most uniform finished result. But satisfactory appearance and performance on interior walls and ceilings are in the hands of the applicator. The quality of his work determines how well wallboard joints are reinforced and concealed and fastener heads covered. His planning and skill will determine the quality of the finished surface.

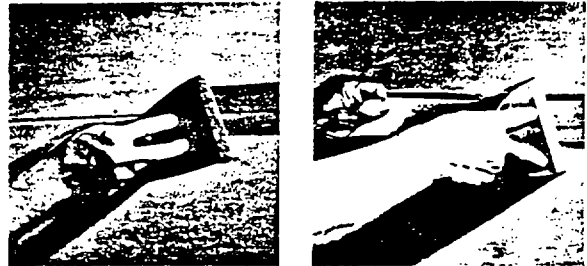
Occasionally, during construction, problems arise which are beyond the control of the manufacturer. Nevertheless, through his experience, the manufacturer has developed improved products and methods of use to overcome recurrent problems. The drywall applicator can save time, trouble and expense by observing proper precautions and, in the event that difficulties arise, by making a complete and frank appraisal of his work. The following are precautionary measures designed to prevent problems.

Materials—Store joint treatment materials in a dry place and rotate stocks; age and dampness affect the working qualities of this material. Protect Ready-Mixed PERF-A-TAPE Compound from freezing.

Check Working Surfaces—Gypsum wallboard must be firmly attached to framing members without cutting the surface paper or fracturing the core of the board. Make certain each board forms a true, even alignment at each joint. Check width and depth of taper in the board.

Mixing—Use clean containers and mixing tools. Follow directions for mixing the particular joint compound shown on the package. Use clean, lukewarm (not hot) water for mixing. Add powdered compounds to the water. *Do not over-thin compound with water!*

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Application—The channel formed by the tapered edges of the gypsum wallboard must be completely filled with compound level with the plane of the board. When tape is applied and wiped down be sure that sufficient compound remains beneath the tape *but not more than 1/64"* under the feather edge. A recommended procedure is to apply a skim coat of compound immediately after embedding tape. *Avoid heavy fills.* Finishing compound should not be used for embedding tape or as a first-coat application. Three-coat work is essential for quality results.

Because of its exceptional smoothness, low shrinkage and ease of sanding, Ready-Mixed Compound is the ideal material for taping and all finishing coats as well as *all* nail spotting. Good workmanship by the mechanic will provide finished jobs that require little or no sanding—the goal of all applicators.

Abnormal Drying Conditions—Allow joint compound to dry properly before applying second and third coats or decorating. In cold, damp weather all types of joint compounds will dry slowly and 24 to 48 hours is often insufficient between coats. DURABOND® Joint Compound will perform at its best under slow drying conditions because its chemical hardening principle is not affected by high humidity conditions. Cold weather difficulties are more prevalent when *improper or inadequate* heat is provided. The minimum heat requirements of 55° F. should be maintained at *all times* during the erection of the gypsum wallboard as well as through the taping, finishing and decorating phases. Use thermostatically controlled central heating and take particular care to maintain proper ventilation.

Applicators will recognize too rapid drying conditions when the compound takes on a shorter working life, especially along the feather edges and where one joint joins or crosses another. Rapid drying is usually due to low humidity and warm winds or over-heating in extremely cold, dry winter weather. During these periods every effort should be made to prolong the working and drying time of the compound. Stop drafts of warm, dry air by closing doors and windows. Shorten the time required to complete the application by working shorter lengths of joint at one time. Raise the humidity by liberally sprinkling sub-floor with water. *Do not thin compound with additional water.*

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Care of Equipment—As with other crafts, applicators should keep tools clean and in good shape to secure maximum benefits. Mechanical taping and finishing equipment must be kept in perfect working order and all parts *must* be replaced as soon as they show the slightest sign of wear. Mechanical tools can often "read the wall" better than the applicator. Therefore, a competent mechanic with a thorough knowledge of his equipment will constantly adjust his tools to obtain higher or lower crowns required by particular surfaces on every job.

It is recommended that a conventional garden hose with nozzle be available to properly flush and clean DURABOND Joint Compound from all tools, mixing containers, bread pans and equipment before the chemical hardening action takes place. *Immersion of equipment in water will not prevent hardening of the compound.* Care of equipment is beyond our control and, therefore, United States Gypsum cannot assume any responsibility for any loss or damage to equipment.

Joint treatment product description and specifications are found in Chapter 2—application procedure in Chapter 3.

Completion of Job—After trim has been applied and before decoration, correct all surface damage and defects to leave walls and ceilings smooth and without observable blemishes which will show through decoration. Remove all debris and rubbish, excess material, equipment and scaffolding from the job and clean all surfaces as necessary to remove joint compound, adhesive droppings, etc. so the finished work will be left ready for decoration.

General Recommendations for Decorating

Quality drywall construction merits equally good decoration, and the wise applicator will recommend paints that enhance the appearance of his finished job. For smooth walls U.S.G. specifically developed SHEETROCK Sealer and TEXOLITE* Primer-Sealer to lay the nap of face paper raised by sanding. Either will give a satisfactory base coat for GRAND PRIZE* or TEXOLITE Alkyd Latex Paint and other quality interior finishes. U.S.G. also manufactures a full line of texturing materials to meet the preference of every customer. Refer to Chapter 2 for the Selector Guide to USG Paint Products.

Good practices for decorating require that:

1. All surfaces, including joint treatment compounds, must be dry, sound, clean, free of dust, grease or oil.
2. Paints should be delivered in original unopened containers and protected from damage and tampering.
3. All materials should be used according to instructions.
4. Wallboard joints and fasteners should be treated with PERFA-TAPE Joint System in accordance with directions.

*T.M. Reg. U.S. Pat. Off.

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