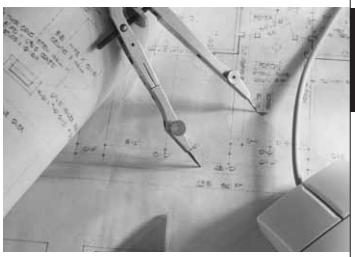
Planning, Execution & Inspection



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Factors Affecting Results

Today's proven-quality products and high-performance systems permit installation of attractive, durable, trouble-free interiors that meet designers' specifications and owners needs. By using correct installation procedures and equipment, contractors can combine these products into systems with high quality results, thus reducing customer dissatisfaction, poor productivity, callbacks and decreased profitability.

This chapter identifies product, system, environmental, handling and storage, equipment, installation, workmanship and inspection factors that can affect the end results of a project.

Selection of Materials

In recent years, technological advances in building construction have resulted in new products and systems. Each requires systematic evaluation of performance and appearance characteristics in relation to cost, before selection and use. Evaluation may be done through benefit-cost analysis or life-cycle cost analysis, which considers the total cost of an assembly throughout its useful life. Building materials selection should always be based on total performance, including maintenance, not simply on initial construction cost or a budgeted cost figure. The following items merit consideration in systematically selecting products and systems for gypsum construction.

Satisfy User Needs

To satisfy the owner's functional requirements, it is basic to match products and systems to the end performance desired. For instance, such high-traffic areas as corridors may require hard-wearing, abuse-resistant surfaces available with specially designed products. Where quiet surroundings or isolation from noise is needed, systems with high resistance to sound transmission and surfaces that provide sound absorption are essential. Predecorated, low-maintenance surfaces may be justified in the form of vinyl-faced gypsum panels. In common walls between apartments, where greater cavity widths are needed to enclose plumbing lines, a system with adequate space in the cavity is called for. The objective is always to select products and systems that will improve the total performance of the building components.

Meet Regulatory Requirements

The performance of gypsum construction products and systems must comply with regulatory requirements established by local, provincial and federal agencies. Local and provincial building codes and insurance and lending agency requirements should be considered in material selection.

Identify Critical Performance

Any selection of appropriate materials should reflect product or system limitations. Such structural factors as limiting height and span, required number of screws, metal thickness, bracing spacing or maximum frame and fastener spacing should be carefully considered since they affect the flexural properties and strength of an assembly. Yield strength of all steel is not the same. Substitution by size alone is not recommended. System performance following any substitution of material or compromise in assembly design cannot be certified and may result in failure under critical conditions. It is important to note that

extreme and continuous high humidity or temperatures may result in sag, joint deformation, poor appearance and possible deterioration of gypsum surface materials. Sealing and painting recommendations are important for proper performance of paints and other finishes.

Establish Performance Requirements

Fire Resistance Select CAN/ULC S101 fire-tested assemblies to comply with regulatory requirements, and construct the assembly according to specifications. If an assembly does not comply, work may be halted by the building inspector or installation may be rejected after completion.

Sound Control Owner's needs and regulatory requirements dictate the sound control needed. Many assemblies are available to meet requirements. Sound test data is obtained under ideal laboratory conditions per ASTM procedures, except as noted. For assemblies to approach testing performance, strict attention must be given to construction details, such as acoustical sealant, and installation. The isolation expected from an assembly can be negated by penetrations, perimeter leaks, accidental coupling of decoupled elements, incompatible surrounding structures and other faulty installation practices. The isolation may also be compromised by flanking sound, e.g., structure-borne sound carried via continuous concrete floors and other building elements, bypassing the sound rated assembly.

Structural Strength and Stability Select systems that provide adequate strength and acceptable deflection under live and dead loads as described in published CGC performance tables. Shear or torque loads caused by shelving, sanitary basins, light fixtures and other accessories should also be considered. Shear forces from wind or earthquake may also require consideration. Cracking probably will occur in assemblies of sufficient strength or stiffness if adequate reinforcing is not provided.

Water and Moisture Choose products and systems that offer adequate resistance to water and high-moisture conditions. Gypsum wallboard products are not suitable under conditions of extreme and sustained moisture. DUROCK Cement Board is recommended as a substrate for ceramic tile under these conditions. Products manufactured from steel or other materials subject to corrosion must have a protective coating equal to the service conditions envisioned.

Humidity and Temperature Determine the environmental conditions to be expected during construction and use. Select products that offer high performance under these conditions or control the job environment. Plaster products should be installed at uniform temperatures above 13°C (55°F) for 48 hours prior to and until the permanent HVAC system is operational in the building. These products may gradually deteriorate under sustained temperatures over 52°C (125°F). High humidity and temperatures may cause problems with veneer plaster finishes, gypsum plasters and gypsum board products.

Durability High-strength gypsum plaster, veneer plaster products and abuse-resistant drywall and gypsum fiber products offer high compressive strength and surface hardness to resist damage from impact and abrasion. For long-lasting, problem-free interiors, select products to meet functional needs.

Appearance Color, texture and surface gloss affect the final appearance of interior surfaces. Texture finishes offer a wide variety of effects for distinctive appearance. Glossy finishes highlight surface defects; textures hide minor imperfections.

Cleanability and Maintenance Select products according to functional requirements for washability and resistance to fading, staining and scuffing. Predecorated SHEETROCK Brand TEXTONE Vinyl-Faced Gypsum Panels offer a tough, stain-resistant vinyl surface easily cleaned with soap and water. Aggregated ceiling texture finishes cannot be washed but can be painted when redecoration is needed.

Light Reflection Select colors and finishes to meet appearance standards, illumination levels and other functional requirements. Strong sidelighting from windows or surface-mounted light fixtures may reveal even minor surface imperfections. The light strikes the surface obliquely, at a very slight angle, and greatly exaggerates surface irregularities. These conditions, which demand precise installation, increase chances for callbacks and should be avoided. If critical lighting cannot be changed, the effects can be minimized by skim coating the gypsum panels, applying CGC First Coat primer, finishing the surface with texture finish or installing draperies and blinds, which soften shadows. As a preventive, use strong parallel-to-the-surface job lights to ensure a flat acceptable joint compound finish prior to priming, texturing and/or painting.

Interface and Compatibility Materials that come into contact with each other must be compatible. Differences in thermal or hygrometric expansion, strength of substrates or basecoats in relation to finish coats, thermal conductivity and galvanic action are common problem-causing situations. Tables of thermal and hygrometric coefficients for selected products are in the Appendix. The subject is too complex to be covered in detail here. Contact specific manufacturers for recommendations should questions arise. Following are some precautions of this kind associated with gypsum construction:

1. Gypsum surfaces should be isolated with control joints or other means where necessary to abut other materials, isolate structural movements, changes in shape and gross area limits.
2. Plaster may be applied directly to concrete block, however, with plaster over poured-in-place concrete, a bonding agent such as USG Plaster Bonder must be used.
3. Due to expansion differences, the application of high-pressure plastic laminates to gypsum panels or plaster generally is not satisfactory.
4. GRAND PRIX Brand Veneer Plaster Base and regular SHEETROCK Brand Gypsum Panels do not provide sufficient moisture resistance as a base for adhesive application of ceramic tile in wet areas. Use FIBEROCK AQUA-TOUGH Interior Panels or DUROCK Cement Board.
5. Install resilient thermal gaskets around metal window frames to keep condensation from damaging wall surface materials. The gasket may also reduce galvanic action and resultant corrosion, which occurs when two dissimilar metals contact in the presence of moisture.

Vapor Control The use and proper placement of vapor retarders is extremely important in modern construction, with its increased use of thermal insulation brought about by the need for energy conservation.

Inattention to proper placement or omission of a vapor retarder may result in condensation in the exterior wall stud cavities. Cold climates typically call for a vapor retarder on the warm interior side of the wall. A vapor retarder may be required on the outside of the exterior wall for air conditioned buildings in climates having sustained high outside temperatures and humidity. A qualified mechanical engineer should determine location of the vapor retarder. Refer to local building codes for requirements or considerations in your project area.

Two vapor retarders on opposite sides of a single wall can trap water vapor between them and create moisture-related problems in the cavity materials.

When a polyethylene vapor retarder film is installed on ceilings behind gypsum panels under cold conditions, it is recommended that ceiling insulation be installed before the board or immediately after the board is installed (if the insulation is blown in). Also the plenum or attic space should be properly vented. Failure to follow this procedure can result in moisture condensation in the back side of the gypsum panels causing board sag.

Handling and Storage

Even quality products can contribute to problems during application and job failures if not protected from damage and improper handling. Generally, gypsum products should be stored inside at temperatures above freezing, protected from adverse weather conditions, condensation, moisture and external damage and used promptly after delivery.

Inspect on Delivery

Products should be inspected for proper quantity and possible damage when delivered on the job. Incorrect quantities may result in job delays due to shortages or extra cost for overages that are wasted. Check products for such physical damage as broken corners or scuffed edges on gypsum board, wet board, bent or corroded steel studs and runners. Inspect containers for evidence of damage that may affect the contents. Look for damaged or torn bags, which could result in waste, lumpy joint compound, preset conventional plaster or veneer plaster finishes. Report any damaged material or shortages immediately.

Store in Enclosed Shelter

Enclosed protection from the weather is required for the storage of all gypsum products. Though not recommended, outdoor storage for up to one month is permissible if products are stored above ground completely covered and protected from adverse weather conditions, condensation and other forms of moisture. Do not store gypsum products on gypsum risers. Use wood risers to prevent moisture from wicking up and wetting material. Various problems can result when these products get wet or are exposed to direct sunlight for extended periods.

Store gypsum boards flat on a clean, dry floor to prevent permanent sag, damaged or wavy edges or deformed board. Do not store board vertically. If board is stored on risers, the risers should be evenly spaced, no more than 710 mm (28″) apart and within 50 mm (2″) of the ends of the board.

The risers should also be placed directly under each other vertically.

Stack bagged goods and metal components off of damp floors and walls. Corrosion on corner bead, trim and fasteners may bleed through finishing materials. Ready-mixed joint compounds that have been frozen and thawed repeatedly lose strength, which may weaken the bond.

Protect From Damage

Locate stored stocks of gypsum products away from heavy-traffic areas to prevent damage from other trades. Keep materials in their packages or containers until ready for use, to protect them from dirt, corrosion and distortion. Damaged board edges are more susceptible to ridging after joint treatment. Boards with rough ends will require remedial action before installation, otherwise, deformation or blistering may occur at end joints.

Use Fresh Material

If possible, gypsum construction products should be ordered for delivery to the job just before application. Materials may become damaged by abuse if stored for long periods. To minimize performance problems caused by variable moisture conditions and aging, fresh plaster and veneer plaster finishes should be received on the job frequently.

Job Conditions

Many problems can be directly traced to unfavorable job conditions. These problems may occur during product application or they may not appear until long after job completion.

Recommendations for proper job conditions, given in the appropriate product application chapters here, should be closely followed. If job conditions are unfavorable, correct them before product installation. The following environmental factors can present problems in gypsum construction.

Temperature

Temperature can have a dramatic effect on the performance of gypsum products. Install gypsum products, joint compounds and textures at comfortable working temperatures above 10°C (50°F). In cold weather, provide controlled, well-distributed heat to keep the temperature above minimum levels. For example, if gypsum board is installed at a temperature of -2°C (28°F), it expands at the rate of 13 mm (1/2″) for every 30 m (100 lin. ft.) when the temperature rises to 22°C (72°F). At lower temperatures, the working properties and performance of plasters, veneer plaster finishes, joint compounds and textures are seriously affected. They suffer loss of strength and bond if frozen after application and may have to be replaced. Ready-mixed compounds deteriorate from repeated freeze-thaw cycles, lose their workability and may not be usable. Avoid sudden changes in temperature, which may cause cracking from thermal shock.

Humidity

High humidity resulting from atmospheric conditions or from on the job use of such wet materials as concrete, stucco, plaster and spray fireproofing often creates situations for possible problems. In certain kinds of gypsum board, water vapor is absorbed, which softens the gypsum core and expands the paper. As a result, the board may sag between ceiling supports. Sustained high humidity increases chances for galva-

nized steel components to rust, especially in marine areas where salt air is present. High humidity can cause insufficient drying between coats of joint compounds, which can lead to delayed shrinkage and/or bond failure. Jobs may be delayed because extra time for drying is required between coats of joint compound.

Low humidity speeds drying, especially when combined with high temperatures and air circulation. These conditions may cause dryouts in veneer plaster finishes and conventional plasters. They also reduce working time and may result in edge cracking of the joint treatment. Crusting and possible contamination of fresh compound, check and edge cracking are also caused by hot and dry conditions. Under hot, dry conditions, handle gypsum board carefully to prevent cracking or core damage during erection.

Moisture

Wind-blown rain and standing water on floors increases the humidity in a structure and may cause the problems previously described. Water-soaked gypsum board and plasters have less structural strength and may sag and deform. Their surfaces, when damp, are extremely vulnerable to scuffing, damage and mould growth. Note that conventional drywall products should not be used in areas that have high humidity or the presence of moisture. SHEETROCK Brand Gypsum Panels, or FIBEROCK AQUA-TOUGH Interior Panels, may be used in areas where occasional moisture or humidity are present. These panels are not intended for use in areas subject to constant moisture, such as interior swimming pools, gang showers and commercial food processing areas. DUROCK Brand Cement Board is recommended for these uses.

Ventilation

Ventilation should be provided to remove excess moisture, permit proper drying of conventional gypsum plasters and joint compounds and prevent problems associated with high-humidity conditions. For veneer plaster finishes, to prevent rapid drying and possible shrinkage, poor bond, chalky surfaces and cracking, air circulation should be kept at a minimum level until the finish is set. Rapid drying also creates problems with joint compounds, gypsum plasters and finishes when they dry out before setting fully and, as a result, don't develop full strength.

Sunlight

Strong sunlight for extended periods will discolor gypsum panel face paper and make decoration difficult. The blue face paper on veneer gypsum base will fade to gray or tan from excessive exposure to sunlight or ultraviolet radiation. Applying finishes containing alkali (lime) to this degraded base may result in bond failure unless the base is treated with an alum solution or bonding agent. Additional information on dealing with this problem is presented on page 360.

Movement in Structures

Modern structural design uses lighter but stronger materials capable of spanning greater distances and extending buildings higher than ever before. While meeting current standards of building design, these frames are more flexible and offer less resistance to structural

movement. This flexibility and resulting structural movement can produce stresses within the usually non load-bearing gypsum assemblies. Unless perimeter relief joints are provided to isolate these building movements, when accumulated stresses exceed the strength of the materials in the assembly, they will seek relief by cracking, buckling or crushing the finished surface.

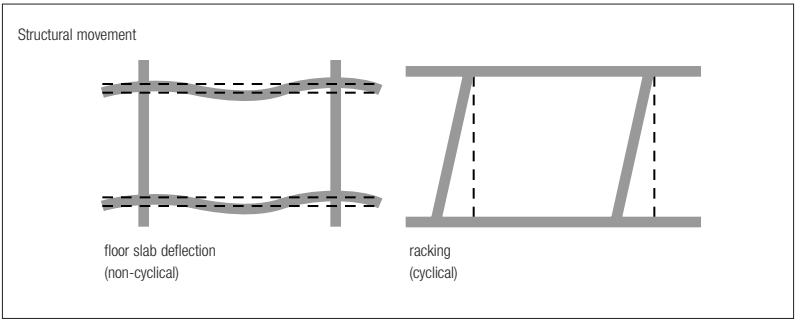
Structural movement and most cracking problems are caused by deflection under load, physical change in materials due to temperature and humidity changes, seismic forces or a combination of these factors.

Concrete Floor Slab Deflection

Dead and live loads cause deflection in the floor slab. If this deflection is excessive, cracks can occur in partitions at the midpoint between supports. If partition installation is delayed for about two months after slabs are completed, perhaps two-thirds of the ultimate creep deflection will have taken place, reducing chances of partition cracking. This is usually a one-time non-cyclical movement.

Wind and Seismic Forces

Wind and seismic forces cause a cyclical shearing action on the building framework, which distorts the rectangular shape to an angled parallelogram. This distortion, called racking, can result in cracking and crushing of partitions adjacent to columns, floors and structural ceilings.

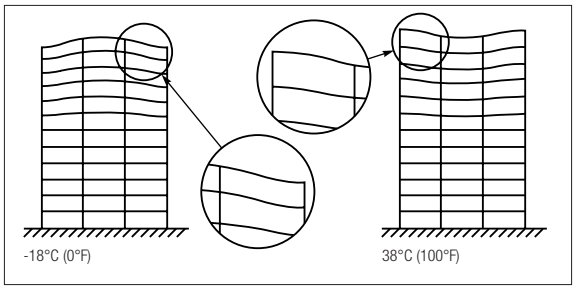


To resist this racking, building frames must be stiffened with shear walls and/or crossbracing. Light steel-frame buildings are diagonally braced with steel strapping. Wood-frame structures are strengthened with let-in crossbracing and/or shear diaphragms of structural sheathing. On larger buildings, racking is resisted by shear walls and wind-bracing without considering the strength added by finishing materials. Moreover, the partitions must be isolated from the structure to prevent cracking caused by racking movement and distortion.

Thermal Expansion

All materials expand with an increase in temperature and contract with a decrease. In tall concrete or steel-frame buildings, thermal expansion and contraction may cause cracking problems resulting from racking when exterior columns and beams are exposed or partially exposed to exterior temperatures. Since interior columns remain at a uniform temperature, they do not change in length.

Exposed exterior columns can be subjected to temperatures ranging from over 38° to -34°C (100° to -30°F), and therefore will elongate or



contract in length. The amount of expansion or contraction of the exposed columns depends on the temperature difference and several other factors. (Structural movement caused by thermal differentials accumulates to the upper floors.) However, the stiffness of the structure resists the movement and usually full unrestrained expansion is not reached. A gypsum board wall 30 m (100′) long will expand 14 mm (0.54″) when the temperature rises 28C° (50F°).

Racking, resulting from thermal movement, is greatest in the outside bays of upper floors in winter when temperature differentials are largest. To prevent major changes as described above, apply proper insulation to exterior structural members. The design should call for control joints to relieve stress and minimize cracking of surfaces.

Hygrometric Expansion

Many building materials absorb moisture from the surrounding air during periods of high humidity and expand; they contract during periods of low humidity. Gypsum, wood and paper products are more readily affected by hygrometric changes than are steel and reinforced concrete. Gypsum boards will expand about 13 mm (1/2″) per 30 m (100′) with a relative humidity change from 13% RH to 90% RH (see Appendix for coefficients). Unless control joints are provided, hygrometric changes create stresses within the assembly, which result in bowed or wavy walls, sag between supports in ceilings, cracking and other problems.

Relief Joints

Select gypsum assemblies to provide the best structural characteristics to resist stresses imposed on them. As described previously, these systems must resist internal stresses created by expansion and contraction of the components and external stresses caused by movement of the structure. The alternative solution is to provide control and relief joints to eliminate stress buildup and still maintain structural integrity of the assembly.

To control external stresses, partitions and other gypsum construction must be relieved from the structural framework, particularly at columns, ceilings and intersections with dissimilar materials. In long partition runs and large ceiling areas, control joints are recommended to relieve internal stress buildup. Methods for providing relief and control joints are shown in Chapters 3, 4, 5, 6 and 8. These recommendations, for normal situations, provide for 6 mm (1/4″) relief. Relief joints for individual structures should be checked for adequacy by the design engineer to prevent cracking and other deformations.

Cracking in High-Rise Structures

Contractors who install commercial partitions and ceilings should be aware of cracking problems caused by structural movement, deflection, expansion and contraction. These problems, described previously, usually are not due to faulty materials. Anticipated structural movement in the frame and floor system should be taken into account in the design of the building. It is better to solve potential problems with preventive measures before installation rather than attempting repairs afterward.

Some types of construction can be expected to cause cracking in gypsum assemblies if not handled properly. Following are clues to potential problems:

Flat Plate Design Particularly with column bay sizes exceeding 6 m (20′).

Exposed Exterior Columns and Shear Walls On buildings over 12 floors high and located in a cold climate.

Reinforced Concrete Structures Erected in cold weather, with partitions installed too soon thereafter. Creep deflection in the floor slab, a cause of partition cracking, is retarded in cold weather and accelerated in warm weather.

Structures Without Shear Walls or Proper Bracing Particularly if the plan is long and narrow, presenting a large wall area to withstand wind load.

Gypsum Systems Without Expansion Joints Long partition runs and large ceiling areas must have control joints to compensate for hygrometric and thermal expansion and contraction. Placement of control joints must be noted in the architectural or design plans.

When one or more of these conditions exists, it is wise to notify the owner, architect and general contractor, by letter, of the indicated possible problems and recommend corrective measures. If corrective measures are effective, all involved will be rewarded with a satisfactory performance, and costly complaints will be avoided.

Structurally Generated Noise

Loads of varying intensity can cause structural movement, which generates noise when two materials rub or work against each other. In high-rise buildings, variable wind pressure can cause a whole structure to drift or sway, causing structural deformation. Such deformation imparts racking stresses to the non-load bearing partition and can create noise.

As another annoyance, lumber shrinkage often results in subfloors and stair treads squeaking under foot traffic. This squeaking can be avoided by using adhesive to provide a tight bond between components and prevent adjacent surfaces from rubbing together.

Acoustical performance values (STC, NRC, CAC, IIC) are based on laboratory conditions. Such field conditions as lack of sealants, outlet boxes, back-to-back boxes, medicine cabinets, flanking paths, doors, windows and structure borne sound can diminish acoustical performance values. These individual conditions usually require the assessment of an acoustical engineer.

CGC assumes no responsibility for the prevention, cause or repair of these job-related noises.

Lumber Shrinkage

In wood-frame construction, one of the most expensive problems encountered is fastener pops, often caused by lumber shrinkage, in drywall surfaces. Shrinkage occurs as lumber dries. Even kiln-dried lumber can shrink, warp, bow and twist, causing board to loosen and fasteners to fail. Gypsum surfaces can also crack, buckle or develop joint deformations when attached across the wide dimension of large wood framing members such as joists. Typically, this installation occurs in stairwells and high wall surfaces where the gypsum finish passes over mid-height floor framing, as in split-level houses.

Framing lumber, as commonly used, has a moisture content of 15% to 19%. After installation, the lumber develops about a 10% moisture content and consequently shrinks, particularly during the first heating season.

Wood shrinks most in the direction of the growth rings (flat grain), somewhat less across the growth rings (edge grain) and very little along the grain (longitudinally). Shrinkage tends to be most pronounced away from outside edges and toward the center of the member. When nails are driven toward the central axis, shrinkage leaves a space between the board and the nailing surface, as shown in the drawings on the next page.

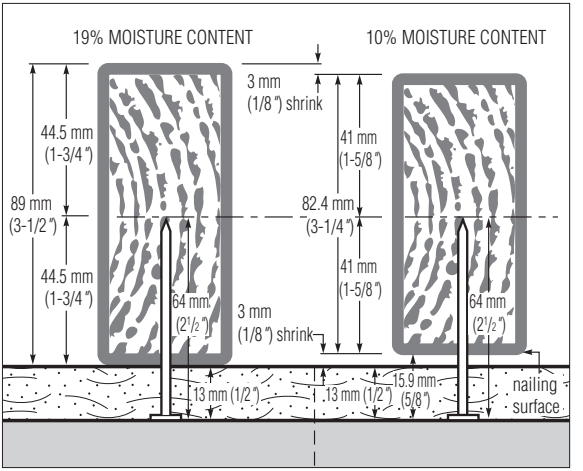
Based on experiments conducted by the Forest Products Laboratory and Purdue University, the use of shorter nails results in less space left between the board and nailing surface after shrinkage (shown on next page) than with longer nails having more penetration. Using the shortest nail possible with adequate holding power will result in less popping due to shrinkage. Longer nails, however, usually are required for fire-rated construction, as specified by design requirements. Choose the proper nail length from the Selector Guide for Gypsum Board Nails on page 44.

The annular drywall nail, with an overall length of 32 mm (1-1/4″), has equivalent holding power to a 41 mm (1-5/8″) coated cooler-type nail, but the shorter length of the nail lessens the chances for nail popping due to lumber shrinkage, according to a study conducted at Purdue University.

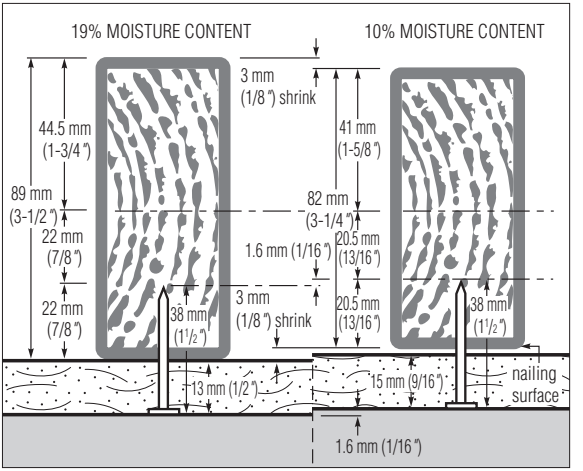
Contractors can take several preventive measures to minimize fastener failures and cracking resulting from lumber shrinkage. Use the shortest recommended nails to reduce the likelihood of popping. Annular-thread (also called annular-ring) drywall nails are recommended because their design results in greater holding power than a smooth-shank nail of the same length and shank diameter (see pages 43-44). Type W screws are even better than the nails because they develop greater holding power and thus reduce possibilities for fastener pops.

The floating interior angle system effectively reduces angle cracking and nail pops resulting from stresses at intersections of walls and ceilings (see intersection detail). Gypsum boards should be floated over the side face of joists and headers and not attached. To minimize buckling and cracking in wall expanses exceeding one floor in height, either float the board over second-floor joists using resilient channels or install a horizontal control joint at this point.

Using 64 mm (2-1/2") nails.



Using 38 mm (1-1/2") nails.



Workmanship

CGC products are quality-tested and job-proven for fast, economical installation and problem-free results. Unfortunately, sometimes these products fail to achieve optimum performance after installation due to improper or unspecified application.

Follow Current Directions

The major cause of job problems and poor performance after application is failure to follow manufacturer's directions and architect's specifications. Application procedures should be checked regularly to conform with current manufacturer's recommendations. Product modifications to upgrade in-place performance may require slight changes in mixing or application methods. New products may require the adoption of entire new procedures and techniques.

Meet Specifications Fully

Building specifications are designed to provide a given result, but unless specified construction materials and methods are used and the proper details followed, the actual job performance will probably fall short of requirements. Excessive water usage, oversanding, improper surface preparation, substitution of materials, skimping and shortcuts should not be tolerated because they lead, inevitably, to problems.

Drywall and Plaster Tolerances

Standards of acceptability for installation of framing, drywall panels and joint treatment vary in different parts of Canada. Nevertheless, several organizations, including the Association of the Wall and Ceiling Industries International, Metal Lath/Steel Framing Association, Gypsum Association and American Society for Testing and Materials (ASTM), have published recommendations, standards and/or tolerances that may be required for a specific project. Similarly, references for tolerances and quality in plaster work have been published in Diehl's "Manual of Lathing and Plastering." Contractors and their customers should reach agreement before starting the project regarding which tolerance standards will be used to judge acceptability of the work. See the Appendix for further information on tolerances.

Equipment Selection

A large selection of equipment is available for gypsum construction and particularly for mechanical application of veneer plaster and texture finishes, conventional plasters and joint treatment (see Chapter 14, Tools & Equipment). The mechanical spray equipment chosen should be based on the type of material and the situations presented on each job. The size of the job, delivery volume required, portability and access through doorways also deserve consideration. Low maintenance and accessibility of parts for cleanup are important factors.

Using the wrong equipment for the job can cause serious problems. Improper equipment affects production as well as strength, workability, setting time and finished appearance.

Mixing

Equipment should provide the correct mixing action and mixing speed. Equally important are proportioning and mixing procedures required for

the particular material as shown in Chapters 5, 6 and 8. Poor mixing practices adversely affect material performance and can cause various problems.

Pumping

Equipment should have capacity sufficient for the job, hose size and pumping distance, and should be kept in good repair. To minimize abrasive wear in the pump mechanism, the pump type should be suitable for the aggregate and mixes being used. High plaster/sand ratios, small-diameter hoses and leakage increase the possibility of aggregate packing in the pump and hose. Use large-diameter hoses and no more hose length than needed. Small-diameter, long hoses cause pumps to wear faster and may lead to quick-set and low-strength problems in fluid materials.

Spraying

Nozzle or orifice size of the spray gun and air pressure used must be suitable for the material being applied. Improper nozzles and incorrect air pressures affect the spray pattern and may cause stoppage and aggregate fallout. With most veneer plaster finishing, a catalyst tank with metering device is required to adjust setting time.

Product Quality

Gypsum construction products from CGC provide the essential requirements of economy, problem-free installation and high performance in fire and sound-rated systems. During manufacture, these products are carefully controlled to meet specific performance standards when applied according to directions and under proper job conditions.

Complaint Procedure

Should a probable product deficiency appear, stop using the suspected defective material immediately and ask your supplier to notify CGC at once so that a representative can investigate the complaint and take remedial action. Do not continue to use improperly performing materials because the labor cost of replacement or reworking far exceeds the material cost.

Sampling

For analyzing suspected materials, obtain samples of the material that fully represent the complaint condition. Save bags, wrappers and packages (or write down the production codes) that will identify place and time of manufacture. For some complaints, samples of related materials such as aggregates, are also necessary. Weather conditions, mixing times and proportions of ingredients should be fully reported.

Substitution and Certification

CGC will provide test certification for published fire, sound and structural data covering systems designed and constructed according to its specifications. Tests on CGC products are conducted to meet the exact performance requirements of established test procedures specified by various building code agencies. Any substitution of materials or compromise in assembly design cannot be certified and may result in failure of a system in service, especially under critical conditions of load or fire exposure. Substitution of materials also usually will nullify acceptability of applicable fire tests.

How to Inspect a Job

Proper job inspection during installation many times reveals potential problem areas or procedures that produce unsatisfactory results. Corrective action taken immediately is usually less costly than call-backs to repair and perhaps rebuild walls and ceilings after the job is completed.

A complete understanding of job details, schedules and specifications is necessary to conduct proper inspection. If the assembly is to meet fire and sound-rating requirements, then construction details must also be known.

All walls and ceilings must be judged by these criteria and the contract conditions. Thus, it is important that drawings and specifications be complete, accurate and easily understood.

The job inspection phase of supervision is most important, and in many cases, will determine the success of the job. An accurate check should be made of the following major categories so that best results can be obtained.

Schedule of Inspection

Make job inspections at the following stages:

- When job is almost ready for materials delivery, in order to check environmental conditions and plan for delivery.
- When materials are delivered to the job.
- When framing is erected but before board or lath application.
- When gypsum board base layer and/or face layer are applied.
- When joints are treated; when veneer plaster finish or conventional plaster is applied.
- When job is substantially completed.

Delivery and Storage

When materials are delivered, check the following:

- First, check for shipping damage.
- See that materials meet specifications and are in good condition.

- Store gypsum boards flat, on the floor; store plasters and bagged goods flat, on a raised platform. Protect from moisture and damage by abuse.
- Protect framing materials from damage and moisture.

Framing Inspection

Framing members, either wood or metal, must meet architect's specifications and be free of defects. During and after framing construction, make the following inspections:

- See that wood and steel framing materials meet specifications as required by local building codes, regulations and standards. Also verify that sizes and gauges are appropriate based on limiting height tables.
- Check accuracy of alignment and position of framing, including bracing if required, according to plans and details. Make sure load-bearing steel studs are directly underneath the members they support.
- See that partitions are acceptably straight and true; ceilings are acceptably level.
- Measure spacing of studs and joists. Spacing should not exceed maximum allowable for the system.
- Look for protrusions of blocking, bridging or piping, and twisted studs and joists that would create an uneven surface. Correct situation before board attachment.
- Make sure there is appropriate blocking and support for fixtures and board.
- See that window and door frames, electrical and plumbing fixtures are set for the board thickness used.
- Check for proper position and attachment of resilient and furring channels.
- Review all wood and steel framing for compliance with minimum framing requirements outlined in Chapter 2.
- Examine steel studs at corners, intersections, terminals, shelf-walls, door and borrowed light frames for positive attachment to floor and ceiling runners. All load-bearing and curtain wall studs must be attached to runner each side, top and bottom. All load-bearing studs should sit tight against web of runner. Verify that appropriate gauge is used.
- See that steel stud flanges in field all face the same direction.
- See that preset door frames are independently fastened to floor slab and that borrowed light frames are securely attached to stud and runner rough framing at all jamb anchors.

Suspended Grillage

- Measure spacing of hangers, channels and studs to see that they are within allowable limits.
- Check ends of main runner and furring channels. They should not be let into, supported by, or in contact with abutting walls. Main runners should extend to within 150 mm (6″) of the wall to support a furring channel.
- Make sure furring channel clips are alternated and that furring channel splices are properly made.
- See that mechanical equipment is independently supported and does not depend upon the grillage for support.

– Inspect construction around light fixtures and openings to see that recommended reinforced channel support is provided.

Inspecting Drywall and Veneer Plaster Installations

Base Layer

– Verify that material being used complies with specifications and requirements of fire or sound rating.

– Make sure that proper perpendicular or parallel application of board is being used and that end joints are staggered.

– See that the recommended fasteners are being used, spaced and set properly.

– Check for proper use of acoustical sealant.

– Inspect installation to make sure thermal insulating or sound attenuation fire blankets are properly attached and fitted.

– Be certain vapor retarder is installed, if required, and sealed as required.

– Review appropriate system construction and application, and inspect for compliance with laminating recommendations and other construction procedures.

– See that required control joints are properly located and installed per architect's drawings.

Face Layer

– Verify material compliance.

– Look for high-quality workmanship. Cracked or damaged-edge boards should not be used. Board surfaces should be free of defects; joints correctly butted and staggered.

– Check for proper application method—perpendicular or parallel.

– Examine fasteners for compliance with specifications, proper spacing and application.

– Review adhesive application method and see that recommendations and specifications are being followed. Under adverse drying conditions resulting from high humidity, at either high or low temperature, drying of the laminating compound could be prolonged. Consult the setting time table on page 174 and the drying time table on page 176 for guidance.

– Inspect trim, corner beads and related components for alignment, grounds, secure attachment and proper installation.

– Make sure that acoustical sealant is applied around electrical outlets and other penetrations and that it completely seals the void.

Fasteners

– Make sure recommended or specified fasteners are used. Use of a specific fastener may be required by fire tests.

– See that fasteners are applied in such a manner that the board is flat against the framing.

– Observe whether board is held tightly against framing during application.

Test for loose board by pushing adjacent to the fastener. See that face paper is not broken when fastener is driven. If necessary, a second fastener should be driven within 38 mm (1-1/2″) of the faulty one.

- Examine fastener positions. Fasteners should be at least 9.5 mm (3/8″) in from edges and ends. Screws should not be set too deep; the screw head should be just below the surface of the wallboard.
- Make sure that fastener heads in veneer plaster assemblies are flush with the gypsum base surface, not dimpled.

Adhesives

- See that adhesive is applied to clean, dry surfaces only.
- So proper bond can be obtained, make sure that board is erected within allowable time limit after adhesive is applied.
- Measure size of bead and spacing, and see that a sufficient quantity is applied.
- Make sure temporary fastening and shoring holds panel tightly in place.
- Review appropriate adhesive application methods (see Chapter 3) and inspect for compliance.

Inspecting Drywall Joint Treatment

- Make sure panel surface is ready for joint treatment. Fastener heads should be properly seated below panel surface. Anything protruding above the plane of the drywall surface must be removed or sanded below the plane of the drywall surface. Gaps between adjacent panels should be prefilled with joint compound before taping begins. When a gap wider than 3 mm (1/8″) is prefilled, the compound must be allowed to set or completely dry before taping.
- See that recommended mixing directions are followed (see Chapter 5). Only clean water and mixing equipment should be used. SHEETROCK and DURABOND Setting-Type Joint Compounds cannot be held over or retempered.
- Inspect joints and corners to see that tape is properly embedded and covered promptly with a thin coat of joint compound. Only compounds suitable for embedding should be used. Avoid heavy fills.
- Make sure compound is used at its heaviest workable consistency and not overthinned with water.
- Make sure joint compound is allowed to dry thoroughly between coats (see drying time guides on pages 174 and 176). Exception: SHEETROCK and DURABOND Setting-Type Joint Compounds need only be set prior to a subsequent application.
- Inspect second and third coats over joints for smoothness and proper edge feathering.
- See that fastener heads and metal trim are completely covered.
- See that the paper surface of the gypsum board has not been damaged by sanding.
- Make sure that all finished joints are smooth, dry, dust free and sealed before decoration.

Inspecting Veneer Plaster Joint Treatment

– See that corner bead is properly attached and aligned at all outside corners.

– See that control joints are properly installed where required.

– See that proper joint reinforcement is used—Under normal working conditions, joints of veneer plaster systems may be treated by applying IMPERIAL Brand Type P (pressure-sensitive) to the joints and then applying the veneer plaster basecoat or finish to preset the tape. However, there are a number of special situations that require the use of a setting-type joint treatment system:

1. High building temperature, low humidity or excessive evaporation conditions fall in the "rapid drying" area of the graph (see page 199).
2. Metal framing is specified.
3. Wood-framing spacing of 600 mm (24″) o.c. and a single-layer gypsum base veneer system is specified (15.9 mm (5/8″) base with one-coat veneer finish and 12.7 mm (1/2″) or 15.9 mm (5/8″) base with two-coat veneer finish).

   Under any of the above conditions, use SHEETROCK Brand Joint Tape and DURABOND Setting-Type Joint Compound to treat all joints and internal angles. Allow joint treatment to set and dry thoroughly before plaster application.

– See that IMPERIAL Brand Tape is not overlapped at intersections.

– Be sure that all taped, preset GRAND PRIX Plaster Base joints are set before finish application begins.

– If gypsum base paper is faded, proper treatment is required (see page 360).

Inspecting Conventional Plaster Installations

Plaster Base

– See that material being used complies with specifications and fire or sound-tested construction.

– Review appropriate system construction and application, and inspect for proper installation practices.

– Check for proper application of base perpendicular to framing members, and see that end joints are staggered.

– Check for cracked and damaged edges of plaster base. These should not be used.

– Be sure recommended fasteners or clips are used and spaced properly.

– Check for proper use of acoustical sealant.

– Inspect installation to make sure that insulating blankets are properly attached and fitted.

– Be sure adequate supports are in place for fixture and cabinet applications.

Grounds for Plastering

The thickness of basecoat plaster is one of the most important elements of a good plaster job. To ensure proper thickness of plaster, grounds should be properly set and followed. Check the following points:

- All openings should have specified plaster grounds applied as directed.
- If plaster screeds are used, the dots and continuous strips of plaster forming the screed must be applied to the ground thickness to permit proper plumbing and leveling.
- Grounds should be set for recommended minimum thickness for particular plaster base being used (see Chapter 8).
- Control joints should be installed as required for materials and construction with lath separated behind joint.

Job Conditions for Plastering

This phase of inspection is also important. Periodically make an accurate check of the following points:

- At no time should plastering be permitted without proper heating and ventilation.
- A minimum temperature of 13°C (55°F) should be maintained for an adequate period before plastering, during plaster application and until the plaster is dry. After set, circulation of air is necessary to carry off excess moisture in the plaster, and a uniform temperature in a comfortable working range helps to avoid structural movement due to temperature differential.
- To prevent 'dryouts,' precautions must be taken against rapid drying before plaster set has occurred.
- Check temperature during damp, cold weather where artificial heat is provided.
- During hot, dry summer weather, cover window and door openings to prevent rapid drying due to uneven air circulation.

Plaster Application

After determining what materials are to be used on the job, refer to correct mixing and application procedures described in Chapter 8.

The visible success of the job is at stake with the finish plaster coat, and required measures should be taken to finish correctly:

- Check plaster type and mixing operation.
- See that proper plaster thickness is maintained.
- Inspect plaster surfaces during drying. Setting of basecoat plaster is indicated by hardening of plaster and darkening of surface as set takes place. Plaster that has set but not yet thoroughly dried will be darker in color than the unset portion. This accounts for the mottled effect as the plaster sets.
- Consult architect's specifications to see that proper surface finish is being used.
- Check temperature of building for proper finish plaster drying conditions.

Cleanup

For a complete job, cleanup is the final stage. All scaffolding, empty containers and excess materials should be removed from the job site. Floors should be swept and the building and site left in good condition for decoration and finishing.