Product and Systems Technology

Environmental Factors—Plaster Application

PM10

Uncontrolled environmental factors at a plastering job can reduce plaster system performance regardless of the quality of materials and workmanship. Job conditions should be investigated well before a project starts, to identify storage requirements and action needed to control environmental factors.

Absorption of moisture by gypsum plaster can cause lumping and partial setting of the plaster, both serious problems. If moisture-damaged materials are used, this results in quick set or early stiffening of plasters, quick set of gauging plaster or poor working qualities of lime putty.

Moisture absorption can occur from direct contact with water, by condensation of water on or within bags or by direct absorption of water vapor from the air when humidity levels are high.

Condensation occurs when warm moist air comes in contact with a cool surface. If material is covered by a waterproof plastic cover, moisture will accumulate in the warm air under the cover during the day, condense on the inside of the cover when it is cooled at night and dampen the plaster under the cover.

Bagged goods must be protected from four possible sources of moisture:

1. Direct contact with rain, snow or splashing water.
2. Direct contact with wet or damp surfaces.
3. Condensation.
4. Absorption from the atmosphere.

Material Storage

The greatest hazards from moisture occur after plastering materials are delivered to the job. All plastering materials should be stored in a dry location, preferably inside the building under a roof. Stack plaster bags on planks or platforms away from damp floors and walls. Store gypsum plaster bases flat on a clean, dry floor. All materials should remain in their packaging until used.

Where necessary to store materials outside, they should be stacked off the ground, properly supported on a level platform and fully protected from the weather and moisture absorption.

Temporary or emergency protection of materials on jobs with poor storage areas may be provided by the following procedure:

1. Using pallets or planks, make a platform to raise material off damp floors and the ground.
2. Place a sheet of plastic or other vapor retarder material on the platform where the material is to be placed, extending about two feet beyond the platform edges. Note: This is recommended even when the time before use will be short.
3. Place one or two layers of the bagged material on the plastic sheet.
4. After the first or second layer of bags has been placed, fold in the overlap of the sheet over this layer of bags. Continue stacking to desired height. The following layer of bags will hold the bottom sheet in place.
5. Cover the completed pile with another protective sheet (preferably waterproofed tarpaulin), extending it below the bottom sheet.

For over 12 hours of storage, use only waterproofed tarpaulins for top covering because, unlike plastic sheets, tarpaulins will breathe and allow condensed trapped moisture to vaporize and escape.

In cases where materials are stored under a good roof, the top cover can be omitted. However, the bottom bags should always be protected with a vapor retarder.

Proper protection of gypsum base is also critical to good system performance. Excessive sunlight and ultraviolet rays will degrade gypsum base face paper, resulting in a loss of bond with any alkaline (lime containing) plaster product. This is especially critical with veneer gypsum base. See PM4, “Sun-Faded IMPERIAL® Gypsum Base” for further information.

In many cases, veneer and conventional plaster systems, because of their applied thickness, have separate requirements relating to the three environmental factors: ventilation, humidity and temperature.

Ventilation

Veneer applications, like those of conventional plaster finish coats, are applied relatively thin (1/16" to 3/32") compared to conventional basecoat applications (1/2" to 7/8") and, therefore, are more subject to problems associated with evaporation due to excessive ventilation.

Conventional basecoat plaster applications require a large amount of air movement to remove the water once the plaster has set, while veneer and conventional plaster finishes require a minimal amount of circulation.

Humidity and Temperature

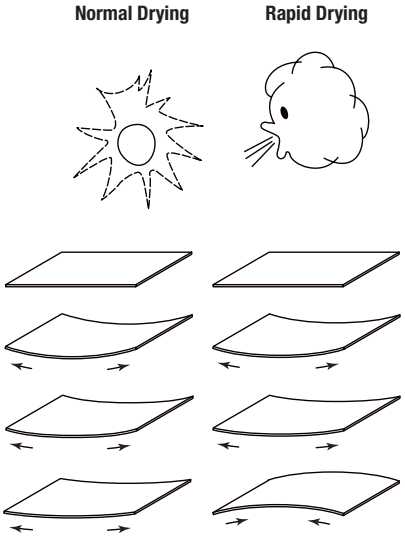
The rate at which the moisture from the plaster system is absorbed during application and removed upon drying also affects the performance of the gypsum panel. This is most noticeable in veneer plaster applications. Under normal conditions, as the veneer plaster is applied to the gypsum base, the surface paper absorbs moisture from the plaster. This causes the face of the board to expand slightly resulting in a slight outward pressure as shown by the force arrows in the diagram on below.

During the application of the plaster, the wet side of the plaster base expands and curves the panel. As the plaster sets, it also expands slightly, causing pressure which forces adjacent base panels together at the joints. During normal drying, this pressure is relieved somewhat by minor shrinkage associated with the drying, but the pressure is still sufficient to keep the joints together. During rapid drying, excessive shrinkage occurs, eliminating the usual pressure at adjacent edges and causing joints to crack open.

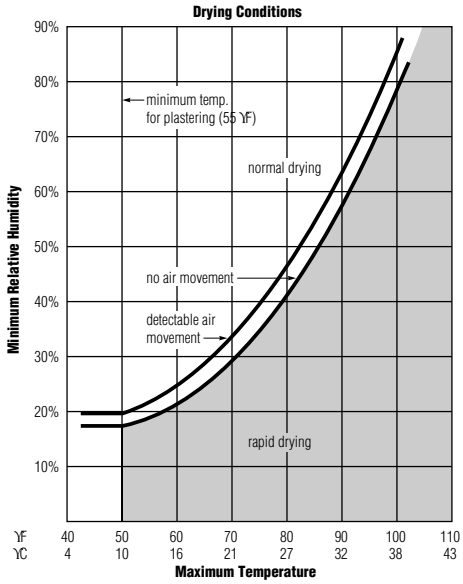
From the above, it is important to identify the environmental conditions present on a veneer plastering job so that the proper joint reinforcement system can be selected. See PM5, “Veneer Plaster Joint Reinforcement Systems,” for more information.

To ensure satisfactory job performance, temperature and humidity conditions should be considered along with ventilation. Optimum conditions for plaster application are 60 to 70 °F (min. 55 °F) and relative humidity corresponding to normal drying conditions (see diagram).

The drying conditions diagram illustrates the effect of humidity and temperature on normal and rapid drying conditions for veneer and conventional plaster finish coat applications.



Movement and forces in the gypsum base which occur during plaster application and subsequent normal and rapid drying conditions.



As illustrated in the diagram, rapid drying occurs when low humidity and high temperatures are present, or when air is being circulated and displaced at a rapid rate. Under either of these conditions, plaster applications are susceptible to dryout and excessive shrinkage.

Dryout is the result of water being removed from the plaster application so quickly that the plaster has no chance to fully hydrate, resulting in a wall or ceiling with a weak, powdery surface. Shrinkage cracking can also occur under similar rapid drying conditions.

Both dryout and/or shrinkage cracking can be prevented in several ways, with job conditions dictating which measures should be taken. Following are several jobsite remedies to improve these problem-causing conditions.

A low humidity level can be raised by wetting the floor prior to plaster application or by plastering the area while maintaining minimal ventilation. In this way, relative humidity will increase as water evaporates. Once the proper humidity level is reached, proper ventilation can begin again.

Conventional plasters require more ventilation after their application than do veneer plasters because more water is used with the thicker basecoat plaster application. In most cases open windows will provide sufficient air circulation for drying. However, if no windows are present or the windows don't open to provide air circulation, then moist air must be mechanically removed.

Drafts from vents, heaters or unglazed windows should not be allowed to blow directly on either veneer or regular plaster because they will cause spot dryouts where the air contacts the plaster. Too much ventilation in the application area may also cause dryout described earlier.

Mixing water temperatures may also contribute to unacceptable job performance:

- Hot water tends to extend the set times of various plaster products and increase the risk of dryout.
- Cold water may quicken set times and alter firmness for finishing.

Optimal water temperature is 55 °F.

Controlling environmental conditions on the jobsite is one of the essential steps in assuring high-quality, long-performance plaster systems.

Plaster should not be applied in freezing temperature, or while the temperature is alternating between freezing and thawing. Temperatures under 32 °F will interfere with the setting action of plaster by not allowing the normal plaster crystals to form. This results in reduced strength, flaking, spalling or delamination from the base or between coats. Always maintain at least 55 °F temperature before, during and after plastering. It is important that the plaster substrate and lath, veneer gypsum base, masonry, etc., be at a temperature above freezing and at the recommended 55 °F minimum temperature to prevent the applied plaster from being affected by the temperature over which is it applied.

Manufactured by
United States Gypsum Company
550 West Adams Street
Chicago, IL 60661

800 USG.4YOU (874-4968)
usg.com

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