

Choosing the **right** compound for drywall joints

PLAINTIFF'S EXHIBIT

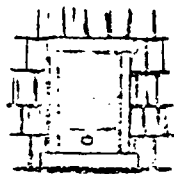
USG-1808

by Earl Maynard, Manager, U.S.G. Drywall Finishes Research

Since the advent of drywall construction in the early 1920's, manufacturers and drywall contractors have wrestled with the problem of how to conceal and reinforce the joint. Over the years many methods have been tried. Some were absolute failures and others only relatively successful. Some products alone do an adequate job while others in combination do a superior job.

Unfortunately no one product solves any one problem completely. The net result has been the development of a family of nine dry powder and three ready-mixed joint compounds. Each is designed to do a specific job under a specific condition. Thus, the careful selection of the proper joint treatment materials by the drywall contractor is important to finished job results.

This report outlines the basic types of joint compounds, their composition and recommended usage. It is hoped that through better understanding of the products, many of your joint treatment problems will be solved. Bear in mind that joint treatment compounds for drywall construction have two primary functions: 1) joint reinforcement and 2) joint concealment.

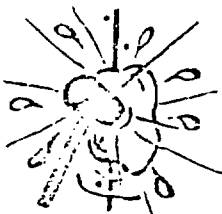


History of Joint Treatment

Early joint treatment of SHEETROCK* Gypsum Panels consisted of plaster of-paris forced into the joints. Severe cracking invariably occurred in nearly all joints. This was followed by an attempt to reinforce the joint with a narrow cloth tape embedded in the plaster. The tape helped, but was far from satisfactory. It became clear that a strong tape and a strong adhesive compound were needed to replace the brittle plaster.

One answer to the problem was a zinc alloy tape called Metal "A" introduced by U.S.G. It was applied with a strong, "high alkaline" joint compound. The tape had large perforations and plenty of strength, but was expensive, hard to handle and an outline of the tape "photographed" through finished walls.

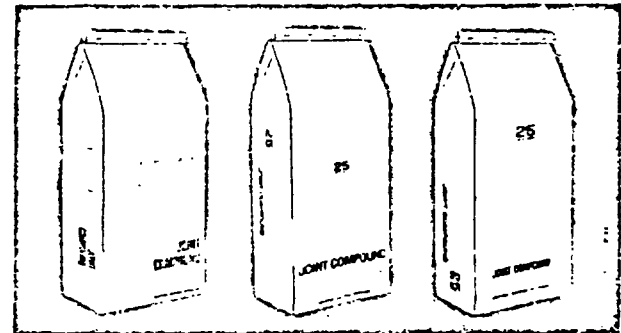
Continued research eventually produced a high-strength paper tape. It was easy to handle and inexpensive. Several modifications have been made since, but paper tape is still used universally for joint reinforcement. From the 1940's to the present, most drywall construction improvements have been made in the compounds and in the formation of the panels themselves.



Basic Types of Joint Compounds

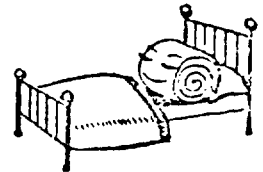
Functionally there are three basic types of joint compounds in use today: taping (embedding) compounds, topping (finishing) compounds and all-purpose (or multi-purpose) compounds. Each is designed for a specific purpose.

Taping Compounds

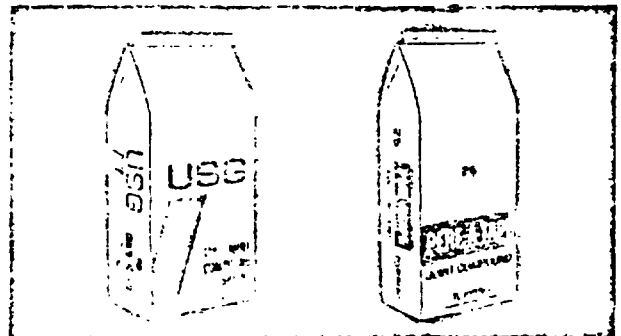


Taping compounds, sometimes called embedding compounds, are used to embed the joint tape.

They have the greatest adhesive strength of all the compounds. Since their function is to reinforce the joint, they are the best products for this use. They are also best for the first coat on metal corner bead and trim. The strong bond also gives superior corner reinforcement. Because of greater adhesive strength they can be thinned slightly for use with mechanical taping tools. Taping compounds are also frequently used for first coat application on fastener heads. They may be used for finishing coats but they're harder to sand.



Topping Compounds



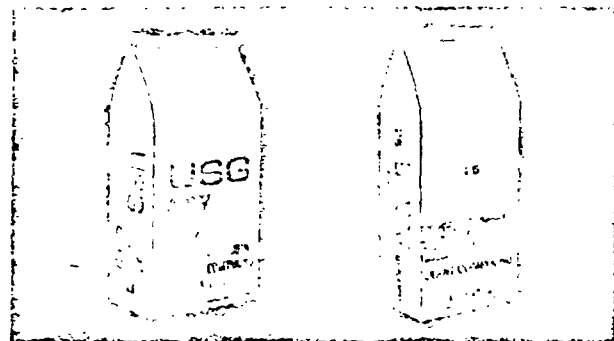
Topping or finishing compounds are used for the fill and final coats over the embedding compound to fully conceal the joint area, fastener heads, corner bead and trim. To finish for decorating, two coats of conventional topping compound are required. Deep fills and poor drying conditions sometimes make additional coats necessary.



GP028 1472

Joint compounds have a lower adhesive strength and are more prone to sand. They are designed to have the best workability in tools, smoothest texture and lowest shrinkage. They are the best products for finishing joints, since they're specifically designed for this purpose.

All-purpose Compounds



All-purpose compounds offer the convenience of a reinforcing, finishing or a texturing compound in one package. However, all-purpose compounds are a compromise between the superior bonding quality of a taping compound and the superior finishing properties of topping compounds.



What's in a Joint Compound?

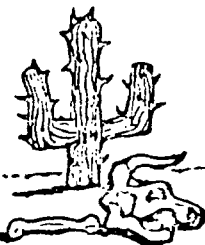
Casein Compounds

Joint compounds, in essence, are water-based adhesives. Until the 1950's all joint compounds were casein-based, dry powder products. Today casein compounds are still used in many areas, including PERF-A-TAPE Compounds, but they are rapidly being replaced by either ready-mixed compounds, non-casein compounds or hardening-type compounds.

Casein is the glue that binds the inert fillers and tape to the gypsum wallboard. Casein is a natural product separated from skim milk; once it is separated and dried for use in joint compounds, it will not dissolve in water. To serve its purpose, however, it must dissolve when the joint compound is stirred into water. Since casein will dissolve in alkaline solutions, joint compound formulae incorporate alkaline reacting salts in small amounts. When the compound is mixed with water, the salts dissolve and produce the alkalinity to dissolve the casein.

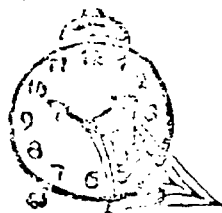
Early casein-based joint compounds were commonly called "high-alkaline" compounds. A heavy concentration of alkali salts in the compound dissolved the casein quickly, even in cold water. However, the alkali reacted with certain types of paints, referred to as "burn-through."

Burn-through, and other problems related to high alkalinity, led to development of "low-alkaline," casein-based joint compounds. Most manufacturers simply reduced the amount of alkali. U.S.G. changed the entire alkaline solvent system to a mild ammonia type which evaporates during drying. There is no alkali left to cause decorating problems.



Non-casein Compounds

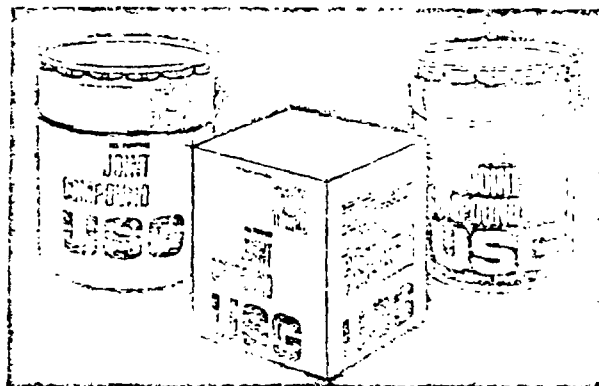
Changing the composition of a compound from one formula to another often presents new problems. The low-alkaline compounds, while they don't burn through, have two inherent disadvantages. Because of low alkalinity, the casein binder takes longer to dissolve, especially in cold water. That's why most manufacturers specify a 30-min. soaking period. Another problem: most casein compounds will thin out or water-down when they stand for long periods after mixing.



These disadvantages led to development of non-casein compounds. Adhesive binders in these powder compounds require no alkaline solvent. The binders themselves are water soluble. Non-casein compounds are useable as soon as they are adequately mixed--and usually stable against thinning out. The non-casein compounds have the advantages of both the high- and low-alkaline casein compounds and none of their disadvantages. These compounds are rapidly replacing the casein types.



Ready-mixed Compounds

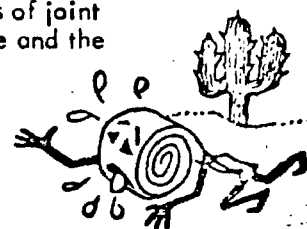


The finest and certainly the fastest growing joint compound in the industry is the ready-mixed compound. The manufacturer has taken the responsibility of mixing the compound to a smooth, lump-free consistency. There are many obvious advantages in ready-mixed--no need to find and carry water, no mixing, no waiting. Application of ready-mixed, compared to casein powder compounds, is "slicker." Ready-mixed has superior crack resistance and ease of handling in tools. It is truly an all-purpose type product, but superior to casein powder all-purpose compounds. Ready-mix usually has better adhesion without excessive hardness for sanding. Vinyl-type binders give ready-mix many of these properties.



Drying- and Hardening-type Compounds

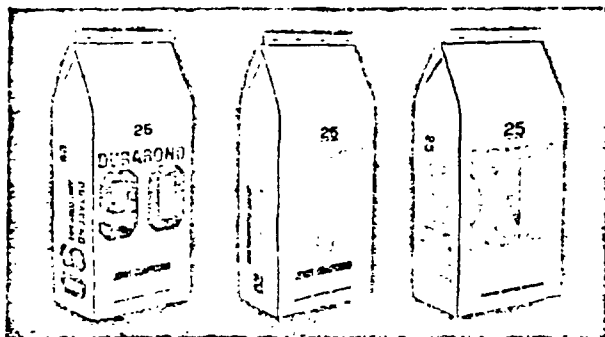
There are two basic forms of joint compounds--the drying type and the hardening type. The drying-type joint compound must dry by evaporation of water to become hard and develop full adhesion. Drying time depends almost entirely on the temperature and humidity. Little can be done by manufacturers to speed up



er slow down the drying rate. All pounds will dry fast on a warm, dry day and very slowly on a cold, damp day (see "Drying Standards" on page 4).

Drying compounds shrink when they dry. Some formulations shrink more than others—but they all shrink. The shrinkage problem led to development of hardening-type compounds... minimal shrinkage compounds. After compounds chemically harden they do not shrink—thus are extremely valuable in deep fills such as on metal corner bead and in openings around pipes, etc.

The primary value of hardening-type compounds,



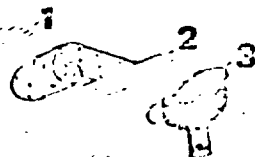
such as DURABOND* Joint Compound—Taping, and DURABOND 90 Joint Compound, is the shorter time required to finish joints. As soon as the DURABOND Taping has hardened—usually less than 4 hours—topping coat may be applied (DURABOND 90 hardens in approximately 90 min.). This brief time period is especially valuable in cold, damp weather when it is often necessary to wait several days before drying-type compounds are ready for another coat. With proper job scheduling and adequate manpower, the three-coat joint treatment on SHEETROCK SW Panels can be completed in a single day. This is sometimes considered impractical or unnecessary. But frequently, pre-filling, taping and fill coats may be applied the first day and final topping coat the second.



USG* Joint Compound—All Purpose, USG Joint Compound—Topping, USG Ready-Mixed Joint Compound—All Purpose or USG Ready-Mixed Joint Compound—Topping are recommended for the final coat over DURABOND. These products are easier to sand and touch up for final decoration. They also give a more even suction across the joint. Thus, hardening-type compounds will not reduce the number of coats, but they give considerably more assurance that no more than three coats are required, even in slow-drying weather.

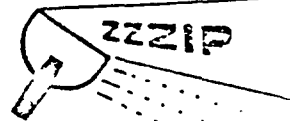


DURABOND XL Joint Compound is an exterior joint treatment formulation in powder form for pre-filling, embedding tape and finishing joints of USG Exterior Gypsum Ceiling Board—also for filling holes in board surfaces, embedding and filling metal accessories and fastener heads. Unlike other DURABOND compounds, DURABOND XL is formulated for all three joint-treatment coats—embedding, filling and finishing, if necessary. However, each coat



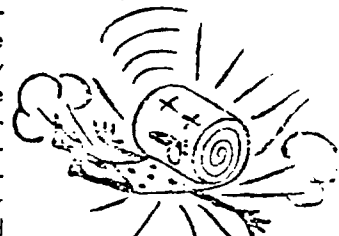
must be applied with professional smoothness in order to avoid sanding and finishing. DURABOND XL Joint Compound hardens in from 30 to 60 min.

The advantages of a hardening-type product are most obvious in slow-drying weather. But what happens when DURABOND Joint Compound is used on a hot, dry day, and dries before it hardens? In such cases a normal amount of shrinkage occurs—about equal to that of ready-mix or casein powder compounds. In other words, DURABOND will perform about the same as a conventional drying-type joint compound. DURABOND Joint Compound—Taping, DURABOND 90 and DURABOND XL Compounds are U.S.G.'s hardening-type products that a skilled drywall mechanic can use effectively. They provide the opportunity to gain speed and quality where his job calls for it. At the same time, he can accommodate a wider range of job conditions.



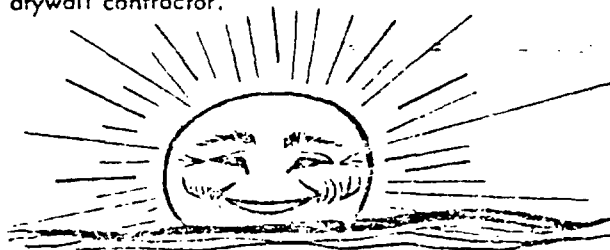
Compatibility of Joint Compounds

As described above, each joint compound is designed to provide a distinct job result. Each product within each line is designed to accomplish a specific job result. The chemistry of each line frequently differs and is often incompatible with another line. The incompatibility arises when products from dissimilar lines become intermixed—either in the mixing container or on the wall. Complete loss of bond or impossible application properties can be evidence of contamination.



Casein compounds generally are incompatible with non-casein compounds and with hardening-type joint compounds. While casein formulas are fairly tolerant of ready-mixed formulations, the two lines were never intended to, nor should they be mixed together.

The drywall contractor should be aware of the need for job cleanliness... cleanliness of mixing containers, tools, water, et cetera. With the introduction and use of new product lines, job cleanliness becomes increasingly important to the drywall contractor.



Joint Treatments for the Future

Every manufacturer is looking hard for new answers to gypsum drywall joint treatment problems. This is true at U.S.G.'s Research Center where the most recent developments—SHEETROCK SW and its companion, DURABOND 90, were developed and released for manufacture. New joint compounds and techniques are now being developed for the manufactured home industry where panel joints must be finished in a matter of hours instead of days.

Perhaps the future will see a practical and effective one-coat joint treatment system.