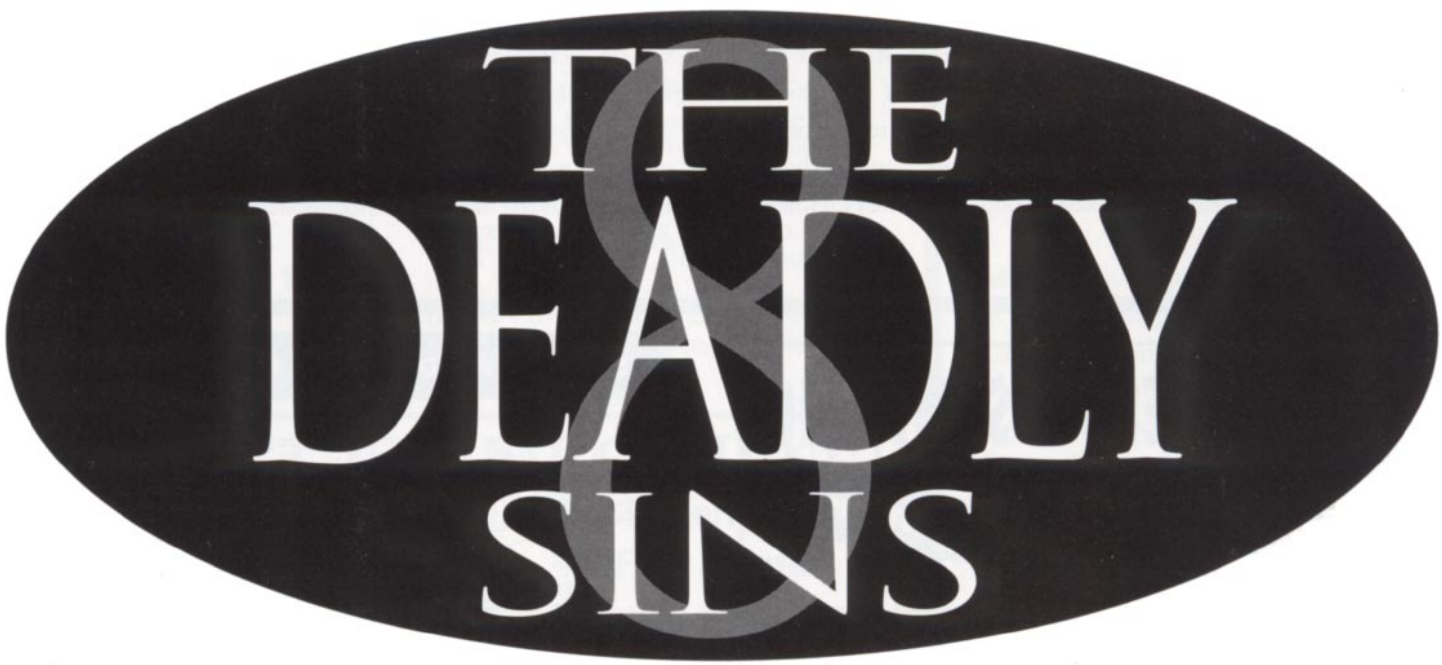
Editor's Note: *This article, the first of two parts, discusses four of the eight "deadly sins" involved in expanded metal lath installation for the application of portland cement stucco. The secondpart, which will cover "sins" five through eight, will be published in the January 1997 issue of Construction Dimensions.*

EXPANDED METAL LATH INSTALLATION FOR THE



APPLICATION OF PORTLAND CEMENT STUCCO

BY GARY J. MAYLON

AUTHORS NOTE: *The following article is the result of contributions from some of the most respected technical consultants in the lath and plaster industry Without their contributions this article would not have been possible. Those contributors and their current affiliation are as follows: Michael Gardner, The Association of the Wall and Ceiling Industries—International; Bruce Pottle, Minnesota Lath and Plaster Bureau; Walter F. Pruter, Information Bureau, Drywall, Lath and Plaster; Jake Ribar, Construction Technology Laboratory; Ron Wollard CEMCO; and Gary J. Maylon, Alabama Metal Industries. These men see many installation problems on a recurring basis and the repercussions of these errors on the finished stucco membrane. We offer this information as a reminder of the proper installation procedures for metal lath as required by ASTM specifications and most code bodies. It has been our observation that many contractors do*

not properly familiarize themselves with these specifications until they experience a catastrophic failure and the dreaded word "litigation" is mentioned At that point many consultants and industry technical representatives are contacted to help rectify, or justify the faulty construction.

We hope to avoid some of these problems by calling to the attention of specifiers, contractors and inspectors those specification items that are most critical to the proper installation of metal lath and portland cement stucco, including those that are most often overlooked or improperly performed. The following are The Eight Deadly Sins of Metal Lath Installation for Portland Cement Stucco.

1. Improper plywood sheathing installation (not necessarily the responsibility of the lathing contractor).

2. Improper selection of metal lath by weight and style for each span and application.

3. Improper installation of metal lath.

4. Improper fastening of lath.

5. Improper use of metal lath accessories or the use of the wrong accessory material for certain applications and areas.

6. Improper installation or inadequate number of expansion joints.

7. Improper installation of flashing and sealants at all possible points of water entry (also not usually the direct responsibility of the lathing contractor).

8. Improper installation of suspended ceilings.

For the purpose of this article I will be discussing the installation of metal lath for the exterior installation of portland cement stucco. The installation of metal lath for interior applications with portland cement or gypsum cement has subtle differences from the require-

ments for exterior installation, and those differences will not be addressed in this article.

Plywood sheathing, which is widely used across the country, offers some unique problems. The American Plywood Association recommends that sheets of plywood be installed with a gap between sheets of not less than 1/8 inch on all sides. This gap is necessary to accommodate any expansion in the plywood that might occur as a result of moisture absorption, which might reach the plywood sheathing via any

number of sources. One should be cognizant of the fact that if large amounts of moisture are allowed to reach and be absorbed by the plywood, delamination and swelling of the plywood will result. This action will undoubtedly result in a deterioration of the stucco membrane. This deterioration usually manifests itself in the form of cracks over much of the plastered surface.

The Uniform Building Code requires two layers of grade D paper to be installed over plywood sheathing. My research indicates that the thinking behind this legislation was moisture might penetrate one layer of grade D and add excessive moisture to the plywood sheathing during the curing process. This might cause initial swelling followed by shrinking after the sheathing dries, all of which might cause excessive stress on the stucco panels and result in stress cracks. Throughout most of the Eastern half of the country, only one layer of grade D is required for applications over plywood sheathing. This is because the grade D paper has proved itself to be an adequate moisture barrier for 40 years, when installed properly and when the stucco is mixed and applied per ASTM C 926.

You will note that UBC specifies a breather-type paper and not grade B saturated kraft paper or asphalt saturated felt, which is very nearly a vapor retarder. In colder climates, if a vapor retarder is placed on the outside of the wall, it is imperative that a vapor barrier be placed on the inside surface of the wall. If this is not done, moisture can condense, collect in the wall cavity and become very destructive to the insulation and all the components of the wall. Also, where a moisture-proof vapor barrier is placed on both sides of the wall, exceptional care must be taken to make all areas of the wall water tight. If moisture is allowed to enter through openings in the wall, such as unflashed windows or poorly flashed roofs, it will likely remain in the wall cavity for extended periods and cause extensive structural deterioration because vapor barriers have been placed on both faces of the wall.

ASTM C 1063, the installation specification for metal lath used with portland cement stucco, provides specific data in table 3 that enables the designer to select the proper weight and style of metal lath for a particular application. Specifically, lath is available in different weights per square yard and in various styles, such as flat, self-furred (dimples or embossed ribs in the mesh only) and rib lath (with solid ribs). It should be mentioned that wire fabric lath, either woven or welded, is used primarily in the West, and usually for residential construction. All these products have specific applications based on the spacing of the structural members, the types of structural members, application to solid surfaces and the orientation of the lath on either vertical or horizontal planes. It is very important that the

designer and the contractor use the proper lathing product for the specific design situation.

Sometimes flat or non-self-furred lath, or flat rib lath, is used over solid surfaces. ASTM states that self-furred lath shall provide approximately 1/4-inch furring away from the solid surface in order to provide proper keying of the stucco, and that self-furred lath must be used on all solid surfaces. Self-furred lath is furred with dimples or embossed ribs in the mesh that provide for the required 1/4 inch of furring. Flat rib lath should not be considered self-furred because it does not offer an adequate amount of furring.

Metal lath is supplied in most markets in hot dipped galvanized (G 60) for exterior applications, and in painted or some equivalent rust-inhibitive coating, such as electrogalvanizing, for interior applications. I have included this element because some contractors have installed painted or electrogalvanized lath for exterior applications. According to ASTM C 1063, only G-60 hot dipped galvanized lath is allowed to be used for exterior applications.

Some of our contributors have found that 3/8-inch rib lath, although permitted by code to be used on vertical surfaces such as walls, often produces cracking. It is believed that this cracking is caused by the variations in the thickness of the stucco created by the ribs, careless nesting of the ribs and also by the added rigidity offered by this product. Rib lath is used most often for the lathing of soffit areas where the truss members or joists are spaced 24 inches on center. In this application the added rigidity prevents sagging of the stucco membrane. It is important to

note that rib lath is installed with the rib against the support. While this seems elementary, there have been numerous reports of this material being installed with the rib projecting out into the stucco. This will cause cracking in every instance.

Proper furring is critical because the lath must be fully embedded in the stucco for it (the lath) to function properly. Remember that the lath acts as a structural support for the stucco during the application and curing process of the stucco, and should be located in the lower third of the stucco membrane. The lath also provides a means of attachment for the entire stucco membrane to the structural framing and furring system. Failure of the stucco to key properly with the metal lath will nearly always result in cracks and eventual delamination of the stucco membrane. Remember also that if excessive moisture enters the wall cavity and is allowed to remain in there, this excessive moisture can corrode and deteriorate the metal lath and the fasteners holding the lath to the structural members. This can also lead to delamination of the stucco matrix. Keeping moisture out of the wall cavity will be covered in a later section of this article.

This item could provide enough data for a separate article. Some of the more critical errors, however, are improper lapping attachment of metal lath to the structural members, improper installation of paper-backed lath, incorrect fastening of adjoining sheets at the laps

and the improper orientation of the lath sheets. A well-defined installation procedure for metal lath with or without paper can be found in ASTM C 1063.

First let's deal with the proper lapping of metal lath. Some of our experts feel that too large of a lap is as detrimental as too small of a lap. ASTM C 1063 requires that expanded metal lath be lapped a minimum of 1/2 inch along the long dimension of the sheet and a minimum of 1 inch along the end of the sheet. This specification does not limit the laps to any maximum size, however. It has been our field experience that very large laps that are often not fastened properly will result in stucco cracks. If a sheet of lath is overlapped excessively at the roof line, for example, and not wire tied between the supports, a separation may occur. When plastered the cement will only key to the top layer of lath in this area; however, in adjacent areas it may penetrate both layers and result in a thicker layer of stucco. This variation in the thickness of the stucco membrane often will result in stress cracks. Also, all vertical laps must occur at a structural support.

The proper lapping of paper-backed metal lath also is critical to the stucco system. Often we see paper-backed lath installed with the paper overlapping the metal lath of the sheet below. When this happens the stucco can pass only through the first sheet, not locking the two sheets together. This creates a situation as described in the paragraph above, where the stucco is thinner in one area, thus creating a weakened plane and a likely area for stress cracks. Stucco walls that exhibit horizontal cracks located between 24 inches and 26 inches apart were, in all likelihood, lathed with the paper overlapping the bottom metal lath sheet.

An unusual situation is created in the West because the Uniform Building Code technically classifies most horizontal semi-horizontal surfaces as being something other than walls. That is to say that architects desiring to have plas-

ter surfaces on top of parapet walls, pot shelves and deep-set window sills must consider the fact that the code does not consider these surfaces as walls; therefore, it seems logical that these surfaces must be considered as a sort of roof According to the UBC, walls are only those surfaces installed in a slope of 60 degrees or more from horizontal. It would follow that anything less pitched than this would have to be weather protected like a roof That would mean covering these surfaces with sheet metal or other water-resistive materials, or underlaying the paper-backed lath and plaster with a roofing type of membrane, preferably one that is self-sealing such as W. R. Grace's Ice and Water Shield. This idea sounds like a good one and should perhaps be adopted wherever this situation occurs.

In the summer months it is important that paper-backed lath products be protected from the sun and from extreme temperatures that might melt the glue that holds the paper to the lath. Furthermore, grade B building paper is susceptible to deterioration when exposed to the sun for more than a week or 10 days. It must be covered with scratch coat plaster before this happens. Grade B paper is used on a limited basis on the West coast.

The final item of importance in this section has to do with the fastening of adjoining sheets of lath at the laps. Where two sheets of lath overlap horizontally between the framing members, C 1063 states that the lap must be wire tied between supports at intervals not greater than 9 inches. That is to say that when framing members are spaced 16 inches on center, the lath lap is required to be secured only once; if the framing members are spaced 24 inches on center, the lath lap must be fastened twice. This will create thickness variations and as described in a preceding paragraph. Failure to accomplish this requirement will result in cracking. Often we see these laps stapled to the sheathing instead of wire tied. Since self-furred lath is used for this application, the result could be a negating of the effect of the self-furring mechanism, which will result in poor plaster keying in these locations.

ASTM requires that lath be fastened at intervals of not less than 7 inches on center, and the Uniform Building Code requires a minimum spacing of 6 inches on center to the structural members. This error occurs more often than any other error listed. We see lath stapled or nailed at random to the sheathing material rather than to the structural member.

Plywood and gypsum sheathing do not offer enough holding power for metal lath and stucco. A nail attached only to sheathing can work loose, particularly if

the sheathing becomes wet, which will lead to serious structural cracking. Additionally, high winds can create a negative pressure (sucking effect) on the opposite side of a building from the wind direction. If the lath is not properly attached to the framing members, the entire stucco membrane can be sucked off the building on the side affected by the negative force of the wind. This was very evident during Hurricane Andrew in South Florida.

The type and size of the fastener also is very important. For installation directly to wood framing members, C 1063 allows for the use of 1 1/2 inch roofing nails for horizontal applications. Vertical applications require the use of 1 inch roofing nails, 1 inch staples with minimum fl-inch crowns, or 6d common nails bent over to engage at least three strands of lath. In all cases, not less than three strands of lath shall be engaged, and penetration into the wood support must be a minimum of three-quarters of an inch. Where 3/8-inch rib lath is attached to wood framing members with nails or staples, they must penetrate the framing member a minimum of 1 3/4 inch for horizontal applications and three-quarters of an inch for vertical applications. The nail must be bent over the rib, or the staple must straddle the rib.

Where welded or woven wire lath is installed it is important that the wire rest on the fastener. Tests have shown that the structural capacity of the lath, fastened to supports with a wire strand below the fastener, is considerably less than when properly secured.

FAILURE OF THE STUCCO TO KEY PROPERLY WITH THE METAL LATH WILL NEARLY ALWAYS RESULT IN CRACKS AND EVENTUAL DELAMINATION OF THE STUCCO MEMBRANE.

For fastening lath to steel supports reference is made to ASTM C 954 by ASTM C 1063 for screw information. We also are told that lath can be wire tied to the member with 18-gauge tie wire. Whether wire or screws are used, the maximum allowed spacing should be maintained, and, once again, all fastening must be into the structural member.

C 954 states that the screw shall have a minimum head size of 7/16 inch with either a pan or wafer head large enough to engage at least three strands of lath. We have seen many instances where contractors have installed lath with bugle-headed drywall screws that are not even coated or galvanized. Due to the small size of the head on these screws and the taper of the shank, they offer very little holding strength for the lath. The diameter of the screw is vague in this specification. However, the Metal Lath/Steel Framing Association recommends a minimum #8 shank, which must penetrate the framing at least 3/8 inch (the UBC requires minimum 1/4-inch penetration).

The least distinct area of lath installation seems to be the attachment to block

(cmu's) or concrete walls. Currently, self-furred lath is recommended to be attached to the wall by driving hardened concrete stub nails at least 3/4 inch long, with heads a minimum of 3/8 inch, in rows no more than 16 inches on center with fasteners spaced a maximum of 7 inches on center down each row. As with other self-furred lath installations, care should be given not to negate the self-furring mechanisms, so all side laps must be wire tied together between rows of fasteners. It appears that ASTM will soon require that six power or powder-actuated fasteners be used along with the stub nails. These will be located at each corner and midway along the long edge of the sheet, and will replace the stub nails at these locations.