

# GYPSUM ASSOCIATION

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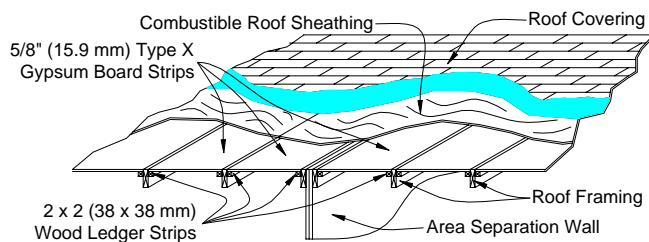
## GYPSUM BOARD ROOF UNDERLAYMENT SYSTEMS (GA-276-05)

Effectively preventing fire from penetrating through the roof eliminates updrafts, both limiting the potential for fire spreading on the roof surface and reducing the generation of flying brands. Adding gypsum board to roof systems also inhibits the spread of fire within an attic while protecting against burning brands from fires originating in another unit or from burning vegetation.

The use of  $\frac{5}{8}$  in. (15.9 mm) thick type X gypsum board as an underlayment for combustible roofs is the preferred alternate to roof parapets separating dwelling units in multi-family construction. This method of fire protection is designed to resist the spread of fire from unit to unit over the top of party walls.

To achieve this fire protection alternative, the Gypsum Association has developed the following three recommended methods of installation. Although the model codes (IBC, BOCA, SBCCI, & ICBO) permit any of these three alternates to parapet construction, individual code provisions may vary. Consult your local code enforcement authority for provisions specific to your jurisdiction. The three methods of applying gypsum board as a roofing underlayment, in order of preference, are described below.

### LEDGER STRIP METHOD

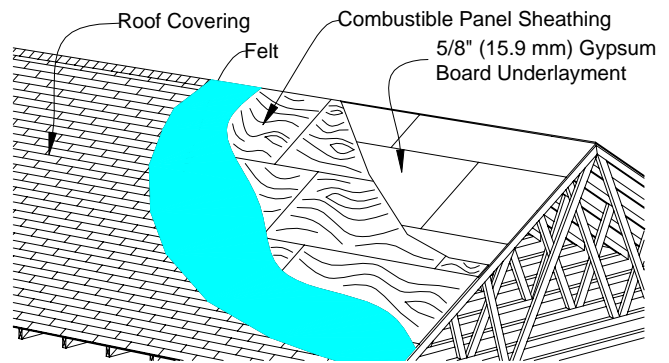


Apply  $\frac{5}{8}$  in. (15.9 mm) type X gypsum board to the top side of nominal 2 x 2 (38 x 38 mm) ledger strips attached to the sides of the roof framing such that the upper surface of the gypsum board is flush with the top of the trusses or rafters. Ledger strips are cut and attached to form a continuous strip. The gypsum board is cut to fit snugly between the roof framing, supported by and attached to the ledger strips with minimum  $1\frac{1}{4}$  in. (32 mm) long fasteners spaced a maximum of 48" (1220 mm) o.c. Care must be taken to ensure that gypsum board end joints spanning between framing members are snugly fitted.

In addition to using gypsum board underlayment in the roof system, using  $\frac{5}{8}$  in. (15.9 mm) type X gypsum board as the ceiling membrane on the top floor of the unit offers a significant increase in protection from a fire within the unit reaching the roof framing.

Adequate ventilation must be provided in attic areas to control moisture and reduce temperature. Careful attention to design is critical to assure proper air flow to all areas

### FULL ROOF UNDERLAYMENT



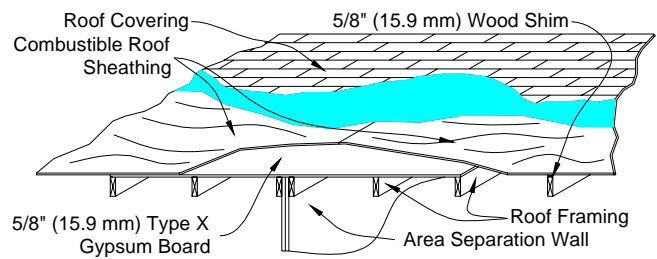
Install  $\frac{5}{8}$  in. (15.9 mm) type X gypsum board over the entire roof area. Apply the gypsum board perpendicular to and on top of roof trusses or rafters prior to the installation of combustible roof sheathing. All gypsum board end joints should occur over and be supported by the roof framing. Nail the gypsum board to each framing member with two minimum 4d common nails, or  $1\frac{3}{8}$  in. (35 mm) nails complying with ASTM C 514, *Standard Specification for Nails for the Application of Gypsum Board*. Butt end joints loosely; fit edge joints snugly together without forcing. End and edge joints need not be taped. Protect gypsum board against exposure to inclement weather during installation and until the roof membrane installation is complete. Attach combustible roof sheathing through the gypsum board to the roof framing with sheathing joints offset from the gypsum board joints. Increase fastener length by  $\frac{5}{8}$  in. (16 mm) to account for the thickness of the gypsum board. Apply the roof membrane as specified by the manufacturer.

This full roof underlayment method offers a number of advantages over the partial roof underlayment and ledger strip methods. First, it provides the greatest degree of fire protection. Second, it is the least complicated of the three methods to install, and finally, it is generally the most cost effective when the additional labor costs incurred by the other methods are considered.

## PARTIAL ROOF UNDERLAYMENT

Install  $\frac{5}{8}$  in. (15.9 mm) type X gypsum board under the combustible roof sheathing on both sides of the party wall for not less than the minimum distance required by the code. Apply the gypsum board on top of roof framing, with the paper-bound edge perpendicular to the framing, prior to the installation of combustible roof sheathing. All gypsum board ends should occur over and be supported by the roof framing. Nail the gypsum board to each framing member with at least two minimum 4d common nails, or  $1\frac{3}{8}$  in. (35 mm) gypsum wallboard nails. Butt end joints loosely; fit edge joints snugly together without forcing. End and edge joints need not be taped. Protect gypsum board against exposure to inclement weather during installation and until the roof membrane installation is complete. Shim all remaining trusses and rafters as necessary to provide a straight and uniform base for the attachment of the combustible roof sheathing. Attach roof sheathing through the gypsum board to the roof framing with sheathing joints offset from the gypsum board joints. Increase fastener length by  $\frac{5}{8}$  in. (16 mm) to account for the thickness of the gypsum board and shims. Apply the roof membrane as specified by the manufacturer.

This second method offers easy attachment of the gypsum board to the roof framing, compared to the ledger strip method. It does however require shimming the roof framing that is not protected with the gypsum board. As an alternate to shimming, two different sizes of rafters or trusses may be used. In typical multi-family housing where individual units are relatively narrow, it is generally more economical to cover the entire roof.



## COMPARISON OF BURN-THROUGH TIMES WHEN GYPSUM BOARD IS ADDED

Tests have been conducted to compare the burn-through times of roofs using gypsum board underlayment to those without gypsum board underlayment. These tests demonstrate the dramatic increase in the amount of time required to burn through a roof into the attic space when gypsum board underlayment is used in conjunction with common roof deck materials. The burning brand test portion of *Methods of Fire Tests of Roof Coverings* (ASTM E 108 & NFPA 256), one of the standard tests used to evaluate roof covering materials, was used in the Gypsum Association test program. The Class A brand was used in the test to provide the most severe test conditions. The results of this comparative testing are summarized in Table 1.

Dramatic results were also shown on burn-through of the roof from a fire originating in the attic space when gypsum board underlayment was used.

Table 1

| Roof Covering            | Felt    | Roof Sheathing          | Sub-Sheathing                    | Burn-Through Time | Test Stopped |
|--------------------------|---------|-------------------------|----------------------------------|-------------------|--------------|
| Cedar Shakes             | Asphalt | 1 x 8                   | None                             | 7:20              | 7:45         |
| Cedar Shakes             | Asphalt | 1 x 8                   | Type X Gypsum Board              | None              | 71:09        |
| Cedar Shakes             | Asphalt | $\frac{1}{2}$ " Plywood | None                             | 16:45             | 17:09        |
| Cedar Shakes             | Asphalt | $\frac{1}{2}$ " Plywood | Type X Gypsum Board              | None              | 70:00        |
| Fire Retard Cedar Shakes | Asphalt | 1 x 6, 10" o.c.         | None                             | 11:25             | 11:40        |
| Fire Retard Cedar Shakes | Asphalt | 1 x 6, 10" o.c.         | Type X Gypsum Board              | None              | 70:00        |
| Asphalt Shingles         | None    | 1 x 8                   | None                             | 6:20              | 6:40         |
| Asphalt Shingles         | None    | 1 x 8                   | $\frac{1}{2}$ " Reg Gypsum Board | None              | 60:50        |
| Asphalt Shingles         | None    | $\frac{1}{2}$ " Plywood | None                             | 40:30             | 40:30        |
| Asphalt Shingles         | None    | $\frac{1}{2}$ " Plywood | Type X Gypsum Board              | None              | *30:00       |
| Built-Up Roof            | None    | $\frac{1}{2}$ " Plywood | None                             | 17:30             | 17:35        |
| Built-Up Roof            | None    | Type X Gypsum           | $\frac{1}{2}$ " Plywood          | None              | 27:40        |
| Built-Up Roof            | None    | $\frac{1}{2}$ " Plywood | Type X Gypsum Board              | None              | 67:00        |
| Cedar Shingles           | None    | 1 x 4, 8" o.c.          | None                             | 2:55              | 5:10         |
| Cedar Shingles           | None    | Type X Gypsum           | 1 x 4, 8" o.c.                   | None              | 72:00        |
| Cedar Shingles           | None    | 1 x 4, 8" o.c.          | Type X Gypsum Board              | None              | 76:35        |

\* Test was terminated at 30:00 because the specimen stopped burning

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