

Fire endurance of welded built-up steel columns, cold formed steel channel columns and steel pipe columns

U.L. tested and classified for 1, 1 ½ and 2-hour fire protection

Insurance Bulletin No. 5 explains how insurance rates or loss costs for metal buildings are affected by exterior wall construction or column protection. Several important points were brought out. All remain applicable; however, this bulletin pertains specifically to one section which stated:

"On the other hand, if the structural exterior wall supports are a minimum of one-hour fire resistive, an improved rating or loss costing can normally be obtained even though the construction class will not be modified from Class 3"

Formerly published classifications by U.L. did not include a fire-resistance rating for steel column sizes less than a W10 x 49. The "state of the art" regarding fire protection of building columns was as follows:

- A. For a given fire endurance period, the required amount of a specific protective material increases as the column section decreases.
- B. Little test documentation of approved fire protection was available for columns weighing less than 49 lbs. per foot.
- C. Test documentation was not available for tapered columns of variable weight and section area.

D. With the exception of masonry and the exotic, expensive "Space Program" products, more data was available on the inherent fire resistive qualities of gypsum board than any other protection material.

E. A rational calculation method was available for predicting the fire endurance of steel columns protected with gypsum wallboard. (Types C, IP-X2)

MBMA recognized this information as the logical basis upon which an extensive fire research and testing program could be justified. After discussions with fire protection authorities, testing agencies and gypsum manufacturers, it was the decision that the calculation method should be equally applicable to either parallel or nonparallel flange columns; but due to the absence of the complete research data, screening tests would be necessary to establish correlation between the calculation method and tests results. It was recognized that a one (1) hour rating was satisfactory in many jurisdictions and that a two (2) hour rating was the minimum endurance needed to satisfy almost all fire protection regulatory agencies.

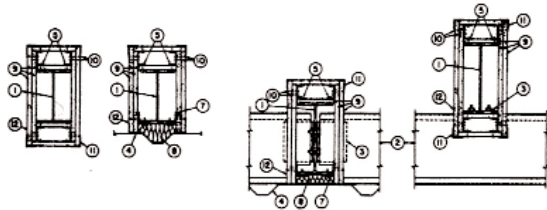
MBMA conducted several tests at Underwriters Laboratories, Inc., which confirmed correlation with the calculation method. Expanded testing included additional members configured as channel and pipe sections. The latest series of testing has now included and validated protected column sections penetrate by unprotected girts.

Note: This bulletin was previously released as Insurance Bulletin #6

MBMA considers this breakthrough in fire protection research most important to the designers and users of economical light steel framed buildings. Recognition and approval by fire protection authorities or regulatory agencies can be expected along with resulting commercial advantages.

Design No. X524

Ratings - 1 and 2 Hr. (See Item 9)



- Steel Column** - Column sizes may vary. Max. depth 60 in., min. flange 4 in. wide by $\frac{3}{16}$ in. thick. Min. web thickness 0.090 in. All columns to be designed in accordance with AISC specifications. In addition to the above requirements, the weight to perimeter (W/D) ratio shall not be less than 0.27.
 $W = \text{Cross-sectional area (ft}^2\text{)} \times 490$
 $D = \text{Perimeter of steel column, (2 X flange width [in.]) + (2 X column depth [in.])}$
- Girts** - "Z" or "C" shape girts fabricated from 0.056 to 0.120 in. thick steel. Girts shall be 6 to 10 in. deep with 2 ½ to 3 in. wide flanges. Secured to columns with girt clips, (Item 3).
- Girt Clips** - Fabricated from 3 by 3 by 0.115 in. thick steel. Clips secured to column with 1½ in. long, X in. diam. bolts and nuts.
- Steel Wall Panels** - No. 26 MSG (min.) galv. steel.

- Wallboard Attachment Studs** - No. 26 MSG (min) galv. steel, 1½ in. deep with 1 3/8 in. legs and ¼ in. stiffening flanges. Studs cut ½ to ¾ in. less in length than column height. Additional studs located inside and along flanges and at the web center when column depth exceeds 36 in.
- Wallboard Attachment Channels** - (Not shown) - No. 26 MSG (min.) galv. steel 1¾ in. deep with nom. 1 in. leg. Required horizontally every 8 ft. across web only when column depth exceeds 36 in.
- Wallboard Attachment Angles** - No. 26 MSG (min.) galv. steel, 1½ and 2 in. legs, secured to column with No. 12-24 by 1½ in. long self drilling screws spaced 24 in. O.C. vertically.
- Batts and Blankets*** - Nom. 1 to 2 in. thick mineral wool batts, placed between column flanges and steel wall panel.
USG Interiors Inc.
United States Gypsum Co.
- Wallboard, Gypsum*** - Nom. ½ in. thick 4 ft. wide.

For 1 Hr. Rating - Two layers of wallboard to be used. Wallboard applied vertically, attached to steel studs and/or angles with screws spaced 12 in. O.C. Horizontal wallboard joints staggered 30 in. O.C. with screws located 1 in. from the joint. When column depth exceeds 36 in., wallboard over web applied horizontally. Screws spaced 12 in. O.C. alternating between inside and outside flange attachment studs for outer web attachment. Screws spaced 12 in. O.C. for center web attachment. Joints staggered 12 in. O.C. with screws located 1 in. from joint.

*Bearing the UL Classification Marking

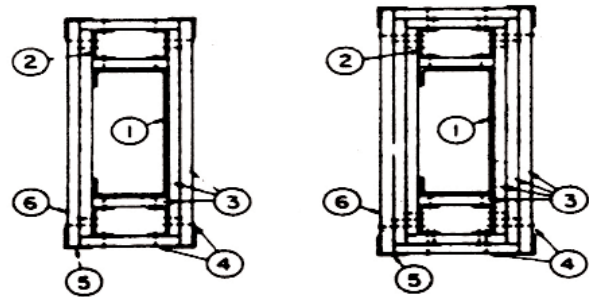
For 2 Hr. Rating – ½ in. thick, three layers, board applied vertically, attached to wallboard studs and/or angles with steel screws, 12 in. O.C. horizontal joints staggered 30 in. O.C. with screws located 1 in. from the joint. When column depth exceed 36 in., wallboard over web applied horizontally. Screw spaced 12 in. O.C. alternating between inside and outside flange attachment channels for outer web attachment. Screws spaced 12 in. O.C. for center web attachment. Joints staggered 12 in. O.C. with screws located 1 in. from joint.

Boral Gypsum Inc. - Type BG-C.
Canadian Gypsum Co. Ltd. - Type C.
Celotex Corp. - Type FRP.
Continental Gypsum Co. - Type CG-C.
Domtar Gypsum - Type 5.
Eagle-Gypsum Products - Type EG-C.
Georgia-Pacific Corp., Gypsum Div. - Type GPFS-C.
Pabco Gypsum Co. - Type PG-C.
Republic Gypsum Co. - Type RG-C.
Standard Gypsum Corp. - Type SG-C.
Temple-Inland Forest Products Corp. - Type TP-5.
United States Gypsum Co., Ltd. - Type C, IP-X2.

- 10. Screws** - Type S self-drilling, selftapping, bugle head screws. For the first and second wallboard layers over the flanges and the first layer over the web areas. 1 in. long screws are used. For the second wallboard layer over the web areas and the third wallboard layer over the flanges, 1 5/8 in. long screws are used. For the third wallboard layer over the web areas, 2 ¼ in. long screws are used.
- 11. Corner Bead** - No. 28 MSG galv. steel, two 1 ¼ in. legs, attached to wallboard with Type 4D gypsum wallboard nails spaced vertically 12 in. O.C.

- 12. Finishing System** - Joint compound, 1/16 in. thick, applied over corner beads and joints.

Design No. X530
Rating - 1 and 2 Hr.



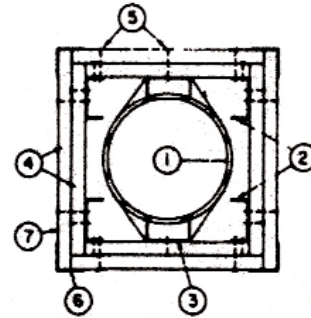
- 1. Steel Column** - Cold formed C-shaped column fabricated from min. 0.066 in. thick painted steel weighing a min. 3.2 lb. per foot. The column shall be a min. 7.0 in. deep with a min. 3.0 in. wide flange and 0.90 in. long stiffening flange.
- 2. Wallboard Attachment Studs** - 1 5/8 in. deep with nom. 1 3/8 in. legs, and ¼ in. stiffening flanges. No. 26 MSG (minimum) galv. steel. Channels cut ½ and ¾ in. less in length than column height.
- 3. Wallboard, Gypsum*** - Nominally ½ in. thick, 4 ft. wide.
For 1 Hr. Rating - Two layers of wallboard to be used. Applied vertically and attached to wallboard studs with steel screws, inner layer wallboard screws spaced 24 in. O.C., outer layer wallboard screws spaced 12 in. O.C.
For 2 Hr. Rating - Three layers of wallboard to be used. Applied vertically and attached to wallboard studs with steel screws. Inner layer wallboard screws spaced 24 in. O.C. Middle and outer layer wallboard screws spaced 12 in. O.C.

*Bearing the UL Classification Marking

Boral Gypsum Inc. - Type BG-C.
Canadian Gypsum Co. Ltd. - Type C.
Celotex Corp. - Type FRP.
Continental Gypsum Co. -Type CG-C.
Domtar Gypsum - Type 5.
Eagle-Gypsum Products - Type EG-C.
Georgia-Pacific Corp., Gypsum Div. - Type GPFS-C.
Pabco Gypsum Co. - Type PG-C.
Republic Gypsum Co. - Type RG-C.
Standard Gypsum Corp. - Type SG-C.
Temple-Inland Forest Products Corp. - Type TP-5.
United States Gypsum Co., Ltd. -Type C.

4. **Screws** - Type S self-drilling, self-tapping, bugle head steel screws. For the first and second wallboard layers over the flanges and the first wallboard layer over the web areas, 1 in. long screws are used. For the second wallboard layer over the web areas and the third wallboard layer over the flanges, 1 5/8 in. long screws are used. For the third wallboard layer over the web areas, 2 1/4 in. long screws are used.
5. **Corner Bead** - No. 28 MSG galv. steel, two 1 1/4 in. legs, attached to wallboard with Type 4d gypsum wallboard nails spaced vertically 12 in. O.C.
6. **Finishing System** - Joint compound, 1/16 in. thick, applied over comer beads, joints and surfaces of wallboard.

Design No. X531



Rating - 1 1/2 Hr.

1. **Steel Column** - steel pipe column with a min. outside diam. of 4 1/2 in., a min. wall thickness of 0.109 in. and a min. weight of 5.1 lb. per ft.
2. **Wallboard Attachment Studs** - 1 5/8 in. deep with nom. 1 3/8 in. legs, and 1/4 in. stiffening flanges fabricated from No. 26 MSG (minimum) galv. steel. Channels cut 1/2 to 3/4 in. less in length than column height.
3. **Wallboard Attachment Channels** - 1 5/8 in. deep with nom. 1 1/4 in. legs, fabricated from No. 26 MSG (minimum) galv. steel. Channels tied to column with No. 18 SWG tie wire spaced approximately 4 ft. O.C.
4. **Wallboard, Gypsum*** - 1/2 in. thick, two layers applied vertically. Inner layer attached to steel studs and channels with 1 in. long steel screws spaced 12 in. O.C. Outer layer attached through inner layer into steel studs with 1 5/8 in. long screws spaced 12 in. O.C.

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Celotex Corp. - Type FRP.
Continental Gypsum Co. - Type CG-C.
Domtar Gypsum - Type 5.
Eagle-Gypsum Products - Type EG-C.
Georgia-Pacific Corp., Gypsum Div. - Type GPFS-C.
Pabco Gypsum Co. - Type PG-C.
Republic Gypsum Co. - Type RG-C.
Standard Gypsum Corp. - Type SG-C.
Temple-Inland Forest Products Corp. - Type TP-5.
United States Gypsum Co., Ltd. - Type C.

5. **Screws** - Self-drilling and self-tapping bugle head Type S wallboard screws, 1 and 1 5/8 in. long.
6. **Corner Bead** - No. 28 MSG galv. steel, two 1/4 in. legs, attached to wallboard with Type 4d gypsum wallboard nails spaced vertically 12 in. O.C.
7. **Finishing System** - Joint compound, 1/16 in. thick, applied over corner beads, joints and surfaces of wallboard.

* Bearing the UL Classification Marking.

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