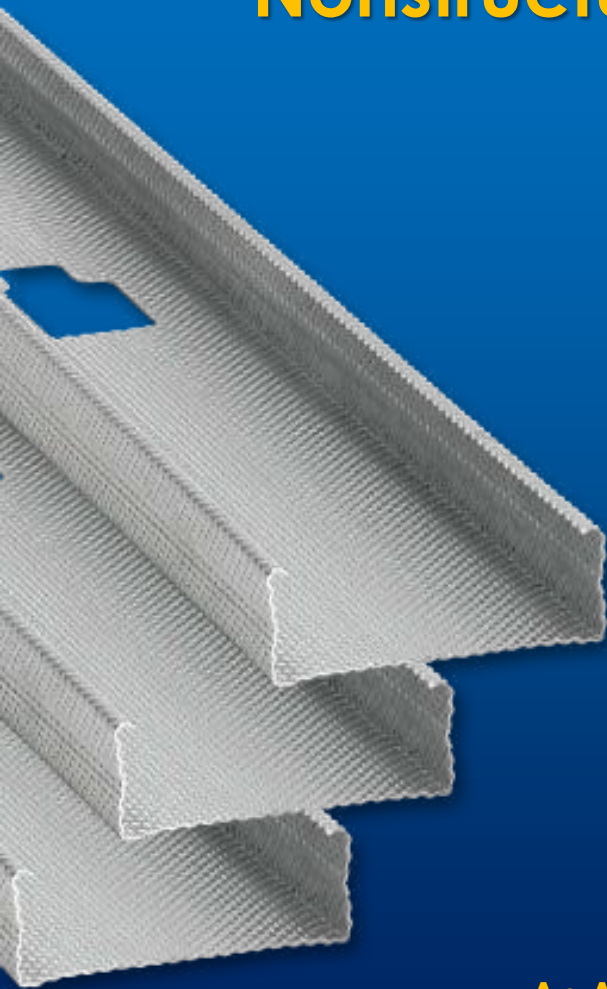


Proper Specification and Installation Recommendations for Nonstructural Wall Framing



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Course Description

Understand the ASTM standards that are typically specified for the material, manufacturing, and installation requirements for drywall studs. This course explains the requirements for drywall studs per ASTM C645 and ASTM C754, and describes how to specify fire-rated partitions.

Learning Objectives

Upon completion of this course the design professional will be able to:

- List the ASTM standards that are typically specified for the material requirements and manufacturing and installation requirements for drywall studs
- Explain the minimum physical requirements for drywall studs per ASTM C645
- Explain the minimum installation requirements for drywall studs per ASTM C754
- Describe how to specify fire-rated partitions

Code Requirements

Building codes are evolving and changing

- IBC 2006 has been adopted and is in use today by many states and local jurisdictions
- We will review what the current requirements are for nonstructural wall stud framing based upon IBC 2006
 - For nonstructural studs, IBC 2006 references **ASTM C645-04** for the physical requirements and **ASTM C754-04** for the installation requirements

(Note: For IBC 2003 requirements, the year dates for the referenced specifications is the only difference.)

Non-Structural Wall Framing

What is a “nonstructural” stud per C645?

Limited to lateral load of 10 psf; a superimposed vertical load, exclusive of sheathing, of 100 lbs of force/ft, or a superimposed vertical load of not more than 200 lbs

How does it differ from a structural stud?

	<u>Structural</u>	<u>Nonstructural</u>
• Sized to resist various loads combinations	●	
• Transfer loads down to the foundations	●	
• Meet a specified deflection criteria	●	●
• Be properly spaced	●	●
• Sized for the partition height	●	●
• Interior design pressure of 5 PSF		●

Non-Structural Wall Framing

Installation Requirements

- Drywall partitions are installed per the project specifications and the partition schedule on the contract drawings
- A submission of engineered shop drawings is not required

Product Approvals

- The contractor submits manufacturer's product literature and samples for the architect's approval

ASTM C645

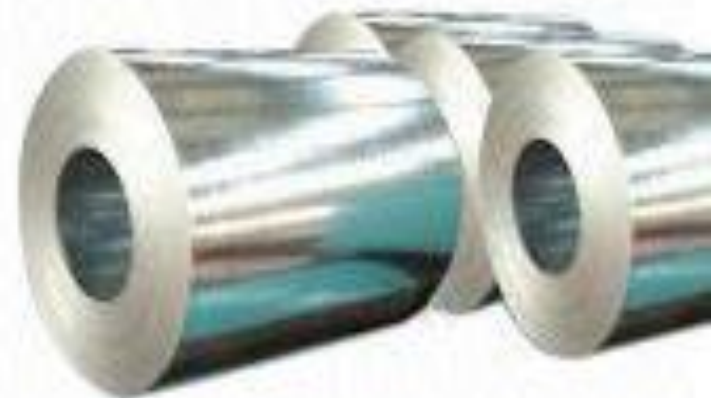
Standard Specification for Non-Structural
Steel Framing Members



What is Required?

ASTM C645

- **Sec. 4 - Materials and Manufacture**
 - Material requirements of the steel coil
 - Product protective coating requirements
 - Product minimum thickness requirements
- **Sec. 5 - Dimensions and Permissible Variations**
 - Physical configuration of typical studs
 - Manufacturing tolerances of studs
- **Sec. 7 - Cutouts**
- **Sec. 14 - Marking and Identification**



Section 4 – Materials and Manufacture

ASTM C645

- C645 references ASTM A1003 for the material requirements of the steel sheet used to manufacture products in conformance to ASTM C 645
- A1003 was developed specifically for steel used for cold-formed steel products. It covers both nonstructural as well as structural products
- C645, Paragraph 4.1, states: “Members shall be manufactured from steel meeting the requirements of Specification A1003 - ”Standard Specification for Steel Sheet, Carbon, Metallic & Nonmetallic - Coated for Cold-Formed Framing Members”

Section 4 – Materials and Manufacture

ASTM C645

A1003 requirements for nonstructural members

- Specifies physical properties of steel sheet:
 - Yield strength – 33 ksi minimum
 - Ductility – no elongation (ductility) requirement for nonstructural (drywall) studs
- Specifies various hot-dipped coatings for steel sheet
- Specifies minimum hourly requirements that coatings must survive in a B117 procedure
- Specifies B117 salt-spray test procedure and the pass/fail criteria for the test procedure

Section 4 – Materials and Manufacture

ASTM C645

Coating Requirements Per ASTM A1003

- Nonstructural ASTM C645 products that have an “equivalent protective coating” must survive a minimum of 75 hours in a B117 salt-spray test
- A G-40 coated sample coupon must be tested side-by-side with the tested specimens to ensure equivalent corrosion resistance

Protective Coating Requirements

***ASTM C645* takes precedent over ASTM A1003 coating requirements for nonstructural drywall studs**

Section 4 – Materials and Manufacture

ASTM C645

Paragraph 4.2

“Members shall have a protective coating conforming to ASTM A653 - G40 minimum - or shall have a protective coating with an equivalent corrosion resistance”

ASTM A653

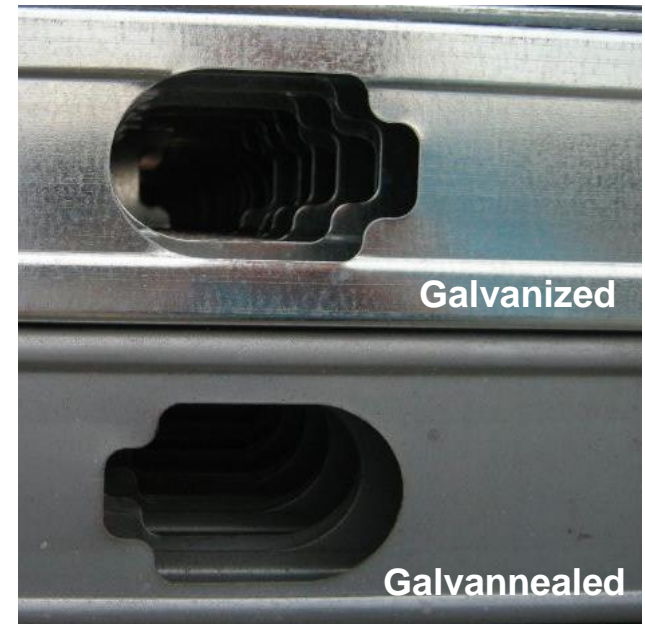
- This is the specification for the general requirements for hot-dipped galvanized steel sheet
- Only two types of galvanized coatings are listed
 - Hot-Dipped Galvanized - 99.9% zinc coating
 - Hot-Dipped Galvannealed - 8% to 12% iron alloy with the balance of the coating being zinc

Section 4 – Materials and Manufacture

ASTM C645

Permissible Coatings per ASTM A653

- **Hot-Dipped Galvanized (G-40)**
 - Standard coating referenced for use in C645.
 - Any other coating used must prove “equivalent corrosion resistance”
- **Hot-Dipped Galvannealed**
 - This coating is intended to be painted
 - It is subject to red-rust when left exposed
 - Is not referenced in C645
 - Used extensively in the automotive industry



Section 4 – Materials and Manufacture

ASTM C645

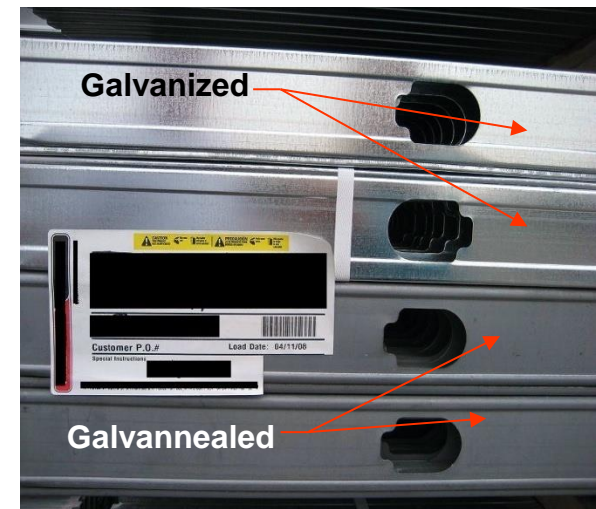
Why does the Construction Market get galvanized steel?

Rejected steel is sold into the secondary market

- Wrong yield strength
- Typically it is the wrong decimal thickness
- Damaged coils
- Wrong coating type or weight - Often less than C645 requirements
- Improper application of coating

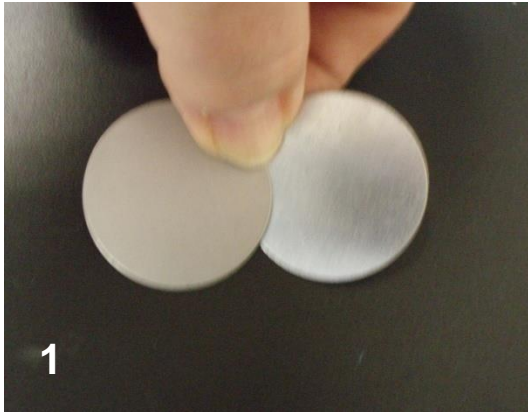
Determining galvanized coating

- Flat, dull gray appearance; no spangle on surface
- Simple field test – Copper sulfate can be used to identify galvanized steel



Copper Sulfate Test

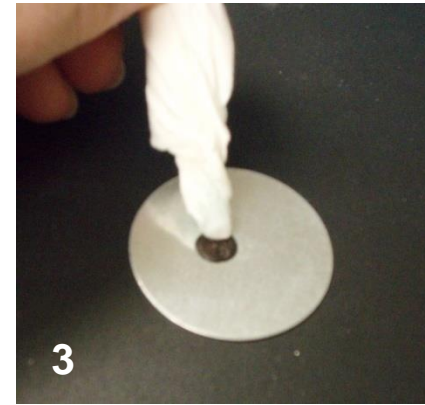
To Determine if Metal Is Galvannealed



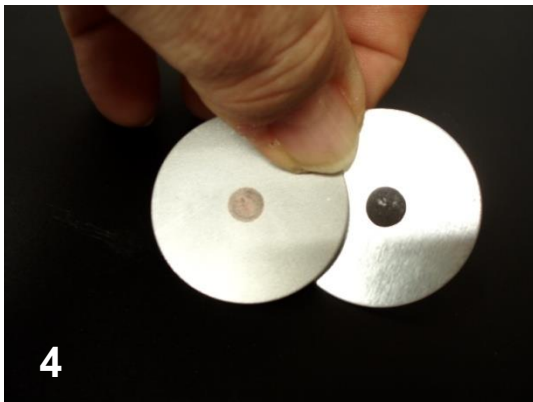
Disks prior to testing



Apply a drop of copper sulfate to disk



Wait 10 seconds and then wick off excess copper sulfate with a tissue or paper towel



Results

The galvannealed disk has a brownish color where the copper sulfate was applied.

The galvanized disk has a black color where the copper sulfate was applied.

Section 4 – Materials and Manufacture

ASTM C645



Physical Appearance

Galvanized vs. Galvannealed

Galvanized steel studs are bright and shiny

Galvannealed steel products - such as this door buck - which is intended to be painted - are dull gray

Section 4 – Materials and Manufacture

ASTM C645

ASTM A1003 specifies that a coating for a nonstructural product must survive 75 hours in an ASTM B117 salt spray test procedure.

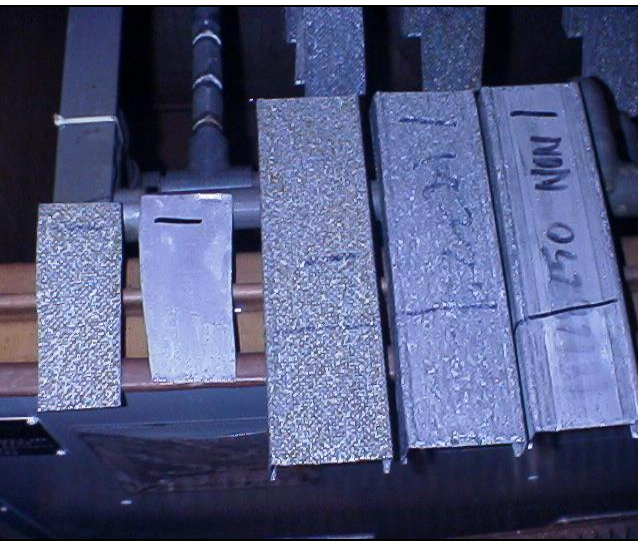
Failure is defined as more than 10% surface area of rust.

The following slides compare the effectiveness of an A40 galvanized coating compared to a G40 galvanized coating and why galvanized coating is specified in C645.

A40 Hot-Dipped Galvannealed Coating

ASTM C645

*Why it is **not** used on studs!*



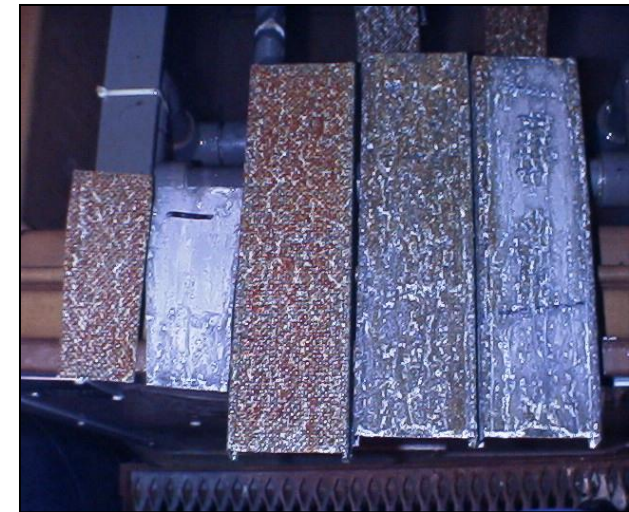
24 hrs. exposure

Note: Sample coupon with known G-40 coating is second sample from the left.



48 hrs. exposure

Note: Samples already failing at less than the required 75 hours

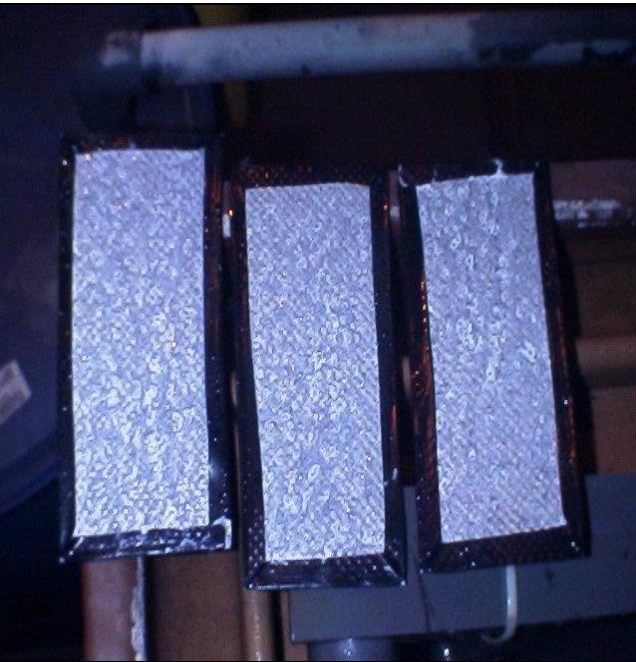


96 hrs. exposure

G40 Hot-Dipped Galvannealed Coating

ASTM C645

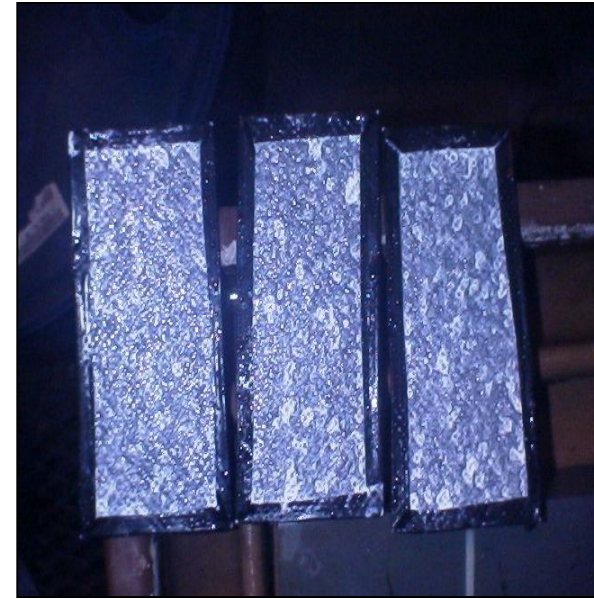
*Why it **is** used on studs!*



24 hrs. exposure



72 hrs. exposure



100 hrs. exposure

Section 4 – Materials and Manufacture

ASTM C645

Paragraph 4.3: Minimum Steel Thickness Requirements

- The minimum base metal thickness of the steel prior to the application of any protective coating is 0.0179"
- The minimum thickness of the delivered product to the field, including the thickness of a G40 coating is 0.019"

This is what the studs should measure in the field



How is this derived?

- ❖ 1 ounce per sq. ft. of zinc coating = 0.0017"
- ❖ G-40 coating requirement = 4/10ths of an ounce per sq. ft.
- ❖ $0.0017" \times 0.4$ requirement = 0.00068" coating thickness
- ❖ $0.0179" \text{ base metal} + 0.00068" \text{ coating} = 0.01858 \sim 0.019" \text{ total}$

Section 4 – Materials and Manufacture

ASTM C645

- The **base metal thickness of nonstructural members** will typically range between 0.0179” (18 mil) to 0.0296” (30-mil).
- Any thickness greater than 0.0296” (30-mil) base metal thickness would then fall into the category of a structural member per the minimum thickness requirements of ASTM C955.

Section 4 – Materials and Manufacture

ASTM C645

Two thicknesses of 20-gauge products that exist today

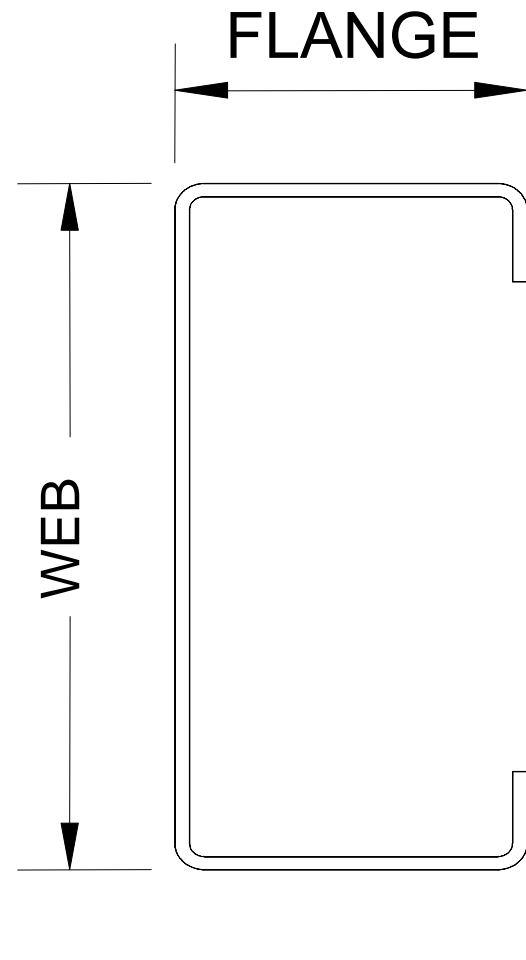
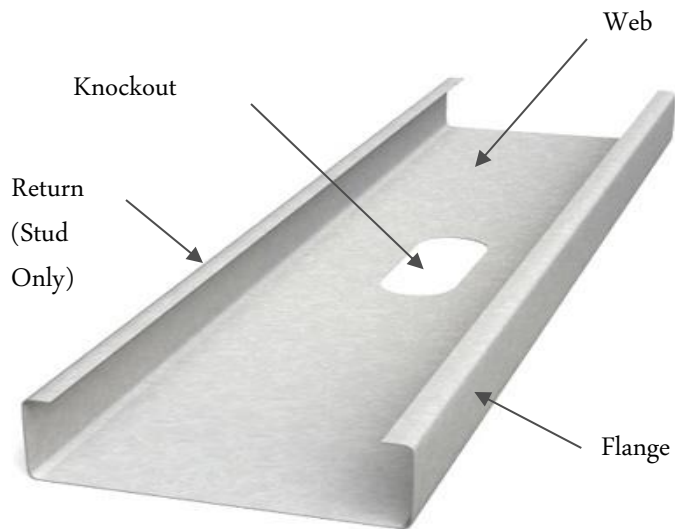
This table shows the difference between the nonstructural and structural products

Thickness Property	Drywall 20-gauge	Structural 20-gauge
Mil Thickness	30-mil	33-mil
Design Thickness	0.0312"	0.0346"
Minimum Delivered Base Metal Thickness *	0.0296"	0.0329"
Minimum Delivered Coated Thickness	0.0302"	0.0339"

* Minimum base metal thickness represents 95% design thickness

Section 5 – Dimensions & Permissible Variations

ASTM C645



Stud: $1\frac{1}{4}$ "

Track: 1"

$1\frac{1}{4}$ " MIN.

LIP

$\frac{3}{16}$ " MIN.

Section 5 – Dimensions & Permissible Variations

ASTM C645

**ASTM C645 Table 1 –
Manufacturing
Tolerances**

*All measurements shall be taken not less than 1 ft. from the end

**Outside dimension for stud; inside dimension for track

Dimension*	Item Checked	Drywall Studs, in	Drywall Track, in
A	length	+ 1/8	+ 1
		– 1/4	– 1/4
B**	web width	+ 1/32	+ 1/8
		– 1/32	– 0
C	flare	+ 1/16	+ 0
	overbend	– 1/16	– 3/16
D	hole width center	+ 1/8	NA
		– 1/8	
E	hole center length	+ 1/4	NA
		– 1/4	
F	crown	+ 1/8	+ 1/8
		– 1/8	– 1/8
G	camber	1/32 per ft	1/32 per ft
		1/2 max	1/2 max
H	bow	1/32 per ft	1/32 per ft
		1/2 max	1/2 max
I	twist	1/32 per ft	1/32 per ft
		1/2 max	1/2 max

Section 5 – Dimensions & Permissible Variations

ASTM C645

What do these tolerances mean?

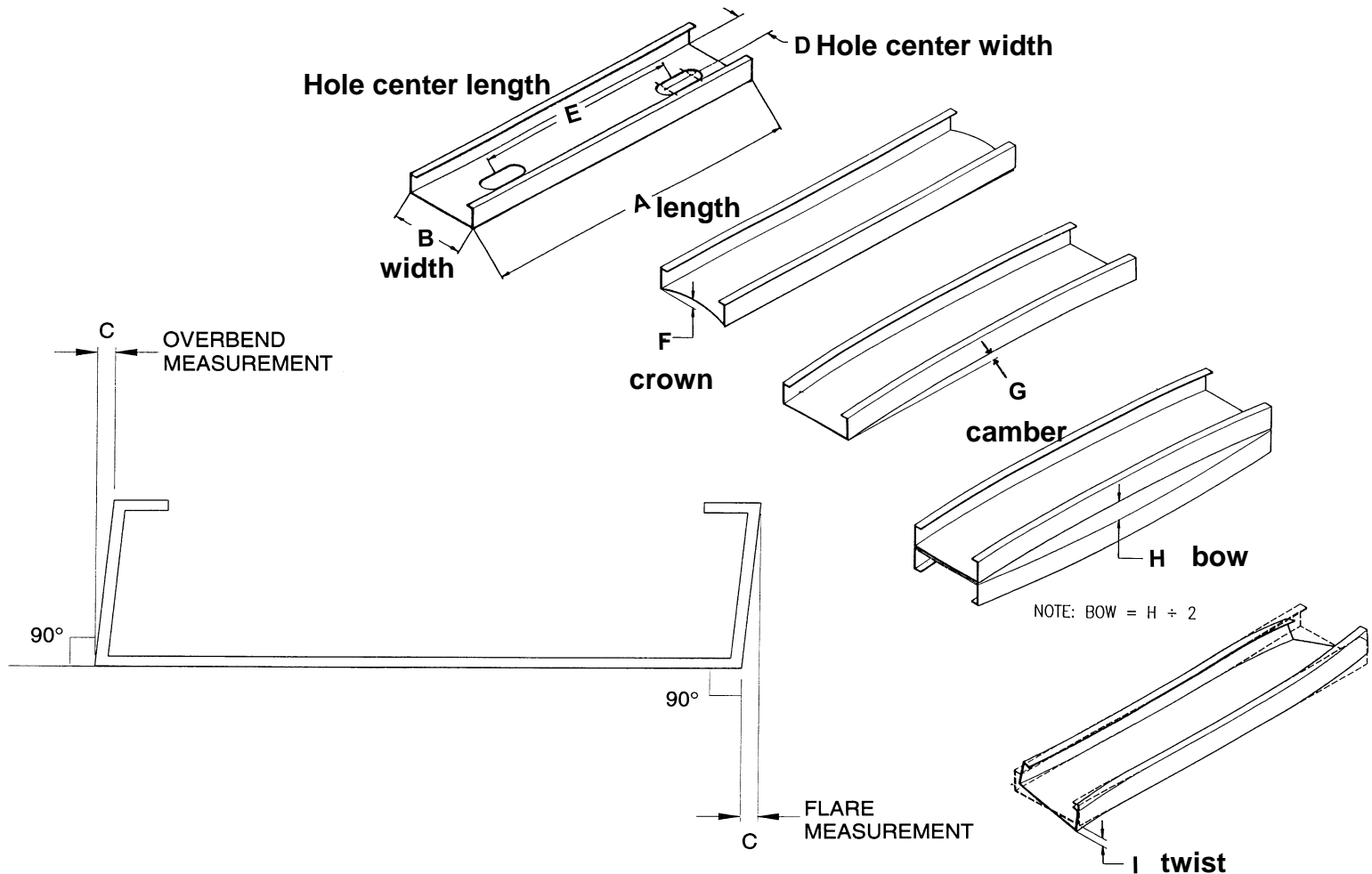
- A/B: Length and Width – the actual length or width measurement of the member
- C: Flare/Overbend – measures whether the flange “toes” out or in from 90 degrees
- D: Hole center width – this is a measurement from the intersection of the flange and the web to the centerline of the punch out
- E: Hole center length – this is a measurement from the center of one punch out to the center of the next punch out
- F: Crown – the measure of “sweep” in the web portion of the stud
- G: Camber – this is a measurement of how much a vertical stud “sweeps” in a direction parallel to the web, i.e., in and out perpendicular to the plane of the wall
- H: Bow – this is a measurement of how much a vertical stud “sweeps” within the depth of the wall cavity when compared to a vertical plumb line
- I: Twist – this is a measurement of how much a vertical stud is rotated along its length within the depth of the wall cavity

Section 5 – Dimensions & Permissible Variations

ASTM C645

Figure 2

How to
measure
tolerances



Section 7 – Cutouts

ASTM C645

Provided to allow the passage of utility services through the studs

- Industry standards:
 - 24" center-to-center spacing
 - $\frac{3}{4}$ " wide for 1-5/8" & 2 1/2" studs
 - 1 1/2" wide for 3 1/2" thru 6" studs
 - 4 1/2" long
 - 10" from end of stud to edge of cutout

Cutouts shall not reduce the performance of the members in the gypsum board construction assembly below the specified performance requirements



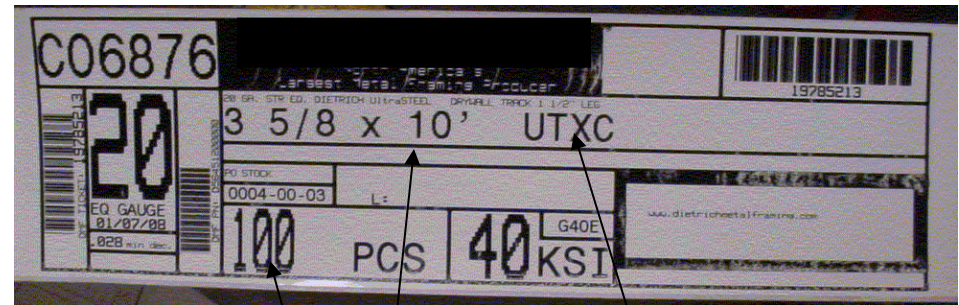
Section 14 – Marking and Identification

ASTM C645

Per ASTM: IBC/IRC and AISI COFS - General Provisions

Skids or like bundles of members shall be marked with:

- Length of member
- Quantity
- Member designator
- Depth
- Flange width
- Minimum steel thickness



Note: Bar code technology can be used to trace the steel from “cradle-to-grave”

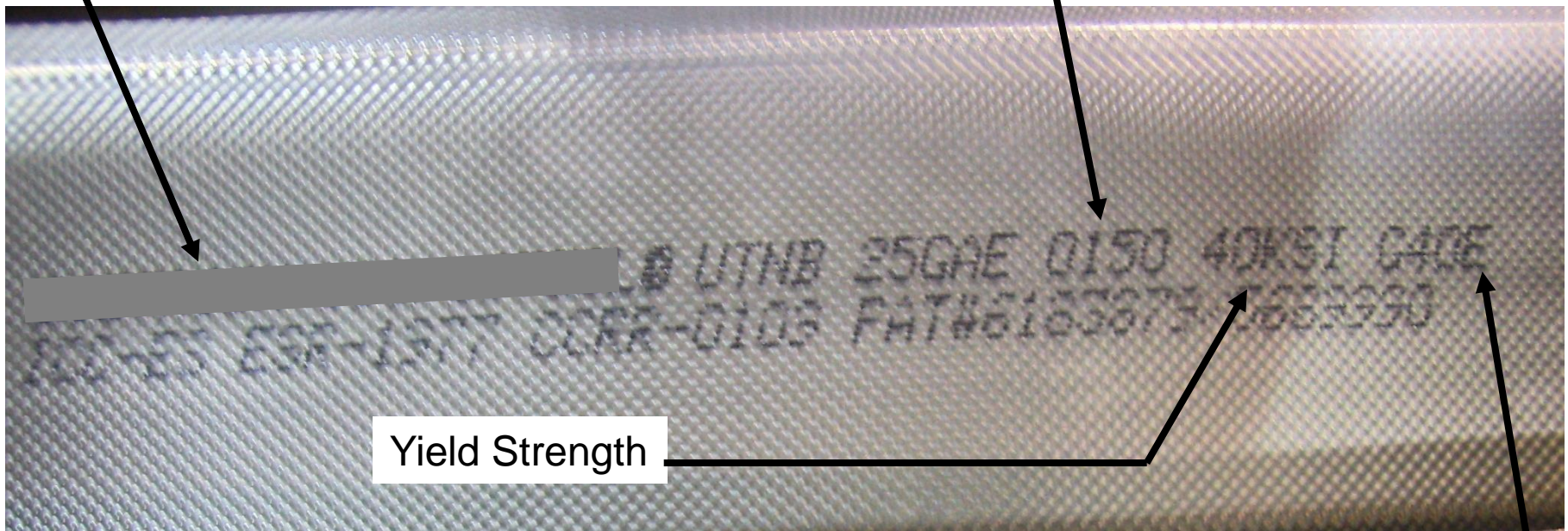
Section 14 – Marking and Identification

ASTM C645

Minimum marking and identification requirements for individual studs/tracks

Minimum Steel thickness

Rollformer's Name



Yield Strength

Protective Coating Weight

Alternative Ways to Meet the ASTM C645 Standards

Per IBC 2006 and C645-04: Section 5: Dimensions and Permissible Variations

- 5.1 Studs ...shall have a configuration and steel thickness such that the system in which they are used will carry the design transverse loads without exceeding either the allowable stress of the steel or the allowable design deflection...The manufacturer shall supply sufficient data for calculating design performance.

Per latest version of C645-08a: Section 9: Performance Requirements

- 9.2 Members that can show certified third party testing in accordance with ICC-ES-AC86 (Approved July 1995- Editorially Revised September 2005) and conform to the limiting height tables in Specification C754 need not meet the minimum thickness limitation set forth in 4.3 or the minimum section properties set forth in 8.1.

Summary

To be Code Compliant

For Nonstructural Studs

- Studs need to have the proper coating
- Studs need to be the proper thickness
- Studs need to be the proper configuration
- Studs (skids/bundles of like members, as well as the individual members) need to be properly labeled

**All four of the above requirements must be met
in order for a stud to be code compliant**



ASTM C754

Standard specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

This specification governs the minimum installation requirements for nonstructural steel framing members made in accordance with ASTM C 645

The Rules are Different!

ASTM C754

The rules are different for nonstructural framing members vs structural framing members

- Studs and tracks do **not** need to be attached
 - Attachment of track to stud is required only at door and window frames, partition intersections, and corners
- Studs need to engage both the floor and ceiling runners.
 - The gap between the end of the stud and the web of the top and/or bottom track shall not be more than $\frac{1}{4}$ " ($\frac{1}{2}$ " total)

What is Required?

ASTM C754

Section 5: Installation of Metal Framing

- Stud installation requirements
- Framing of partition intersections and corners
- Stud maximum composite limiting heights
- Header installation
- Track installation requirements

Section 5 – Stud Installation Requirements

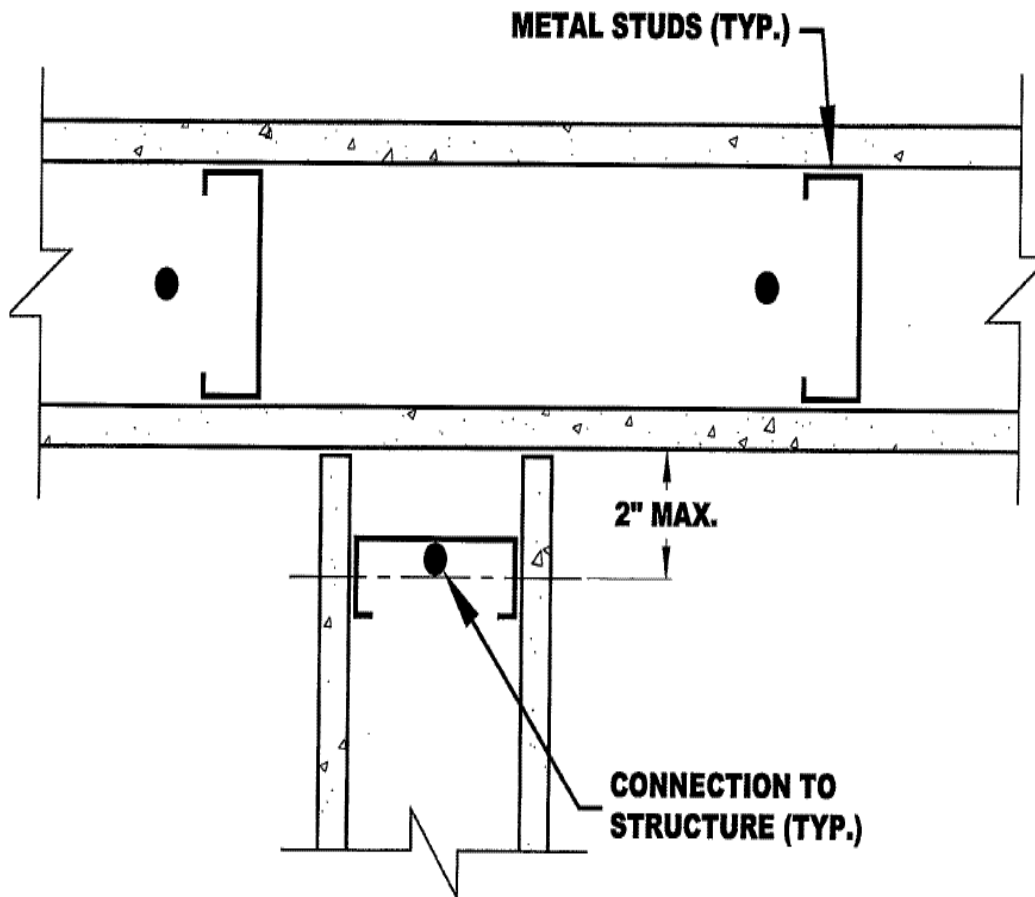
ASTM C754

- Table 1 limits framing spacing of studs to 16" or 24" on center maximum based upon:
 - Thickness of board
 - Ability of board to span distance between studs
 - Number of layers of board
- Stud spacing is not permitted to exceed spacing requirements by more than $\pm 1/8$ "

Section 5 — Framing of Partition Intersections and Corners

ASTM C754

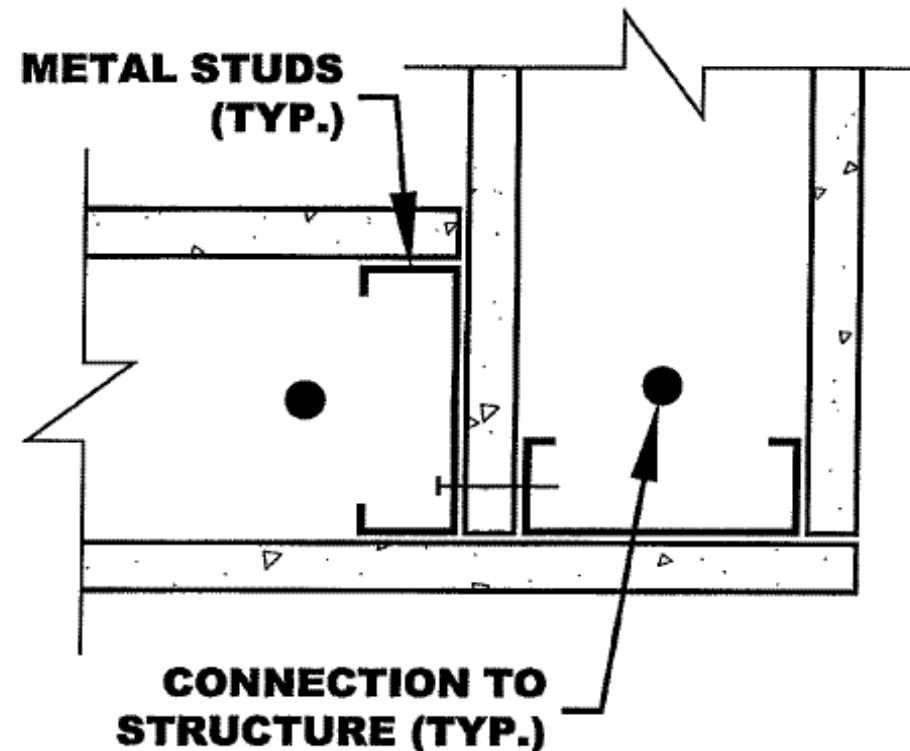
Specified Stud Locations: Partition Intersections



Studs shall be located **not more than 2"** away from the intersection of through and abutting partitions

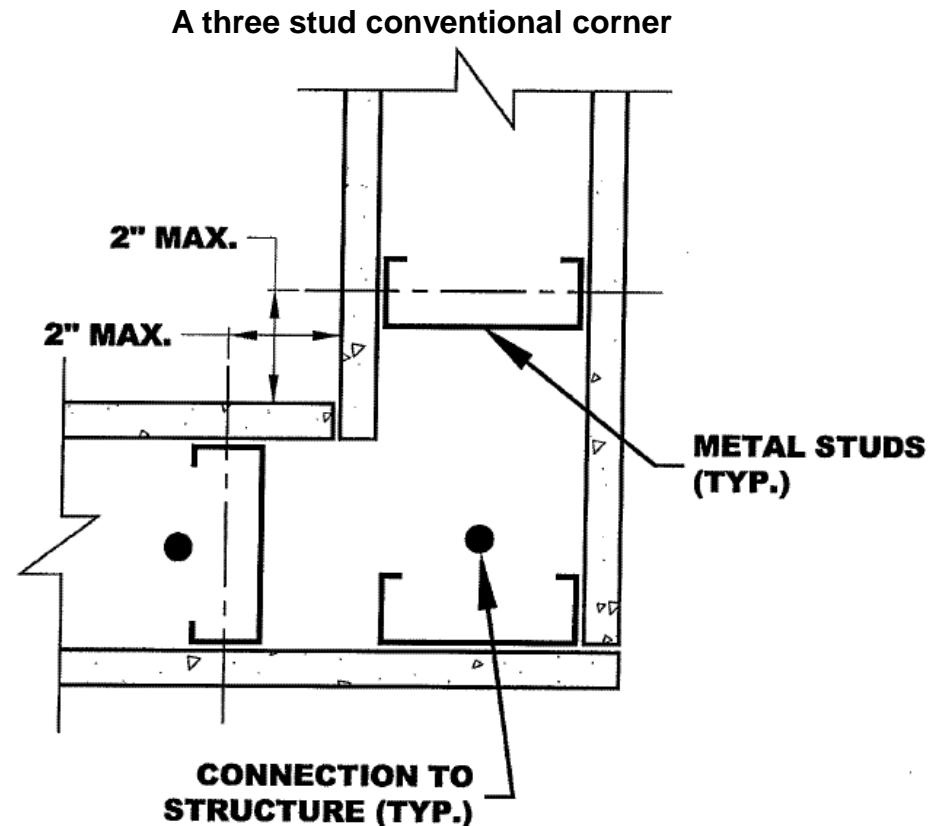
Section 5 — Framing of Partition Intersections and Corners

ASTM C754



At partition corners, a stud should be installed so that it forms the outside corner. Following the application of a single layer of board to this stud, a second stud should be installed in the abutting track. The web of the second stud should be screwed through the board into the flange of the first stud

Specified Stud Locations: Corner Conditions



Section 5 – Composite Limiting Height Table

ASTM C754

A cooperative industry effort is the basis for the current limiting height tables in C754. They were developed in conjunction with SSMA (Steel Stud Manufacturers Assoc.) & the GA (Gypsum Association)

- Tables are based upon ICC-ES AC86 – 1995:
“Acceptance Criteria for Steel Studs and Gypsum- board Interior Nonload-Bearing Walls – Composite Construction”
- Testing conducted at Oregon State University
- Data was submitted to ASTM for inclusion into C754

Section 5 – Composite Limiting Height Table

ASTM C754

C754: Tables 3, 4, and 5 are based upon the following

- The testing is based upon ½” regular wallboard installed vertically
- The wallboard must be installed full height on both sides of the wall
- The tables incorporate a 0.75 load reduction factor for strength determination
- The stud heights are limited to those shown in Tables 3, 4, and 5

Section 5 – Header Installation

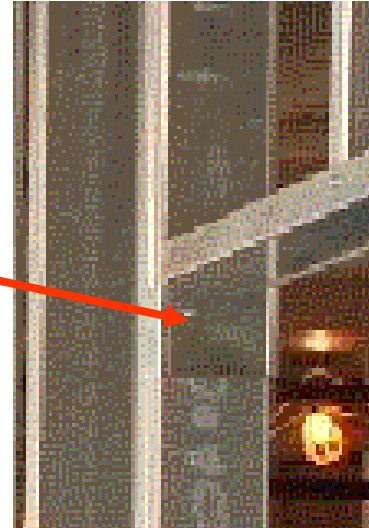
ASTM C754

Headers should be installed over openings.

- Use a cut-to-length section of track with the flanges cut and the web bent vertically at each end as shown on the header detail (next slide).
- The header should be securely attached to the adjacent vertical studs

Section 5 – Header Installation

ASTM C754

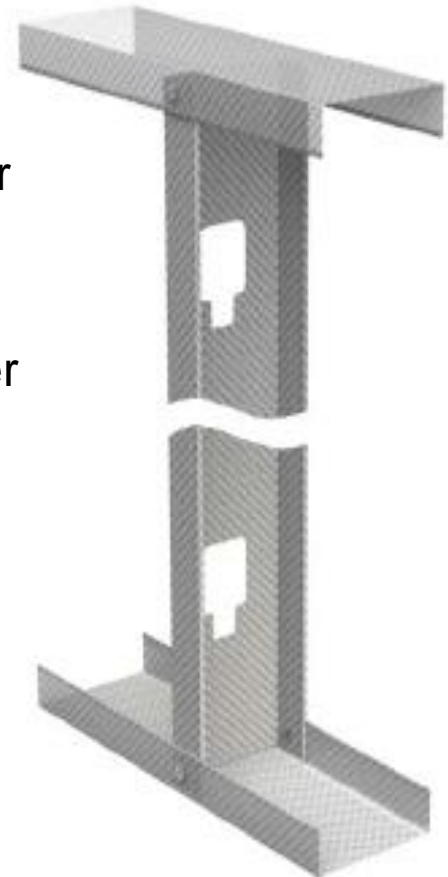


- ASTM C754 sets *no limit* on the height or width of openings!
- An engineered solution may be needed which may require more than a single track head/sill/jamb member

Section 5 – Track Installation Requirements

ASTM C754

- Accurately align at floor and ceiling tracks
- Anchor 2" from ends and maximum 24" on-center
- When attaching track-to-stud (metal-to-metal) a sharp point pan head or low profile, #6 diameter screw with a flat surface on the underside of the head should be used



Section 5 – Track Installation Requirements

ASTM C754

- Fasten track to concrete slab with:
 - Concrete stub nails, expansion anchors, shielded screws, powder driven fasteners (paf's)
- Fasten track to wood with:
 - Screws (1" minimum)
 - Nails (1½" minimum penetration)
- Fasten track to suspended ceilings with:
 - "Molly" type expandable fasteners, toggle bolts, or screws fastened into channels, splines, T-runners or other framing members



Fire-Rated Partitions

What you need to know!



This portion of the presentation is limited to the steel studs – the other components of the tested assembly should be reviewed

Fire-Rated Partitions

Note

- The following section is based upon UL fire-rated assemblies
- These assemblies may be seen and checked on the UL website (ul.com)
- Only the studs are discussed. See the actual assembly for other components and installation requirements

Fire-Rated Partitions

General

- A fire-rated partition must adhere to the actual tested assembly or it is not in compliance!
- Common fire-rated assemblies used today were tested *decades ago*
- There is no requirement for re-testing
- The metal framing members originally tested have changed - may not be the same thickness or configuration

Fire-Rated Partitions

General

- Per C754 – Details of construction for a specific assembly to achieve the fire resistance shall be obtained from the reports of fire resistance tests, engineering evaluations, or listings from recognized fire testing laboratories
- This over-rides ASTM C645 minimum stud requirements
- There are traditional flat steel studs as well as proprietary studs with up-to-date 1-hour and 2-hour fire-rated assemblies
- Members in assemblies are permitted to be deeper in depth and/or thicker than tested

Fire-Rated Partitions

Steel Thickness for Studs in UL Tested Assemblies

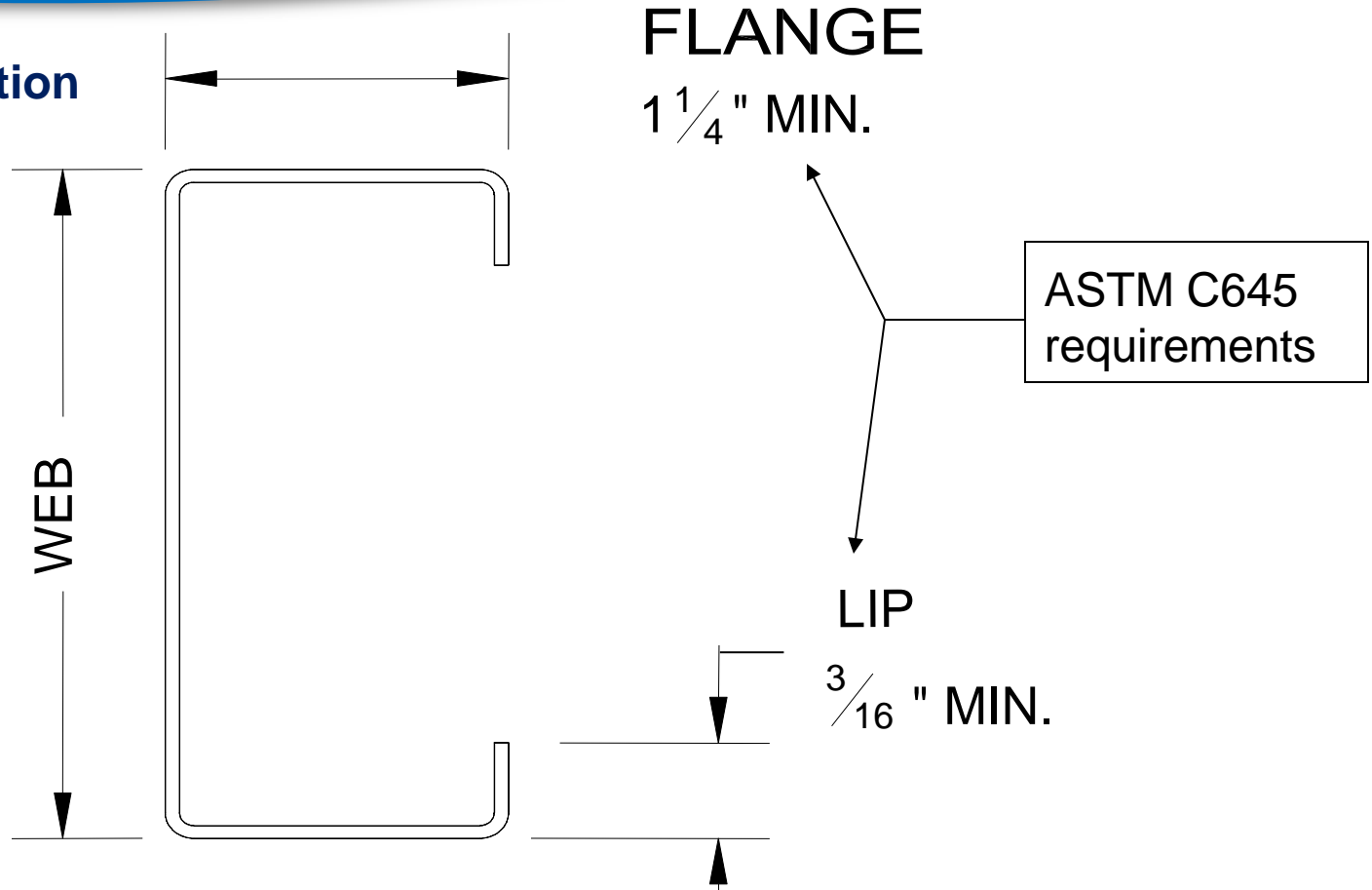
- UL tests call for “MSG” = manufacturers standard gauge
- See table below for the UL ‘MSG’ bare metal and coated thickness
 - For 25 MSG this means 0.018” base metal / 0.019” with coating
 - For 20 MSG this means 0.033” base metal / 0.034” with coating

If today’s drywall-20 gauge product is used in a fire-rated assembly it does NOT meet the requirements of the UL “20 MSG” material that was tested!

UL Minimum Thickness Requirements (Per UL BXUV.GUIDENFO Section VI Wall and Partition Assemblies - Par. 3 - Metal Thickness)		What you need to know in the Field
Gauge	Minimum Base Metal Thickness (in.)	Overall Delivered Thickness with G-40 Coating (min base metal thkns + 0.00068" (in.)
25	0.018	0.019
24	0.021	0.022
22	0.027	0.028
20	0.033	0.034
18	0.044	0.045
16	0.055	0.056

Fire-Rated Partitions

Stud Configuration



If ASTM C645 is specified – this is the stud configuration you will receive for the fire-rated assemblies.

Fire-Rated Partitions

Stud Configuration

- The return lips and stud flanges are smaller than what was tested in the fire tests run 20-50 years ago.
- Lets look at what is actually required to meet the tested assembly
- Many UL assemblies specify larger return lips and larger flanges...some specify thicker metal

Fire-Rated Partitions

Common UL Designs

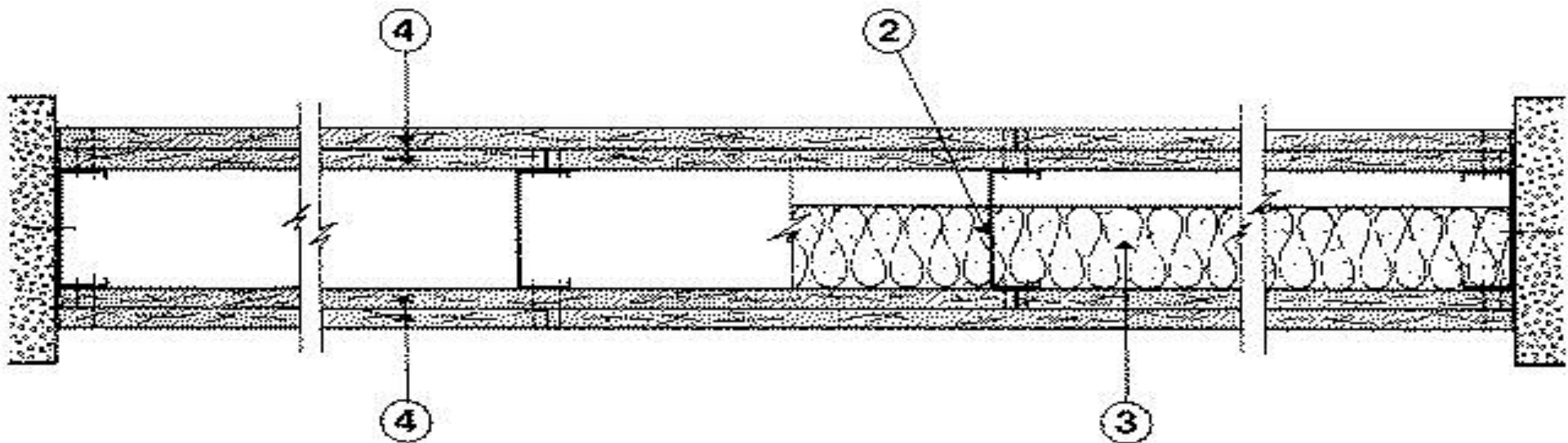
Commonly Specified Nonbearing UL Fire-Rated Wall Assemblies

Design Number	Hourly Rating	Steel Thickness	Flange Width	Return Lip
Design No. U403	Nonbearing 2-hr. wall	0.020 (25 GAUGE)	1 1/4"	1/4"
Design No. U411	Nonbearing 2-hr. wall	25 MSG	1 1/4"	3/8"
Design No. U420	Nonbearing 1 or 2-hr. chase wall	25 MSG	1 3/8"	1/4"
Design No. U452	Nonbearing 1 or 2-hr. wall	25 MSG	1 1/4"	1/4"
Design No. U465	Nonbearing 1-hr. wall	25 MSG	1 1/4"	3/8"
Design No. U491	Nonbearing 2-hr. wall	25 MSG	1 1/4"	1/4"

- **Red** indicates minimum ASTM C 645 stud does not meet the UL tested stud configuration
- **Blue** indicates that the gauge requires verification that it meets the thickness requirement
- We will now look at UL fire assembly U411 in detail

Fire-Rated Partitions

U-411: The following is taken from the UL Website



1. **Floor and Ceiling Runner** — (Not Shown) — **Min. 25 MSG** galv steel 1 in. high, return legs 2-1/2 in. wide (min), attached to floor and ceiling with fasteners 24 in. OC.
2. **Steel Studs** — Min 2-1/2 in. wide, 1-1/4 in. legs, **3/8 in. return**, formed of min **25 MSG** galv steel max stud spacing 24 in. OC. Studs to be cut 3/4 in. less than assembly height.

Fire-Rated Partitions

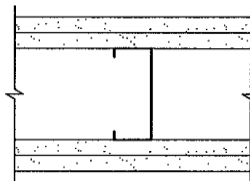
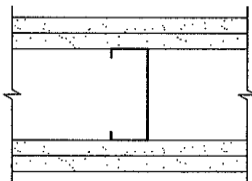
UL U-411

- Stud and track are described as “**25 MSG**”: This means:
 - 0.0180” uncoated base metal thickness for the steel
 - Delivered steel thickness 0.019” with coating - Many nonstructural studs do not meet this thickness
- Stud has **3/8”** return lip – most manufacturers cannot make a drywall stud with this big of a return lip
- Gypsum board was installed vertically in this test – is it being constructed this way in the field?
- **Traditional flat steel 25 gauge ASTM C645 studs will not meet the requirements of this fire-rated assembly!**

Fire-Rated Partitions

“Generic” assemblies such as those found in compilations do not list all of the information required to determine the stud requirements. To determine the actual thickness and physical configuration of the tested studs you need to examine the tested assembly. Only *then* you can check what is actually being installed at the jobsite

Example:

GENERIC		2 HOUR FIRE	45 to 49 STC SOUND
GYPSUM WALLBOARD, STEEL STUDS Base layer 5/8" type X gypsum wallboard or gypsum veneer base applied parallel to each side of 35/8" steel studs 24" o.c. with 1" Type S drywall screws 8" o.c. at vertical joints and 12" o.c. at intermediate studs. Face layer 5/8" plain or predecorated type X gypsum wallboard or gypsum veneer base applied parallel to each side laminating compound combed over entire surface. Metal base and top retainer channels. Joints staggered 24" each layer and side. (NLB)			
Here the studs are only described as “steel studs”. In General Note No.14 (defined elsewhere in the manual), metal studs and runners are defined as “nominal 25 gage unless otherwise specified”.		Thickness: 61/8" Approx. Weight: 10 psf Fire Test: UL R1319-31, 6-2-60, UL Design U411	Sound Test: NGC 2005005, 6-15-05 RAL TL06-115, 4-12-06
Note: This assembly was tested in 1960. This also tells the reader that the assembly is UL 411 and this is where they can find the material description.			

Fire-Rated Partitions

Stud Configuration

- This is not an isolated case
- Let's examine those listed assemblies in the UL database that use metal studs and gypsum board on each side to see how widespread the issue is...

Fire Ratings: Life Safety Issues

Items shown in **red** do not meet UL assembly requirements if an ASTM C645 drywall stud is used!

Stud Requirements - UL Fire-Rated Assemblies					
Design No.	Hourly Rating	Bare Steel Thickness	Coated Steel Tkns (in.)	Flange Width (in.)	Return Lip (in.)
Single Stud Wall Assemblies					
U403	2hr	25 gauge (0.020")	0.021	1.250	0.250
U404	1 hr or 2 hr	20 MSG (0.0329")	0.034	1.500	0.250
U405	1 hr	25 gauge	0.019	1.375	0.250
U406	1 hr	25 gauge	0.019	1.313	0.250
U407	1 hr	20 MSG (0.0329")	0.034	not specified	not specified
U408	2 hr	25 MSG	0.019	1.250	0.188
U410	1 hr.	25 MSG	0.019	1.375	0.250
U411	2 hr.	25 MSG	0.019	1.250	0.375
U412	2 hr.	25 MSG	0.019	1.250	0.250
U419	1 hr	25 MSG	0.019	1.250	0.250
U419	2 hr	25 MSG	0.019	1.250	0.250
U419	3 hr	25 MSG	0.019	1.250	0.250
U419	4 hr	25 MSG	0.019	1.250	0.250
U419	1, 2, 3 or 4 hr	0.0149" L	n/a	1.250	0.219
U421	2 hr	25 MSG	0.019	1.250	0.250
U422	1 hr	25 MSG	0.019	1.250	0.250
U430	1 hr or 2 hr	20 MSG (0.0327")	0.033	1.500	0.250
U432	1 hr	20 MSG (0.0329")	0.034	not specified	not specified
U435	3 or 4 hr	25 MSG	0.019	1.250	0.313
U439	2hr	20 MSG	0.034	1.250	0.313
U442	1 hr	20 MSG (0.0329")	0.034	1.250	0.188
U443	2 hr	20 MSG (0.0329")	0.034	1.250	0.313
U448	1 hr	25 MSG	0.021	1.375	not specified
U450	3 hr	25 MSG	0.019	1.250	0.250
U450	4 hr	18 MSG	0.045	1.250	0.250
U451	1 hr	25 MSG	0.019	1.250	0.313
U452	1 1/2 hr	20 MSG	0.034	1.250	0.313
U453	2 hr	20 MSG	0.034	1.250	0.313
U454	2 hr	25 MSG	0.019	1.250	0.313
U455	3 hr	20 MSG	0.034	1.250	0.313
U457	1 hr	20 MSG (0.0329")	0.034	1.250	0.313
U463	3 hr or 4 hr	25 MSG	0.019	1.250	0.313
U465	1 hr	25 MSG	0.019	1.250	0.375
U470	1 1/2 hr	25 MSG	0.019	2.000	0.250
U471	1 1/2 hr	25 MSG	0.019	1.250	0.375
U474	2 hr	20 MSG (0.0329")	0.034	1.250	0.313
U475	1, 2, or 3 hr	25 MSG	0.019	1.250	0.250
U475	4 hr	18 MSG	0.045	1.250	0.250
U478	3 hr	25 MSG	0.019	1.250	0.313
U484	2 hr	20 MSG	0.034	1.250	0.250
U488	1 hr	20 MSG	0.034	1.250	0.250
U490	4 hr	25 MSG	0.019	1.250	0.250

Stud Requirements - UL Fire-Rated Assemblies					
Design No.	Hourly Rating	Bare Steel Thickness	Coated Steel Tkns (in.)	Flange Width (in.)	Return Lip (in.)
Single Stud Wall Assemblies					
U491	2 hr	25 MSG	0.019	1.250	0.250
U494	1 hr	25 MSG	0.019	1.250	0.313
U495	1hr or 2 hr	25 MSG	0.019	1.250	0.375
U496	1 hr	25 MSG	0.019	1.250	0.250
V401	1 hr	25 MSG	0.019	1.375	0.250
V409	1 hr	25 MSG	0.021	1.375	0.250
V410	2 hr	25 MSG	0.019	1.250	0.250
V412	2 hr	25 MSG	0.019	1.250	0.250
V414 (int.)	1 hr	20 MSG	0.034	1.625	0.313
V419	2 hr	25 MSG	0.019	1.250	0.375
V425	1 hr	25 MSG	0.019	1.250	0.250
V435	1 hr	25 MSG	0.019	1.250	0.313
V438	1 hr	25 MSG	0.019	1.250	0.250
V438	2 hr	25 MSG	0.019	1.250	0.250
V438	3 hr	25 MSG	0.019	1.250	0.250
V438	4 hr	25 MSG	0.019	1.250	0.250
V438	1, 2, 3 or 4 hr	0.0149" L	n/a	1.250	0.219
V439	1 hr or 2 hr	20 MSG (0.0327")	0.033	1.500	0.250
V440	1 hr or 2 hr	22 MSG	0.028	1.375	0.250
V444	1 hr	25 MSG	0.019	1.250	0.375
V444 (alt.)	1 hr	20 MSG	0.034	1.250	0.375
V448	1 hr	25 MSG	0.019	1.250	0.250
V449	2 hr	25 MSG	0.019	1.250	0.250
V450	1 hr	0.0149" L	n/a	1.250	0.219
V450	2 hr or 2-1/2 hr	0.0150" L	n/a	1.250	0.219
V452	1 hr or 2 hr	25 MSG	0.019	1.250	0.250
V453	1 1/2 hr	20 MSG	0.034	1.250	0.188
V457	1 hr or 2 hr	20 MSG	0.034	1.625	not specified
Chase or Double Stud Wall Assemblies					
U420	1 hr or 2 hr	25 MSG	0.019	1.375	0.250
U436	1, 2, or 3 hr	25 MSG	0.019	1.625	0.250
U444	2 hr	20 MSG (0.0329")	0.034	1.250	0.188
U445	1 hr	20 MSG (0.0329")	0.034	1.250	0.188
U458	1 hr	20 MSG (0.0329")	0.034	1.250	0.313
U466	1 hr	25 MSG	0.019	1.250	0.250
U493	1hr or 2 hr	25 MSG	0.019	1.625	0.375
U493 (alt.)	1hr or 2 hr	20 MSG	0.034	1.188	0.250
U493 (alt.)	1hr or 2 hr	20 MSG (0.0327")	0.033	1.500	0.250
V437	1 hr	25 MSG	0.019	1.250	0.250
V442	1hr or 2 hr	22 MSG	0.028	1.375	0.250

Fire-Rated Partitions

How do you overcome the issue of specifying the proper fire-rated partition assemblies on projects?

- Examine your current partition schedules
- Research what the components of the partitions are on the listed assemblies and determine:
 - Do the specified assemblies have components that are readily available from manufacturers today?
 - If not, another assembly will need to be specified. There are numerous traditional flat steel and proprietary assemblies that may be suitable alternatives.
 - A manufacturer may need to modify their section profile to be more than the ASTM minimum 3/16" return lip to meet the assembly requirements.

Fire-Rated Partitions

Steps you can take now

- Verify that the literature and sample submissions for the studs submitted for approval on the project comply with the requirements of the fire-rated assemblies shown on the partition schedule
- Verify in the field that the proper thickness of product and profile of stud is being installed per the fire-rated assembly requirements
- Specify alternate assemblies that currently meet the project fire-rating requirements on the partition schedule

Summary

Many different factors go into the proper specification and installation recommendations for nonstructural wall framing:

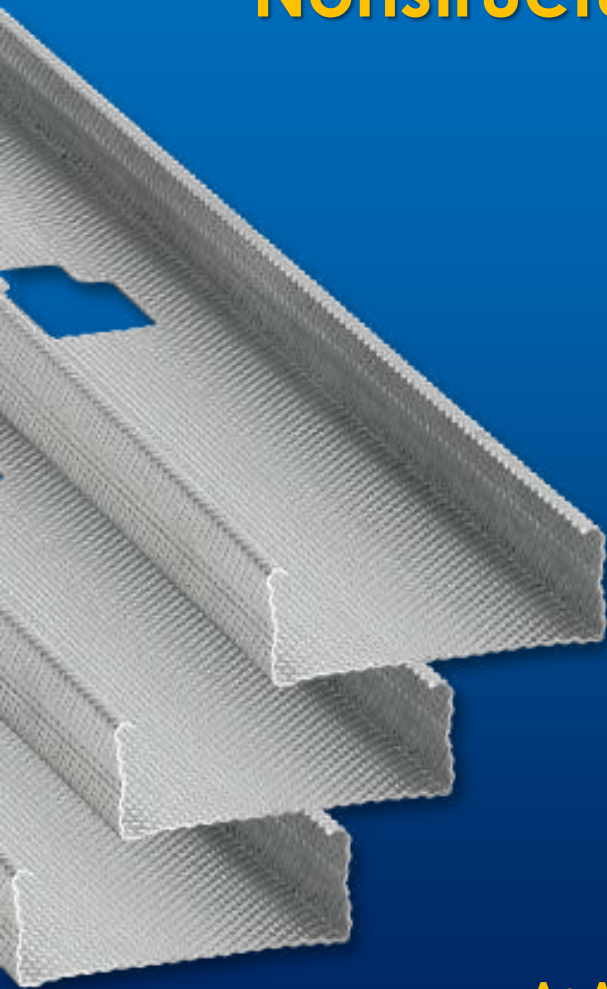
- Selection of the proper stud
- The proper installation of the metal stud framing
- The proper understanding and use the correct studs in the construction of fire-rated partitions

Course Summary

The design professional will now be able to:

- List the ASTM standards that are typically specified for the material requirements and manufacturing and installation requirements for drywall studs
- Explain the minimum physical requirements for drywall studs per ASTM C645
- Explain the minimum installation requirements for drywall studs per ASTM C754
- Describe how to specify fire-rated partitions

Proper Specification and Installation Recommendations for Nonstructural Wall Framing



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