

*Florida:*  
*Code Compliance*  
*Issues Facing the*  
*Steel Stud Industry*



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# What are the code compliance issues?

- *Coatings*
- *Material Thicknesses*
- *Stud Physical Dimensions*
- *Marking & Identification*
- *Fire-Rating –Life Safety Issues*

# Coatings

## What Governs the Coating Requirements of Studs?

We need to start with the big picture – the building code and then drill down through the code provisions to determine what the requirements are that need to be followed in order to be code compliant.

# Coatings

## **FBC 2004 - Coating Weight Requirements**

**FBC 2004: 2210.1 General:** The design, installation and construction of cold-formed carbon or low-alloy steel, [structural and nonstructural steel framing](#) shall be in accordance with **AISI-General** and **AISI-NASPEC**.

- **AISI General Provisions 2001:** Section A4 Corrosion Protection: Structural and non-structural framing members utilized in steel construction shall have a minimum metallic coating complying with the requirements of ASTM A1003.
- **AISI NASPEC 2001:** *Silent on coatings*

## **FBC 2004: Table 2506.2: Gypsum Board Materials & Accessories**

### Referenced Material Standards:

Steel studs – nonstructural	<b>ASTM C 645 - 00</b>
Steel studs – structural	<b>ASTM C 955 - 01</b>

# Coatings

## **FBC 2007 - Coating Weight Requirements**

**FBC 2006: 2210.1 General:** The design, installation and construction of cold-formed carbon or low-alloy steel, [structural and nonstructural steel framing](#) shall be in accordance with **AISI-General** and **AISI-NASPEC**.

- **AISI General Provisions 2004:** Section A4 Corrosion Protection: Structural and non-structural framing members utilized in steel construction shall have a minimum metallic coating complying with the requirements of ASTM A1003.
- **AISI NASPEC 2001 with 2004 Supplement:** *Silent on coatings*

**FBC 2007: 2210.4 Wall Stud Design:** The design and installation of cold-formed steel studs for [structural and nonstructural](#) walls shall be in accordance with **AISI-Wall Stud Design**.

# Coatings

## **FBC 2007 - Coating Weight Requirements (cont)**

**AISI Wall Stud Design 2004:** Section C2 Corrosion Protection: Wall studs, track, and fasteners shall have corrosion protection as required by the *General Provisions*

**FBC 2007: Table 2506.2: Gypsum Board Materials & Accessories**  
Referenced Material Standard:

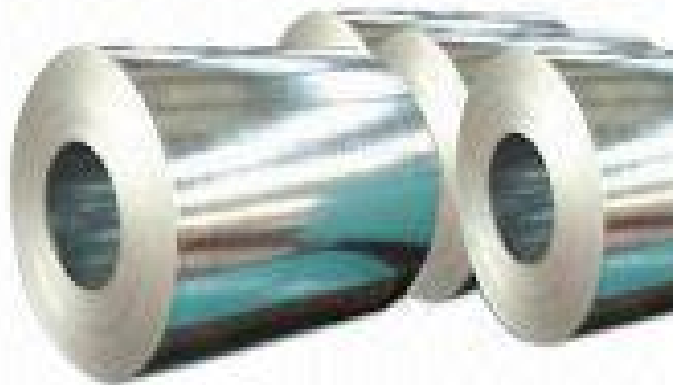
Steel studs – nonstructural	<b>ASTM C 645 - 04</b>
Steel studs – structural	<b>ASTM C 955 - 03</b>

# Coatings

## Requirements for Studs

Nonstructural Studs: ASTM C645

Structural Studs: ASTM C955



# Coatings – Nonstructural Studs

## C645: Section 4 Materials and Manufacture

- Paragraph 4.1 – “Members shall be manufactured from steel meeting the requirements of Specification A 1003.” (Standard Specification for Steel Sheet, Carbon, Metallic and Nonmetallic - Coated for Cold-Formed Framing Members)
  - Specifies physical properties of steel sheet: Drywall Studs
    - ❖ Yield strength – 33 ksi minimum
    - ❖ Ductility – no elongation (ductility) requirement for nonstructural (drywall) studs
  - Specifies various permissible hot-dipped coatings for steel sheet
  - Specifies minimum hourly requirements for coatings
  - Specifies B117 salt-spray test procedure

# Coatings – Salt Spray Testing

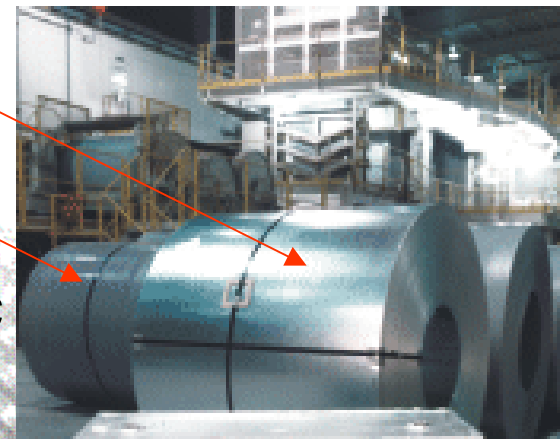
## Test Requirements for the Steel Sheet per A1003:

- Steel for **nonstructural products** must survive a minimum of 75 hours in an ASTM B117 salt-spray test
- Steel for **structural products** must survive a minimum of 100 hours in an ASTM B117 salt-spray test
- In a B117 salt spray test a sample coupon with the coating standard you are testing against must be tested side-by-side with the tested specimens to ensure equivalent corrosion resistance

# Coatings – Nonstructural Studs

## Section 4: Materials and Manufacture

- 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 lists 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



# Coatings – Nonstructural Studs

## Permissible Coatings per ASTM A653:

- Hot-Dipped Galvanized (G-40) – This is the 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



# Coatings – Nonstructural Studs

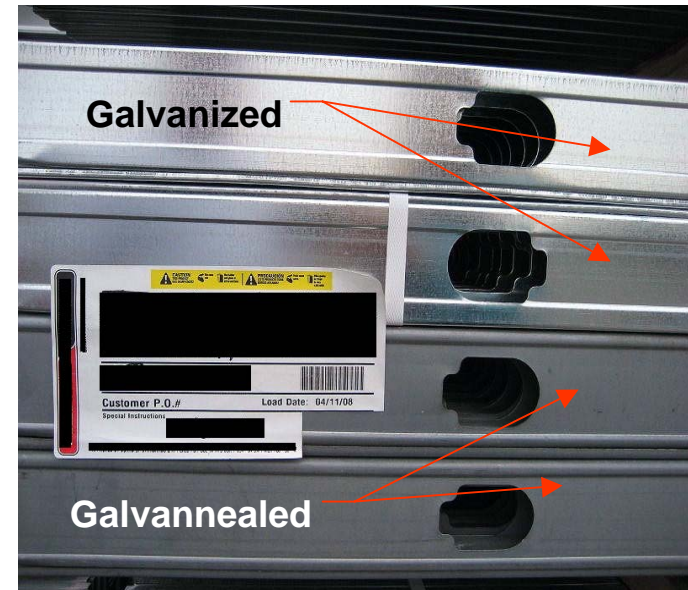
## Why does the Construction Market get galvanized steel?

### 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
- Improper application of coating

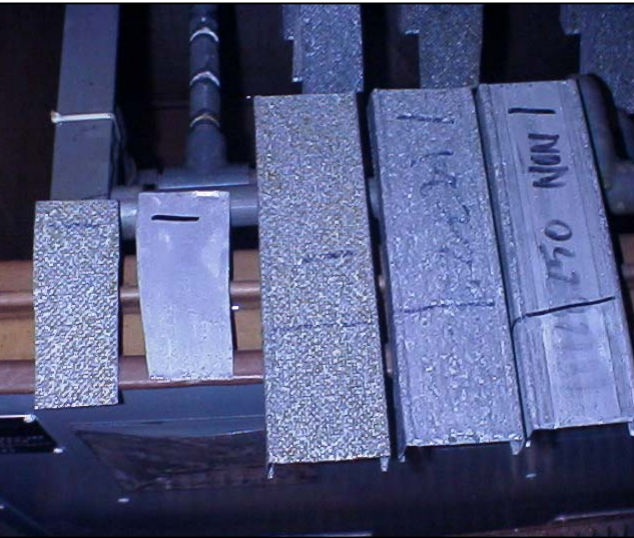
### Determining galvanized coating

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



# Coatings – Nonstructural Studs

A40 Hot-Dipped Galvannealed:  
Why it is not used!

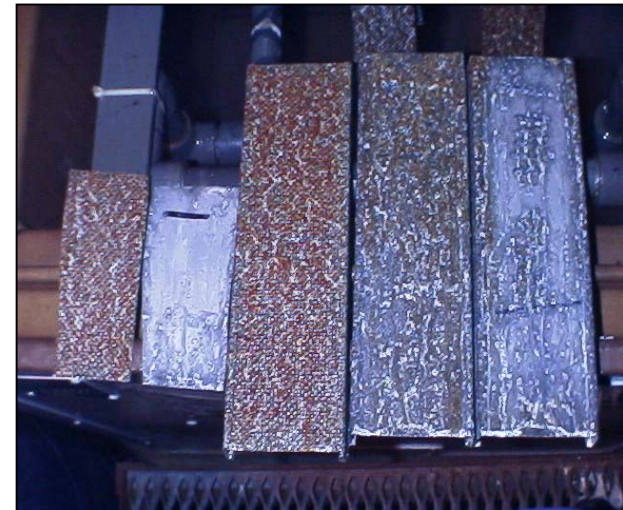


24 hrs. exposure



48 hrs. exposure

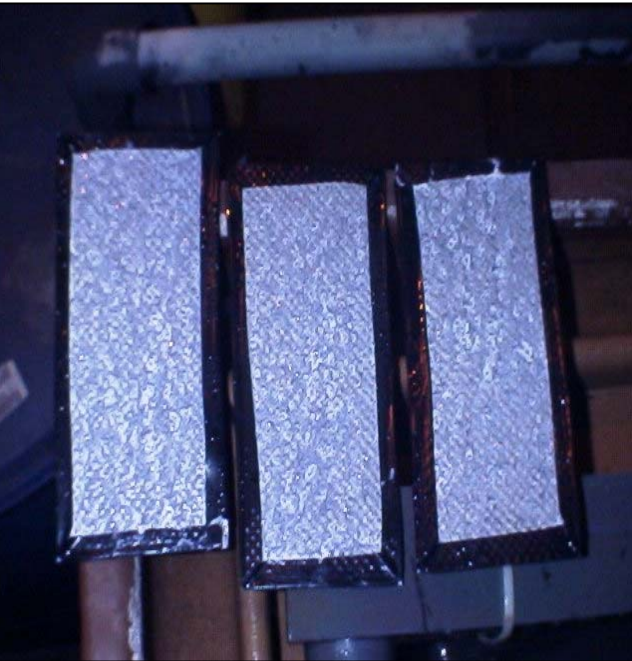
Note: Samples already failing at less than the required 75 hours



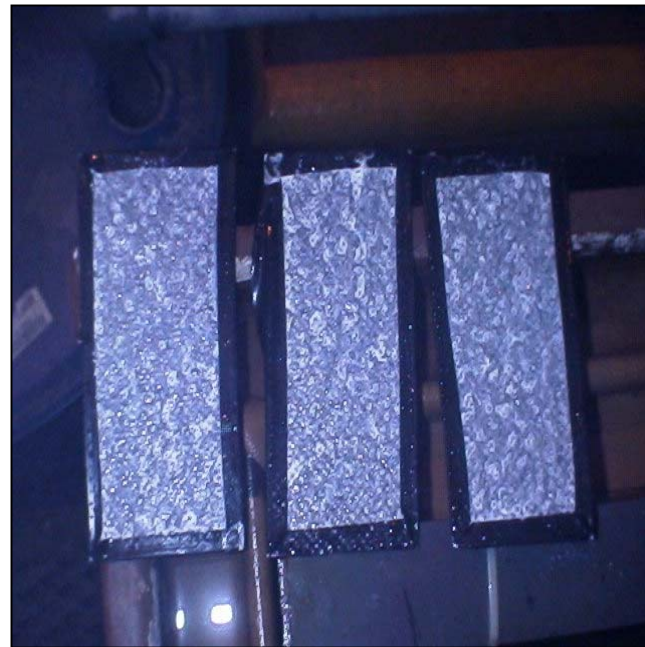
96 hrs. exposure

# Coatings – Nonstructural Studs

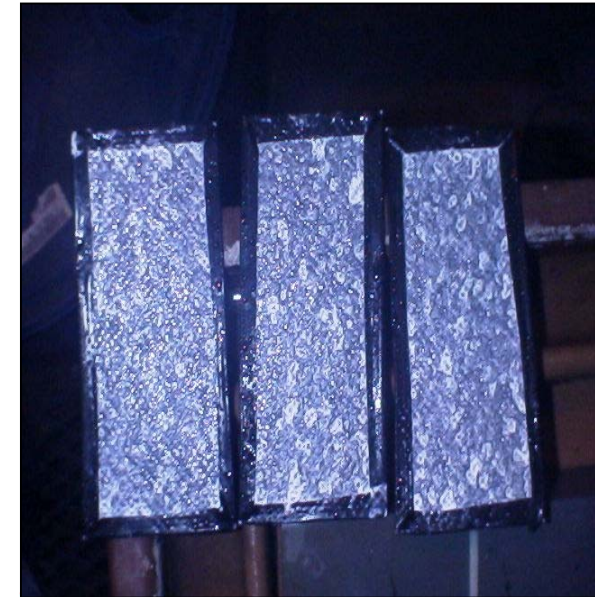
G40 Hot-Dipped Galvanized:  
Why it is used!



**24 hrs. exposure**



**72 hrs. exposure**



**100 hrs. exposure**

# Coatings: Structural - FBC 2004

## C955-01: Section 4 Materials and Manufacture

- Paragraph 4.1 – “Members shall be manufactured from steel meeting the requirements of Specification A 1003.” (Standard Specification for Steel Sheet, Carbon, Metallic and Nonmetallic - Coated for Cold-Formed Framing Members)
  - Specifies physical properties of steel sheet: Structural Studs
    - ❖ Yield strength – 33 ksi minimum
    - ❖ Ductility – 10% in 2” for type L steels
  - Specifies various permissible hot-dipped coatings for steel sheet
  - Specifies minimum hourly requirements for coatings
  - Specifies B117 salt-spray test procedure

# Coatings: Structural - FBC 2004

## C955-01: Section 4 Materials and Manufacture

- Paragraph 4.4: “Members shall have a protective coating conforming to specification ASTM [A653](#) – G60 minimum, or equivalent corrosion resistance, or shall have a rust-inhibitive coating providing equivalent corrosion resistance.”
  - This is the same as what we just saw except the amount of the coating required (coating weight) is more.

# Coatings: Structural - FBC 2007

## C955-03: Section 4 Materials and Manufacture

- Paragraph 4.4: “Members shall have a protective coating in accordance with Table 1, CP 60 minimum.”

Coating Classification	Coating Designator	Minimum Coating Requirements			
		Zinc-Coated <sup>A</sup>	Zinc Iron <sup>B</sup>	55 % Al-Zinc <sup>C</sup>	Zinc-5 % <sup>D</sup>
Metallic Coated	CP 40	G 40	A 40	AZ 50	GF 30
	CP 60	G 60	A 60	AZ 50	GF 30
	CP 90	G 90	Not Applicable	AZ 50	GF 45
Painted Metallic	PM	The metallic coated substrate shall meet the requirements of metallic coated. In addition, the paint film shall have a minimum thickness of 0.5 mil per side (primer plus topcoat) with a minimum primer thickness of 0.1 mil per side. <sup>E</sup>			
Painted	PTD	Non-metallic coated substrate shall be painted after roll forming and shall have a minimum paint thickness of 1.0 mil on all surfaces including edges. Use of painted product is limited to environments where the rate of corrosion is low; typically areas such as interiors of buildings and areas of low rainfall and low humidity as defined by ISO 9223, Category 1 and 2. <sup>E,F</sup>			

<sup>A</sup> Zinc-coated steel sheet as described in Specification A 653/A 653M.  
<sup>B</sup> Zinc-iron alloy-coated steel sheet as described in Specification A 653/A 653M.  
<sup>C</sup> 55 % Aluminum-zinc alloy-coated steel sheet as described in Specification A 792/A 792M.  
<sup>D</sup> Zinc-5 % aluminum alloy-coated steel sheet as described in Specification A 875/A 875M.  
<sup>E</sup> In accordance with the requirements of A 1003.  
<sup>F</sup> ISO International Standard 9223.

# Coatings: Structural - FBC 2007

Per Table 1 there are only four acceptable coatings that may be used:

- G60          Hot-dipped Galvanized coated
- A60          Hot-dipped Galvannealed coated
- AZ50        55% Aluminum - zinc alloy coated
- GF30        Zinc - 5% Aluminum alloy coated

If any other coating is used, the provisions of the specification are not met and the material is therefore not code compliant

# Coatings Summary – FBC 2004

**Summary:** To be code compliant to **FBC 2004:**

**For drywall studs**, the provisions of ASTM C645-00, paragraph 4.2 prevail: “Members shall have a protective coating conforming to specification A653 – G40 minimum or shall have a protective coating with an equivalent corrosion resistance.

**For structural studs**, the provisions of ASTM C955-01, paragraph 4.4 prevail. “Members shall have a protective coating conforming to Specification A 653 - G60 minimum or equivalent corrosion resistance, or shall have a rust-inhibitive coating providing equivalent corrosion resistance.”

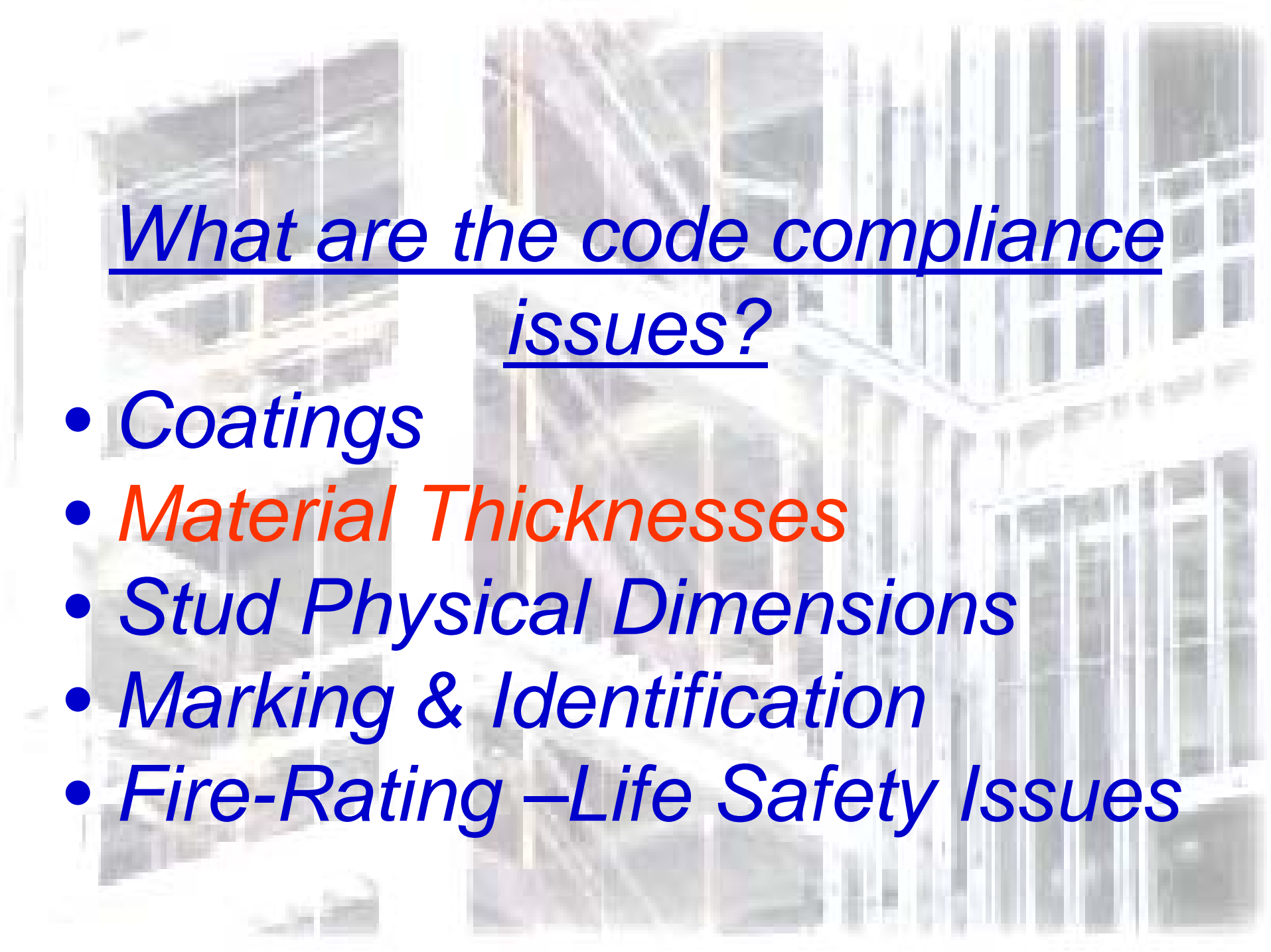
# Coatings Summary – FBC 2007

**Summary:** To be code compliant to **FBC 2007:**

**For drywall studs,** per ASTM C645-04, paragraph 4.2:

“Members shall have a protective coating conforming to specification A653 – G40 minimum or shall have a protective coating with an equivalent corrosion resistance.

**For structural studs,** per ASTM C955-03, the provisions of paragraph 4.3 and Table 1: Coating protection level of CP 60 and one of the four permissible coatings in the applicable coating weight specified in the table must be used.



*What are the code compliance issues?*

- *Coatings*
- *Material Thicknesses*
- *Stud Physical Dimensions*
- *Marking & Identification*
- *Fire-Rating –Life Safety Issues*

# Material Thickness - Nonstructural

## Section 4: Materials and Manufacture: Thickness

Paragraph 4.3: 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” x 0.4 requirement = 0.00068” coating thickness

0.0179” base metal + 0.00068” coating = 0.01858 ~ 0.019” total

# Material Thickness - Structural

## Section 4: Materials and Manufacture: Thickness

Paragraph 4.2 - The minimum steel thickness (base steel) shall not be less than 0.0329" (prior to application of coating)

- The minimum thickness of the delivered product to the field, including the thickness of a G60 coating is 0.034"

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-60 coating requirement = 6/10ths of an ounce per sq. ft.

0.0017" x 0.6 requirement = 0.00102" coating thickness

0.0329" base metal + 0.00102" coating = 0.03392 ~ 0.034" total

# Material Thickness Summary

**Summary:** To be code compliant to **FBC 2004 & FBC 2007:**

## **For nonstructural studs:**

- For traditional flat steel studs, a minimum 0.0179" uncoated base metal thickness and a 0.019" delivered thickness is required.
- For other than traditional flat steel studs the manufacturer must supply sufficient data such that the product will carry the design transverse loads without exceeding the allowable stress or design deflection.

## **For structural studs:**

- Minimum structural thickness is 0.0329" uncoated base metal thickness and 0.034" coated thickness.

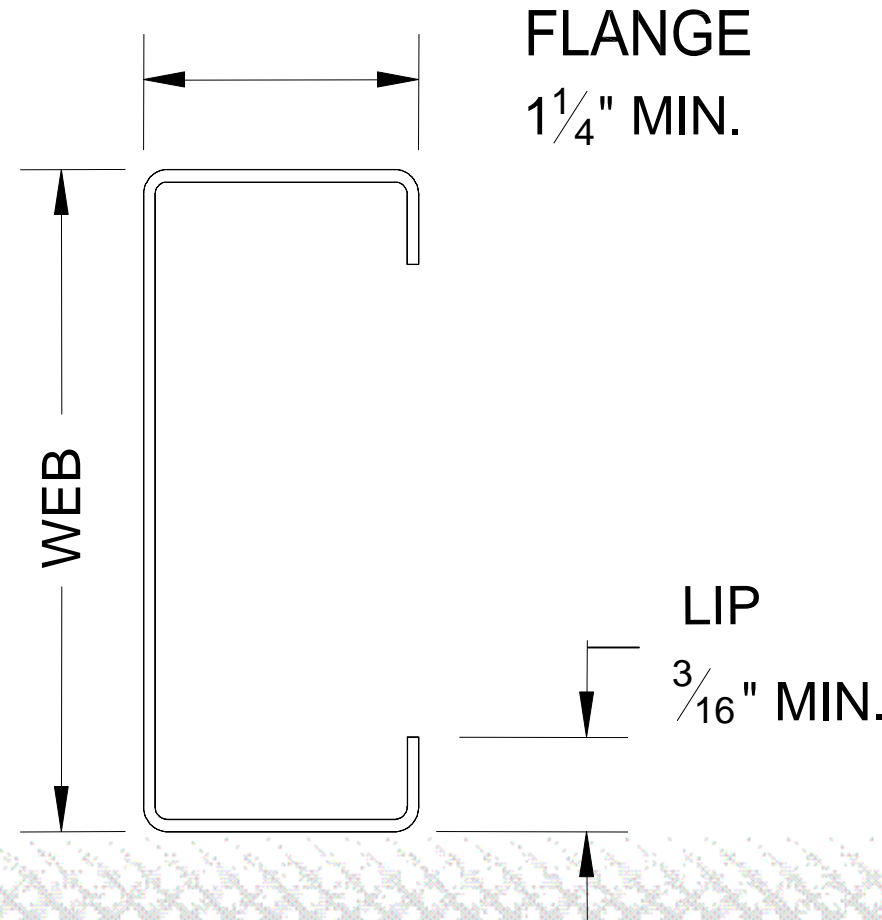
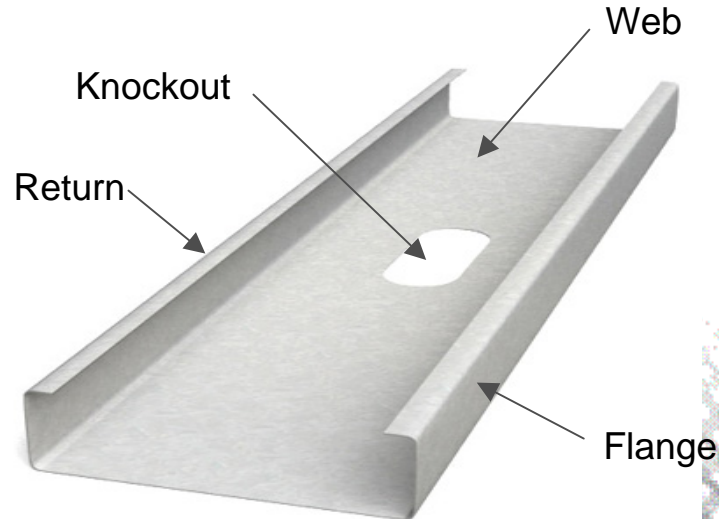
# *What are the code compliance issues?*

- *Coatings*
- *Material Thicknesses*
- *Stud Physical Dimensions*
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# Stud Physical Dimensions

## Nonstructural Stud:

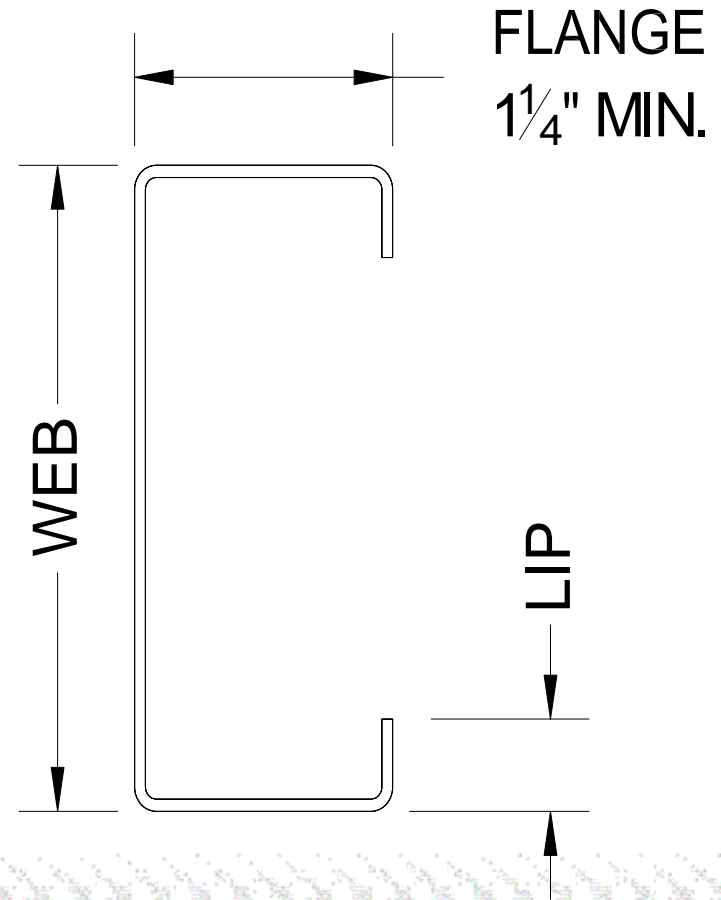
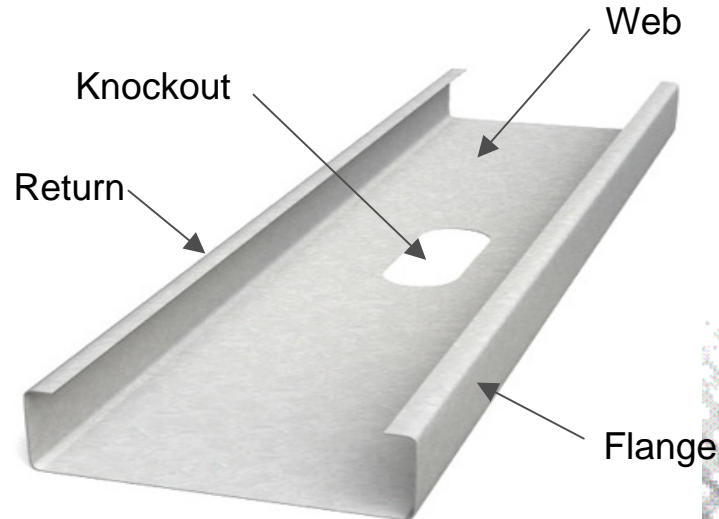
Minimum flange width and return lip dimensions are specified in C645.



# Stud Physical Dimensions

## Structural Stud:

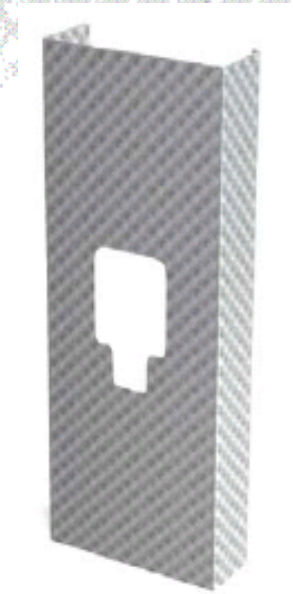
Only the minimum flange width dimension is specified in C955.



# ASTM C645

## Section 7: Cutouts

- 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



# ASTM C955

## Section 4: Punch-outs

- locate along the centerline of the webs
- minimum 24” center-to-center spacing
- maximum width =  $\frac{1}{2}$  the member depth, but not more than 2½ wide”
- maximum 4 ½” long
- minimum 10” from the end of the stud to edge of the cutout



# Stud Physical Dimensions Summary

Summary: To be code compliant to [\*\*FBC 2004 and FBC 2007\*\*](#)

For nonstructural studs: The stud must have a minimum 1-1/4" flange and a minimum 3/16" return lip.

For structural studs: The stud must have a minimum 1-1/4" flange.

# What are the code compliance issues?

- *Coatings*
- *Material Thicknesses*
- *Stud Physical Dimensions*
- *Marking & Identification*
- *Fire-Rating –Life Safety Issues*

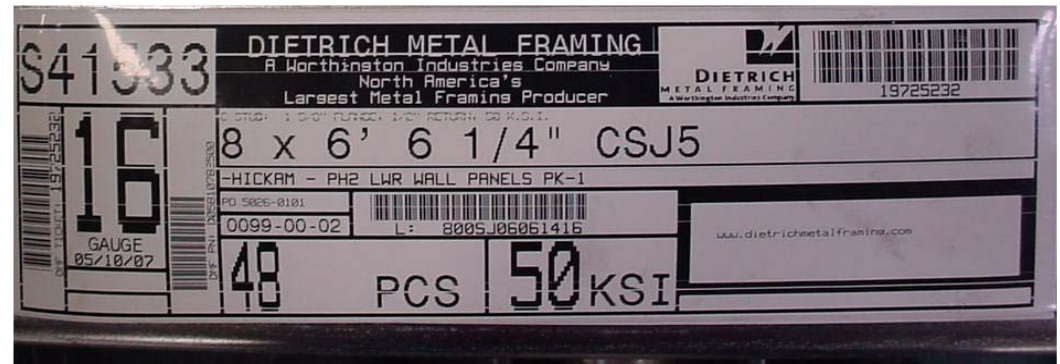
# Marking and Identification

Both nonstructural and structural studs are required to be marked on the bundles of like members as well as on the individual members themselves.

# Marking and Identification

**Skids or like bundles of members must be marked with:**

- Rollformer's name
- Length of member
- Quantity
- Member designator indicating:
  - Depth
  - Flange width
  - Minimum steel thickness



# Marking and Identification

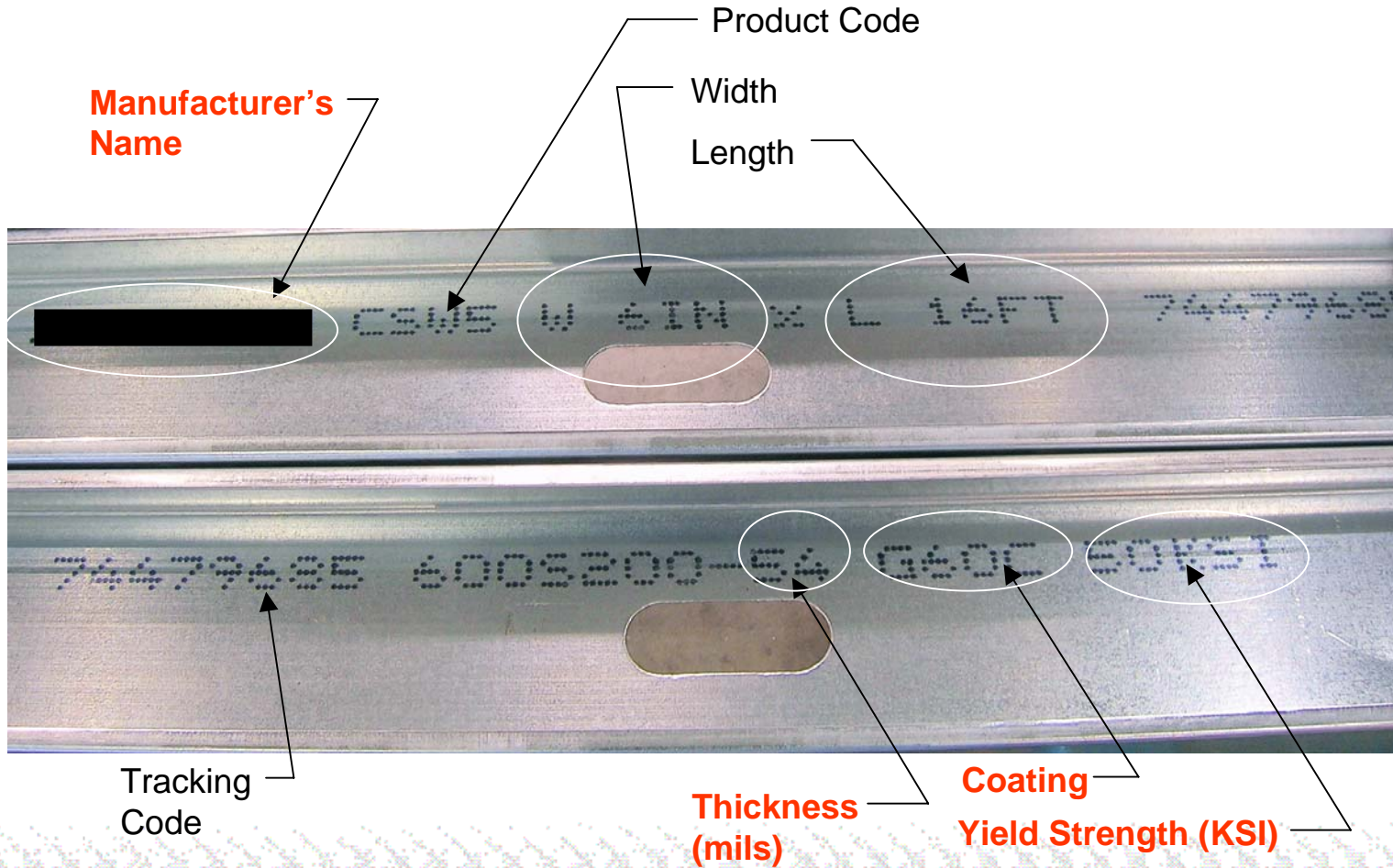
## Individual members must be marked with:

- Rollformer's name
- Thickness without coating
- Yield strength
  - Nonstructural – required if other than 33 ksi
  - Structural – required for any ksi
- Protective coating weight
  - Nonstructural – required if other than G-40
  - Structural – required for any coating weight



# Marking and Id - Structural

## Section 12: Marking and Identification: Each Member



Markings required by ASTM (48" o.c. maximum) are shown in **RED**. Additional markings shown in **BLACK**

# Marking and Identification Summary

Summary: To be code compliant to **FBC 2004 and FBC 2007:**

For both nonstructural studs and structural studs:

- Bundles of like members need to be marked.
- Individual members need to be marked



# *Material Summary Checklists*

The following four slides are checklists that can be taken into the field and used as a guide when examining cold-formed steel stud framing.

## Code Compliance Inspection Checklist - Drywall Products (FBC 2004 references ASTM C645 - 00)



Requirement	Code Reference	Specification Requirements	How to Inspect	Misc.	Compliant
<b>Protective Coating</b>	IBC 2003 - Table 2506.2 which then directs the user to ASTM C645-00	4.2 Members shall have a protective coating conforming to Specification A 653/A 653M – G40 minimum or shall have a protective coating with an equivalent corrosion resistance.	* Request mfgs. certification * Copper sulfate test to verify use of hot dipped galvanized coating * Elcometer test to measure proper thickness of coating	Copper sulfate reacts black with hot dipped galvanize. Reacts greenish brown with galvanized.	<input type="checkbox"/> yes <input type="checkbox"/> no
		4.3 Members shall be manufactured from steel having a minimum thickness, individual measurement of 0.0179 in. before application of protective coating	* Measure with micrometer	Thickness with G-40 coating = 0.0187"	<input type="checkbox"/> yes <input type="checkbox"/> no
<b>Base Metal Thickness</b>	IBC 2003 - Table 2506.2 which then directs the user to ASTM C645-00	5.1 Studs and rigid furring channels 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.	* Check manufacture's literature * Check marking on the members * Request manufacture's certification * Verify proper minimum thickness based on independent test report	If less than C645 minimum requirements manufacturer shall provide an independent test report to verify required minimum thickness.	<input type="checkbox"/> yes <input type="checkbox"/> no
		14.1... individual members shall have a legible label, stencil, or embossment, at a maximum distance of 48 in. on center, on the member, with the following minimum information: 14.2.1 The rollformer's identification (that is, name, logo or initials). 14.2.2 The minimum steel thickness, in mils or inches, exclusive of protective coating. 14.2.3 The minimum yield strength in ksi if other than 33 ksi 14.2.4 The minimum protective coating weight, G-XX, if other than as specified in Section 4. (G40 or equivalent corrosion resistance)	48" on center repeated pattern		<input type="checkbox"/> yes <input type="checkbox"/> no
<b>Marking &amp; Identification (Individual Members)</b>	IBC 2003 - Table 2506.2 which then directs the user to ASTM C645-00	Manufacturers name or logo			<input type="checkbox"/> yes <input type="checkbox"/> no
		Minimum steel thickness exclusive of coating		Minimum should be 0.0179". If G40 coating overall thickness should be 0.0187"	<input type="checkbox"/> yes <input type="checkbox"/> no
		Minimum yield strength (assumed 33 ksi if not marked)			<input type="checkbox"/> yes <input type="checkbox"/> no
		Minimum coating weight (assumed G40 or equivalent if not marked)			<input type="checkbox"/> yes <input type="checkbox"/> no
		8.1 The mechanical properties of the steel sheet shall conform to the requirements shown in Table 2. Table 2 requires type "NS" studs (Non Structural) to have a minimum 33 ksi. There are no elongation (ductility) requirements.		* Check manufacture's literature * Check marking on the members * Request manufacture's certification	* Only means to verify is through a destructive test ASTM A370
<b>Yield Strength</b>	IBC 2003 - Section 2210.4 which directs the user to the AISI - General Provisions which in turn points to ASTM A1003-00				

**Code Compliance Inspection Checklist - Structural Products**  
**( FBC 2004 references ASTM C955 - 01)**



Requirement	Code Reference	Specification Requirements	How to Inspect	Misc.	Compliant
<b>Protective Coating</b>	IBC 2003 - Table 2506.2 which then directs the user to ASTM C955-01	4.4 Members shall have a protective coating conforming to Specification A 653/A 653M, G60 minimum or equivalent corrosion resistance, or shall have a rust-inhibitive coating providing equivalent corrosion resistance.	* Request mfgs. certification * Copper sulfate test to verify use of hot dipped galvanized coating * Elcometer test to measure proper thickness of coating	Copper sulfate reacts black with hot dipped galvanized. Reacts greenish brown with galvanized.	<input type="checkbox"/> yes <input type="checkbox"/> no
<b>Base Metal Thickness</b>	IBC 2003 - Table 2506.2 which then directs the user to ASTM C955-01	4.2 The minimum steel thickness (base steel) shall be not less than 0.0329".	* Measure with micrometer	Thickness with G60 coating = 0.0338"	<input type="checkbox"/> yes <input type="checkbox"/> no
<b>Marking &amp; Identification (Individual Members)</b>	IBC 2003 - Table 2506.2 which then directs the user to ASTM C955-01	12.2 ...individual members shall have a legible label, stencil, or embossment, at a maximum distance of 48 in. on center, on the web of the member, with the following minimum information: 12.2.1 The rollformer's identification (that is, name, logo or initials). 12.2.2 The minimum steel thickness, in mils or inches, exclusive of protective coating. 12.2.3 The minimum yield strength in ksi 12.2.4 The minimum protective coating weight, shall be indicated with the appropriate coating designator in accordance with Table 2. 12.3 Individual members or bundles of like members shall be color-coated in accordance with Table 3.	48" on center repeated pattern		<input type="checkbox"/> yes <input type="checkbox"/> no
			Manufacturers name or logo		<input type="checkbox"/> yes <input type="checkbox"/> no
			Minimum steel thickness exclusive of coating	minimum should be 0.0329" If G60 coating overall thickness should be 0.0338"	<input type="checkbox"/> yes <input type="checkbox"/> no
			Minimum yield strength		<input type="checkbox"/> yes <input type="checkbox"/> no
			Minimum coating weight		<input type="checkbox"/> yes <input type="checkbox"/> no
			Check color coating		<input type="checkbox"/> yes <input type="checkbox"/> no
<b>Yield Strength</b>	IBC 2003 - Section 2210.4 which directs the user to the AISI - General Provisions which in turn points to ASTM A1003-00	8.1 The mechanical properties of the steel sheet shall conform to the requirements shown in Table 2. Table 2 gives the options of ST33H, ST37H, ST40H, ST50H. Each of these has a minimum yield strength equal to the number, for example ST33H has a minimum yield requirement of 33 ksi. All of the options require a minimum 10% elongation.	* Check manufacture's literature * Check marking on the members * Request manufacture's certification	* Only means to verify is through a destructive test ASTM A370	<input type="checkbox"/> yes <input type="checkbox"/> no

Notes: 1) Check project specifications - They may have newer versions of ASTM specifications and / or stricter requirements.

## Code Compliance Inspection Checklist - Drywall Products ( Pending FBC 2007 references ASTM C645 - 04)



Requirement	Code Reference	Specification Requirements	How to Inspect	Misc.	Compliant
<b>Protective Coating</b>	IBC 2006 - Table 2506.2 which then directs the user to ASTM C645-04	4.2 Members shall have a protective coating conforming to Specification A 653/A 653M – G40 minimum or shall have a protective coating with an equivalent corrosion resistance.	* Request mfgs. certification * Copper sulfate test to verify use of hot dipped galvanized coating * Elcometer test to measure proper thickness of coating	Copper sulfate reacts black with hot dipped galvanize. Reacts greenish brown with galvanized.	<input type="checkbox"/> yes <input type="checkbox"/> no
		4.3 Members shall be manufactured from steel having a minimum thickness, individual measurement of 0.0179 in. before application of protective coating...or	* Measure with micrometer	Thickness with G40 coating = 0.0187"	<input type="checkbox"/> yes <input type="checkbox"/> no
<b>Base Metal Thickness</b>	IBC 2006 - Table 2506.2 which then directs the user to ASTM C645-04	5.1 Studs and rigid furring channels 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.	* Check manufacture's literature * Check marking on the members * Request manufacture's certification *Verify proper minimum thickness based on independent test report	If less than C645 minimum requirements manufacturer shall provide an independent test report to verify required minimum thickness.	<input type="checkbox"/> yes <input type="checkbox"/> no
			48" on center repeated pattern		<input type="checkbox"/> yes <input type="checkbox"/> no
<b>Marking &amp; Identification (Individual Members)</b>	IBC 2006 - Table 2506.2 which then directs the user to ASTM C645-04	14.1...individual members shall have a legible label, stencil, or embossment, at a maximum distance of 48 in.on center, on the member, with the following minimum information:	Manufacturers name or logo		<input type="checkbox"/> yes <input type="checkbox"/> no
		14.2.1 The rollformer's identification (that is, name, logo or initials).	Minimum steel thickness exclusive of coating	Minimum should be 0.0179". If G40 coating overall thickness should be 0.0187"	<input type="checkbox"/> yes <input type="checkbox"/> no
		14.2.2 The minimum steel thickness, in mills or inches, exclusive of protective coating.	Minimum yield strength (assumed 33 ksi if not marked)		<input type="checkbox"/> yes <input type="checkbox"/> no
		14.2.3 The minimum yield strength in ksi if other than 33 ksi	Minimum coating weight (assumed G40 or equivalent if not marked)		<input type="checkbox"/> yes <input type="checkbox"/> no
		14.2.4 The minimum protective coating weight, G-XX, if other than as specified in Section 4. (G40 or equivalent corrosion resistance)			
<b>Yield Strength</b>	IBC 2006 - Section 2210.4 which directs the user to the AISI - General Provisions which in turn points to ASTM A1003-02a	8.1 The mechanical properties of the steel sheet shall conform to the requirements shown in Table 2. Table 2 requires type "NS" studs (Non Structural) to have a minimum 33 ksi. There are no elongation (ductility) requirements.	* Check manufacture's literature * Check marking on the members * Request manufacture's certification	* Only means to verify is through a destructive test ASTM A370	<input type="checkbox"/> yes <input type="checkbox"/> no


Notes: 1) Check project specifications - They may have newer versions of ASTM specifications and / or stricter requirements.

**Code Compliance Inspection Checklist - Structural Products**  
**( Pending FBC 2007 references ASTM C955 - 03)**



Requirement	Code Reference	Specification Requirements	How to Inspect	Misc.	Compliant
<b>Protective Coating</b>	IBC 2006 - Table 2506.2 which then directs the user to ASTM C955-03	4.4 Members shall have a protective coating in accordance with Table 1, CP 60 minimum. (Table 1 - CP 60 lists 4 options: G60; A60; AZ50; or GF30.)	* Request mfgs. certification * Elcometer test to measure proper thickness of coating		<input type="checkbox"/> yes <input type="checkbox"/> no
<b>Base Metal Thickness</b>	IBC 2006 - Table 2506.2 which then directs the user to ASTM C955-03	4.2 The minimum steel thickness (base steel) shall be not less than 0.0329".	* Measure with micrometer	Thickness with G60 coating = 0.0338"	<input type="checkbox"/> yes <input type="checkbox"/> no
<b>Marking &amp; Identification (Individual Members)</b>	IBC 2006 - Table 2506.2 which then directs the user to ASTM C955-03	12.2 ...individual members shall have a legible label, stencil, or embossment, at a maximum distance of 48 in.on center, on the web of the member, with the following minimum information: 12.2.1 The rollformer's identification (that is, name, logo or initials). 12.2.2 The minimum steel thickness, in mils or inches, exclusive of protective coating. 12.2.3 The minimum yield strength in ksi 12.2.4 The minimum protective coating weight, shall be indicated with the appropriate coating designator in accordance with Table 1. 12.3 Individual members or bundles of like members shall be color-coated in accordance with Table 3.	48" on center repeated pattern		<input type="checkbox"/> yes <input type="checkbox"/> no
			Manufacturers name or logo		<input type="checkbox"/> yes <input type="checkbox"/> no
			Minimum steel thickness exclusive of coating	Minimum should be 0.0329" If G60 coating overall thickness should be 0.0338"	<input type="checkbox"/> yes <input type="checkbox"/> no
			Minimum yield strength		<input type="checkbox"/> yes <input type="checkbox"/> no
			Minimum coating weight	Product should be marked: G60; A60; AZ50 or GF30	<input type="checkbox"/> yes <input type="checkbox"/> no
			Check color coating		<input type="checkbox"/> yes <input type="checkbox"/> no
<b>Yield Strength</b>	IBC 2006 - Section 2210.4 which directs the user to the AISI - General Provisions which in turn points to ASTM A1003-02a	8.1 The mechanical properties of the steel sheet shall conform to the requirements shown in Table 2. Table 2 gives the options of ST33H, ST37H, ST40H, ST50H. Each of these has a minimum yield strength equal to the number, for example ST33H has a minimum yield requirement of 33 ksi. All of the options require a minimum 10% elongation.	* Check manufacture's literature * Check marking on the members * Request manufacture's certification	* Only means to verify is through a destructive test ASTM A370	<input type="checkbox"/> yes <input type="checkbox"/> no

Notes: 1) Check project specifications - They may have newer versions of ASTM specifications and / or stricter requirements.



*What are the code compliance issues?*

- *Coatings*
- *Material Thicknesses*
- *Stud Physical Dimensions*
- *Marking & Identification*
- *Fire-Rating –Life Safety Issues*

# Fire-Rated Partitions



## What You Need to Know

# Fire-Ratings –Life Safety Issues

- A fire-rated partition must adhere to the actual tested assembly or it is not in conformance!
- 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-Ratings –Life Safety Issues

- 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-Ratings –Life Safety Issues

## Steel Thickness for Studs in UL Tested Assemblies:

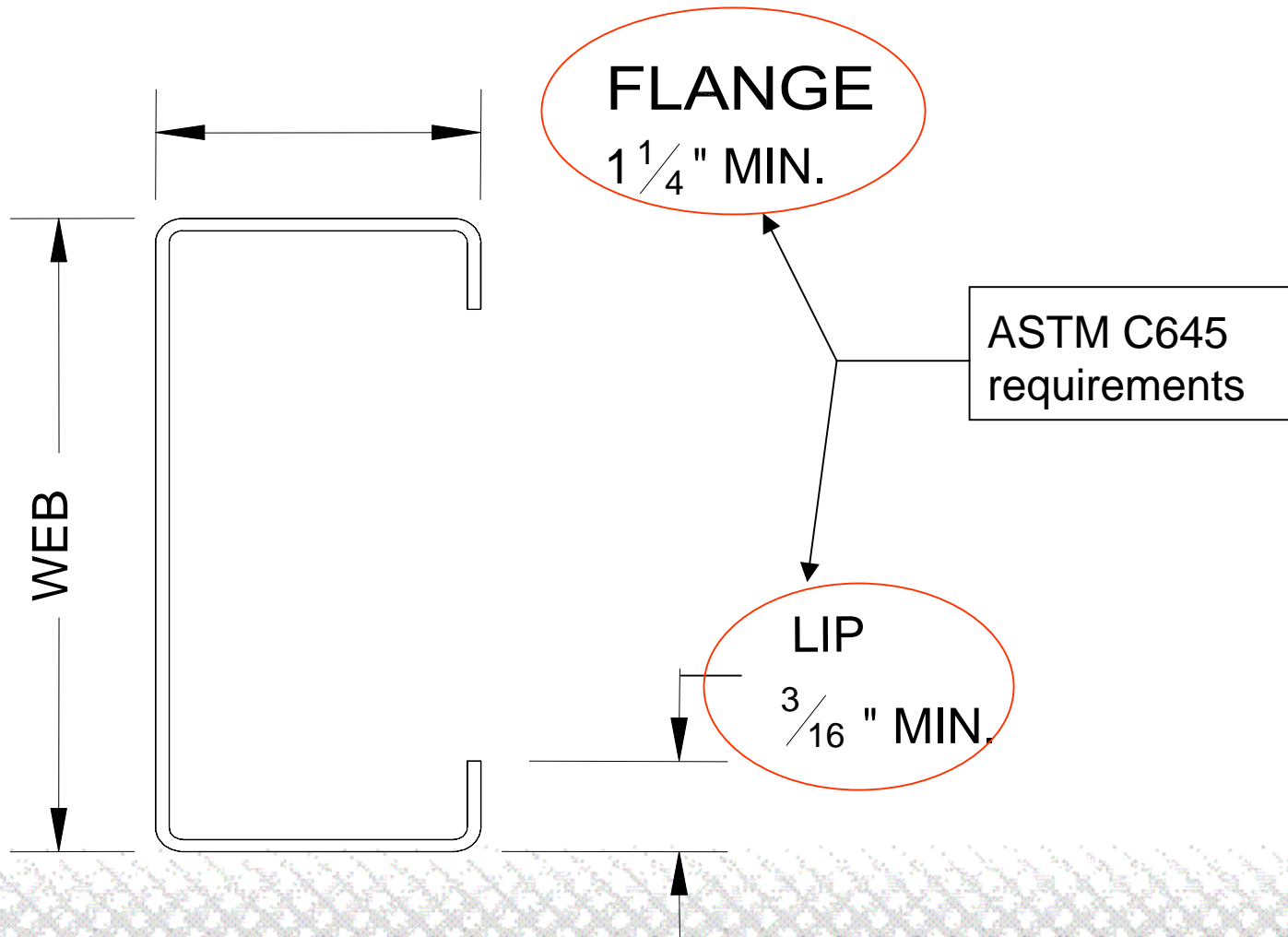
UL tests call for “MSG” = manufacturers standard gauge

- 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 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.)
<b>25</b>	<b>0.018</b>	<b>0.019</b>
24	0.021	0.022
22	0.027	0.028
<b>20</b>	<b>0.033</b>	<b>0.034</b>
18	0.044	0.045
16	0.055	0.056

# Fire-Ratings – Life Safety Issues

## Stud configuration:



# Fire-Ratings –Life Safety Issues

## Common UL Designs:

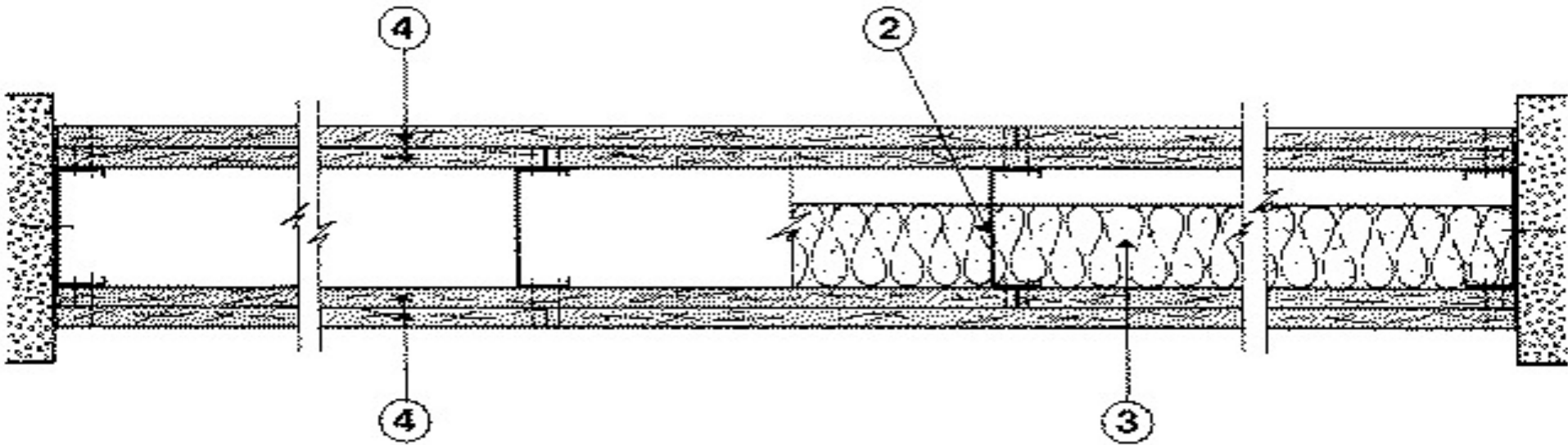
Commonly Specified Nonbearing UL Fire-Rated Wall Assemblies

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 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-Ratings –Life Safety Issues

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



**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-Ratings –Life Safety Issues

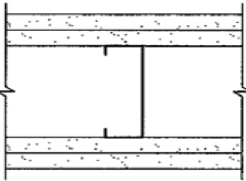
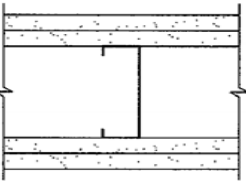
## UL U 411:

- 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
- Traditional flat steel 25 gauge ASTM C645 studs will not meet the requirements of this fire-rated assembly!

# Fire-Ratings –Life Safety Issues

“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. Then you can check what is actually being installed at the jobsite

## Example:

	GENERIC	2 HOUR FIRE	45 to 49 STC SOUND
<p style="text-align: center;"><b>GYPSUM WALLBOARD, STEEL STUDS</b></p> <p><b>Base layer</b> 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. <b>Face layer</b> 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.</p> <p>Joints staggered 24" each layer and side. (NLB)</p> <div style="border: 1px solid blue; padding: 5px; color: blue;"><p>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”.</p></div> <div style="border: 1px solid blue; padding: 5px; color: blue;"><p>Note: This assembly was tested in 1960. This also tells the reader that the assembly is UL 411 and this is were they can find the material description.</p></div>		 <p>Thickness: 6 1/8" Approx. Weight: 10 psf Fire Test: UL R1319-31, 6-2-60, UL Design U411 Sound Test: NGC 2005705, 6-15-05 RAL TL06-115, 4-12-06</p>	

**Fire Ratings:**

**Life Safety Issues**

Stud Requirements - UL Fire-Rated Assemblies					
Design No.	Hourly Rating	Bare Steel Thickness	Coated Steel Thkns (in.)	Flange Width (in.)	Return Lip (in.)
<b>Single Stud Wall Assemblies</b>					
U403	2hr	25 gauge 0.020"	0.021	1.250	0.250
U404	1 hr or 2	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, 4		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 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 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, 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

Stud Requirements - UL Fire-Rated Assemblies					
Design No.	Hourly Rating	Bare Steel Thickness	Coated Steel Thkns (in.)	Flange Width (in.)	Return Lip (in.)
<b>Single Stud Wall Assemblies</b>					
U490	4 hr	25 MSG	0.019	1.250	0.250
U491	2 hr	25 MSG	0.019	1.250	0.250
U494	1 hr	25 MSG	0.019	1.250	0.313
U495	1 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 (interior)	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, 2, 3, 4	25 MSG	0.019	1.250	0.250
V438	1, 2, 3, 4		n/a	1.250	0.219
V439	1 or 2 hr	20 MSG 0.0327"	0.033	1.500	0.250
V440	1 or 2 hr	22 MSG	0.028	1.375	0.250
V444	1 hr	25 MSG	0.019	1.250	0.375
V444 (alternate)	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		n/a	1.250	0.219
V450	2 or 2-1/2		n/a	1.250	0.219
V452	1 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 or 2 hr	20 MSG	0.034	1.625	not specified
<b>Chase or Double Stud Wall Assemblies</b>					
U420	1 or 2 hr	25 MSG	0.019	1.375	0.250
U436	1, 2, 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	1 or 2 hr	25 MSG	0.019	1.625	0.375
U493 (alternate)	1 or 2 hr	20 MSG	0.034	1.188	0.250
U493 (alternate)	1 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	1 or 2 hr	22 MSG	0.028	1.375	0.250



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