Table of Contents

Industry Technical Note Cold Formed Steel Construction

8415 220th Street W ▪ Lakeville ▪ MN ▪ 55044 ▪ 952▪985▪7000 ▪ Fax 952▪469▪1240

INDUSTRY TECHNICAL NOTE
COLD FORMED STEEL CONSTRUCTION

1

JAN 2000

SINGLE DEFLECTION TRACK SELECTION

INTRODUCTION

Since the popular use of steel studs for framing full height walls, there has been a recognition that the top of the wall needs to allow for deflection of the floor or roof assembly above when subjected to an applied live load. The allowance for deflection is essential for interior non-load bearing applications.

It has been common practice to utilize either a single track with the wall studs nested into the track (see Figure 1) with no attachment of the wall sheathing or stud to the deflection track. An alternate assembly uses a track nested into another track with no attachment of the nested inside track to the outside track. The track within a track allows the stud at the top of the wall to be attached to the inside track to provide a more uniform load transfer to the outside deflection track flange, and to stabilize the studs against rotation.

OBSERVATIONS

Over the years the question of how to determine the effective width of that portion of the track flange to be used for calculating the required design thickness of the leg for the single track deflection assembly was largely unanswered and was up to the design professional to determine. The design professional could assume an effective width equal to the width of the stud flange bearing against the side of the deflection track (conservative) or a width equal to the on center spacing of the studs (un-conservative). The Army Corps of Engineers has adopted a procedure (ETL 1110-3-411) which recognizes the width of the stud flange plus a portion of the track flange on each side of the stud as being the effective width b_{eff} (see Figure 1).

It is recommended that the steel used for the deflection track have good ductility characteristics, (tensile strength to yield point ratio not less than 1.08 and total elongation not less than 10 percent in a two-inch gage length). Good ductility characteristics reduce the possibility of micro cracking during the roll-forming process and provide inelastic reserve.

Satisfactory performance is based on the following:

1. The track thickness must be sufficient to resist plate bending along the effective track flange width, b_{eff}.
2. Each stud flange must be stabilized to resist rotation of the stud.

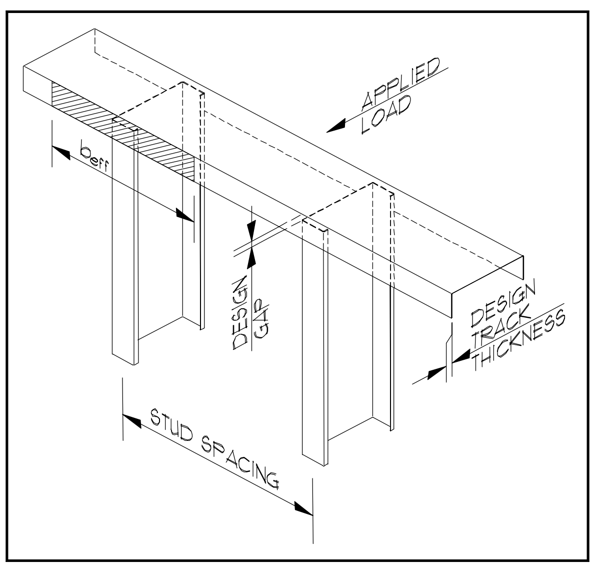


FIGURE 1

DEFLECTION TRACK THICKNESS DETERMINATION

Deflection track thickness determination based on the Army Corps of Engineers ETL 1110-3-411 procedure utilizes the effective width of the track leg in plate bending. The equation for determining the required thickness is:

$$t = \sqrt{\frac{7.5 \cdot P \cdot e}{F_y \cdot b_{eff}}}$$

where:

- t = required design thickness, in inches
- P = the maximum reaction at the top of the stud, in lbs. multiplied by 0.75 for wind or earthquake loads per A5.1.3 of the AISI Specification if applicable (Check local building code for application of reduction factor)
- e =distance between the track web and the point of application of the reaction P, in inches (design gap times 1.5)
- F_y = minimum steel yield stress, in psi
- b_{eff}=effective width of the track in plate bending, given by:

$$b_{eff} = w_{stud} + 2 \cdot \left[\frac{e + 1.25}{\tan(30^o)}\right]$$

- w_{stud}=the stud flange width, in inches.

Design curves can be developed utilizing a typical interior, non-load bearing stud flange width of 1.25”, a yield stress of either 33 ksi or 50 ksi (50 ksi is noted on the curves) and 16” and 24” on center stud spacing. A series of such curves are given in Figures 2 through 7.

By knowing the non-load bearing wall height, the lateral design load (typically 5 psf for interior walls), the design gap (gap between the end of the stud and the track web), the stud spacing, and the steel minimum yield stress of the track, the required design thickness of the single deflection track can be determined.

Thickness - Steel Components

Minimum Thickness[1] (mils)	Design Thickness (in)	Reference On Gauge No.
18	0.0188	25
27	0.0283	22
33	0.0346	20
43	0.0451	18
54	0.0566	16
68	0.0713	14
97	0.1017	12

[1] Minimum Thickness represents 95% of the design thickness and is the minimum acceptable thickness delivered to the job site based on Section A3.4 of the 1996 AISI Specification.

As an example:

Design load = 5 psf
Stud spacing = 24”o.c.
Design gap = 0.5”
Min. yield stress = 33 ksi
Wall height = 15’-0”
From Figure 3 design thickness of
t = .0451” (18ga.)

NOTE: Maximum allowable wall height = 19.52ft.

It is recommended that the depth of the deflection track flange be equal to the design gap plus 1 inch for one story buildings, and equal to 2 times the design gap plus 1 inch for all other applications to provide engagement of the stud into the deflection track. The longer track leg, for multiple story buildings, allows for the floor system supporting the stud wall to deflect while still maintaining engagement of the stud in the deflection track.

NOTE: The minimum uncoated delivered thickness can be equal to 95 percent of the design thickness per the 1996 AISI “Specification for The Design of Cold-Formed Steel Structural Members”, Section A3.4.

DESIGN CHART FOR SINGLE DEFLECTION TRACK[a,b,c.]

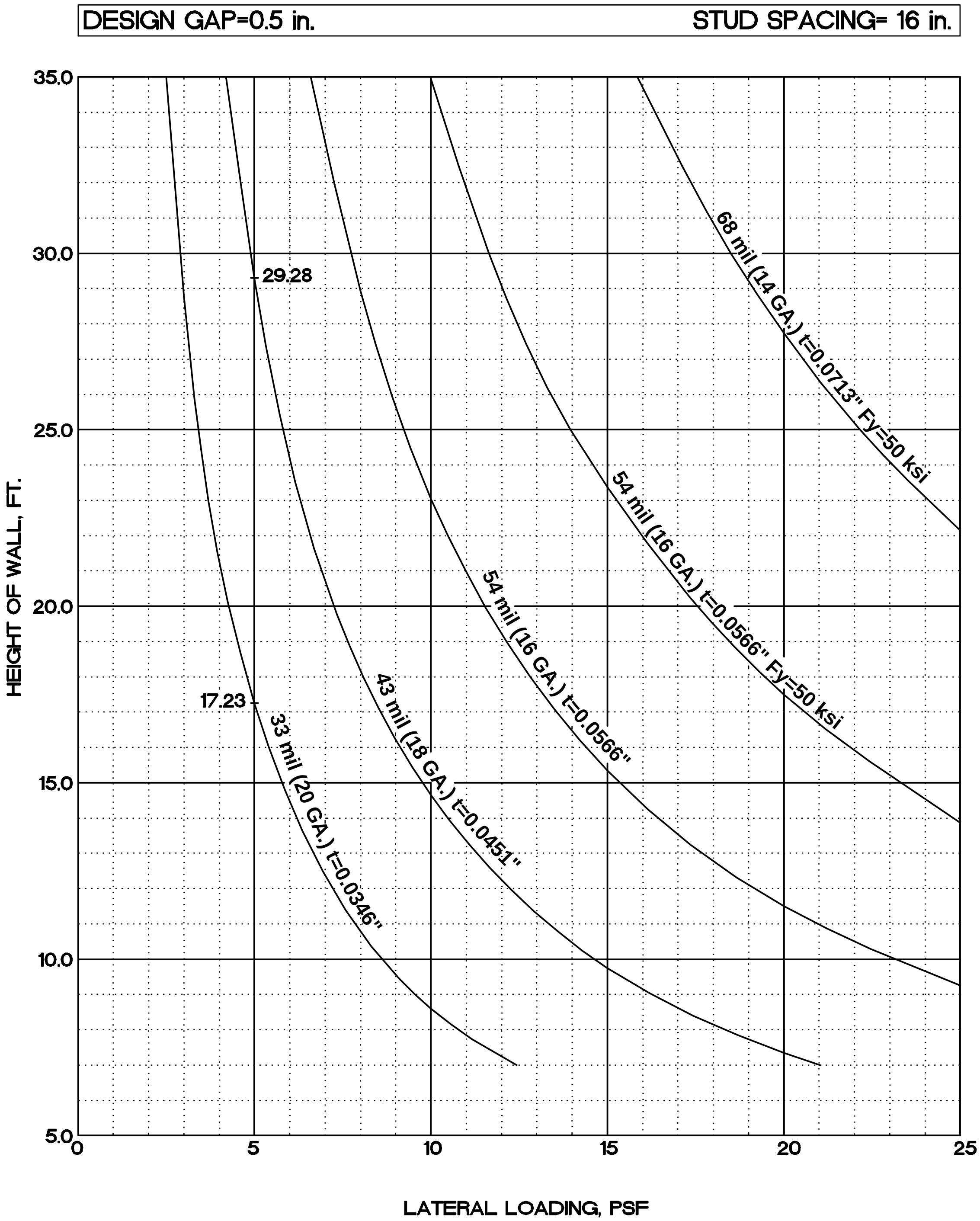


FIGURE 2

Notes:

a. Fy=33 ksi unless noted otherwise.

b. t=Design thickness.

c. Lateral load has been modified for duration of load (0.75) per A5.1.3 of the AISI Specification. No further reduction allowed; increase lateral load where other load durations govern.

DESIGN CHART FOR SINGLE DEFLECTION TRACK [a,b,c.]

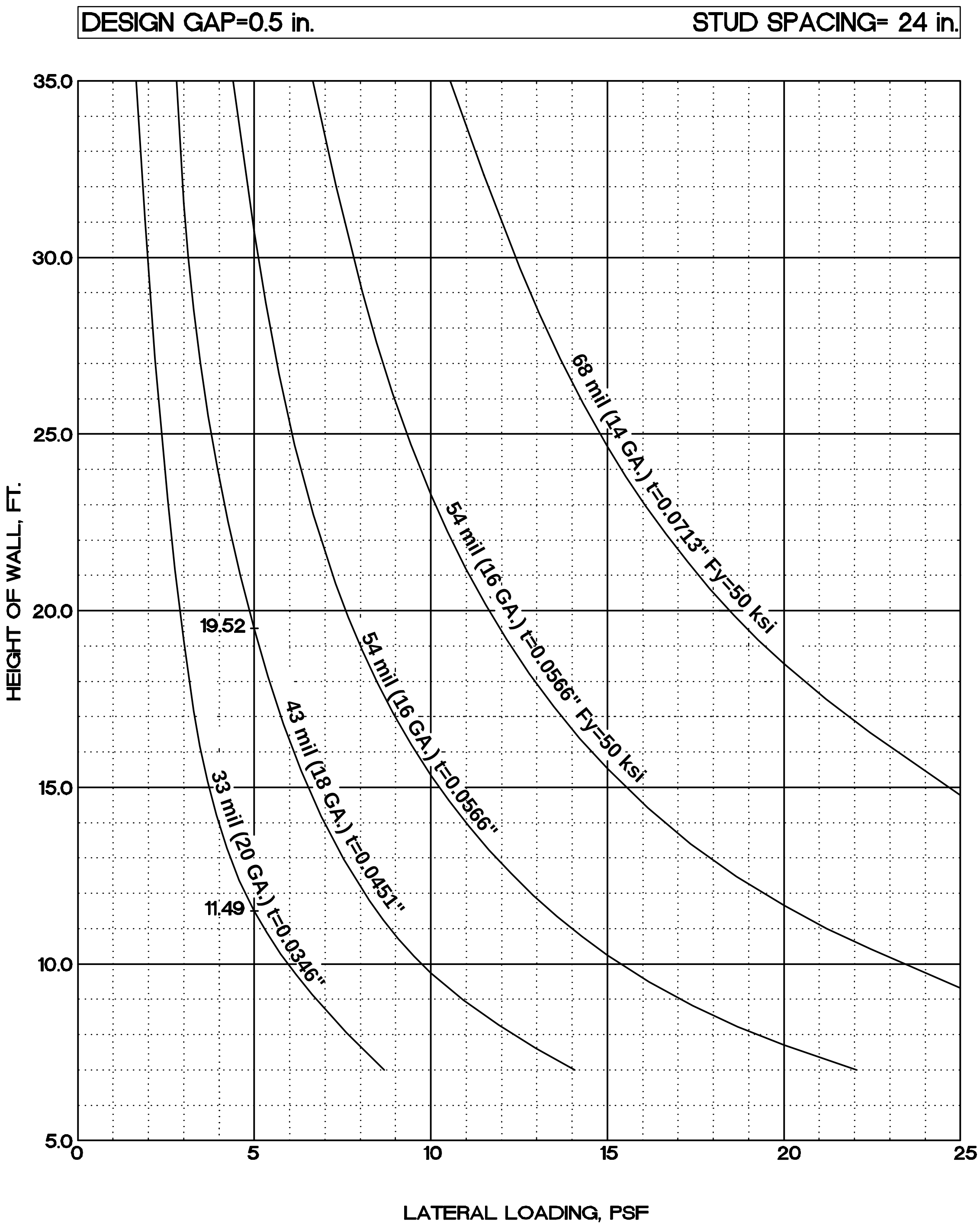


FIGURE 3

Notes:

a. Fy=33 ksi unless noted otherwise.
b. t=Design thickness.
c. Lateral load has been modified for duration of load (0.75) per A5.1.3 of the AISI Specification. No further reduction allowed; increase lateral load where other load durations govern.

DESIGN CHART FOR SINGLE DEFLECTION TRACK[a,b,c.]

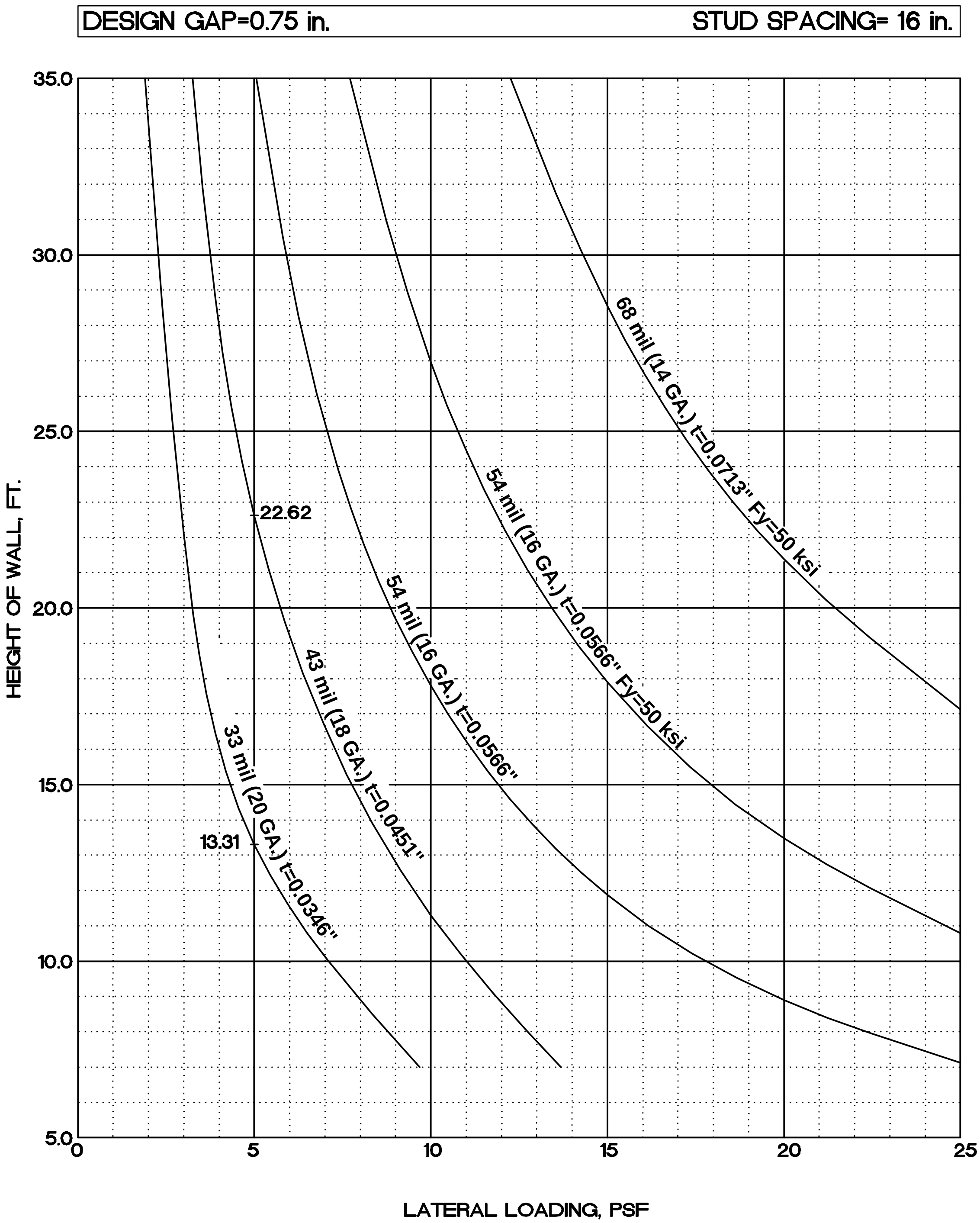


FIGURE 4

Notes:
a. Fy=33 ksi unless noted otherwise.
b. t=Design thickness.
c. Lateral load has been modified for duration of load (0.75) per A5.1.3 of the AISI Specification. No further reduction allowed; increase lateral load where other load durations govern.

DESIGN CHART FOR SINGLE DEFLECTION TRACK[a,b,c.]

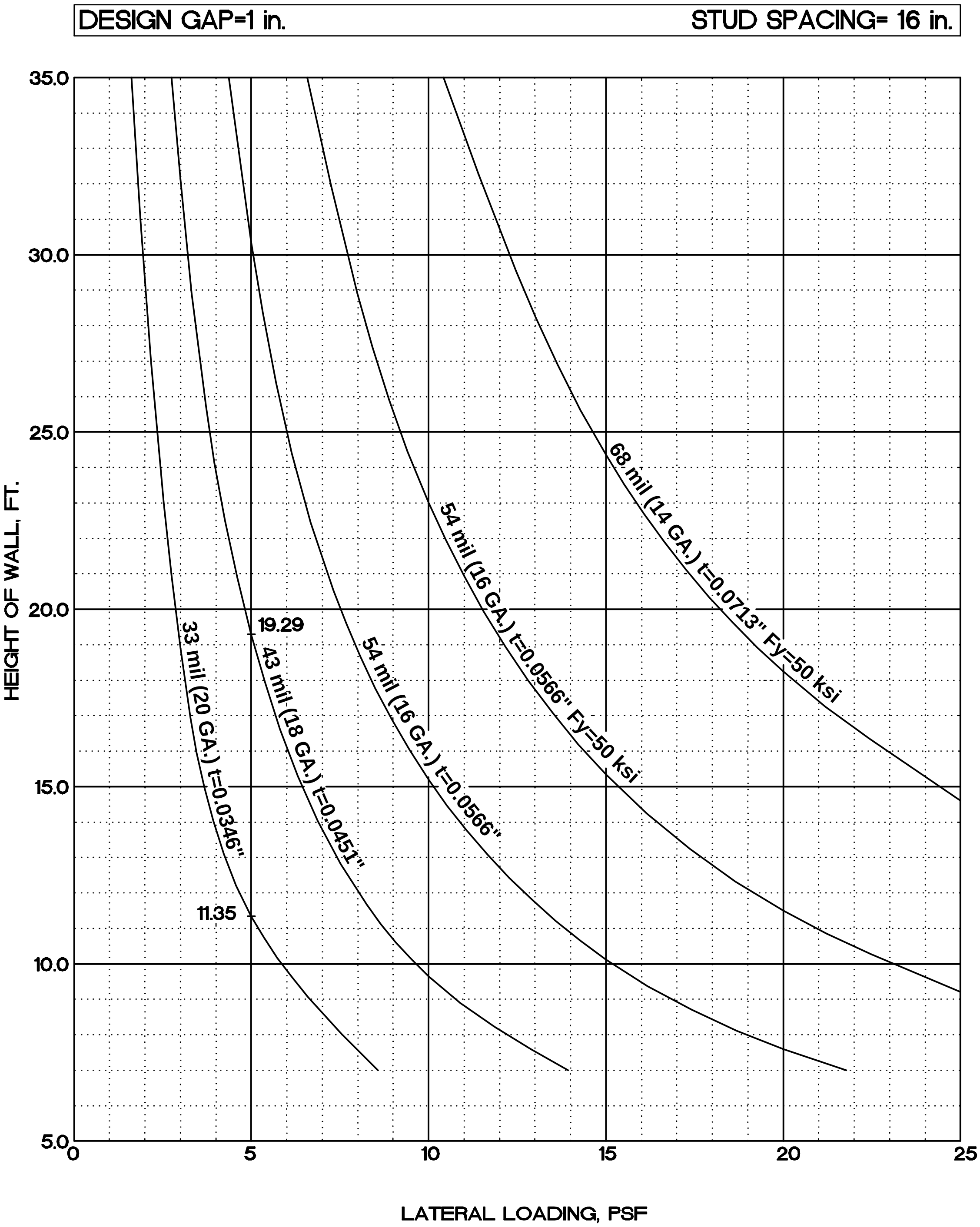


FIGURE 6

Notes:
- a. Fy=33 ksi unless noted otherwise.
- b. t=Design thickness.
- c. Lateral load has been modified for duration of load (0.75) per A5.1.3 of the AISI Specification. No further reduction allowed; increase lateral load where other load durations govern.

DESIGN CHART FOR SINGLE DEFLECTION TRACK[a,b,c.]

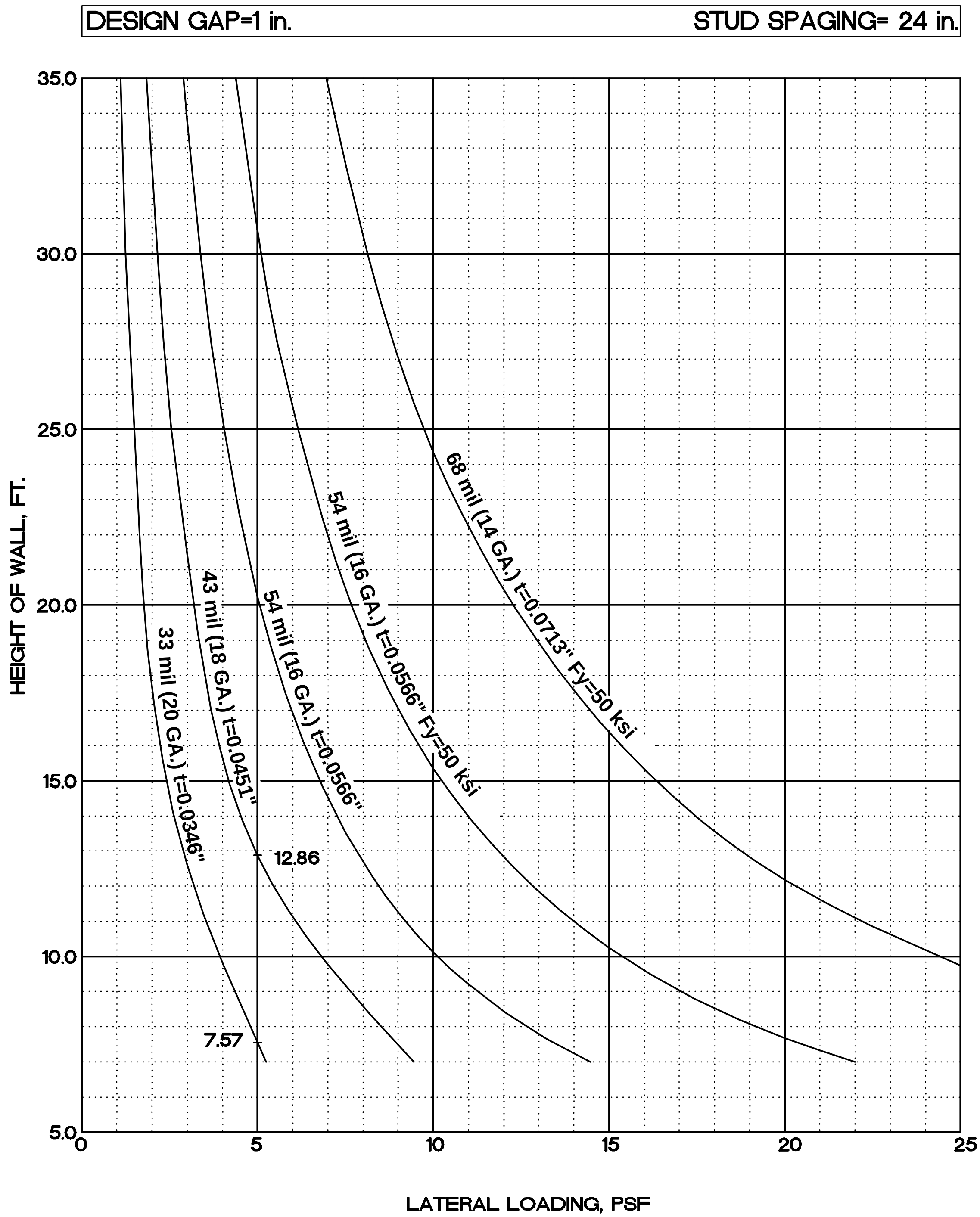


FIGURE 7

Notes:

a. Fy=33 ksi unless noted otherwise.
b. t=Design thickness.
c. Lateral load has been modified for duration of load (0.75) per A5.1.3 of the AISI Specification. No further reduction allowed; increase lateral load where other load durations govern.

2

INDUSTRY TECHNICAL NOTE
COLD FORMED STEEL CONSTRUCTION

MARCH 2000

UNSHEATHED FLANGE BRACING

INTRODUCTION

Non-structural interior walls framed with cold-formed steel studs are often framed with cladding (gypsum wall board, etc.) on one side only. With cladding on one side only, the unsheathed flange needs to be braced to resist torsional rotation of the framing member when the wall is subjected to a lateral load. The model codes require, as a minimum, a 5 psf interior lateral load.

In most cases this will be the controlling design load, except when higher loads are required by contract specifications. In high seismic areas the 5 psf load may be exceeded where heavy cladding materials are attached to the wall. An engineered solution is required for these applications. Examples of such applications are:

- Support of wall hung cabinets or plumbing fixtures.
- Floor mounted tall cabinets connected to the wall for lateral support.
- Heavy cladding materials (i.e. marble, stone, ceramic tile, etc.)

Traditionally, it has been common practice to require cold rolled channel to be installed at 4 foot on center through the web punch-outs to stiffen and stabilize the wall. The cold rolled channel installed through the punch-outs is effective in providing unsheathed flange bracing if there is a positive attachment of the cold rolled channel to the web of 6” and smaller studs (see Detail A).

The installation of the cold rolled channel, at 4 ft. o.c. will, in most cases, allow the wall to be considered fully braced similar to the wall having cladding installed on each flange, full height. However, the practice of bracing at 4 ft. on center may be uneconomical and unnecessary in some instances.

OBSERVATIONS

The ability to select an economical wall assembly for interior non-structural (non-axial loaded) walls sheathed on one flange is possible for a given depth of member, flange width and member thickness and the unsheathed flange bracing interval.

Historically, the bracing interval for walls sheathed on one flange, (chase walls, furred walls, etc.) if other than 4 ft. o.c. has been left to the design professional to determine or the manufacturer’s recommendation.

The 1996 American Iron and Steel Institute’s (AISI) “Specification for the Design of Cold-Formed Steel Structural Members” has design provisions for determining the bracing interval. The procedure contained in the Specification for determining the spacing of mechanical bracing for a given lateral load is easily applied using specialized cold formed steel software.

MECHANICAL BRACING INTERVAL DETERMINATION

The spacing of mechanical bracing to provide adequate stability for the unsheathed flange of a non-load bearing wall assembly can be determined in accordance with Section C3.1.2 of the AISI Specification. A series of curves (Figures 1 through 8), for a given stud depth, thickness, and stud spacing (16” or 24” o.c.), a specified deflection limit, wall height and a lateral load of 5 psf have been developed for determining the required bracing interval based on these provisions.

Satisfactory performance of the mechanical bracing is based on the following:

1. Each flange of the wall stud is engaged and secured to the flange of a track at the top and bottom of the wall.

2. Mechanical bracing is to be positively attached to each wall stud and spaced vertically at the maximum interval selected from the design curves.

3. When Detail A is used, punch-outs are to be installed in accordance with the provisions contained in Section D4 of the AISI Specification.

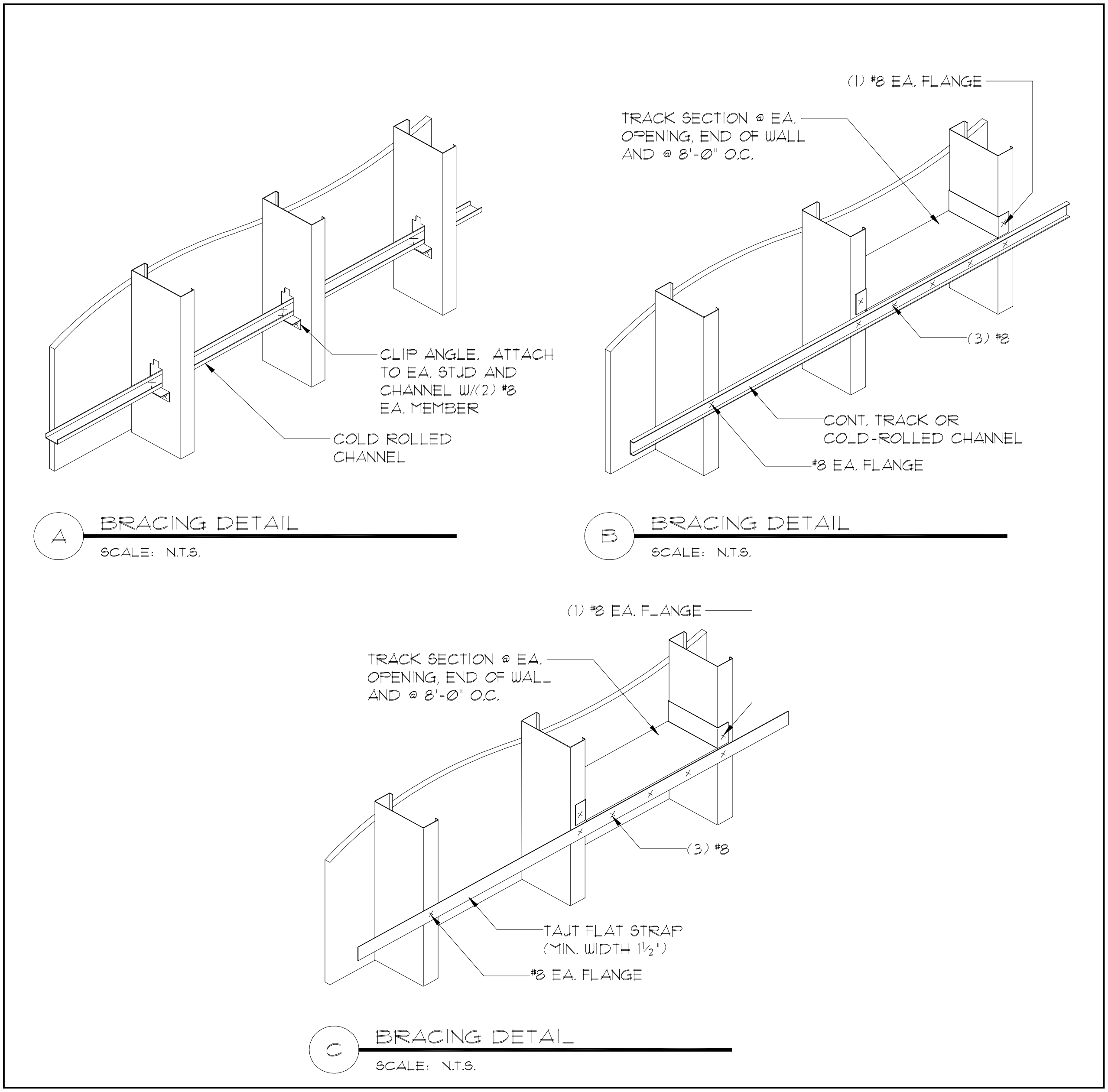
Once the required bracing interval has been determined, the method of stabilizing the unsheathed flange of the stud can be chosen from one of three methods shown in details A, B and C.

The stud depths used in Figures 1 through 8 are based on members commonly used for interior non-load bearing applications with a minimum yield stress of 33 ksi. If a 3 5/8” stud depth is specified, Figures 3A & B and 4A & B for the 3 1/2” stud depth can be used for selecting the bracing interval. The flange widths and steel thickness used are based on the designator system adopted as a national standard for specifying cold formed steel members which is as follows:

Stud Members Flange		Stiffener Lip
Width	Designator	Inches
1 1/4”	S125	3/16”
1 3/8”	S137	3/8”
1 5/8”	S163	1/2”

Min. Steel Thickness (Min. Yield Stress 33 ksi)	
Inches	Mils (.001 in.)
.0179 (25 ga.)	18
.0329 (20 ga.)	33
.0429 (18 ga.)	43

For a 5 psf lateral load, knowing the stud depth, wall height, and deflection limit required, a selection of possible stud members can be made with different bracing intervals. A final selection as to which stud and mechanical bracing interval to use can be made based on material cost, availability of materials and labor cost for installation.



The following examples are provided to assist in using the attached figures.

Example No. 1:

Stud size:	4”
Stud spacing:	24” o.c.
Deflection limit:	L/240
Lateral load:	5 psf
Wall height:	13 feet

From Figure 6B the following options are possible:

Stud Size and Thickness	Brace Interval, ft.
S125 - 33 (1 1/4” flg., 20 ga.)	6.8 ft. (1 row)
S137 - 43 (1 3/8” flg., 18 ga.)	10.4 ft. (1 row)
S162 - 33 (1 5/8” flg., 20ga.)	11.6 ft. (1 row)
S162 - 43 (1 5/8” flg., 18ga.)	None required

From these four possibilities, the most economical section can be selected.

Example No. 2:

Stud size:	3 1/2”
Stud spacing:	16” o.c.
Deflection limit:	L/240
Lateral load:	5 psf
Wall height:	13 feet

From Figure 3B the following options are possible:

Stud Size and Thickness	Brace Interval, ft.
S125 - 33 (1 1/4” flg., 20 ga.)	7.8 ft. (1 row)
S137 - 43 (1 3/8” flg., 18 ga.)	12.6 ft. (1 row)
S162 - 33 (1 5/8” flg., 20 ga.)	None required
S162 - 43 (1 5/8” flg., 18 ga.)	None required

From these four possibilities, the most economical section can be selected.

Example No. 3

Stud size:	2 1/2”
Stud spacing:	16” o.c.
Deflection limit:	L/120
Lateral load:	5 psf
Wall height:	14 feet

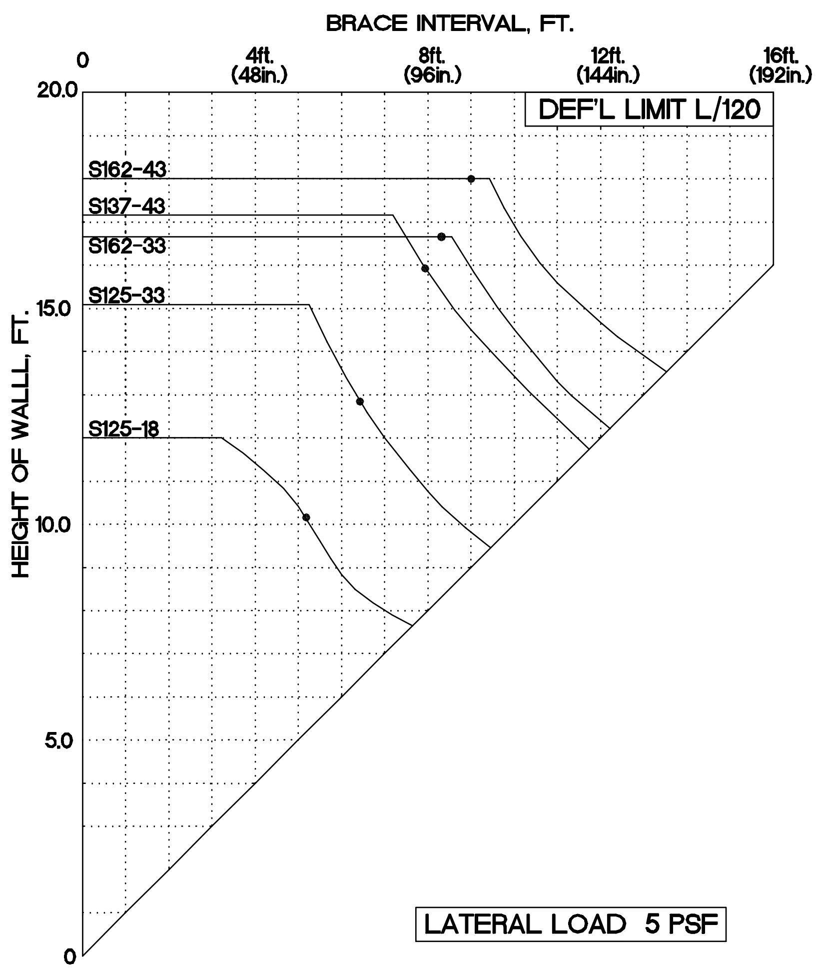
From Figure 1A the following options are possible:

Stud Size and Thickness	Brace Interval, ft.
S125 - 33 (1 1/4” flg., 20 ga.)	5.8 ft. (2 rows)
S137 - 43 (1 3/8” flg., 18 ga.)	9.5 ft. (1 row)
S162 - 33 (1 5/8” flg., 20 ga.)	10.4 ft. (1 row)
S162 - 43 (1 5/8” flg., 18 ga.)	12.8 ft. (1 row)

From these four possibilities, the most economical section can be selected.

FIGURE 1A

250 (2 1/2") STUD • 16" O.C.



• = Mid-Wall Brace Height

FIGURE 1B

250 (2 1/2") STUD • 16" O.C.

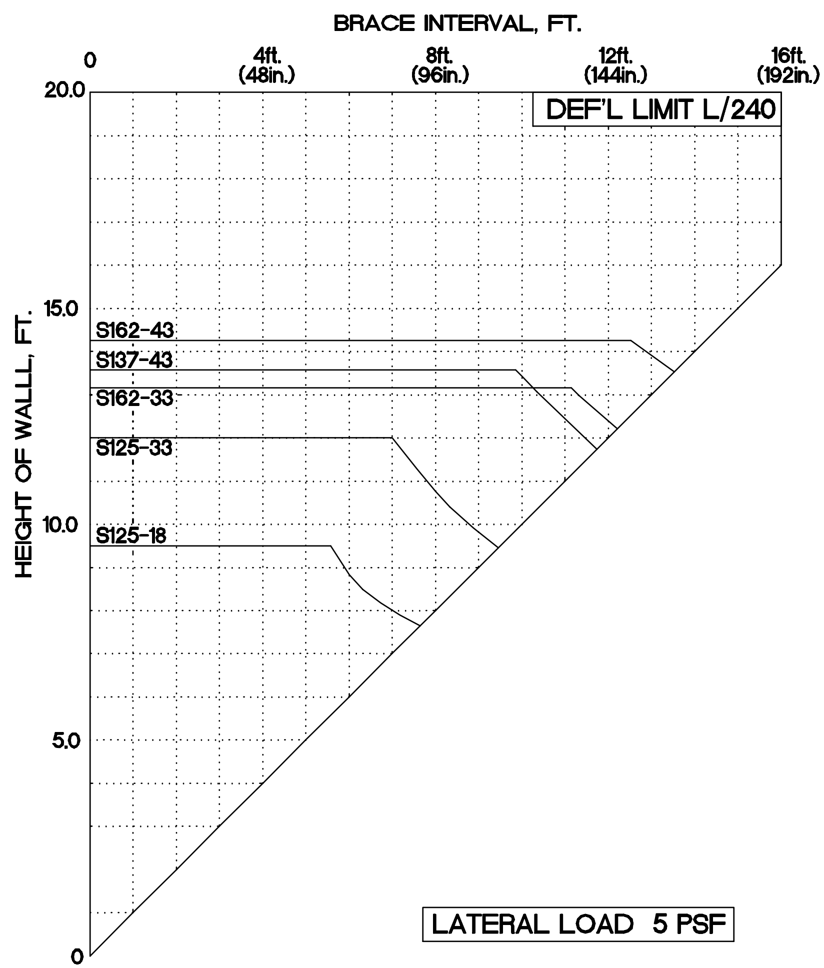


FIGURE 3A

350 (3 1/2") STUD @ 16" O.C.

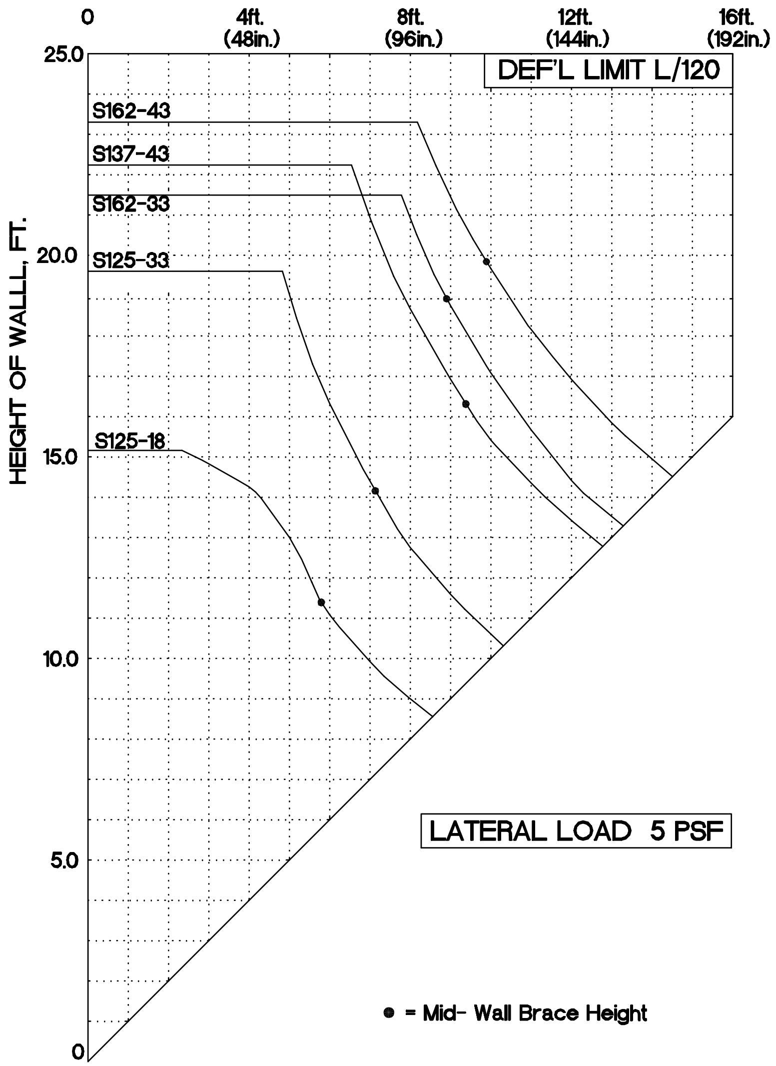


FIGURE 3B

350 (3 1/2") STUD @ 16" O.C.

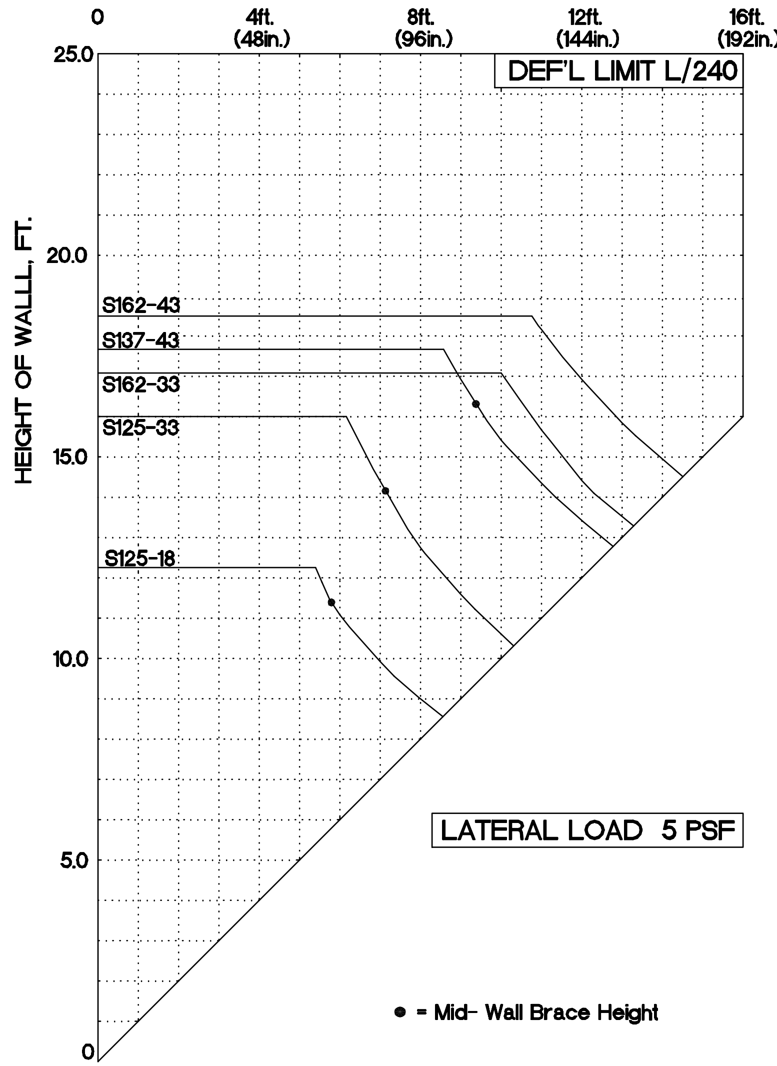


FIGURE 4A

350 (3 1/2") STUD • 24" O.C.

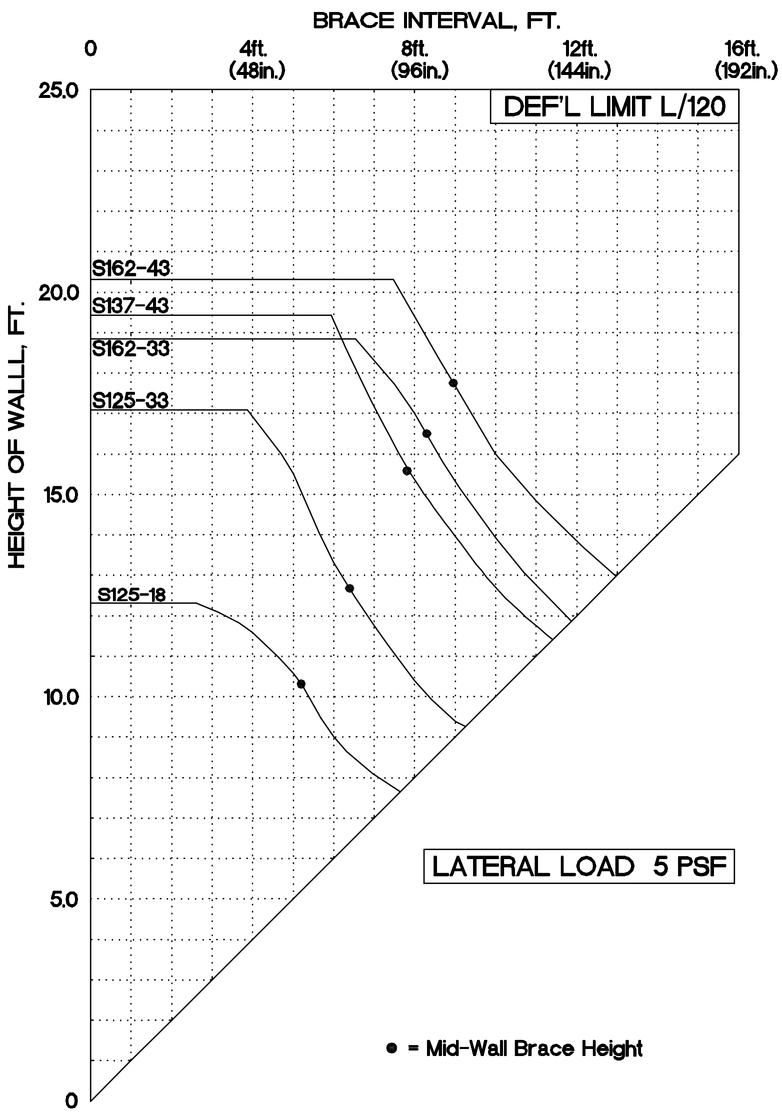


FIGURE 4B

350 (3 1/2") STUD • 24" O.C.

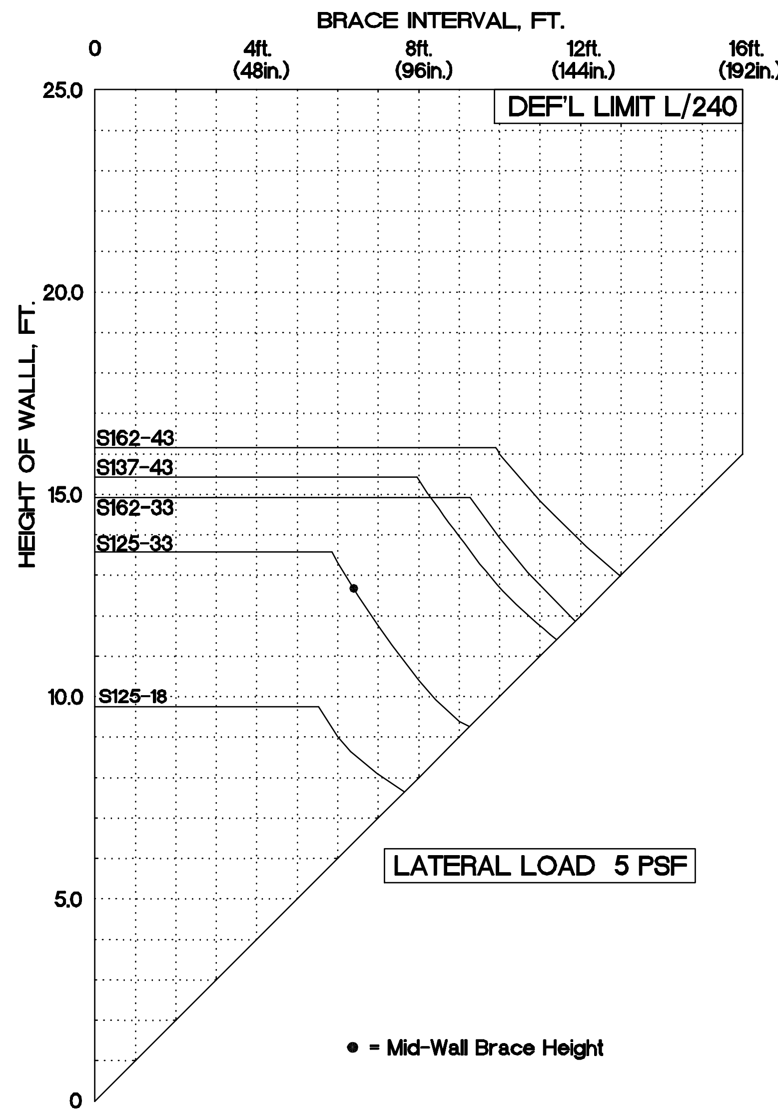


FIGURE 5A

400 (4") STUD • 16" O.C.

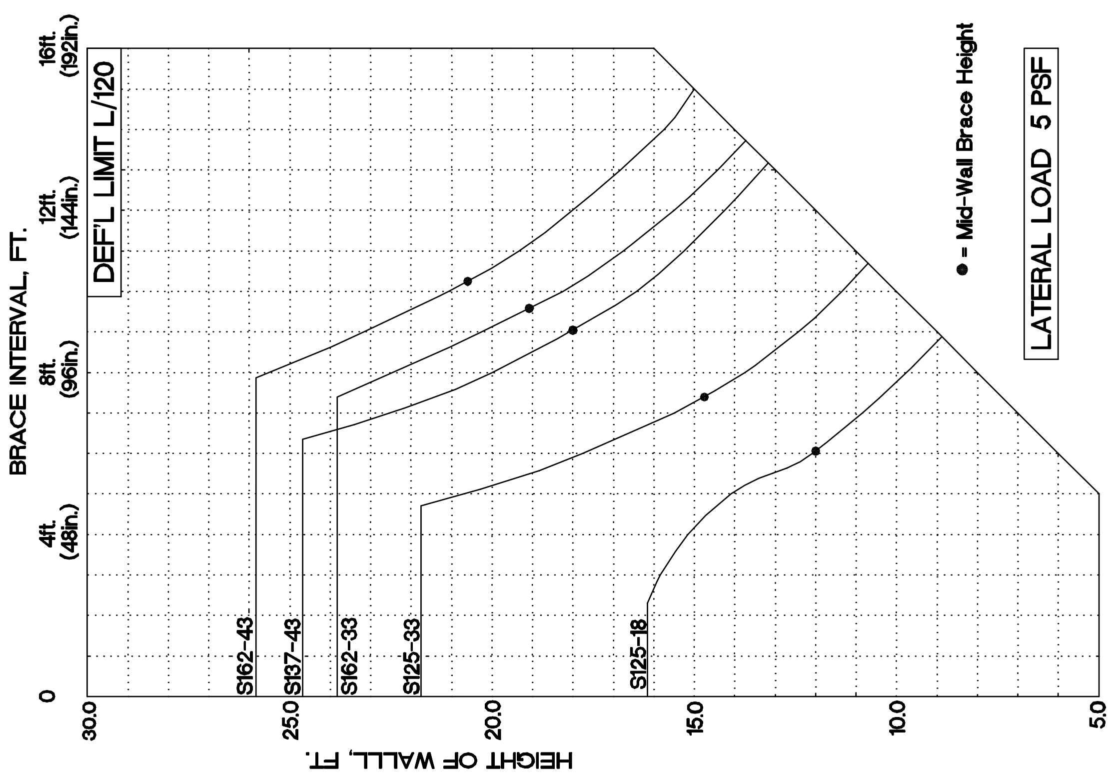


FIGURE 5B

400 (4") STUD • 16" O.C.

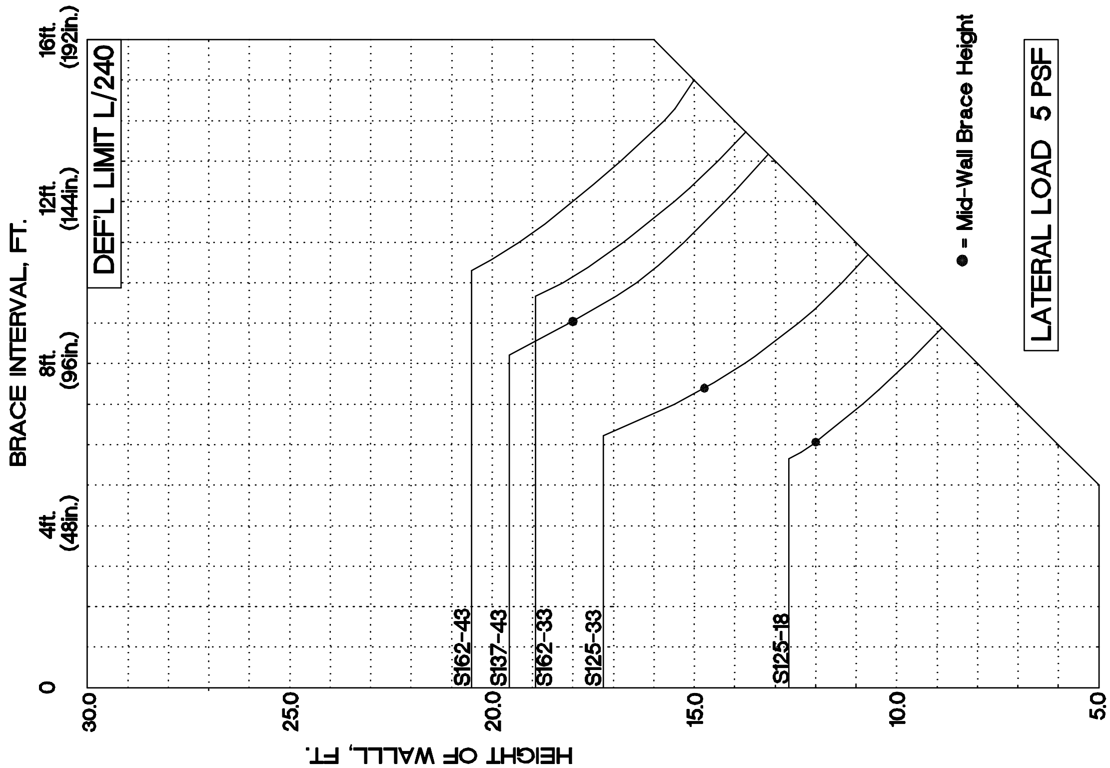


FIGURE 6A

400 (4") STUD • 24" O.C.

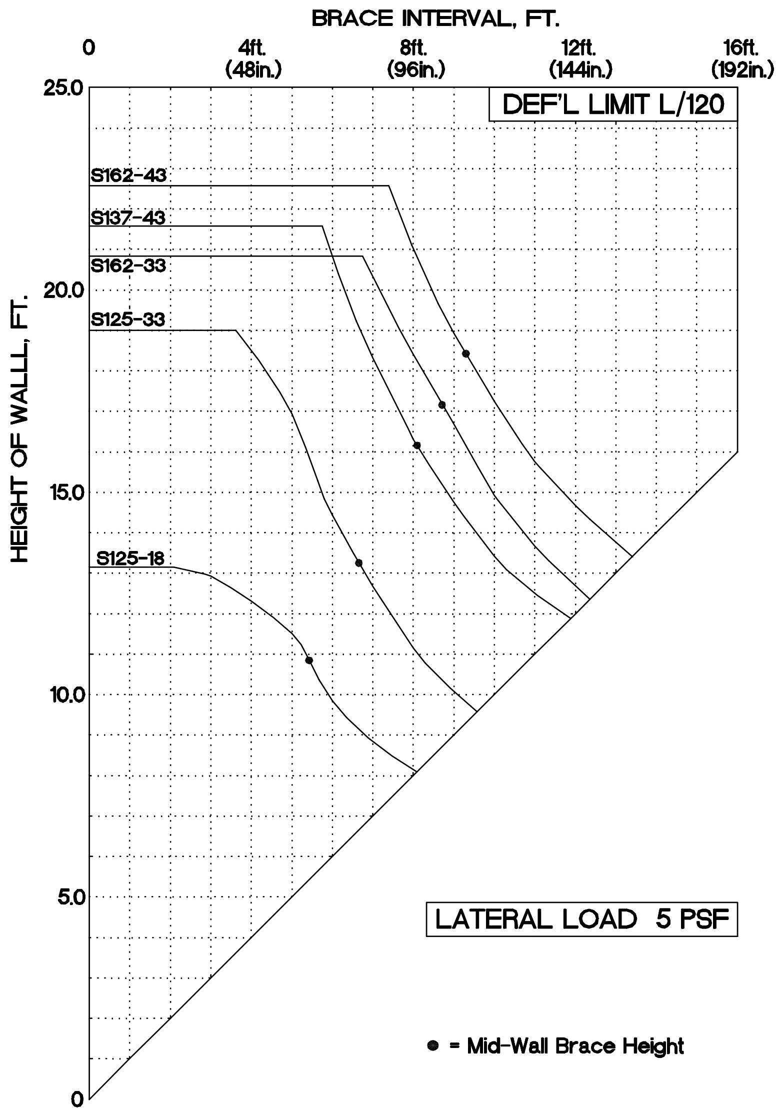


FIGURE 6B

400 (4") STUD • 24" O.C.

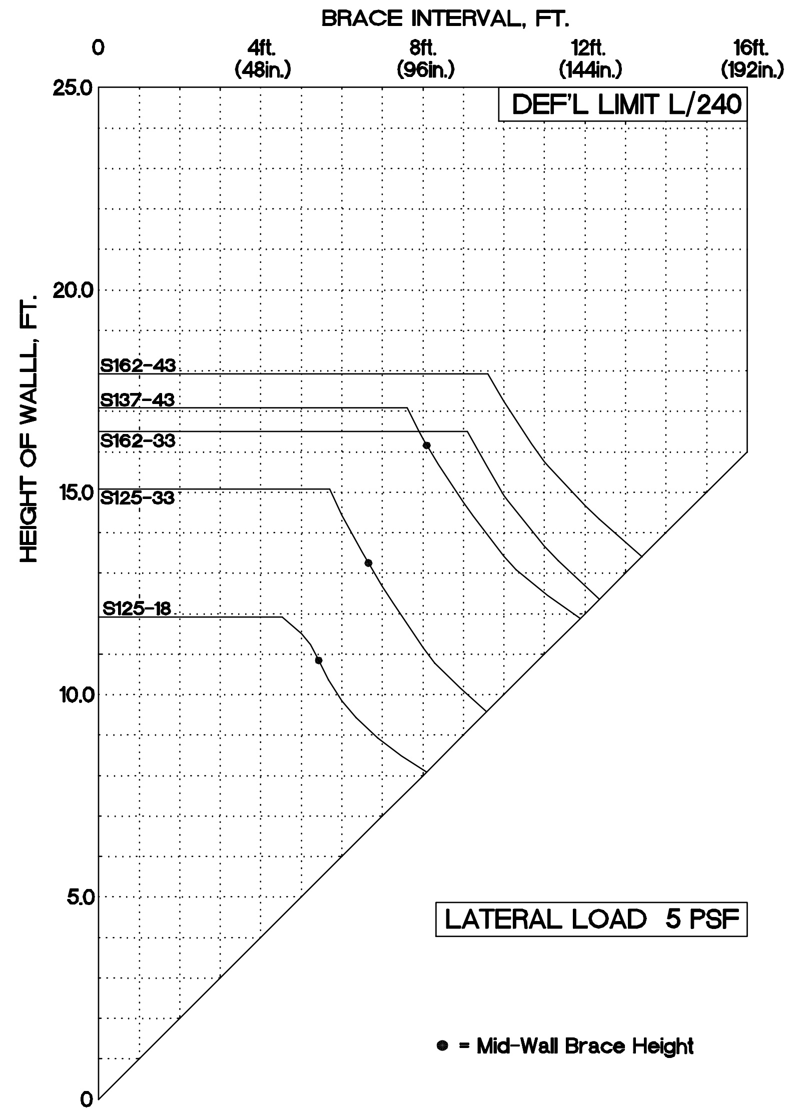


FIGURE 7A

600 (6") STUD @ 16" O.C.

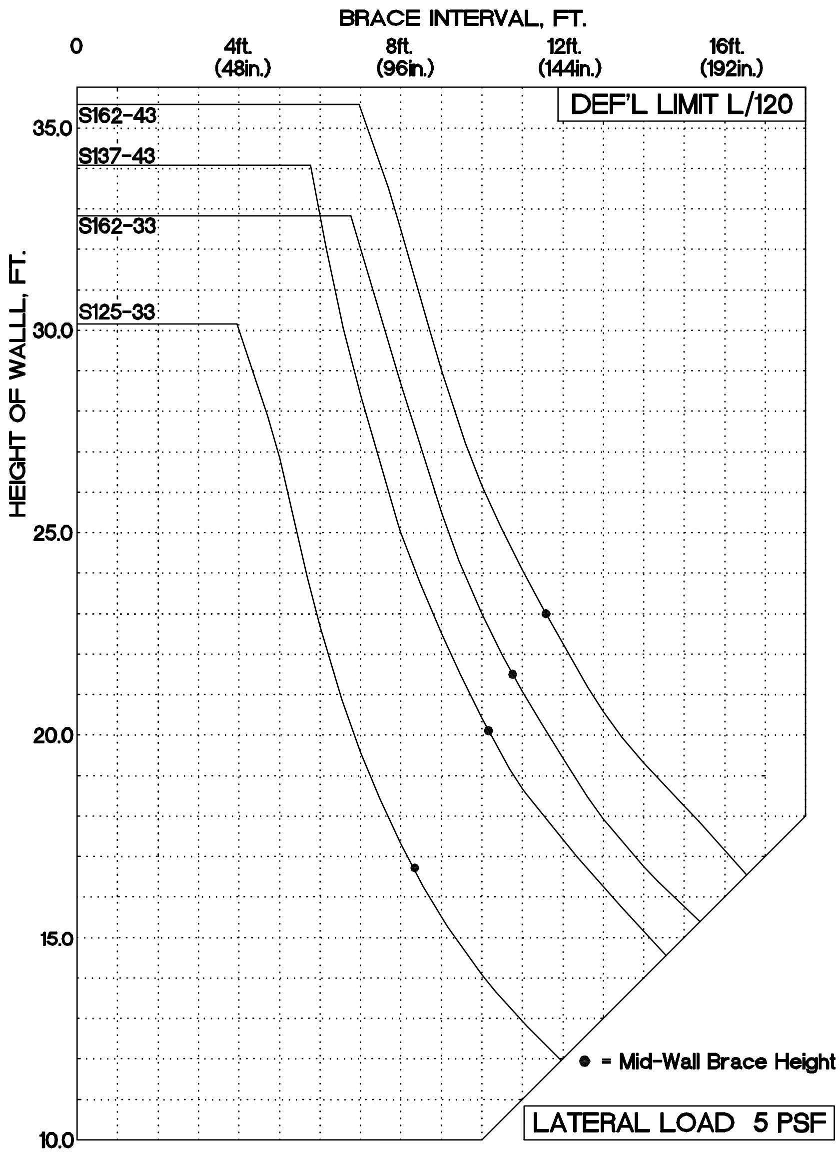


FIGURE 7B

600 (6") STUD @ 16" O.C.

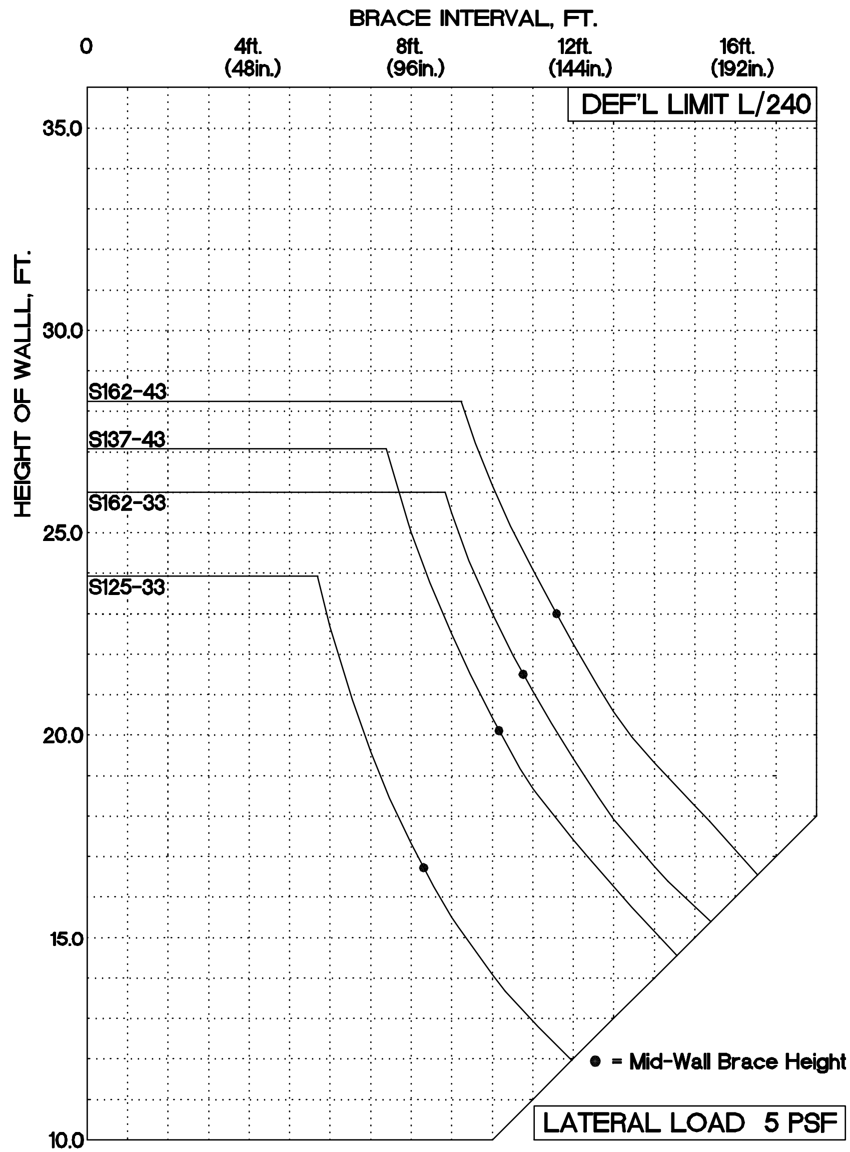


FIGURE 8A

600 (6") STUD @ 24" O.C.

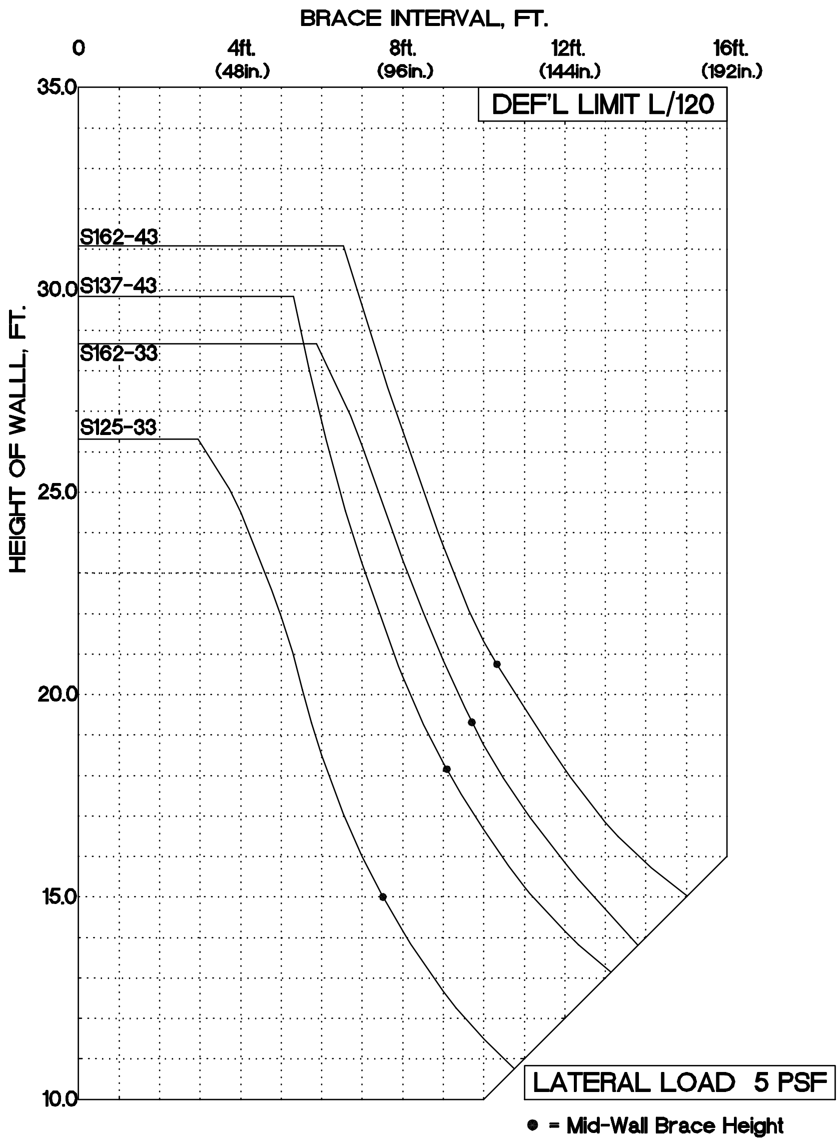
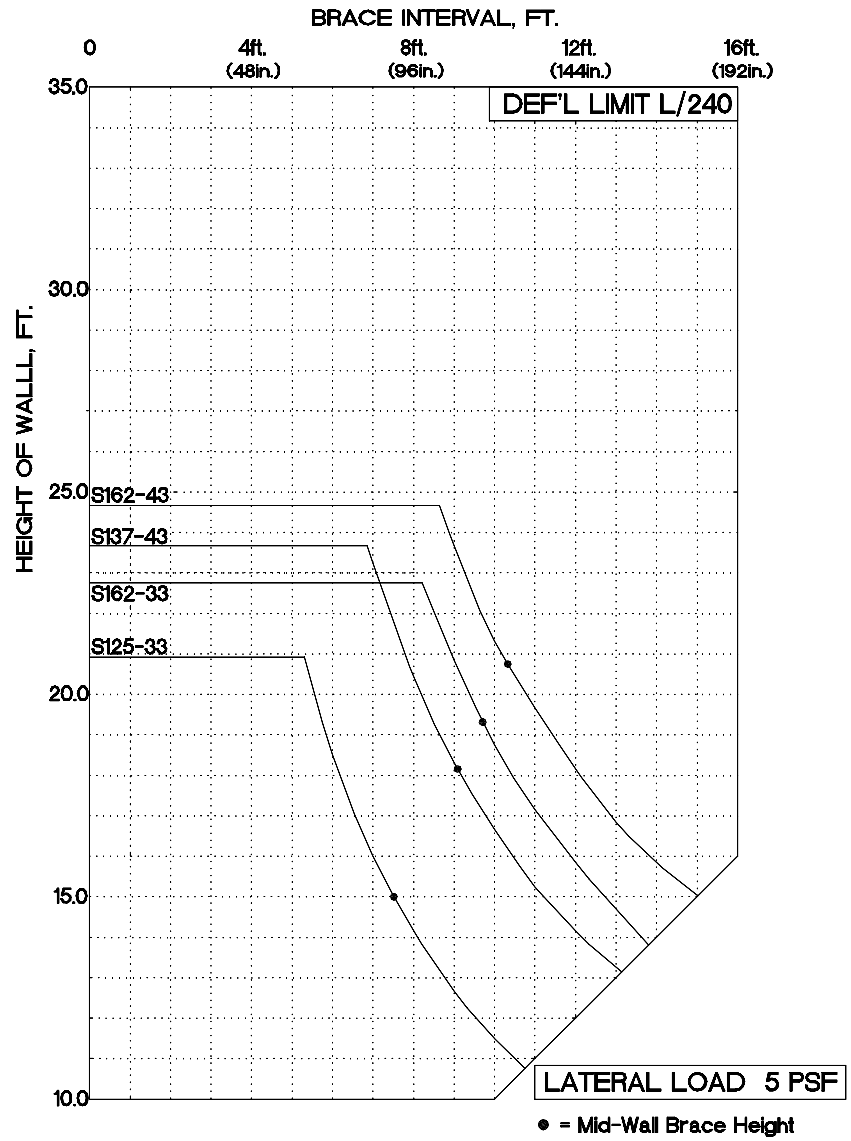


FIGURE 8B

600 (6") STUD @ 24" O.C.



SSMA

INDUSTRY TECHNICAL NOTE
COLD FORMED STEEL CONSTRUCTION

3

APRIL 2000

TRACK WITHIN A TRACK DEFLECTION ASSEMBLY

INTRODUCTION

Since the popular use of steel studs for framing full height walls, there has been a recognition that the top of the wall needs to allow for deflection of the floor or roof assembly above when subjected to an applied vertical live load. The allowance for deflection is essential for interior non-load bearing applications.

It has been common practice to utilize a track nested into another track with no attachment of the nested inner track to the outside track. Wall sheathing can be attached to the nested track providing the legs of the inside track are of sufficient length so the screw attachment does not interfere with the vertical movement of the deflection assembly. The track within a track allows the stud at the top of the wall to be attached to the inside track to provide a more uniform load transfer to the outside deflection track flange, and to stabilize the studs against rotation.

OBSERVATIONS

With the nested track attached to the stud flange (see Figure 1) the load transfer is uniformly distributed along the inner track to the leg of the outer track. Using the basics of strength of materials, the thickness of the outer deflection track can be determined.

It is recommended that the steel used for the deflection track (outer track) have good ductility characteristics, (tensile strength to yield point ratio not less than 1.08 and total elongation not less than 10 percent in a two-inch gage length). Good ductility characteristics reduce the possibility of micro cracking during the roll-forming process and provides inelastic reserve.

Satisfactory performance is based on the following:

1. Each stud flange is stabilized to resist rotation of the stud by attaching the stud flange to the leg of the nested (inner) track.
2. The inner track has sufficient stiffness to provide a uniform distribution of load to the deflection (outer) track.

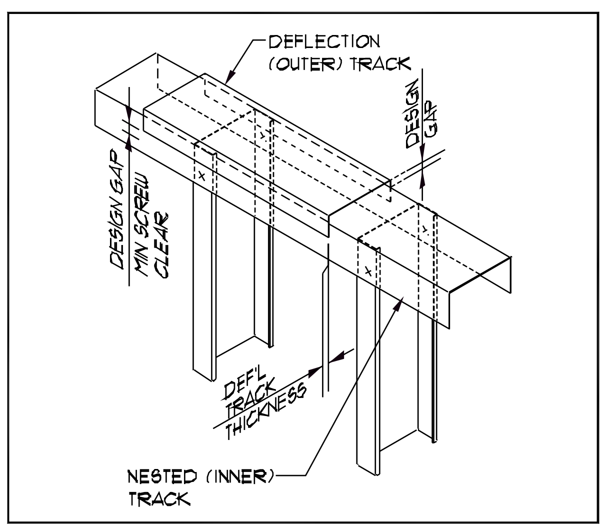


FIGURE 1

DEFLECTION TRACK THICKNESS DETERMINATION

Deflection track (outer track) thickness can be determined based on the principals of strength of materials. The equation for determining the required thickness is:

$$t = \sqrt{\frac{0.833 \cdot P \cdot e}{F_y}}$$

where:

t = required design thickness, in inches.

P = the maximum reaction at the top of the wall, in lbs/ft. NOTE: The equation includes the 0.75 reduction factor for wind or earthquake loads per A5.1.3 of the AISI Specification. (Check local building code for application of reduction factor).

e = distance between the track web and the point of application of the reaction P, in inches (design gap times 1.5).

F_y = minimum steel yield stress, in psi.

Design curves can be developed for a given non-load bearing (non-axial load) wall height, lateral load (typically 5psf for interior walls), design gap (gap between the inner and outer track webs), and the minimum yield stress of the material to be used, either 33 ksi or 50 ksi (50 ksi is noted on the curve). A series of such curves are given in Figures 2 through 5. The required design thickness of the defelection track (outer track) can then be determined from the figure.

Design load = 15 psf
Design gap = 0.5"
Wall height = 13'- 6"
Min. Steel Yield Stress = 33 ksi

From Figure 2 the deflection track design thickness of t = .0451" (18ga.) can be used.

NOTE: Maximum allowable wall height = 19.0 ft.

Thickness - Steel Components

Minimum Thickness[1] (mils)	Design Thickness (in)	Reference On Gauge No.
18	0.0188	25
27	0.0283	22
33	0.0346	20
43	0.0451	18
54	0.0566	16
68	0.0713	14
97	0.1017	12

[1] Minimum Thickness represents 95% of the design thickness and is the minimum acceptable thickness delivered to the job site based on Section A3.4 of the 1996 AISI Specification.

It is recommended that the depth of the deflection track (outer track) flange be equal to the design gap plus 1 inch for one story buildings, and equal to 2 times the design gap plus 1 inch for all other applications to provide engagement of the nested (inner) track into the deflection track. The longer track leg for multiple story buildings, allows for the floor system supporting the stud wall to deflect while still maintaining engagement of the stud in the deflection track.

The depth of the nested (inner) track flange that engages the wall stud should be equal to the design gap plus 1-½ inches for one story buildings, and equal to 2 times the design gap plus 1-½ inches for all other applications. The additional inner track flange length to be installed allows the screw connecting the track to the stud so the screw does not interfere with the vertical movement of the deflection assembly

NOTE: The minimum uncoated delivered thickness of the cold-formed product can be equal to 95 percent of the design thickness per the 1996 AISI "Specification for The Design of Cold-Formed Steel Structural Members", Section A3.4.

D

Notes:
a. Fy=33 ksi unless noted otherwise.
b. t=Design thickness.
c. Lateral load has been modified for duration of load (0.75) per A5.1.3 of the AISI Specification. No further reduction allowed; increase lateral load where other load durations govern.

DESIGN CHART FOR DEFLECTION (OUTER) TRACK[a,b,c.]

DESIGN GAP=1.0 in.

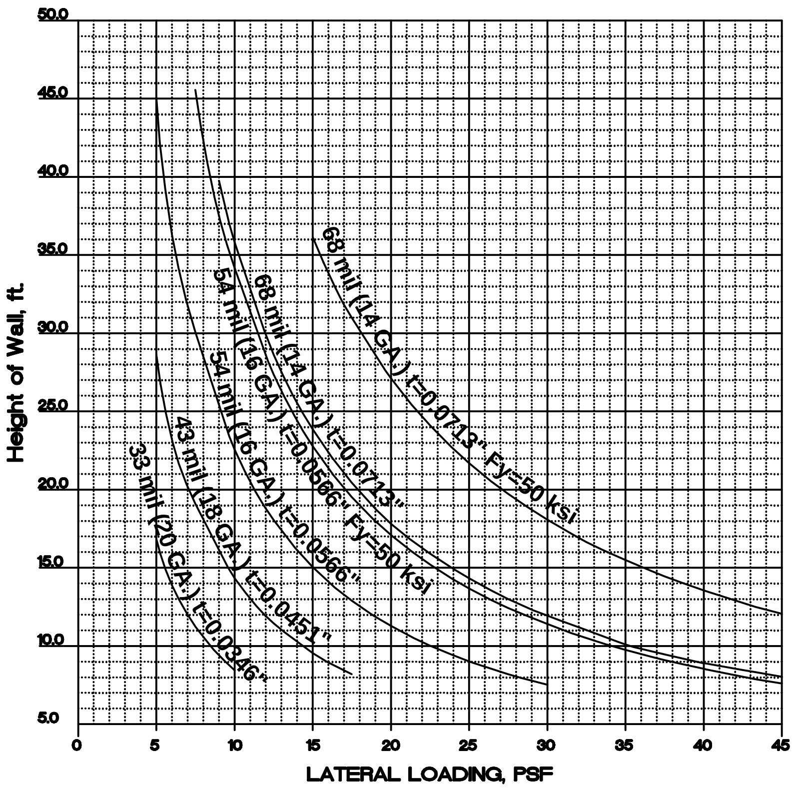


FIGURE 4

DESIGN GAP=1.5 in.

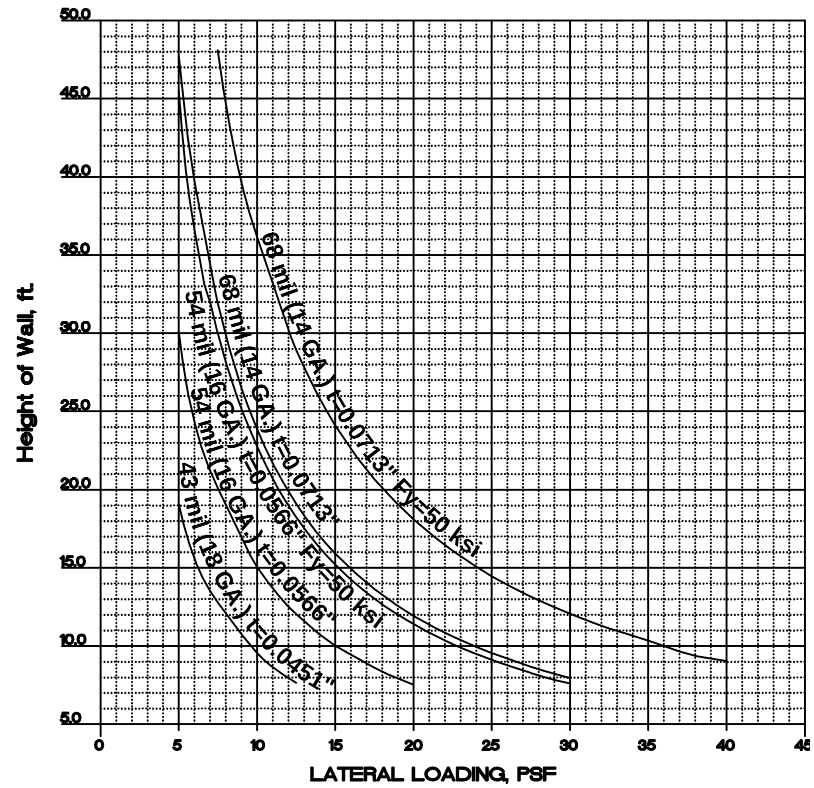


FIGURE 5

Notes:

a. Fy=33 ksi unless noted otherwise.
b. t=Design thickness.
c. Lateral load has been modified for duration of load (0.75) per A5.1.3 of the AISI Specification. No further reduction allowed; increase lateral load where other load durations govern.

SSMA	**INDUSTRY TECHNICAL NOTE** **COLD FORMED STEEL CONSTRUCTION**	**4**
		NOV 2001

INTERIOR NON-STRUCTURAL 30 MIL FRAMED WALLS

INTRODUCTION

Non-Structural interior walls framed with cold-formed steel studs were tested in order to determine limiting wall heights based on the composite action between the gypsum sheathing attached to each stud flange. The SSMA "Product Technical Information" catalog has composite non-structural interior wall tables with a minimum base steel thickness range of 18 mils to 68 mils (.0179 in to .0677 in) except for 30 mil thickness steels which in certain geographic regions is considered a drywall stud (20 ga).

The member companies of SSMA selected Professor Tom Miller at Oregon State University, to complete a series of 30 mil test panels with various stud depths for determining the limiting wall heights for interior applications. These tests were initiated to complement the testing completed by OSU for steel with a thickness of 18 mil to 68 mil for determining the limiting height wall tables incorporated in ASTM A754.

OBSERVATIONS

The testing was completed to determine the limiting height based on deflection, flexural stress, or web crippling. It was generally observed that the deflection is the controlling criteria for limiting the wall height for a given applied uniform pressure.

The test assemblies were constructed using 30 mil thick steel C-sections that complied with the dimensional properties established by SSMA. Each face of the stud and track flanges received ½" gypsum board attached with screws spaced at 12 in o.c. in the field and ends.

The track sections used were the same thickness as the studs. When the studs were engaged into the track at each end of the wall assembly, the only attachment being made to secure the stud and track together was the screws installed through the gypsum board into each framing member.

There was no positive screw attachment between the track and stud to simulate field conditions.

The various assemblies were tested in a vacuum chamber with incremental pressures applied and deflection data recorded. The tested assemblies were tested in a vertical orientation to simulate field service conditions. Gypsum board used in the test matrix was obtained from different manufactures and randomly selected for fabrication of the test panels.

Based on information supplied by the Gypsum Association in the original series of tests, regular gypsum board provided the least increase stiffness and strength when compared to other types of wall board (i.e., moisture-resistant board, type x, etc.)

All testing was completed in accordance with ICBO Evaluation Service AC86 "Acceptance Criteria for Determining Heights of Composite Walls Constructed of Gypsum Board and Steel Studs."

LIMITING HEIGHT

The data recorded from the tested assemblies was normalized for dimensional differences; thicknesses measuring differently than 30 mil base metal thickness and yield strength differing from a minimum yield of 33 ksi.

The limiting heights shown in Table 1 are based on a minimum yield stress of 33 ksi. The section properties used for normalizing the calculated flexural stress and web crippling, was based on the 1996 American Iron and Steel Institute's "Specification for Designing Cold-Formed Steel Members."

TABLE 1
MAXIMUM STUD HEIGHT [1, 2, 3]

Stud Size	Frame Spacing (in) o.c.	5 psf			7.5 psf			10 psf		
		L/120	L/240	L/360	L/120	L/240	L/360	L/120	L/240	L/360
162S125-30	12	12' 5"	9' 11"	-	10' 10"	-	-	9' 11"	-	-
162S125-30	16	11' 6"	9' 2"	-	10' 1"	-	-	9' 2"	-	-
162S125-30	24	10' 5"	8' 3"	-	9' 2"	-	-	8' 3"	-	-
250S125-30	12	16' 8"	13' 2"	11' 6"	14' 7"	11' 6"	10' 0"	13' 2"	10' 5"	9' 1"
250S125-30	16	15' 4"	12' 1"	10' 6"	13' 4"	10' 6"	9' 2"	12' 1"	9' 6"	8' 4"
250S125-30	24	13' 9"	10' 9"	9' 4"	11' 11"	9' 4"	8' 1"	10' 9"	8' 6"	7' 4"
350S125-30[4]	12	21' 8"	17' 1"	14' 10"	18' 11"	14' 10"	12' 10"	17' 1"	13' 5"	11' 8"
350S125-30[4]	16	19' 11"	15' 8"	13' 7"	17' 5"	13' 7"	11' 9"	15' 8"	12' 3"	10' 7"
350S125-30[4]	24	17' 9"	14' 0"	12' 0"	15' 6"	12' 0"	10' 5"	14' 0"	10' 10"	9' 4"
400S125-30	12	24' 0"	19' 0"	16' 6"	20' 11"	16' 6"	14' 4"	19' 0"	14' 11"	12' 11"
400S125-30	16	22' 0"	17' 6"	15' 2"	19' 3"	15' 2"	13' 1"	17' 6"	13' 8"	11' 10"
400S125-30	24	19' 8"	15' 7"	13' 5"	17' 1"f	13' 5"	11' 7"	14' 9"f	12' 1"	10' 5"
600S125-30	12	32' 1"	25' 6"	22' 3"	28' 0"	22' 3"	19' 5"	24' 7"f	20' 3"	17' 6"
600S125-30	16	29' 2"	23' 2"	20' 3"	24' 9"f	20' 3"	17' 8"	21' 5"f	18' 4"	15' 10"
600S125-30	24	25' 1"f	20' 3"	17' 8"	20' 6"f	17' 8"	15' 5"	17' 9"f	16' 0"	13' 8"

f Flexural stress controls allowable height.

1 Based on tests conducted with ½" gypsum board attached with screws spaced 12 in o.c. to framing members.

2 Maximum stud heights also applicable to walls sheathed with gypsum board greater than ½" thick and multiple layout of gypsum.

3 Runner track flanges need not be fastened to stud flanges except at doorjambs, window frames, partition intersections, and corners.

4 Also applicable to 3-5/8"stud depth 362S125-30.

INDUSTRY TECHNICAL NOTE **COLD FORMED STEEL CONSTRUCTION**	**5** **FEB 2002**

METRIC CONVERSION – SSMA TABLES

INTRODUCTION

Occasionally it is desirable to convert English units to metric units especially for federal projects where a "soft conversion" is required.

SSMA along with the input from the ASTM Committees that address cold-formed steel issues have agreed that a "soft conversion" is appropriate for section properties and the limiting load or span capacities, but is not required for the section designator. The depth of the member, width of the flange, and thickness are part of the designation call-out and is not to be converted to a metric designator. The designator is for specifying a certain member configuration, which is based on the English system, however it does not require converting to a metric designator. As an example, 600S162-33 in the English system would remain 600S162-33 in the metric system. All of the section properties and limiting heights or load capabilities can be converted to the metric system using a conversion multiplier.

OBSERVATIONS

To perform the "soft conversion", the appropriate conversion factor must be used for each section property value and each load or limiting height table. In general, dimensions will be expressed in millimeters (mm), height in meters (m), loads per unit length in Newton per meter (N/m), and applied pressure in Newton per square meter (N/m^2). Allowable spans will be expressed in meters (m), allowable axial loads in kilo Newtons (k-N), and allowable uniform loads in Newton per meter of length (N/m).

For the commonly used section property values, the yield stress (F_y) will be expressed in megapascals (Mpa), moment of inertia (I_{xx}) in millimeters to the fourth power (mm^4), section modulus (S_{xx}) in millimeters to the third power (mm^3), cross sectional area (A) in millimeters squared (mm^2), and allowable moment (M_a) in Newton-meters (N-m).

To assist with the "soft conversion", the common references and dimensional properties of the SSMA published standard shapes can be cross referenced as follows:

Thickness – Steel Components

Minimum Thickness (mils)	Minimum Thickness (mm)	Design Thickness (inches)	Design Thickness (mm)	Gauge Reference Only
18	0.454	0.0188	0.478	25
27	0.683	0.0283	0.719	22
30	0.753	0.0312	0.792	20(drywall)
33	0.835	0.0346	0.879	20(structural)
43	1.088	0.0451	1.146	18
54	1.366	0.0566	1.438	16
68	1.720	0.0713	1.811	14
97	2.454	0.1017	2.583	12

Member Properties

Web Depths (inches)	Web Depths (mm)	Flanges (inches)	Flanges (mm)
1.625	41	1.00	25
2.5	64	1.25	32
3.5	89	1.375	35
3.625	92	1.50	38
4	102	1.625	41
5.5	140	2.00	51
6	152	2.50	64
8	203		
10	254		
12	305		

CONVERSION VALUES

The conversion values to be used for the section properties and allowable load or span tables listed in the SSMA Catalog are as follows:

Section Properties	Multiplier	Units
Dimensions in inches	25.4	mm
Yield Stress (F_y) ksi	6.895	Mpa
Area in sq. inches	645.2	mm^2
Weight in lb/ft	14.592	N-m
Mom. of Inertia (I_{xx},I_{yy}) in^4	416,231	mm^4
Sect. Modulus (S_{xx},S_{yy}) in^3	16,387	mm^3
Allowable Mom. (M_a) in-kips	113.0	N-m
Allowable Shear (V_a) lb	4.448	N
St. Venant Constant (J) in^4	416,231	mm^4
Warping Constant (C_w) in^6	268.5×10^6	mm^6
Allowable Tables	**Multiplier**	**Units**
Limiting Span (ft & in) (convert to feet first)	0.3048	meter (m)
Pounds/sq.ft. (psf)	47.880	N/m^2
Kips (1000 lbs)	4.448	k-N
Uniform Loads (lb/ft)	14.594	N/m
Load in Pounds (lbs)	4.448	N
Pound per Inch (lb/in)	0.175	N/mm

EXAMPLE

An example of a standard section from the SSMA Catalog will be used to demonstrate a conversion from English to metric units. A **600S162-33** will be used in this example.

Section Properties (Page 7)		
Area (in^2) =	(0.344 x 645.2) =	221.9mm^2
Weight (lb/ft) =	(1.17 x 14.592) =	17.07 N/m
Effective I_{xx} (in^4) =	(1.793 x 416,231) =	746,302mm^4
Effective S_{xx} (in^3) =	(0.577 x 16,387) =	9,455mm^3
Allow. Mom. M_a (in-k) =	(11.41x 113.0) =	1289 N-m
Allowable Shear V_a (lb) =	(612 x4.448) =	2722 N
Torsional Properties:		
St. Venant Coef. J =	(0.137x416,231) =	57,023mm^4
Warping Cons. C_w =	($0.851 \times 268.5 \times 10^6$) =	228.5×10^6
Shear Ctr. to N.A. X_o =	(-1.091x25.4) =	-27.711mm
Radii of Gyration R_o =	(2.595x25.4) =	65.913mm

The allowable limit values for this section can also be converted based on the respective tables in the SSMA Catalog.

Limiting Wall Heights – Curtain Wall (Page 18)

15psf (718 N/m^2), 16 in. oc (406mm)		
L/240	18' 0"	(18.0' x 0.3048) = 5.49m
L/360	15' 9"	(15.75' x 0.3048) = 4.80m
L/600	13' 3"	(13.25' x 0.3048) = 4.04m

Combined Axial And Lateral Load (Page 23)

20psf (957 N/m^2), 10ft. Wall (3.05m)	
12" oc 305mm)	2.54 Kips (x 4.448) = 11.30 k-N
16" oc 406mm)	2.41 Kips (x 4.448) = 10.72 k-N
24" oc 610mm)	1.95 Kips (x 4.448) = 8.67 k-N

Floor Joist Span Tables (Page 33)

10psf (479 N/m^2), 40psf (1915 N/m^2), Single Span	
12" oc (305mm)	12' 3" (12.25' x 0.3048) = 3.73m
16" oc (406mm)	10' 8" (10.67' x 0.3048) = 3.25m
24" oc (610mm)	8' 8" (8.67' x 0.3048) = 2.64m

Header Allowable Uniform Loads (Page 37)

3' Span (0.91m), 816 lb/ft (x 14.594) =	11,909 N/m
4' Span (1.22m), 612 lb/ft (x 14.594) =	8931 N/m
5' Span (1.52m), 489 lb/ft (x 14.594) =	7136 N/m
6' Span (1.83m), 408 lb/ft (x 14.594) =	5954 N/m
8' Span (2.44m), 237 lb/ft (x 14.594) =	3459 N/m

Allow. Web Crippling - Single Member (Page 40)

Condition 1, with Different Bearing Lengths
1.0" (25mm) 156lbs (x 4.448) = 694 N/web
3.5" (89mm) 244lbs (x 4.448) = 1085 N/web
4.0" (102mm) 262lbs (x 4.448) = 1165 N/web
6.0" (152mm) 332lbs (x 4.448) = 1477 N/web

Allow. Ceiling Spans - Def'l Limit L/240 (Page 42)

4psf (192 N/m^2) Unsupported Compression Flange	
Joist Spacing	
12"oc (305mm)	16' 10" (16.83' x .3048) = 5.13m
16"oc (406mm)	15' 7" (15.58' x .3048) = 4.75m
24"oc (610mm)	14' 0" (14.0' x .3048) = 4.27m