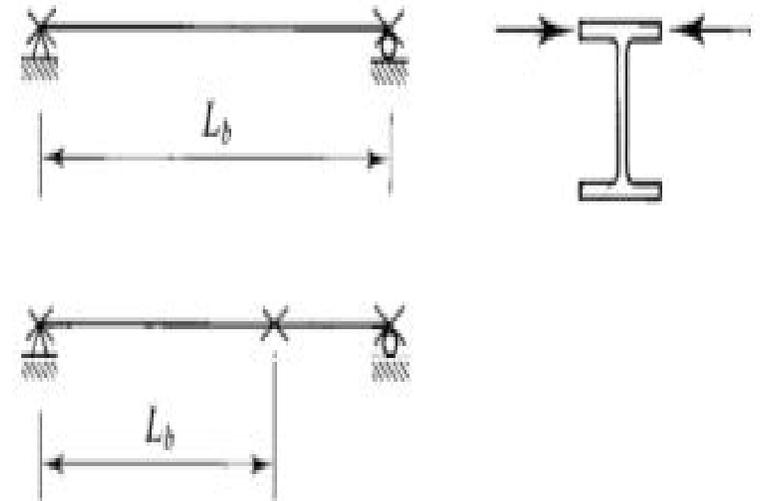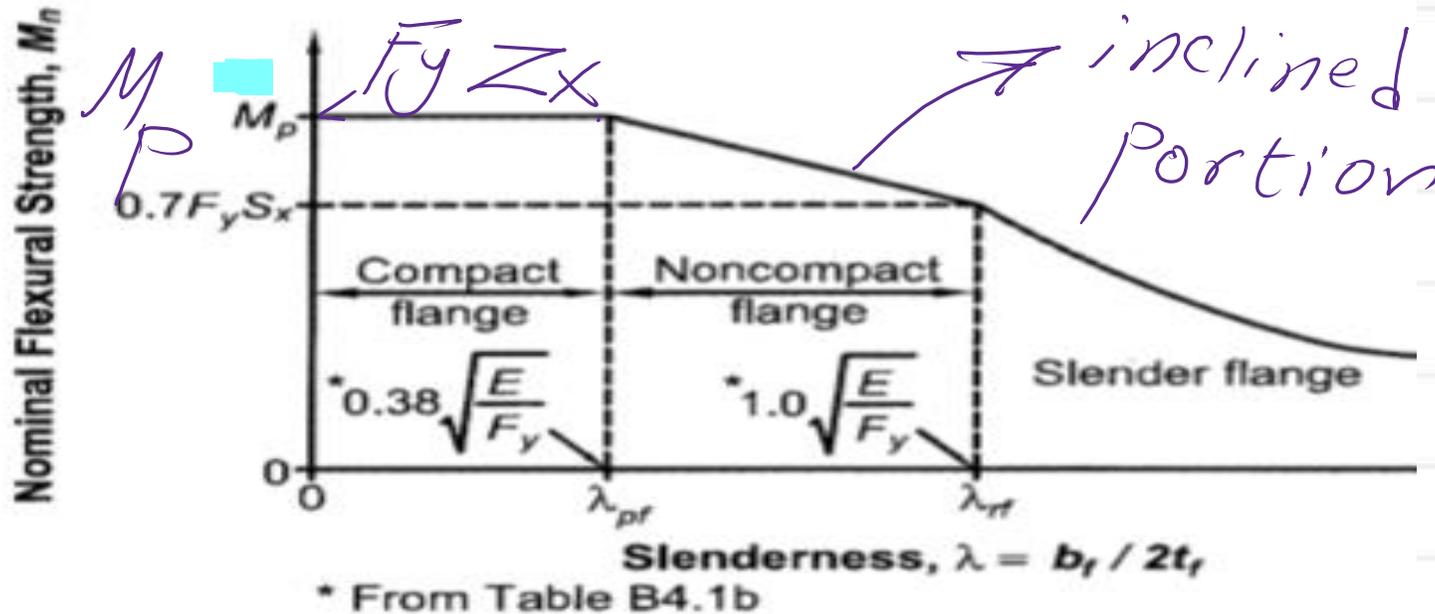## Compact Section

A compact section is one that can develop a plastic hinge prior to local buckling of the flange or web, provided that adequate lateral bracing is provided. The criteria for determining compactness in the flange of rolled beams are defined in AISC 360 Table B4.1b as

Horizontal Portion

$$M_n = M_p = F_y Z_x$$

$$M_n = M_p - \left(\frac{M_p - 0.7 f_y S_x}{\lambda_r - \lambda_p} \right) (\lambda - \lambda_p)$$

inclined Portion

M_p

$\frac{M}{P}$ $F_y Z_x$

L_b

L_b

Nominal Flexural Strength, M_n

M_p

$0.7 F_y S_x$

Compact flange

Noncompact flange

$0.38 \sqrt{\dfrac{E}{F_y}}$

$1.0 \sqrt{\dfrac{E}{F_y}}$

Slender flange

λ_{pf}

λ_{rf}

Slenderness, $\lambda = b_f / 2t_f$

* From Table B4.1b

CHAPTER B

DESIGN REQUIREMENTS

This chapter addresses general requirements for the design of steel structures applicable to all chapters and appendices of this Specification.

The chapter is organized as follows:

B1.   General Provisions
B2.   Loads and Load Combinations
B3.   Design Basis
B4.   Member Properties   ← *Member Properties*
B5.   Fabrication and Erection
B6.   Quality Control and Quality Assurance
B7.   Evaluation of Existing Structures
B8.   Dimensional Tolerances

Table B4.1b   *for beams*

TABLE B4.1b
Width-to-Thickness Ratios: Compression Elements
Members Subjected to Flexure

Case	Description of Element	Width-to-Thickness Ratio	Limiting Width-to-Thickness Ratio		Examples
			λ_p (compact/noncompact)	λ_r (non-compact/slender)	
10	(1) Flanges of rolled I-shaped sections (2) Flanges of channels (3) Flanges of tees	b/t	$0.38\sqrt{\dfrac{E}{F_y}}$	$1.0\sqrt{\dfrac{E}{F_y}}$	
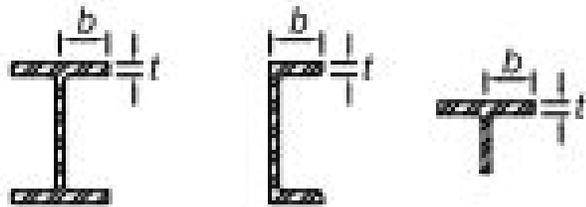
Flange Part

The first category, laterally supported compact beams, is quite common and is the simplest case. For a doubly-symmetric, compact I- or C-shaped section bent about its major axis, AISC F2.1 gives the nominal strength as

$$M_n = M_p \qquad \text{(AISC Equation F2-1)}$$

where

$$M_p = F_y Z_x$$

Width to Thickness relation

AISC 360 spec. Table B 4.1b

TABLE B4.1b
Width-to-Thickness Ratios: Compression Elements
Members Subject to Flexure

Case	Description of Element	Width-to-Thickness Ratio	Limiting Width-to-Thickness Ratio		Examples
			λ_p (compact/ noncompact)	λ_r (noncompact/ slender)	
10	Flanges of rolled I-shaped sections, channels, and tees	b/t	$0.38\sqrt{\dfrac{E}{F_y}}$	$1.0\sqrt{\dfrac{E}{F_y}}$	

Prepared by Eng.Maged Kamel.

λ = width-to-thickness ratio

λ_p = upper limit for compact category

λ_r = upper limit for noncompact category

Then

if $\lambda \leq \lambda_p$ and the flange is continuously connected to the web, the shape is compact;

if $\lambda_p < \lambda \leq \lambda_r$, the shape is noncompact; and

if $\lambda > \lambda_r$, the shape is slender.

Local buckling Parameters

For $E = 29000$ ksi

$\lambda \infty f(\sqrt{F_y})$

$\dfrac{0.38\sqrt{29(10^3)}}{\sqrt{f_y}} = \dfrac{64.7}{\sqrt{f_y}}$

For $E = 29 \times 10^6$
$F_y = 50 \times 10^3$
or Higher

Element	λ	λ_p	λ_r
Flange	$\dfrac{b_f}{2t_f}$	$0.38\sqrt{\dfrac{E}{F_y}}$	$1.0\sqrt{\dfrac{E}{F_y}}$ → $\dfrac{170.30}{\sqrt{f_y}}$
Web	$\dfrac{h}{t_w}$	$3.76\sqrt{\dfrac{E}{F_y}}$	$5.70\sqrt{\dfrac{E}{F_y}}$ → $\dfrac{970.67}{\sqrt{f_y}}$

$\dfrac{3.76\sqrt{29\times10^3}}{\sqrt{f_y}} = \dfrac{640.30}{\sqrt{f_y}}$

Prepared by Eng.Maged Kamel.