5.2-3 Verify the value of Z_x for a W18 × 50 that is tabulated in the dimensions and properties tables in Part 1 of the *Manual*.

I ⇒ T WT 9 x 25

I WT 9 x 25

W18x50

Part-1 of Table 1-8

t_F = 7.5"

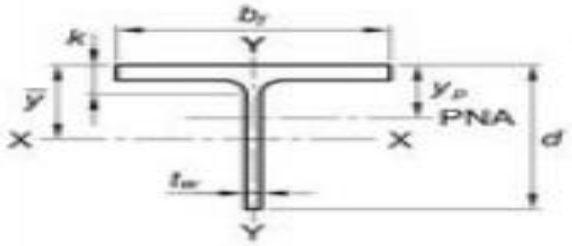


Table 1-8 (continued)
WT-Shapes
Dimensions

Shape	Area, A	Depth, d	Stem			Flange		Distance		
			Thickness, t_w	$\frac{t_w}{2}$	Area	Width, b_f	Thickness, t_f	k		Workable Gage
								k_{des}	k_{det}	
	in.²	in.	in.	in.	in.²	in.	in.	in.	in.	in.
×25[c]	7.34	9.00	9	0.355	3/8	3/16	3.19	7.50	7 1/2	0.570	9/16	0.972	1 1/4	
WT9×23[c]	6.77	9.03	9	0.360	3/8	3/16	3.25	6.06	6	0.605	5/8	1.01	1 1/4	3 1/2
×20[c]	5.88	8.95	9	0.315	5/16	3/16	2.82	6.02	6	0.525	1/2	0.927	1 3/16	
×17.5[c,v]	5.15	8.85	8 7/8	0.300	5/16	3/16	2.66	6.00	6	0.425	7/16	0.827	1 1/8	

⇒ Area = 7.34 inch²

depth = 9.00"

5.2-3 Verify the value of Z_x for a W18 × 50 that is tabulated in the dimensions and properties tables in Part 1 of the *Manual*.

Part 2- of Table 1-8

Table 1-8 (continued)
WT-Shapes
Properties

$\bar{y} = 2.12$"

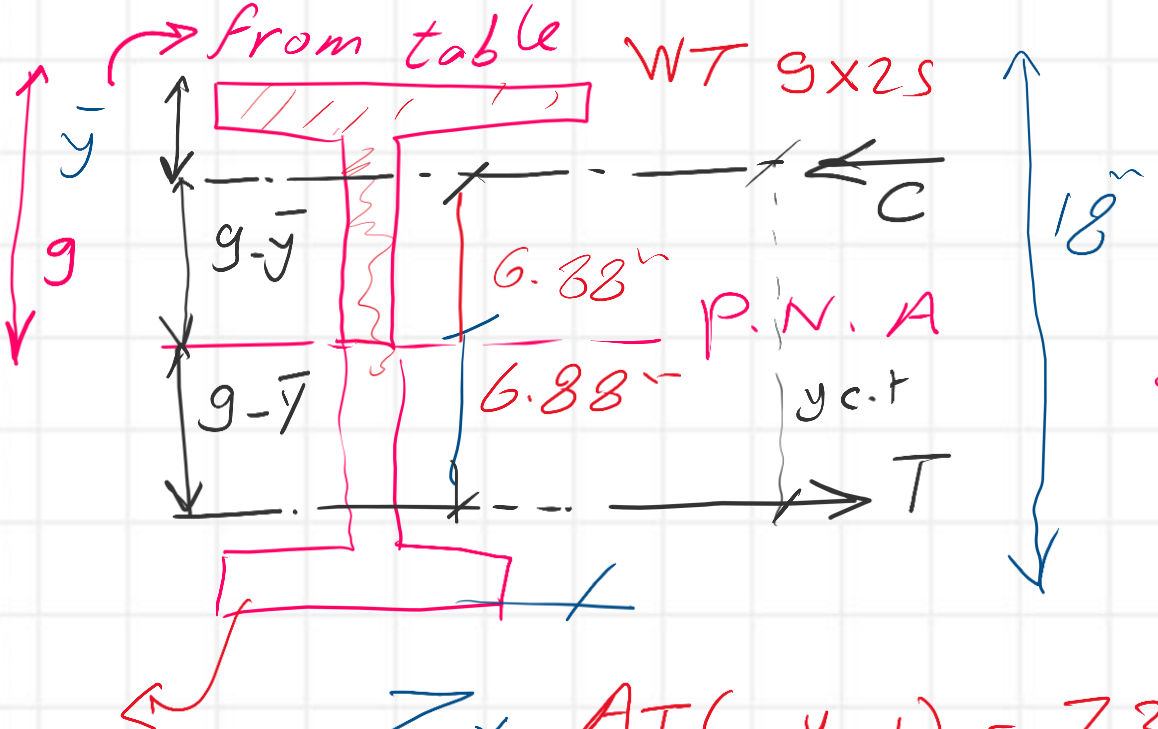
$I_{\bar{y}}$, $\bar{y}$, h

Nom-inal Wt.	Compact Section Criteria		Axis X-X						Axis Y-Y				Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{d}{t_w}$	I	S	r	$\bar{y}$	Z	y_p	I	S	r	Z	J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{6}
27.5	5.98	23.2	59.5	8.63	2.71	2.16	15.3	0.538	22.5	5.97	1.67	9.26	0.830	1.84
25	6.57	25.4	53.5	7.79	2.70	2.12	13.8	0.489	20.0	5.35	1.65	8.28	0.619	1.36

$\bar{y}$

5.2-3 Verify the value of Z_x for a W18 × 50 that is tabulated in the dimensions and properties tables in Part 1 of the *Manual*.

If We Consider W18 x 50 as 2WT 9x25



$\bar{y} = 2.12"$ From table 1-8

$A = 7.34$ inch^2

$y_{c.t} = 18 - 2\bar{y}$

$= 18 - (2)(2.12)$

$= 18 - 4.24 = 13.76$

$Z_x = \frac{A_T}{2}(y_{c.t}) = 7.34(13.76) = 100.998$ inch^3

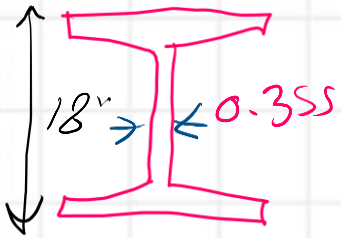
≈ 101 inch^3

From Table 1-8

5.2-3 Verify the value of Z_x for a W18 × 50 that is tabulated in the dimensions and properties tables in Part 1 of the *Manual*.

Part – 1

$t_F = 0.570''$



$A = 14.70$ inch²

$\frac{AT}{2}$

d

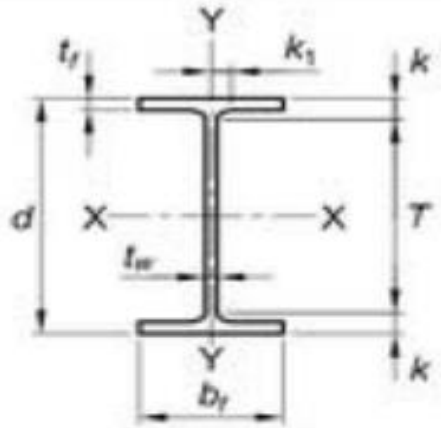


Table 1-1
W-Shapes
Dimensions

Shape	Area, A	Depth, d		Web: Thickness, t_w		Web: $\frac{t_w}{2}$	Flange: Width, b_f		Flange: Thickness, t_f		Distance: k, k_{des}	Distance: k, k_{det}	Distance: k_1	Distance: T	Distance: Workable Gage
	in.²	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
W18×71	20.9	18.5	18 1/2	0.495	1/2	1/4	7.64	7 5/8	0.810	13/16	1.21	1 1/2	7/8	15 1/2	3 1/2
×65	19.1	18.4	18 3/8	0.450	7/16	1/4	7.59	7 5/8	0.750	3/4	1.15	1 7/16	7/8		
×60[c]	17.6	18.2	18 1/4	0.415	7/16	1/4	7.56	7 1/2	0.695	11/16	1.10	1 3/8	13/16		
×55[c]	16.2	18.1	18 1/8	0.390	3/8	3/16	7.53	7 1/2	0.630	5/8	1.03	1 5/16	13/16		
×50[c]	14.7	18.0	18	0.355	3/8	3/16	7.50	7 1/2	0.570	9/16	0.972	1 1/4	13/16		

5.2-3 Verify the value of Z_x for a W18 × 50 that is tabulated in the dimensions and properties tables in Part 1 of the *Manual*.

2nd Part

W 18X50

$Z_x = 101\ inch^3$

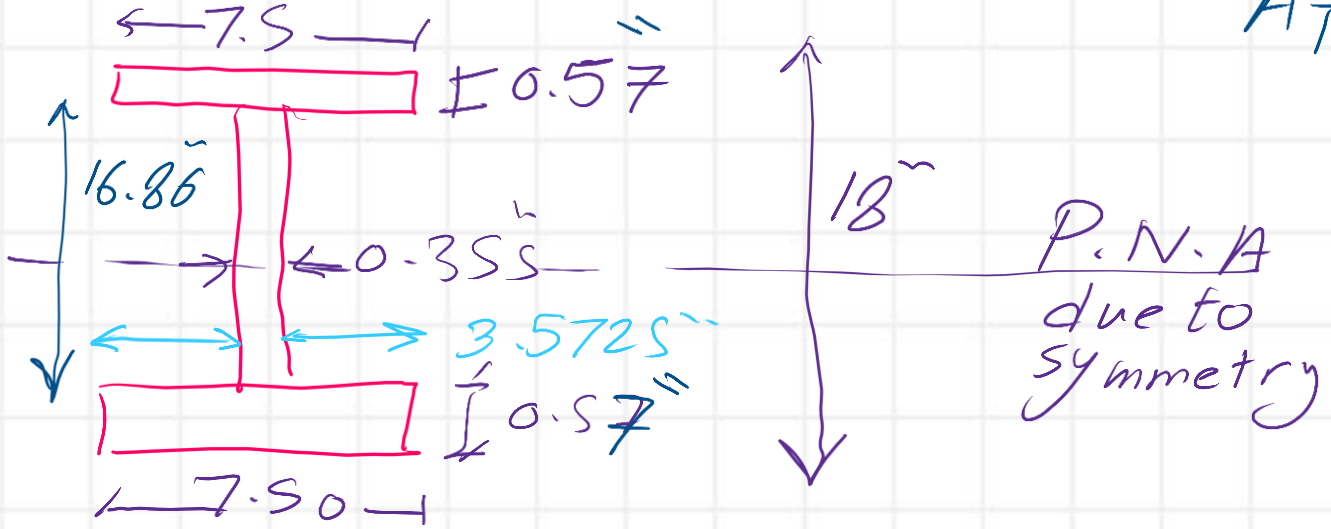
To check

Table 1-1 (continued)
W-Shapes
Properties

W18–W16

Nom-inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
71	4.71	32.4	1170	127	7.50	146	60.3	15.8	1.70	24.7	2.05	17.7	3.49	4700
65	5.06	35.7	1070	117	7.49	133	54.8	14.4	1.69	22.5	2.03	17.7	2.73	4240
60	5.44	38.7	984	108	7.47	123	50.1	13.3	1.68	20.6	2.02	17.5	2.17	3850
55	5.98	41.1	890	98.3	7.41	112	44.9	11.9	1.67	18.5	2.00	17.5	1.66	3430
50	6.57	45.2	800	88.9	7.38	101	40.1	10.7	1.65	16.6	1.98	17.4	1.24	3040

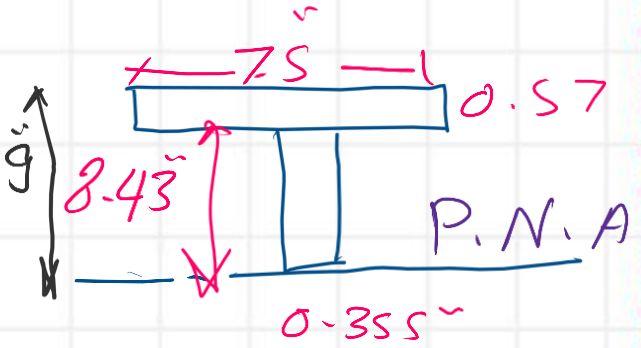
5.2-3 Verify the value of Z_x for a W18 × 50 that is tabulated in the dimensions and properties tables in Part 1 of the *Manual*.



$$A_T = 2(7.5)(0.57) + 16.86(0.355)$$
$$= 8.55 + 5.985 = 14.535 \text{ inch}^2$$

$$A_T = 14.70 \text{ inch}^2$$

$$Z = \frac{M_P}{F_y} = \frac{C \cdot y_{c.t}}{F_y} = \frac{A_T}{2} \cdot \frac{y_{c.t}}{F_y} \cdot F_y = \frac{A_T}{2} \cdot y_{c.t}$$



$$h - \bar{y} = \frac{7.5(0.57)(8.43 + 0.285) + 0.355(8.43)^2(\frac{1}{2})}{(14.535/2)}$$

5.2-3 Verify the value of Z_x for a W18 × 50 that is tabulated in the dimensions and properties tables in Part 1 of the *Manual*.

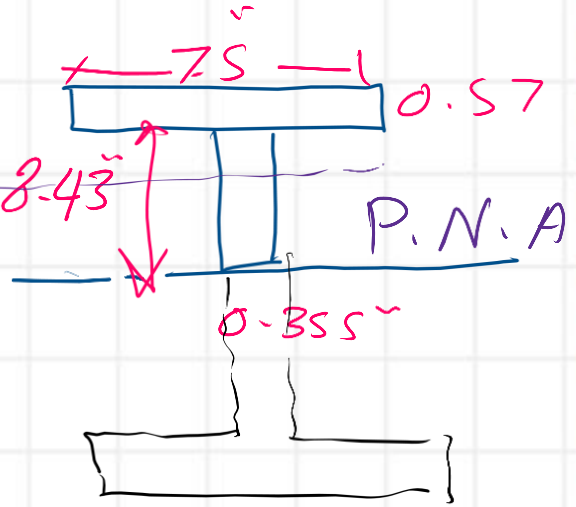
$$h-\bar{y} = \frac{7.5(0.57)(8.43+0.285)+0.355(8.43)^2\left(\frac{1}{2}\right)}{(14.535)\frac{1}{2}}$$

$$= 37.257 + 12.614) / 7.2675$$

$$h-\bar{y} = 6.8622$$

From P.N.A

$$(h-\bar{y}) = 6.8622$$



$$Y_{CT} = 2(h-\bar{y}) = 2(6.8622) = 13.7244 \text{ inch}^2$$

$$Z_x = \frac{A_T}{2} Y_{C.T} = \frac{14.535}{2}(13.7244) = 99.742 \text{ inch}^3$$

$$Z_x = 101.0 \text{ inch}^3 \text{ from table}$$