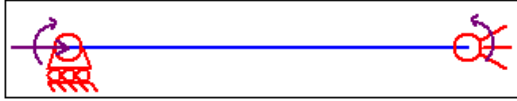


<b>TEST SCHEDULE B 23</b>	<b>EN 1993-1-1: 2005 (EUROCODE 3)</b>	<b>Sargon ©, Cescoplus ©</b>
BUCKLING	COMPRESSION + BENDING 2	<b>EC3.BUC.NNM2.003</b>



**Program:** WEURO © version October 2007 for Sargon and Cescoplus  
**Keywords:** EN 1993, Eurocode 3, example, validation, benchmark, reliability, quality control, error measure. **Parole chiave:** Eurocodice 3, esempio, validazione, test ,affidabilità, controllo di qualità, misura dell'errore  
**Tv**=exploitation target value, **Cv**=exploitation computed value  
**Authors:** Ing. Marco Croci, Ing. Paolo Rugarli

<b>BEAM</b>			
Length [mm]	Buckling factors	Left end	Right end
3500	$\beta_1=0 \quad \beta_2=1 \quad \beta_3=1$	SIMPLY SUPPORTED	HINGE

<b>LOAD</b>			
Type	Value	Point of application	
COMPRESSION	N=2.400.000N	LEFT END	
Type	Value	Point of application	
BENDING MOMENT $M_2$	M=180.000.000Nmm	LEFT END	
BENDING MOMENT $M_2$	M=-180.000.000Nmm	RIGHT END	

<b>MATERIAL</b>	<b>S235</b>					
$f_y$ [N/mm <sup>2</sup> ]	$f_u$ [N/mm <sup>2</sup> ]	E [N/mm <sup>2</sup> ]	$\nu$	$\gamma_{M0}$	$\gamma_{M1}$	$\gamma_{M2}$
235	360	2,10E+05	0,3	1,1	1,1	1,25

<b>CROSS-SECTION</b>	<b>HE 300 M</b>	<b>CLASS: N → 1 M<sub>2</sub> → 1 N + M<sub>2</sub> → 1 (reclasses method****)</b>			
A [mm <sup>2</sup> ]	$J_2$ [mm <sup>4</sup> ]	$J_3$ [mm <sup>4</sup> ]	$J_t$ [mm <sup>4</sup> ]	$W_2$ [mm <sup>3</sup> ]	$W_3$ [mm <sup>3</sup> ]
30308	5,920E+08	1,940E+08	1,408E+07	3,482E+06	1,252E+06
$W_{pl2}$ [mm <sup>3</sup> ]	$W_{pl3}$ [mm <sup>3</sup> ]	$i_2$ [mm]	$i_3$ [mm]	$i_t$ [mm]	
4,078E+06	1,913E+06	139,8	80	89,49	
h	b	$t_w$	$t_f$	r	
340	310	21	39	27	

<b>OTHER DATA*</b>				
	$k_{yy}$	$k_{yz}$	$k_{zy}$	$k_{zz}$
Method 1	0,965	/	0,520	/
Method 2	1,025	/	0,615	/

**TARGET VALUES BASED ON PRELIMINAR COMPUTATIONS**

$$\left. \begin{aligned}
 Tv_{1,j} &= N / (\chi_2 A f_y / \gamma_{M1}) + k_{yy} M_2 / (\chi_{LT} W_{pl2} f_y / \gamma_{M1}) \\
 Tv_{2,j} &= N / (\chi_3 A f_y / \gamma_{M1}) + k_{zy} M_2 / (W_{pl2} f_y / \gamma_{M1})
 \end{aligned} \right\} Tv_{method j} = \max(Tv_{1,j}, Tv_{2,j})$$

$Tv_{method1}^{**}$	$Tv_{method2}^{***}$
5,791E-01	5,915E-01

**CHECKER'S RESULTS (COMPUTED VALUES) AND COMPARISON WITH THE TARGET**

$Cv_{method1}$	$(Cv_1 - Tv_1) / Tv_1$	$Cv_{method2}$	$(Cv_2 - Tv_2) / Tv_2$
5,791E-01	<b>1,184E-05</b>	5,915E-01	<b>-2,071E-05</b>

(\*) formulae given in EN 1993-1-1 6.3.3, annex A and annex B

(\*\*) more accurated

(\*\*\*) easier to use

(\*\*\*\*) P. Rugarli, *Strutture in acciaio, La classificazione delle sezioni, Commento all'Eurocodice 3*, EPC Libri, 2007