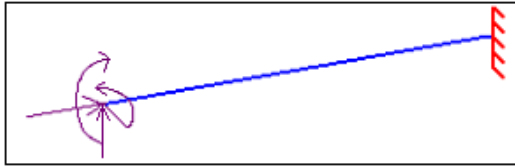


<b>TEST SCHEDULE R 50</b>	<b>EN 1993-1-1: 2005 (EUROCODE 3)</b>	<b>Sargon ©, Cescopus ©</b>
RESISTANCE	COMPRESSION+BENDING2 AND 3+ SHEAR2 AND 3	<b>EC3.RES.NNM2M3T2T3.004</b>



**Program:** WEURO © version October 2007 for Sargon and Cescopus  
**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]	Left end	Right end
5000	FREE	FIXED

<b>LOADS</b>			
Type	Value	Point of application	
BENDING MOMENT M <sub>2</sub>	M=60.000.000Nmm	LEFT END	
BENDING MOMENT M <sub>3</sub>	M=30.000.000Nmm	LEFT END	
COMPRESSION	N=900.000N	LEFT END	
SHEAR T <sub>2</sub>	T=400.000N	LEFT END	
SHEAR T <sub>3</sub>	T=220.000N	LEFT END	

<b>MATERIAL</b>	<b>S235</b>					
f <sub>y</sub> [N/mm <sup>2</sup> ]	f <sub>u</sub> [N/mm <sup>2</sup> ]	E [N/mm <sup>2</sup> ]	ν	γ <sub>M0</sub>	γ <sub>M1</sub>	γ <sub>M2</sub>
235	360	2,10E+05	0,3	1,1	1,1	1,25

<b>CROSS-SECTION</b>	<b>HE 240 A</b>	<b>CLASS: N<sup>-</sup> →1 M<sub>2</sub> →1 M<sub>3</sub> →1 N<sup>-</sup> + M<sub>2</sub> + M<sub>3</sub> →1 (reclasses metod**)</b>			
A [mm <sup>2</sup> ]	J <sub>2</sub> [mm <sup>4</sup> ]	J <sub>3</sub> [mm <sup>4</sup> ]	J <sub>t</sub> [mm <sup>4</sup> ]	W <sub>2</sub> [mm <sup>3</sup> ]	W <sub>3</sub> [mm <sup>3</sup> ]
7684	7,763E+07	2,769E+07	4,155E+05	6,751E+05	2,307E+05
W <sub>pl2</sub> [mm <sup>3</sup> ]	W <sub>pl3</sub> [mm <sup>3</sup> ]	i <sub>2</sub> [mm]	i <sub>3</sub> [mm]	i <sub>t</sub> [mm]	
7,446E+05	3,517E+05	100,5	60	69,28	
h	b	t <sub>w</sub>	t <sub>f</sub>	r	
230	240	7,5	12	21	

<b>OTHER DATA</b>					
N <sub>pl</sub> =A f <sub>y</sub> /γ <sub>M0</sub> [N]		M <sub>pl2</sub> =W <sub>pl2</sub> *f <sub>y</sub> /γ <sub>M0</sub> [Nmm]		M <sub>pl3</sub> =W <sub>pl3</sub> *f <sub>y</sub> /γ <sub>M0</sub> [Nmm]	
1.641.582		159.073.636		75.135.909	
A <sub>V3</sub> =A-2bt <sub>f</sub> +(t <sub>w</sub> +2r)t <sub>f</sub> [mm <sup>2</sup> ]		V <sub>pl2</sub> =A <sub>V2</sub> *(f <sub>y</sub> /√3)/γ <sub>M0</sub> [N]		V <sub>pl3</sub> =A <sub>V3</sub> *(f <sub>y</sub> /√3)/γ <sub>M0</sub> [N]	
2.518		710.456		310.578	
a <sub>V2</sub>	a <sub>V3</sub>	N <sub>pl.v</sub> =N <sub>pl</sub> *(1-ρ <sub>2</sub> a <sub>V2</sub> -ρ <sub>3</sub> a <sub>V3</sub> ) [N]		n <sub>v</sub> =N/N <sub>pl.v</sub>	
0,750	0,328	1.528.621		0,589	
M <sub>N2</sub> =M <sub>pl</sub> (1-n)/(1-0,5a) [Nmm]		M <sub>N3</sub> =M <sub>pl</sub> [1-((n-a)/(1-a)) <sup>2</sup> ] [Nmm]		w <sub>2,2</sub>	
74.761.688		59.806.521		0,843	
w <sub>3,2</sub>		w <sub>3,3</sub>		M <sub>NV2</sub> =M <sub>N2</sub> *(1-w <sub>2,2</sub> ρ <sub>2</sub> -w <sub>2,3</sub> ρ <sub>3</sub> )	
0,983		0,038		70.626.718	
				M <sub>NV3</sub> =M <sub>N3</sub> *(1-w <sub>3,2</sub> ρ <sub>2</sub> -w <sub>3,3</sub> ρ <sub>3</sub> )	
				58.475.750	

**TARGET VALUES BASED ON PRELIMINAR COMPUTATIONS**

$$T_v = (M_{2MAX}/M_{NV2})^\alpha + (M_{3MAX}/M_{NV3})^\beta \quad \text{with } \alpha=2, \beta=5n_v=2,944$$

Tv
8,619E-01

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

Cv	(Cv-Tv)/Tv
8,617E-01	-2,355E-04

(\*) length is only 1mm in order to diminish the increase of moment along the beam

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