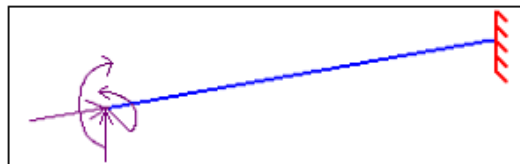


TEST SCHEDULE R 50	EN 1993-1-1: 2005 (EUROCODE 3)	Sargon ©, Cescoplus ©
RESISTANCE	COMPRESSION+BENDING2 AND 3+SHEAR2 AND 3	EC3.RES.NNM2M3T2T3.004



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

BEAM		
Length [mm]	Left end	Right end
5000	FREE	FIXED

LOADS			
Type	Value	Point of application	
BENDING MOMENT M_2	$M=60.000.000\text{Nmm}$	LEFT END	
BENDING MOMENT M_3	$M=30.000.000\text{Nmm}$	LEFT END	
COMPRESSION	$N=900.000\text{N}$	LEFT END	
SHEAR T_2	$T=400.000\text{N}$	LEFT END	
SHEAR T_3	$T=220.000\text{N}$	LEFT END	

MATERIAL	S235					
f_y [N/mm ²]	f_u [N/mm ²]	E [N/mm ²]	ν	γ_{M0}	γ_{M1}	γ_{M2}
235	360	2,10E+05	0,3	1,1	1,1	1,25

CROSS-SECTION	HE 240 A	CLASS: $N \rightarrow 1 \quad M_2 \rightarrow 1 \quad M_3 \rightarrow 1 \quad N + M_2 + M_3 \rightarrow 1$ (reclasses metod**)			
A [mm ²]	J_2 [mm ⁴]	J_3 [mm ⁴]	J_t [mm ⁴]	W_2 [mm ³]	W_3 [mm ³]
7684	7,763E+07	2,769E+07	4,155E+05	6,751E+05	2,307E+05
W_{pl2} [mm ³]	W_{pl3} [mm ³]	i_2 [mm]	i_3 [mm]	i_t [mm]	
7,446E+05	3,517E+05	100,5	60	69,28	
h	b	t_w	t_f	r	
230	240	7,5	12	21	

OTHER DATA					
$N_{pl}=A f_v/\gamma_{M0}$ [N]		$M_{pl2}=W_{pl2} * f_v/\gamma_{M0}$ [Nmm]	$M_{pl3}=W_{pl3} * f_v/\gamma_{M0}$ [Nmm]	$A_{V2}=2b t_f$ [mm ²]	
1.641.582		159.073.636	75.135.909	5.760	
$A_{V3}=A-2b t_f+(t_w+2r) t_f$ [mm ²]		$V_{pl2}=A_{V2} * (f_y / \sqrt{3}) / \gamma_{M0}$ [N]	$V_{pl3}=A_{V3} * (f_y / \sqrt{3}) / \gamma_{M0}$ [N]	ρ_2	ρ_3
2.518		710.456	310.578	1,589E-02	1,737E-01
a_{v2}	a_{v3}	$N_{pl.v}=N_{pl} (1-p_2 a_{v2}-p_3 a_{v3})$ [N]	$n_v=N/N_{pl.v}$	$a=(A-2b t_f)/A$	
0,750	0,328	1.528.621	0,589	0,250	
$M_{N2}=M_{pl}(1-n)/(1-0,5a)$ [Nmm]		$M_{N3}=M_{pl}[1-((n-a)/(1-a))^2]$ [Nmm]		$w_{2,3}$	
74.761.688		59.806.521		0,241	
$w_{3,2}$		$w_{3,3}$		$M_{NV2}=M_{N2} * (1-w_{2,2} p_2-w_{2,3} p_3)$	
0.983		0.038		$M_{NV3}=M_{N3} * (1-w_{3,2} p_2-w_{3,3} p_3)$	
		70.626.718		58.475.750	

TARGET VALUES BASED ON PRELIMINAR COMPUTATIONS

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

T_v
8,619E-01

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

C_v	$(C_v - T_v)/T_v$
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