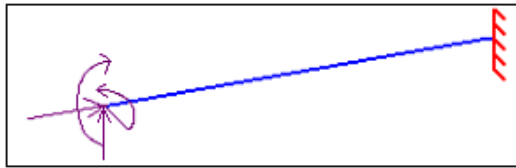


TEST SCHEDULE R 49	EN 1993-1-1: 2005 (EUROCODE 3)	Sargon ©, Cescopus ©
RESISTANCE	COMPRESSION+BENDING2 AND 3+ SHEAR2 AND 3	EC3.RES.NNM2M3T2T3.003



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

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

LOADS			
Type	Value	Point of application	
BENDING MOMENT M_2	$M=100.000.000\text{Nmm}$	LEFT END	
BENDING MOMENT M_3	$M=10.000.000\text{Nmm}$	LEFT END	
COMPRESSION	$N=900.000\text{N}$	LEFT END	
SHEAR T_2	$T=300.000\text{N}$	LEFT END	
SHEAR T_3	$T=250.000\text{N}$	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	IPE 360	CLASS: N⁻ →2 M₂ →1 M₃ →2 N⁻ + M₂ + M₃ →2 (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]
7273	1,627E+08	1,043E+07	3,732E+05	9,037E+05	1,228E+05
W_{pl2} [mm ³]	W_{pl3}	i_2 [mm]	i_3 [mm]	i_t [mm]	
1,019E+06	1,911E+05	149,5	37,9	49,07	
h	b	t_w	t_f	r	
360	170	8	12,7	18	

OTHER DATA					
$N_{pl} = A f_y / \gamma_{M0}$ [N]	$M_{pl2} = W_{pl2} * f_y / \gamma_{M0}$ [Nmm]	$M_{pl3} = W_{pl3} * f_y / \gamma_{M0}$ [Nmm]	$A_{v2} = 2bt_f$ [mm ²]		
1.553.777	217.695.455	40.825.909	4.318		
$A_{v3} = A - 2bt_f + (t_w + 2r)t_f$ [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	
3.513,8	532.600	433.400	1,602E-02	2,361E-02	
a_{v2}	a_{v3}	$N_{pl.v} = N_{pl} (1 - \rho_2 a_{v2} - \rho_3 a_{v3})$ [N]	$n_v = N / N_{pl.v}$	$a = (A - 2bt_f) / A$	
0,594	0,483	1.521.276	0,592	0,406	
$M_{N2} = M_{pl} (1 - n) / (1 - 0,5a)$ [Nmm]	$M_{N3} = M_{pl} [1 - ((n - a) / (1 - a))^2]$ [Nmm]	$W_{2,2}$	$W_{2,3}$		
111.549.458	36.839.702	0,736	0,358		
$W_{3,2}$	$W_{3,3}$	$M_{NV2} = M_{N2} * (1 - W_{2,2} \rho_2 - W_{2,3} \rho_3)$	$M_{NV3} = M_{N3} * (1 - W_{3,2} \rho_2 - W_{3,3} \rho_3)$		
0,960	0,072	109.292.571	36.210.455		

TARGET VALUES BASED ON PRELIMINAR COMPUTATIONS

$$T_v = (M_2 / M_{NV2})^\alpha + (M_3 / M_{NV3})^\beta \quad \text{with } \alpha=2, \beta=5n_v=2,958$$

T_v
8,594E-01

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

C_v	$(C_v - T_v) / T_v$
8,588E-01	-7,098E-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