

AD 388

Partial factors for material properties for design in the UK

Partial factors and the methodology of their use are described in BS EN 1990¹. Partial factors for actions (commonly called load factors) allow for unfavourable deviations in the effects of the action, while the partial factors for material properties (known as material or resistance factors) take account of variability of material and type of design situation. The principle of structural design using the partial factor method is that the effect of the characteristic action multiplied by the load factor must not exceed the design resistance i.e. characteristic resistance divided by the material factor.

The values of the load factors (γ_f) are given in Annex A of BS EN 1990 and its National Annex. Recommended values of the material factors (γ_M) are given in Eurocodes 2 to 9, generally with the opportunity for the recommended values to be varied in the National Annexes.

To improve ease of reference for steel designers, Table 1 lists the recommended material factors used in steel design together with values taken from the relevant UK National Annex. Note that the values tabulated are correct at June 2015, but may be revised in the future.

Table 1 List of partial factors for material properties used in steel design - values recommended for use in the UK

Partial factor	Design situation/application	Reference to BS EN clause	Value given in the Eurocode	Value given in the UK National Annex
γ_{M0}	Resistance of cross sections	1993-1-1 ² §6.1 Note 2B	1.0	1.0
γ_{M1}	For resistance of members to instability assessed by member checks (buckling resistance)	1993-1-1 §6.1 Note 2B	1.0	1.0
γ_{M2}	Resistance of cross sections in tension to fracture	1993-1-1 §6.1 Note 2B	1.25	1.1
γ_{M2}	Joints: bolts, rivets, pins, welds	1993-1-8 ³ Note, Table 2.1	1.25	1.25
γ_{M2}^*	Joints: plates in bearing	1993-1-8 Note, Table 2.1	1.25	1.25 (1.5 where SLS governs)*
γ_{M3}	Joints: slip resistance at ULS (Category C)	1993-1-8 Note, Table 2.1	1.25	1.25
$\gamma_{M3,ser}$	Joints: slip resistance at SLS (Category B)	1993-1-8 Note, Table 2.1	1.1	1.1
γ_{M5}	Joints: resistance of hollow section joints	1993-1-8 Note, Table 2.1	1.0	1.0
$\gamma_{M6,ser}$	Joints: resistance of pins at SLS	1993-1-8 Note, Table 2.1	1.0	1.0
γ_{M7}	Joints: preload of high strength bolts	1993-1-8 Note, Table 2.1	1.1	1.1 for bolts to BS EN 14399-4 ⁴ & BS EN 14399-8 ⁵ 1.0 for others
γ_c	Resistance of concrete	1992-1-1 ⁶ Table 2.1N	1.5 for persistent and transient design situations 1.2 for accidental design situations	Use the recommended value
$\gamma_{M,u}^{**}$	Resistance of components in structural integrity checks	**	**	**

* In circumstances where deformation at serviceability limit state governs the design $\gamma_{M2} = 1.5$ is more appropriate. Controlling deformation is pertinent where deformation of the bolt holes needs to be avoided, i. e. when $\alpha_b = 1$ (as defined in Table 3.4 of BS EN 1993-1-8).

** $\gamma_{M,u}$ is not given in BS EN 1993-1-8, however it is used in the [Green Book Joints in Steel Construction: Simple Joints to Eurocode 3](#)⁷ when verifying structural integrity. A value of $\gamma_{M,u} = 1.1$ is recommended.

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- BS EN 1990:2002+A1:2005 - Eurocode. Basis of structural design, BSI
NA to BS EN 1990:2002+A1:2005 - UK National Annex for Eurocode. Basis of structural design
- BS EN 1993-1-1:2005 (incorporating corrigenda February 2006 and April 2009) Eurocode 3: Design of steel structures. General rules and rules for buildings, BSI
NA to BS EN 1993-1-1:2005:2008 Eurocode 3: Design of steel structures. General rules and rules for buildings, BSI
- BS EN 1993-1-8:2005 (incorporating corrigenda December 2005, September 2006, July 2009 and August 2010) Eurocode 3: Design of steel structures. Design of joints, BSI
NA to BS EN 1993-1-8:2005:2008 UK National Annex to Eurocode 3: Design of steel structures. Design of joints, BSI
- BS EN 14399-4:2015 High-strength structural bolting assemblies for preloading. System HV. Hexagon bolt and nut assemblies, BSI
- BS EN 14399-8:2007 High-strength structural bolting assemblies for preloading. System HV. Hexagon fit bolt and nut assemblies, BSI
- BS EN 1992-1-1:2004 (incorporating corrigendum January 2008, November 2010 and February 2014) Eurocode 2: Design of concrete structures. General rules and rules for buildings, BSI
NA to BS EN 1992-1-1:2004:2005 (incorporating National Amendment No. 1) UK National Annex to Eurocode 2: Design of concrete structures. General rules and rules for buildings, BSI
- Joints in steel construction: Simple joints to Eurocode 3 (revised edition), (P358), SCI and BCSA, 2014

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