

# Steel Design to Eurocode 3

## Joints

### Eurocode 3 Part: 1-8

#### Joint Types

CL 5.2.2.2 'Nominally pinned' joints are capable of transmitting internal forces without developing significant moments, and capable of accepting the resulting rotations under the design loads.

CL 5.2.2.3 'Rigid and full strength' joints have sufficient rotational stiffness to justify analysis based on full continuity.

'Semi-rigid' joints lie somewhere between 'nominally pinned' and 'rigid'.

#### Eurocode 3

- Principles mostly the same as BS 5950
- Results are similar although EC3 results are slightly more conservative and this is due to the larger partial safety factor ( $\gamma_{M2}=1.25$ )

#### Bolt Strength

These values should be adopted as characteristic values in design calculations :

Bolt classes	4.6	5.6	8.8	10.9
$f_{yk}$ (N/mm <sup>2</sup> )	240	300	640	900
$f_{uk}$ (N/mm <sup>2</sup> )	400	500	800	1000

EN 1993-1-8 Table 3.1 - Nominal values of  $f_y$  and  $f_u$  for bolts

#### Steel Strength

Steel grade	$f_y$ (N/mm <sup>2</sup> )				$f_u$ (N/mm <sup>2</sup> )	
	Nominal thickness of element $t$ (mm)				Nominal thickness of element $t$ (mm)	
	$t \leq 16$	$16 < t \leq 40$	$40 < t \leq 63$	$63 < t \leq 80$	$t < 3$	$3 \leq t \leq 100$
S 275	275	265	255	245	430 to 580	410 to 560
S 355	355	345	335	325	510 to 680	470 to 630

Extract from Table 7 of EN 10025-2

#### EN 1993-1-8 Clause 2.2

- Partial safety factors,  $\gamma_{M2}$  for joints are given in Table 2.1 of EC 3-8.
- Refer to NA to get the required values of the different partial safety factors
- Resistance of bolts and welds,  $\gamma_{M2} = 1.25$

#### Bolted Joints – Table 3.4

Table 3.4 of EN 1993-1-8 gives the different checks required for individual fasteners subjected to shear and/or tension.

Checks need to be carried out for a number of possible failure modes:

- Shear resistance per shear plane
- Bearing Resistance
- Tension Resistance
- Combined shear and tension

#### Bolted Joints – Tension

Tension resistance for ordinary bolts:

$$F_{t,Rd} = k_2 f_{ub} \frac{A_s}{\gamma_{M2}}$$

where:

- $A_s$  is the tensile stress area of the bolt
- $\gamma_{M2} = 1.25$
- $f_{ub}$  is the ultimate tensile strength of the bolt
- $k_2 = 0.63$  for countersunk bolt, otherwise  $k_2 = 0.9$

#### Bolted Joints – Shear

Shear resistance per shear plane for ordinary bolts where the shear plane passes through the threaded portion of the bolt:

$$F_{v,Rd} = \alpha_v f_{vb} \frac{A_s}{\gamma_{M2}}$$

where:

- $A_s$  is the tensile stress area of the bolt
- $f_{vb}$  is the ultimate tensile strength of the bolt
- $\gamma_{M2} = 1.25$

Bolt classes	4.6	4.8	5.6	5.8	6.8	8.8	10.9
$\alpha_v$	0.6	0.5	0.6	0.5	0.5	0.6	0.5

# Eurocode 3 Part 8 Design Guide

**Michael N Fardis, Eduardo  
Carvalho, Amr S Elnashai, Haig  
Gulvanessian**



### **Eurocode 3 Part 8 Design Guide:**

*Designers' Guide to EN 1991-1-2, EN 1992-1-2, EN 1993-1-2 and EN 1994-1-2* Tom Lennon, 2007-01-12 A guide to 4 documents EN1991 Part 1 2 EN1992 Part 1 2 EN1993 Part 1 2 and EN1994 Part 1 2 It provides an introduction to the procedures required to achieve design solutions for a typical range of structural elements and assemblies Worked examples are included to illustrate the use of the Eurocodes for specific design scenarios

**Innovative Bridge Design Handbook** Alessio Pipinato, 2021-09-08 Innovative Bridge Design Handbook Construction Rehabilitation and Maintenance Second Edition brings together the essentials of bridge engineering across design assessment research and construction Written by an international group of experts each chapter is divided into two parts the first covers design issues while the second presents current research into the innovative design approaches used across the world This new edition includes new topics such as foot bridges new materials in bridge engineering and soil foundation structure interaction All chapters have been updated to include the latest concepts in design construction and maintenance to reduce project cost increase structural safety and maximize durability Code and standard references have been updated Completely revised and updated with the latest in bridge engineering and design Provides detailed design procedures for specific bridges with solved examples Presents structural analysis including numerical methods FEM dynamics risk and reliability and innovative structural typologies

**Steel Designers' Manual** SCI (Steel Construction Institute), 2016-06-27 In 2010 the then current European national standards for building and construction were replaced by the EN Eurocodes a set of pan European model building codes developed by the European Committee for Standardization The Eurocodes are a series of 10 European Standards EN 1990 EN 1999 that provide a common approach for the design of buildings other civil engineering works and construction products The design standards embodied in these Eurocodes will be used for all European public works and are set to become the de facto standard for the private sector in Europe with probable adoption in many other countries This classic manual on structural steelwork design was first published in 1955 since when it has sold many tens of thousands of copies worldwide For the seventh edition of the Steel Designers Manual all chapters have been comprehensively reviewed revised to ensure they reflect current approaches and best practice and brought in to compliance with EN 1993 Design of Steel Structures the so called Eurocode 3

**Fire Safety Design for Tall Buildings** Feng Fu, 2021-02-18 Fire Safety Design for Tall Buildings provides structural engineers architects and students with a systematic introduction to fire safety design for tall buildings based on current analysis methods design guidelines and codes It covers almost all aspects of fire safety design that an engineer or an architect might encounter such as performance based design and the basic principles of fire development and heat transfer It also sets out an effective way of preventing the progressive collapse of a building in fire and it demonstrates 3D modeling techniques to perform structural fire analysis with examples that replicate real fire incidents such as the Twin Towers and WTC7 This helps readers to understand the design of structures and analyze their behavior in

fire *Designers' Guide to Eurocode 5: Design of Timber Buildings* Jack Porteous, Alexander Porteous, Peter Ross, Haig Gulvanessian, 2013-04-26 Interprets and assists in the use of EN 1995 1 1 structural timber This guide shows typical material properties and dimensions modifiers and structural responses It also explains relationships with other Eurocodes particularly those for EN 1990 Basis of Design

**Tubular Structures XV** Eduardo de Miranda Batista, Pedro Vellasco, Luciano Rodrigues Ornelas de Lima, 2015-04-23 Tubular Structures XV contains the latest scientific and engineering developments in the field of tubular structures as presented at the 15th International Symposium on Tubular Structures ISTS15 Rio de Janeiro Brazil 27 29 May 2015 The International Symposium on Tubular Structures ISTS has a long standing reputation for being the principal

**Designers' Guide to EN 1991-1-4** Nicholas John Cook, 2007 This text aims to provide the user with a commentary on the interpretation and use of EN 1991 Eurocode 1 Actions on structures General actions Part 1 4 Wind actions This title also includes a commentary on the changes introduced in the UK National Annex

**Designers' Guide to EN 1993-1-1** Leroy Gardner, D. A. Nethercot, 2005 After some 25 years in preparation the key parts of EN 1993 1 1 Eurocode 3 Design of steel structures General rules and rules for buildings have now been finalised Eurocode 3 covers many forms of steel construction and provides the most comprehensive and up to date set of design guidance currently available Throughout this book concentrates on the most commonly encountered aspects of structural steel design with an emphasis on the situation in buildings Much of its content is therefore devoted to the provisions of the Part 1 1 General rules and rules for buildings of EN 1993 This is however supplemented by material on loading joints and cold formed design For each of the principal aspects covered the book provides background to the structural behaviour explanation of the codified treatment including departure from existing practice BS 5950 and numerous worked examples This Guide should serve as the primary point of reference for designing steel structures to Eurocode 3

**BOOK JACKET Designer's Guide to EN 1998-1 and 1998-5** Michael N Fardis, Eduardo Carvalho, Amr S Elnashai, Haig Gulvanessian, 2005-09-28 Covers EN1998 1 General Rules seismic actions and rules for buildings and EN1998 5 Foundations retaining structures geotechnical aspects This book is useful for Civil and Structural Engineers Code drafting committees Clients Structural Design students and Public authorities

Design of Joints in Steel Structures ECCS - European Convention for Constructional Steelwork, 2017-06-19 This book details the basic concepts and the design rules included in Eurocode 3 Design of steel structures Part 1 8 Design of joints Joints in composite construction are also addressed through references to Eurocode 4 Design of composite steel and concrete structures Part 1 1 General rules and rules for buildings Moreover the relevant UK National Annexes are also taken into account Attention has to be duly paid to the joints when designing a steel or composite structure in terms of the global safety of the construction and also in terms of the overall cost including fabrication transportation and erection Therefore in this book the design of the joints themselves is widely detailed and aspects of selection of joint configuration and integration of the joints into the analysis and the design process of the whole construction are also fully covered Connections using

mechanical fasteners welded connections simple joints moment resisting joints and lattice girder joints are considered Various joint configurations are treated including beam to column beam to beam column bases and beam and column splice configurations under different loading situations axial forces shear forces bending moments and their combinations The book also briefly summarises the available knowledge relating to the application of the Eurocode rules to joints under fire fatigue earthquake etc and also to joints in a structure subjected to exceptional loadings where the risk of progressive collapse has to be mitigated Finally there are some worked examples plus references to already published examples and to design tools which will provide practical help to practitioners

*Proceedings of the Institution of Civil Engineers* ,2008      Introduction to the Fire Safety Engineering of Structures ,2003      **The Structural Engineer** ,2004      *Proceedings of the ASME Pressure Vessels and Piping Conference--2005: Seismic engineering* ,2005      **Structures with Hollow Sections** Dipak Dutta,2002-06-28 Structures using hollow sections are a special area within steel construction and are often ignored as such in publications This work represents a comprehensive treatment of the whole field from manufacture right up to useful applications in steel construction      **Steel Design Handbook** Akbar R. Tamboli,1997 Very Good No Highlights or Markup all pages are intact      Building in Steel 1991 ,1991      **Machine Tool Technology, Mechatronics and Information Engineering** Zhong Min Wang,Dong Fang Yang,Kun Yang,Liang Yu Guo,Jian Ming Tan,2014-09-22 Selected peer reviewed papers from the 2014 International Conference on Machine Tool Technology and Mechatronics Engineering ICMTTME 2014 June 22 23 2014 Guilin Guangxi China      Materials Transactions, JIM. ,2001      Materials Transactions ,2001

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