

DIN EN 13001-3-1:2012-09 (E)

Cranes - General Design - Part 3-1: Limit States and proof competence of steel structure

Contents		Page
Foreword		4
Introduction		5
1	Scope	6
2	Normative references	6
3	Terms ,definitions, symbols and abbreviations	7
3.1	Terms and definitions	7
3.2	Symbols and abbreviations	7
4	General	11
4.1	Documentation	11
4.2	Materials for structural members	12
4.2.1	Grades and qualities	12
4.2.2	Impact toughness	14
4.3	Bolted connections	16
4.3.1	Bolt materials	16
4.3.2	General	16
4.3.3	Shear and bearing connections	17
4.3.4	Friction grip type (slip resistant) connections	17
4.3.5	Connections loaded in tension	17
4.4	Pinned connections	17
4.5	Welded connections	18
4.6	Proof of competence for structural members and connections	18
5	Proof of static strength	19
5.1	General	19
5.2	Limit design stresses and forces	19
5.2.1	General	19
5.2.2	Limit design stress in structural members	19
5.2.3	Limit design forces in bolted connections	21
5.2.4	Limit design forces in pinned connections	28
5.2.5	Limit design stresses in welded connections	32
5.3	Execution of the proof	35
5.3.1	Proof for structural members	35
5.3.2	Proof for bolted connections	35
5.3.3	Proof for pinned connections	36
5.3.4	Proof for welded connections	36
6	Proof of fatigue strength	37
6.1	General	37
6.2	Limit design stresses	38
6.2.1	Characteristic fatigue strength	38
6.2.2	Weld quality	40
6.2.3	Requirements for fatigue testing	41
6.3	Stress histories	41
6.3.1	General	41
6.3.2	Frequency of occurrence of stress cycles	42
6.3.3	Stress history parameter	42

6.3.4	Stress history classes S	43
6.4	Execution of the proof	44
6.5	Determination of the limit design stress range	45
6.5.1	Applicable methods	45
6.5.2	Direct use of stress history parameter	45
6.5.3	Use of class S	45
6.5.4	Independent concurrent normal and/or shear stresses	47
7	Proof of static strength of hollow section girder joints	47
8	Proof of elastic stability	47
8.1	General	47
8.2	Lateral buckling of members loaded in compression	48
8.2.1	Critical buckling load	48
8.2.2	Limit compressive design force	49
8.3	Buckling of plate fields subjected to compressive and shear stresses	51
8.3.1	General	51
8.3.2	Limit design stress with respect to longitudinal stress x	53
8.3.3	Limit design stress with respect to transverse stress y	55
8.3.4	Limit design stress with respect to shear stress	57
8.4	Execution of the proof	58
8.4.1	Members loaded in compression	58
8.4.2	Plate fields	58
Annex A (informative) Limit design shear force F_v, R_d per bolt and per shear plane for multiple shear plane connections		60
Annex B (informative) Preloaded bolts		61
Annex C (normative) Design weld stresses W, S_d and W, S_d		63
C.1	Butt joint	63
C.2	Fillet weld	64
C.3	T-joint with full and partial penetration	65
C.4	Effective distribution length under concentrated load	66
Annex D (normative) Values of slope constant m and characteristic fatigue strength c, c		67
Annex E (normative) Calculated values of limit design stress ranges R_d and $R_{d,1}$		88
Annex F (informative) Evaluation of stress cycles (example)		90
Annex G (informative) Calculation of stiffnesses for connections loaded in tension		92
Annex H (informative) Hollow Sections		95
Annex I (informative) Selection of a suitable set of crane standards for a given application		107
Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC		108
Bibliography		109