

# DIN EN 13001-3-3:2015-02 (E)

## Cranes - General design - Part 3-3: Limit states and proof of competence of wheel/rail contacts

---

<b>Contents</b>		<b>Page</b>
Foreword .....		3
Introduction .....		4
1	Scope .....	5
2	Normative references .....	5
3	Terms, definitions, symbols and abbreviations .....	5
3.1	Terms and definitions .....	5
3.2	Symbols and abbreviations .....	6
4	General .....	7
4.1	General principles .....	7
4.2	Line and point contact cases .....	8
4.3	Hardness profile below contact surface .....	9
4.4	Equivalent modulus of elasticity .....	10
5	Proof of static strength .....	10
5.1	General .....	10
5.2	Design contact force .....	10
5.3	Static limit design contact force .....	11
5.3.1	General .....	11
5.3.2	Calculation of the limit design force .....	11
5.3.3	Edge pressure in line contact .....	12
5.3.4	Non-uniform pressure distribution in line contact .....	12
6	Proof of fatigue strength .....	13
6.1	General .....	13
6.2	Design contact force .....	13
6.3	Limit design contact force .....	13
6.3.1	Basic formula .....	13
6.3.2	Reference contact force .....	14
6.3.3	Contact force history parameter .....	14
6.3.4	Contact force spectrum factor .....	15
6.3.5	Counting of rolling contacts .....	15
6.3.6	Relative total number of rolling contacts .....	16
6.3.7	Classification of contact force history parameter .....	16
6.4	Factors of further influences .....	17
6.4.1	Basic formula .....	17
6.4.2	Edge pressure for fatigue .....	17
6.4.3	Non-uniform pressure distribution for fatigue .....	17
6.4.4	Skewing .....	17
6.4.5	Mechanical drive factor .....	18
Annex A (informative) Strength properties for a selection of wheel and rail materials .....		19
Annex B (informative) Conversion table of hardnesses .....		20
Annex C (informative) Examples for wheel/rail material pairs and their wear behaviour .....		21

<b>Annex D (informative) Selection of a suitable set of crane standards for a given application .....</b>	<b>22</b>
<b>Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC .....</b>	<b>23</b>
<b>Bibliography .....</b>	<b>24</b>