



National Standards Authority of Ireland

IRISH STANDARD

I.S. EN 13814:2005

ICS 91.040.99

National Standards
Authority of Ireland
Glasnevin, Dublin 9
Ireland

Tel: +353 1 807 3800
Fax: +353 1 807 3838
<http://www.nsai.ie>

Sales
<http://www.standards.ie>

FAIRGROUND AND AMUSEMENT PARK

MACHINERY AND STRUCTURES - SAFETY

This Irish Standard was published under the authority of the National Standards Authority of Ireland and comes into effect on:

March 4, 2005

NO COPYING WITHOUT NSAI
PERMISSION EXCEPT AS
PERMITTED BY COPYRIGHT
LAW

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 13814

December 2004

ICS 91.040.99

English version

**Fairground and amusement park machinery and structures -
Safety**

Machines et structures pour fêtes foraines et parcs
d'attraction - Sécurité

Fliegende Bauten und Anlagen für Veranstaltungplätze
und Vergnügungsparks - Sicherheit

This European Standard was approved by CEN on 19 May 2004.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

EN 13814:2004 (E)

Contents

	page
Foreword	6
1 Scope	8
2 Normative references	8
3 Terms and definitions	11
4 Symbols	12
5 Common requirements for design analysis and examination	12
5.1 Design documents	12
5.1.1 General	12
5.1.2 Description of design and operation	13
5.1.3 Design and manufacturing drawings	13
5.1.4 Principles of analysis	13
5.2 Selection of materials	14
5.2.1 General	14
5.2.2 Recommended steels	14
5.2.3 Aluminium alloy	15
5.2.4 Timber	15
5.2.5 Plastic composites	15
5.2.6 Concrete	15
5.2.7 Fasteners	15
5.3 Design loads	16
5.3.1 General	16
5.3.2 Permanent actions	16
5.3.3 Variable actions	16
5.3.4 Seismic forces	22
5.3.5 Applicable coefficients for impacts, the vibration of structural components directly travelled over and collisions	22
5.3.6 Load combinations	23
5.4 Structural analysis – Principles	24
5.4.1 General	24
5.4.2 Analysis principles for various types of rides	24
5.4.3 Roller coasters with rail track bound vehicles	30
5.4.4 Other railways with track bound vehicles	37
5.4.5 Grandstands	37
5.5 Verification of stability	37
5.5.1 Safety against overturning, sliding and lifting	37
5.5.2 Ground anchorages	40
5.5.3 Further requirements	43
5.5.4 Ground support for packing	43
5.6 Verification of strength	44
5.6.1 General	44
5.6.2 Predominantly static stress	44
5.6.3 Fluctuating stress	45
5.6.4 Bolts	48
5.6.5 Ropes, chains, safety devices, connectors and adapters	50
5.7 Structural design and workmanship	53
5.7.1 Arrangement, accessibility	53
5.7.2 Locking and safety devices for fasteners	53
5.7.3 Joints intended for dismantling	53
5.7.4 Designing of components subject to fluctuating loads	53
5.7.5 Supports	54

5.7.6	Central masts	54
5.7.7	Prevention of corrosion and rot.....	54
6	Requirements for design and manufacture of rides and structures.....	54
6.1	Risk reduction by prevailing design and safety measures	54
6.1.1	General.....	54
6.1.2	Hazard analysis.....	54
6.1.3	Risk reduction for platforms, ramps, floors, stairs and walkways.....	54
6.1.4	Risk reduction by the use of railings, fencing and guarding.....	56
6.1.5	Risk reduction in the case of access and egress	59
6.1.6	Risk reduction for passenger units	60
6.1.7	Risk reduction by special provisions	67
6.2	Supplementary safety requirements for various types of amusement device	68
6.2.1	Round-abouts with horizontal and/or vertical movements	68
6.2.2	Giant wheels, swings (with and without motor drives)	70
6.2.3	Roller coasters, flume rides, dark rides, railways and other rail-guided channel or trackbound devices.....	72
6.2.4	Maximum deceleration shall not exceed 0,7 g for an emergency and 0.5 g for normal stopping brakes (service brakes) unless special provisions for passengers are installed (lap bars, etc.).....	75
6.2.5	Side shows, booths, win-a-prize and sales stands, mazes, halls of mirrors, fun houses, labyrinths, hammers, ring the bell and similar	84
6.2.6	Temporary grandstands, maneges, etc.....	86
6.2.7	Shooting stands and trailers, shooting devices	86
6.3	Mechanical systems	88
6.4	Manufacture and supply	92
6.4.1	General.....	92
6.4.2	Manufacture	92
6.4.3	Supply	95
6.5	Initial approval, examination and acceptance – Recommended procedures	97
6.5.1	General.....	97
6.5.2	Initial approval of amusement devices.....	97
6.6	Provisions before supply and use	100
6.6.1	Log book.....	100
6.6.2	Official technical dossier	101
6.6.3	Identification marking	102
7	Operation and use of rides and structures	102
7.1	Introduction.....	102
7.2	Standard documentation	103
7.3	Requirements for Personnel	103
7.4	Duties of the controller	103
7.4.1	General.....	103
7.4.2	Buying and selling	104
7.4.3	Selection and training of staff	104
7.4.4	Build up ad pull down	105
7.4.5	Care of equipment	107
7.4.6	Trial Operations and Checks	109
7.4.7	Operation	110
7.4.8	Special duties for the supervision of the operation.....	112
7.4.9	Maintenance, repair and modifications	116
7.5	Duties of the amusement device operator	117
7.6	Duties of the attendant.....	119
7.7	Independent examinations	119
7.7.1	Independent thorough examination	119
7.7.2	Installation examination.....	121
7.7.3	Examination after repair and modification.....	121
7.7.4	Reports	122
7.7.5	Examination intervals.....	122
7.8	Fire	122
7.8.1	General.....	122
7.8.2	Fire procedures	122
7.8.3	Provisions in case of fire	122
7.8.4	Access of emergency services	123

EN 13814:2004 (E)

Annex A (informative) Fatigue analysis	125
A.1 General.....	125
A.2 Symbols and definitions	125
A.3 Requirements for fatigue assessment.....	126
A.4 Fatigue strength of steel structures	127
A.4.1 Constant amplitude stress range (Palmgreen-Miner-Rule).....	127
A.4.2 Equivalent constant amplitude stress range at N	127
A.4.3 Equivalent constant amplitude stress range at $N_c = 2 \times 10^6$	128
A.5 Damage assessment for combined stresses.....	129
A.6 Formulae for life time prediction.....	130
A.6.1 General.....	130
A.6.2 Basic procedure.....	130
A.6.3 Calculation of fatigue life	130
Annex B (normative) Detailed analysis rules.....	132
B.1 Swings	132
B.1.1 General.....	132
B.1.2 Forces on struts.....	133
B.1.3 Safety of the swing against overturning	134
B.1.4 Motor driven swings.....	136
B.2 Ferris wheels	136
B.2.1 Loads	136
B.2.2 Dominant loading cases	138
B.2.3 Calculation.....	138
B.2.4 Erection.....	143
B.2.5 General indications.....	143
B.3 Chair-O-Planes and suspension roundabouts	143
B.4 Roundabout with floor (suspended floor and turntable roundabouts).....	148
B.5 Motor-driven vehicle attractions	149
B.5.1 Motor-driven vehicle attractions with carriageways for unidirectional driving (e. g. car racing tracks, multi storey car tracks, go-cart tracks, motor scooter tracks).....	149
B.5.2 Driving installations with arbitrary directions of driving (dodgem cars).....	150
B.6 Steep wall tracks.....	150
B.7 Globes	151
B.8 Installations for artistic aerial displays	151
B.9 Rotors	151
B.10 Toboggans.....	151
B.11 Rolling barrels.....	152
B.12 Travelling platforms	152
B.13 Turntables.....	152
Annex C (normative) Examination forms	153
C.1 Thorough examination form	153
C.2 Initial examination form	154
Annex D (normative) Electrical equipment and Control systems	155
D.1 Electrical equipment.....	155
D.1.1 General.....	155
D.1.2 Protection class of equipment	155
D.1.3 Sliding contacts	155
D.1.4 Earthing systems	155
D.1.5 Protection against electric shocks	155
D.1.6 Lightning protection measures	156
D.1.7 Lighting and emergency lighting	156
D.1.8 Overload and short circuit protection	156
D.1.9 Additional requirements for water rides	156
D.2 Control systems.....	156
D.2.1 General.....	156
D.2.2 Relevant standards.....	157
D.2.3 Safety related control systems elements	157
D.2.4 Stop functions.....	158
D.2.5 Safety related parameters	158
D.2.6 Passenger restraint status.....	159



This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

- Looking for additional Standards? Visit Intertek Inform Infostore
- Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation