RISK ASSESSMENT
SKI JUMP, JUVENILE COASTER
ADIPS ID: 10981



ADIPS 10981

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1. General

This standard follows the principles laid down in EN 414 and uses the risk assessment principles developed in EN 1050. In doing so it recognizes the limitation of the application of machinery standards to amusement devices.

1.1 Amusement device related risk

For definitions, of hazards, risk and risk assessments, see clause 3. For amusement devices, special consideration should be given to the presence of any inappropriate behavior of passengers and public.

1.2 Application

The technique of risk assessment formalizes the intuitive process by which designers and safety engineers use their experiences to identify hazards, assesses risks and select the appropriate safety measures. The general principles of the procedure to be followed are described in EN 1050. The assessment of risk determines, to a large extent, the level of safety precautions which it is necessary to take. Three factors should be taken into account:

Severity of harm x Likelihood of occurrence –Risk arising

1.3 Safety Analysis

For general principles see EN 1050 and EN 292 (replace by BS EN ISO 12100

2. Hazard Identification

In relation to machinery in general, the hazards for which the risks may need to be assessed are shown in Table A.1 of EN 1050. These are repeated in table 1 below, retaining the original numbering, except that some hazards do not apply to fairground and amusement park machinery and structures have been omitted. In some cases the wording describing the particular hazard has been altered to relate it more specifically to amusement devices. Amusement devices involve additional potential hazards not encountered in general machinery and these have been included at the end of table 1(hazard numbers higher than 37).
Table 1 has been given two additional columns which provide the cross references to relevant clauses and sub-clauses within the two parts of this standard.

ADIPS ID: 10981

3. Legends

Columns:

- S =severity of foreseeable harm
- L =likelihood of occurrence
- R =risk of occurrence
- C =conformity to the standard

In the list of hazard we have considered 3 possibilities for the severity of foreseeable injuries and the probabilities of their occurrence:

- L =low
- M=medium
- H=high

In the column of conformity we report the following possibilities:

- C =in conformity
- NC=not in conformity
- NA=not applicable
- NV=not valuable

Standard references

PrEN13814	Fairground and Amusement Park Machinery and structures - Safety
BS EN ISO 12100-1	Safety of machinery – Basic concepts, general principles for design -Basic terminology, methodology
BS EN ISO 12100-2	Safety of machinery – Basic concepts, general principles for design -Technical principles and specifications
EN 1050	Safety of machinery – Principles of risk assessment
EN 60204 -1	Safety of machinery – Electrical equipment of machines –Part 1 general requirements
PD 5304	Guidance on Safe Use of Machinery

Key to Risk Rating:
High – Death or major harm /permanent disability
Medium –Short term disabilities
Low- Minor injury or illness

Severity / Likelihood

High / High =100%	Medium /High =50%	Low/High =10%
High /Medium =50%	Medium/Medium =25%	Low/Medium =5%
High /Low =10%	Medium/Low = 5%	Low/Low =1%

ADIPS ID: 10981

Risk Assessment: MINI SKI JUMP COASTER: ADIPS ID: 10981

TABLE OF RISK ANALYSIS

Ref	Hazard	Description	S	L	R	C	Carried Out Controls
1	Structural and mechanical hazards due to: -amusement device parts, e.g.:						
	a) shape	Structural failure due to inadequate design. Incorrect design of passenger containment	H	L	10%		Dimension check of passenger car design has proven history Daily, weekly safety checks are ongoing
	b) relative location of passenger seats;	Incorrect design of passenger clearance envelope	H	L	10%		Dimensional check of passenger clearance envelope
	c)mass and stability (potential energy of elements which may move under the effect of gravity);	Danger from unexpected movement of ride High winds	H	L	10%		In the phases of loading and unloading the ride has no movement. Stable packing and on suitable foundations, and leveling jacks prevent movement. Daily, weekly safety checks are ongoing. Device does not operate in high winds.
	d) mass and velocity (kinetic energy of elements in controlled or uncontrolled motion);	Structural failure due to rotational forces. Incorrect design of passenger containment.	H	L	10%		Mature design has proven record. Daily, weekly safety checks are ongoing. Annual inspection carried out by independent examiner
	e) inadequacy of structural or mechanical strength;	Structural failure due to inadequate design	H	L	10%		Regular NDT as specified in the NDT schedule If required.
	f) limitation of fatigue life due to stress repetition (including vibration) – accumulation of energy inside the amusement device e.g.:	Structural failure due to inadequate fatigue design	H	L	10%		Regular NDT as specified in the NDT schedule If required. Annual inspection carried out by independent examiner
	g) elastic elements (springs)	N/A					
	h) liquids and gasses under pressure	N/A	M	L	5%		Cylinders protected from public access pressurized hoses also are enclosed wherever possible. Daily, weekly safety checks are ongoing
	i) the effect of vacuum	N/A					

ADIPS ID: 10981

Risk Assessment: MINI SKI JUMP COASTER: ADIPS ID: 10981

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1.1	Crushing hazard	Clearance envelope Loading and unloading procedures	H	L	10%		Attendant ensures no crushing occurs during loading as shown in their on site training. Procedures checked against the operation and maintenance manual
1.2	Shearing hazard	Clearance envelope Loading and unloading system	H	L	10%		Procedures checked against the operation and maintenance manual
1.3	Cutting or serving hazard	N/A					
1.4	Entanglement hazard (including ride passenger's hair and clothing)	Potential of hair /clothing entanglement	M	L	5%		Attendants ensure no entanglements occur when ensuring restraints are in place, as shown in their on site training. No loose clothing i.e. scarf's to be worn on ride
1.5	Drawing in or trapping hazard	Potential of hand/finger trapping	M	L	5%		Trapping points are inaccessible from the seat. Attendants are trained to ensured hands/head does not get trapped by restraint
1.6	Impact hazard	Potential for passengers to be collided by ride	H	L	10%		Safety barriers/fencing & gates are in place. Instruction procedures checked against the operation and maintenance manual. Attendants stand clear of restricted areas when devices is in operation
1.7	Stabbing or skin puncture hazard	Due to poor surface finishing	L	L	1%		Visual check. Daily safety checks are ongoing
1.8	Friction or abrasion hazard	N/A					Friction or abrasion is not hazard on this device. This has been proven this with no incidents occurring
1.9	High pressure fluid injection or ejection hazard	N/A					
2.	Electrical Hazards due to:						
2.1	Contact of persons with live parts(direct contact)	Injury from electrical components due to not being adequately enclosed	H	L	10%		Conformity to EN 60204-1 has been checked Electricity at Work Regulations 1989 Components are enclosed
2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)	Injury from electrical components due to not being adequately enclosed	H	L	10%		Protection against indirect contact has been checked and Conformity EN 60204-1 has been checked Components are enclosed
2.3	Approach to live parts under high voltage	Injury from electrical components due to not being adequately enclosed.	H	L	10%		Conformity to EN 60204-1 has been checked Electricity at Work Regulations 1989 Components are enclosed

ADIPS ID: 10981

Risk Assessment: MINI SKI JUMP COASTER: ADIPS ID: 10981

Ref	Hazard	Description	S	L	R	C	Carried Out Controls
2.4	Electrostatic phenomena		H	L	10%		Conformity to EN 60204-1 has been checked
2.5	Thermal radiation or other phenomena such as the projection of molten particles and chemical effects from short circuits, overloads, etc.		H	L	10%		Conformity to EN 60204-1 has been checked Electricity at Work Regulations 1989 Components are enclosed Annual inspection carried out by independent examiner
3.	Thermal Hazards, resulting in:						
3.1	Burns, scalds and other injuries by a possible contact or persons with objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources	Injury from mechanical components during maintenance	H	L	10%		Safe systems of maintenance are in place and adhered to. Procedures checked against operation & maintenance manual. Emergency procedures are in place and training provided. Fire extinguishers in place and tested annually
3.2	Damage to health by hot or cold working environment	Injury from mechanical component running hot or catching fire due to incorrect design	M	L	5%		The mechanical items are inaccessible to the public Maintenance schedule in place and adhered to. Procedures checked against operation & maintenance manual Emergency procedures are in place and managed
4.	Hazards generated by noise, resulting in:						
4.1	Hearing loss (deafness),other physiological disorders (e.g. loss of balance, loss of awareness)	Injury from high emission of noise	M	L	5%		Low emission level Short exposition of the passengers to the noise Noise at Work Regulations 2005
4.2	Interference with speech communication, acoustic signals,etc	No general /emergency information for public	H	L	10%		Visual signs are in place and prominent to see. Staff give verbal instructions and received training for emergency procedures
5.	Hazards generated by vibration						
5.1	Use of hand –held machines resulting in a variety of neurological and vascular disorders	Maintenance requiring regular & frequent use of vibration tools & equipment	L	L	1%		Control of Vibration at Work Regulations 2005 hand held machines are used infrequently and only when necessary. (Mostly drills)
5.2	Mechanical/structural vibrations hastening fatigue failure or other limit states	Structural failure due to inadequate fatigue design	H	L	10%		Regular NDT testing as per NDT schedule if required. Annual inspection carried out by independent examiner

ADIPS ID: 10981

Risk Assessment: MINI SKI JUMP COASTER: ADIPS ID: 10981

Ref	Hazard	Description	S	L	R	C	Carried Out Controls
6.	Hazards generated by radiation	N/A					
6.2	Infrared, visible and ultraviolet light	N/A					
6.5	Lasers	N/A					
7	Hazards generated by materials and substances (and their constituent elements) processed or used by the machinery						
7.1	Hazards from contact with or inhalation of harmful fluid, gases, mists, fumes, and dusts	Injury caused by hazardous substances during maintenance	H	L	10%		Not used during operation of the device Staff training provided & documented in Control of Substances Hazardous to Health Regulations 2002
7.2	Fire or explosion hazard	Injury from mechanical component running hot or catching fire due to incorrect design	H	L	10%		The mechanical items are inaccessible from the seat. Refer to the structural calculation report. Fire extinguishers are in place and tested annually. Emergency procedures in place and practiced regularly.
7.3	Biological or microbiological (e.g. viral or bacterial) hazards	N/A					
8	Hazards to operators, attendants and passengers generated by neglecting ergonomic principles in amusement device design as e.g. hazards from:						
8.2	Inadequate consideration of hand arm or foot leg anatomy	Passenger seating design	H	L	10%		Visual / dimensional check as per body space.
8.3	Neglected use of personal protection equipment	Passenger seating design PPE for maintenance	H	L	10%		Visual /dimensional check. Used in accordance with manufacturer's guidance. Personal Protection Equipment at Work Regulations 2005
8.4	Inadequate local lighting	Lack of visibility	M	L	5%		Visual /dimensional check Natural & artificial light, work lights supplied as required
8.5	Mental overload and under load, stress	Potential hazard to operator and passengers due to loss of concentration	H	L	10%		Procedures checked against the operation and maintenance manual. Training provided and monitored.

ADIPS ID. 10981

Risk Assessment: MINI SKI JUMP COASTER: ADIPS ID: 10981

Ref	Hazard	Description	S	L	R	C	Carried Out Controls
8.6	Human error, human behavior	Criteria for ride operation Operator's ability	H	L	10%		Procedures checked against the operation and maintenance manual. Staff training provided and monitored.
8.7	Inadequate design, location or identification of manual controls	Control panel –Instructions for use	H	L	10%		Instruction and training provided for use of the control panel checked against the operation and maintenance manual
8.8	Inadequate design, location of visual display units	Control panel –Instruction for use	H	L	10%		Instruction and training provided for use of the control panel checked against the operation and maintenance manual
9	Combination of hazards						
10	Unexpected start-up, unexpected over run/over speed (or any similar malfunction)						
10.1	Failure /disorder of the control system	Potential hazard to passengers	H	L	10%		Emergency stop button fitted on Operators Control Panel. Emergency procedures are in place, practiced regularly and adhered to.
10.2	Restoration of energy supply after an interruption	Unexpected start up with passengers or attendants in close proximity	H	L	10%		Device is isolated from main supply, automatically in the event of a power failure. Emergency procedures are in place and overseen by Management.
10.3	External influences on electrical equipment	Projectiles from members of public or other sources	H	L	10%		Protected from external influences by use of suitable enclosures, conduit & other methods of protection.
10.4	Other external influences (gravity, wind, etc.)		H	L	10%		In extreme weather the ride does not operate
10.5	Errors in the software	N/A					
10.6	Errors made by operator (due to mismatch of machinery with human characteristics and abilities. See 8.6	Criteria for ride operation Operator's ability	H	L	10%		Procedures checked against the operation and maintenance manual Staff training provided and monitored.
11	Impossibility of stopping the machine in the best possible conditions		L	L	1%		Emergency stop procedures are in place and managed Emergency stop button located on operators control panel Machine can be isolated from main supply

ADIPS ID: 10981

Risk Assessment: MINI SKI JUMP COASTER: ADIPS ID: 10981

Ref	Hazard	Description	S	L	R	C	Carried Out Controls
12	Variations in the rotational speed tools	N/A					
13	Failure of power supply	Local power cut or electricity surge causing power failure	L	L	1%		Emergency procedures are in place and managed. Device is isolated from main supply
14	Failure of the control circuit	Potential Hazard to passengers	H	L	10%		Emergency stop button fitted on operator control panel. Emergency procedures in place and managed
15	Errors of fitting	During maintenance /installation	H	L	10%		Installation and maintenance procedures are in place and managed. Procedures checked against operation & maintenance manual.
16	Break up during operation	Failure of mechanical parts welds, bolted joints etc.	H	L	10%		Regular NDT as per NDT Schedule if required. Daily, weekly visual inspection carried out, procedures are monitored and documented. Annual inspection carried out by independent examiner.
17	Falling or ejected objects or fluids	Falling personal objects from passengers or objects/ fluids from the device	H	L	10%		Daily checks are carried ensuring that no fluids or objects are ejected. Passengers are informed not to take personal belonging on the ride
18	Loss of stability /overturning of machinery	Foundations /packing High winds	H	L	10%		Foundations and packing of device are suitable and sufficient, checked daily. Leveling jacks in place and checked daily. Device does not operate in high winds.
19	Slip, trip and fall persons (related to machinery)	Neglecting the surface of the floorings & access may result in injuries. Wet weather may make surfaces slippy	L	L	1%		Daily checks are carried out ensuring there are no slip /trip hazards During wet weather attendants instruct passengers to take extra care due to slippery surfaces.
20	Relating to the traveling function						
20.1	Movement when starting the truck /lorry	N/A					D
21	Linked to the work position (including driving station) on the machine						
21.1	Fall of persons during access to(or at /from) the work position		M	L	5%		Daily checks are carried out ensuring the access is suitable & sufficient with no risk of falling. Attendants & operators take extra care during wet weather due to slippery surfaces. Harnesses are used when working above 2m.

ADIPS ID: 10981

Risk Assessment: MINI SKI JUMP COASTER: ADIPS ID: 10981

Ref	Hazard	Description	S	L	R	C	Carried Out Controls
21.2	Exhaust gases/lack of oxygen at the work position	N/A					
21.3	Fire(flammability, lack of extinguishing means)		H	L	10%		Fire extinguishers are in place and tested annually Emergency procedures in place
21.4	Mechanical hazards at the work position:	During maintenance	H	L	10%		Procedures checked against maintenance manual Safe systems of work in place
21.5	Insufficient visibility from the work positions		H	L	10%		There is good visibility of the device from the operator position when ride is stationery and whilst in motion. Attendants in place who are observant at all times
21.6	Inadequate lighting		M	L	5%		Natural and artificial light
21.7	Inadequate seating		L	L	1%		Adequate seating selected
21.8	Noise at the work position		L	L	1%		Noise at Work Regulations are complied with
21.9	Vibration at the work position		L	L	1%		Control of Vibration at Work Regulation complied with
21.10	Insufficient means for evacuation /emergency exit		H	L	10%		Emergency evacuation procedures are in place, practiced regularly and managed. Staff training provided and monitored
22	Due to the control system						
22.2	Inadequate design of manual controls and their mode of operation	Criteria for ride operation Operators ability	H	L	10%		Procedures checked against the operation and maintenance manual. Staff training provided and monitored.
23	From handling the machine & lack of stability	During the Installation /pull down	H	L	10%		Safe system of work in place. Procedures checked against operations & maintenance manual
24	Due to the power source and to the transmission of power						
24.1	Hazards from transmission of power between machines		H	L	10%		Conformity to EN 60204-1 has been checked Electricity at work regulations apply

ADIPS ID: 10981

Risk Assessment: MINI SKI JUMP COASTER: ADIPS ID: 10981

Ref	Hazard	Description	S	L	R	C	Carried Out Controls
24.2	Hazards from coupling and towing						
25	From/to third persons						
25.1	Unauthorized start up /use		H	L	10%		Device is isolated preventing unauthorized start up /use
25.2	Drift of a part away from its stopping position		H	L	10%		When in loading /unloading position the device has no movement. Procedures checked against operation & maintenance manual
25.3	Lack or inadequacy of visual or acoustic warning means	Insufficient general/emergency information	H	L	10%		Safety signs are in place on the device operators also give verbal warnings as shown in on site training.
26	Insufficient instructions for the driver /operator		H	L	10%		Procedures are in place and managed –checked against operation manual. Training provided and monitored
27	Mechanical hazards and hazardous events						
27.1	From load falls, collisions, machine tipping caused by:	Insufficient foundations /packing High winds	H	L	10%		Foundations /packing of device are suitable and adequate leveling jacks prevent movement daily, weekly checks are carried out. Device does not operate during high winds. Above 20m/s
27.1.1	Lack of stability	Insufficient foundations /packing High winds	H	L	10%		Foundations /packing of device are suitable and adequate leveling jacks prevent movement daily, weekly checks are carried out. Device does not operate during high winds.
27.1.2	Uncontrolled loading –overloading overturning moments exceeded	Criteria for ride operation Operators ability High winds	H	L	10%		Attendants load the device as recommended by manufacturers Device does not operate during high winds
27.1.3	Uncontrolled amplitude of movement						Device on suitable foundations, leveling jacks prevent movement; checked daily
27.1.4	Unexpected /unintended movement of loads	Insufficient foundations/packing High winds	H	L	10%		Foundations/packing of device and leveling jacks prevent movement and are checked daily. Device does not operate during high winds.
27.1.5	Inadequate holding devices/ accessories	Insufficient foundations/packing	H	L	10%		Foundations/packing and leveling jacks of device is checked daily

ADIPS ID: 10981

Risk Assessment: MINI SKI JUMP COASTER: ADIPS ID: 10981

Ref	Hazard	Description	S	L	R	C	Carried Out Controls
27.1.6	Collisions of more than one machine	N/A					
27.2	From access of persons to load support	N/A					
27.3	From derailment	N/A					
27.4	From insufficient mechanical strength of parts		H	L	10%		Regular NDT as specified in the NDT schedule where required. Daily, weekly safety checks are carried out Annual inspection carried out by independent examiner.
27.5	From inadequate design of pulleys, drum	N/A	H	L	10%		
27.6	From inadequate selection of chains, ropes ,lifting and accessories and their inadequate integration into the machine	N/A	H	L	10%		
27.7	From lowering of the load under the control of friction break	N/A					
27.8	From abnormal conditions of assembly /testing/use/maintenance		H	L	10%		Assembly /testing/use & maintenance are carried out in accordance with the manufacturers, guidelines Procedures checked against operation & maintenance manual
27.9	From the effect of load on persons (impact by load or counterweight)		H	L	10%		Manual Handling Operations Regulations apply

The previous referring numbers are complying with

Draft N.9 –pr EN 13814 –FAIRGROUND AND AMUSEMENT PARK MACHINERY AND STRUCTURES – SAFETY –BSI MCE/3/4

The risks arising from above stated hazards would be excluded or minimized by following the risk reduction requirements given in the sub-clauses listed in the tables.

Any hazards which are not listed in table 1 and any risk which have not been addressed in this standard or the others listed should be assessed in accordance with the procedure in EN 1050.

ADIPS ID.10981