



Design Review Report 7463-01A

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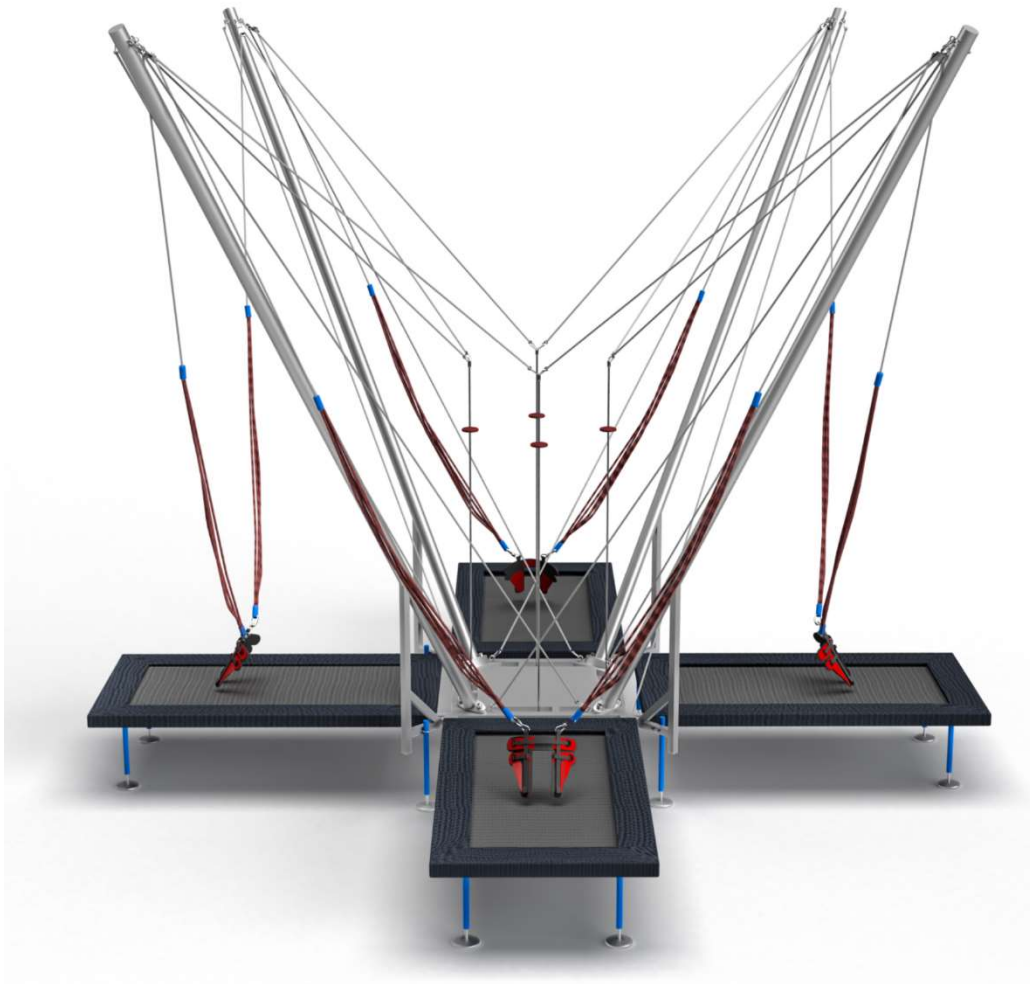
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Bungee Trampoline 4in1 Mobile Model

Eurojumper



a design &
engineering consultancy

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1.0 Introduction & Brief

- 1.1 ASP Consulting (Melbourne) Ltd ASP Consulting (Melbourne) Ltd was commissioned by Eurojumper s.c of Poland, to prepare a Design Review Report, in accordance with the amusement device inspection procedure scheme (ADIPS) EN 13184 – 1:2019 Safety of Amusement Rides and Amusement Device Part 1: Design and Manufacture for their “**Bungee Trampoline 4in1 – Mobile Model**” Amusement Device
- 1.2 This report is produced by ASP Consulting (Melbourne) Ltd and covers the Bungee Trampoline 4in1 Mobile Model amusement device, to be operated in accordance with the document listed in this design review. Any future safety critical modifications made are to have a separate design review of the modification.

2.0 Description of Device

- 2.1 The 4 person bungee trampoline is an amusement device capable for use by either children or adult participants.
- 2.1 The device is constructed of aluminium circular and square hollow sections, making it lightweight, easy and simple to erect
- 2.2 The structural elements cover an area of 8.6m x8.6m, with a height of 7.3m to the tip of the highest structural section.
- 2.3 Once erected, it is arranged in a crucifix.
- 2.4 The device comprises 4 Number raking members. The raking members are attached to a sub frame fabricated from rectangular hollow sections (primarily 80x40x3, 40x40x3, 30x20x3 RHS). The sub frame is then mounted on a trailer frame).
- 2.5 Members supporting the rectangular trampoline beds are attached to the sub frame with a pin connection allowing them to pivot and fold up. Once extended the horizontal members of the trampoline bed are propped up at 6 locations.
- 2.6 Each raking member is made up from two section sizes of different lengths. The member connected to the base frame is 4m long and is 90mm dia circular hollow section, 4mm thk and the upper member is 2.80m long and 80mm dia circular and 3mm thk.
- 2.7 Stability to the raking members is provided by the use of cables which are attached to the tips of the raking members and the sub frame. These cables are arranged in such a way that the cable from the tip of one raking member is attached to the sub frame at the foot of the adjacent raking member.
- 2.8 Additional vertical support is provided to each raking member by a 60x60x3 SHS, which is positioned approximately 635mm from the edge of the sub frame.
- 2.9 Rectangular trampoline beds are provided in the quadrants between the structural members.
- 2.10 Each passenger harness is supported by two sets of bungees (1 set each side of harness), these are then connected together by a single cable that loops around two

adjacent diagonal passenger supports. A further cable is provided which connects a winch motor and the cable supporting the passenger.

- 2.11 During the activity, the passenger bounces vertically on the trampoline. At a maximum height, the motor reduces the effective length of the cables, to permit the passenger to release progressively more potential energy with each bounce.
- 2.12 The downward motion of the passenger is arrested by a combination of the trampoline and tension in the bungees. Lighter passengers may not necessarily make contact with the trampoline.

3.0 Design Review Procedure

- 3.1 Design Risk Assessment was performed in accordance with the following standards, to establish potential areas of hazards and to determine the elements/ items of the design which require detailed inspection to assist in the review process.
- 3.2 BS EN ISO 12100:2010 Safety of Machinery – Basic Concepts., General Principles for Design.
- 3.3 BS EN 13814: 2019 Safety of Amusement Rides and Amusement Devices – Design and Manufacture
- 3.4 HSG 175 Fairgrounds and Amusement Parks: Guidance on Safe Practice.
- 3.5 ASP Consulting (Melbourne) Ltd identified the following areas and components as requiring detailed inspection and verification, either by available Design Calculations or Independent Analysis
 - Frame & Connections
- 3.1 Drawings of the device were provided by Eurojumper, unfortunately, no calculations were provided there some calculations were prepared to strength varies elements. .

4.0 Dynamic and Structural Report

- 4.1 The Risk Assessment had identified Structural Failure as a possible area of concern, therefore a structural analysis was carried out.
- 4.2 Loads exerted by the passengers are difficult to determine due the wide variation of possible passenger masses. However, a maximum acceleration of 2g has been adopted. This gives the passenger a sensation of twice the body mass when bouncing. to the galleon frame beneath the fibre glass shell was not possible.
- 4.3 BS EN 13814 indicates a load of 0.75kN which corresponds to a mass of 76kg. A passenger mass of 90kg has been adopted in the ASP calculations, which is more onerous than the load given in BS EN 13814.
- 4.4 Wind loading in the analysis was based on the minimum for in-service with a basic wind speed of 15m/s.
- 4.5 Out of service winding loading was not considered as the device can be quickly disassembled if bad weather has been forecast.

- 4.6 Seismic loads have not been considered, as these would be based on the mass of the device and in this particular case, the mass is low and this seismic forces will be low.
- 4.7 A passenger load of 75kg has been adopted within the check calculations as given in EN 13814. The full load from passengers was based on 75kg multiplied by 33 No.
- 4.8 Analysis
- 4.8.1 The analysis has been carried on TEDDS Structural Designer, an industry wide frame analysis software.
- 4.8.2 The geometry and properties are based on the dimensions and properties shown on the drawings provided by Eurojumper. Unfortunately, the drawings have no drawing numbers.
- Bungee 4 Person Mobile
- Drawing -4 person mobile
- Element 1
- Element 2
- Element 1 +2
- Element 3
- Element 4
- Element 5
- 4.8.3 The raking members are attached to the sub frame using a single bolt/ pin providing a pin connection in one axis.
- 4.8.4 Member properties are listed within the calculations
- 4.8.5 Loading combinations
- 4.8.5.1 6No. load combinations have been considered,
- 4.8.5.2 Combination 1 – All Four quadrants loaded,
- 4.8.5.3 Combination 2 – Three quadrants loaded
- 4.8.5.4 Combination 3 – Two Opposite quadrants loaded
- 4.8.5.5 Combination 4 – Two Adjacent quadrants loaded
- 4.8.5.6 Combination 5 – Single quadrant loaded
- 4.8.5.7 Combination 6 - SW

4.9 Results from Analysis

4.9.1 Cables

The maximum load in the cables was determined to be 4.1 kN (uf) and 5.54 kN (f). Standard 6x19, 5mm diameter cable has a capacity of 13.8 kN. As the capacity is greater than the applied, the 5mm cable has been found to be satisfactory.

4.9.2 D Shackles

Based on unfactored loads 4.1 kN (uf) and factored load of 5.54 kN (f) the following comparisons have been made with the working load and breaking load given in the data table of the Dee Shackle.

Pin Size	unfactored Applied Load	Working load capacity	Utilization	Factored Applied Load	Break Load Capacity	Utilization
8mm	4.1 kN	1.962 kN	200%	5.54 kN	5.886 kN	94%
10mm	4.1 kN	3.14 kN	130%	5.54 kN	9.41 kN	60%
12mm	4.1 kN	5.10 kN	80%	5.54 kN	15.3 kN	36%

It would appear the 8mm pin is clearly overstressed.

The 10mm pin, has a 130% utilization for working load capacity and 60% utilization for the breaking load. The working load is given by the manufacturer and is the safe load that can be applied to the shackle. Clearly, the loading is not recommended, however, failure is not likely to occur. To be within both the criteria, the 12mm shackle would need to be adopted.

4.9.3 Turnbuckle

The 12mm diameter turnbuckles adopted appear to be satisfactory, they have a utilization of 65%.

4.9.4 Eye Nut

Based on the same loads applied in the Dee Shackles the following comparisons were made between the working loads and breaking loads for the Eye nuts,

Pin Size	unfactored Applied Load	Working load capacity	Utilization	Factored Applied Load	Break Load Capacity	Utilization
8mm	4.1 kN	1.37 kN	300%	5.54 kN	10.98 kN	50%
10mm	4.1 kN	2.256 kN	182%	5.54 kN	18.05 kN	31%
12mm	4.1 kN	3.34 kN	122%	5.54 kN	26.68 kN	21%
14mm	4.1 kN	4.81 kN	85%	5.54 kN	38.45	14%

The utilization based on the unfactored applied load and working is high the 8mm,10,12mm sizes of eye nut. **It is recommended that eye nut with a size of 14mm or greater be adopted.**

4.9.5 Raking Members

The max stress in the raking members was determined using the properties of the 80m dia tube and was found to be 9.12 N/mm² (uf) and 12.5 N/mm²(f). The capacity of the 80x3 CHS was calculated to be 41 N/mm² and therefore the raking members 80x3 and 90x3 CHS acceptable.

The stress bottom M12 bolt supporting the raking member was calculated to be 110 N/mm², which was considered to be acceptable.

4.9.6 Struts

The struts provide support to the raking members. The struts are shown as being 60x60x3 SHS. Calculations indicate that the load in them is relatively low at 2.7 kN(uf) and 3.65 kN(f) when compared to a compressive capacity of 52 kN.

4.9.7 Trailer Frame

The trailer frame was checked using TEDDS STRUCTURAL design for all the load combinations and found to be adequate.

4.10 Fatigue

Reversal of stresses is not expected. Stress fluctuations occur but no reversal of stress was observed in the analysis.

The bolt securing the raking member to the base frame appears to the highest stress and the based on a fatigue life of 5×10^6 , the utilization is 96%. Therefore adequate.

5.0 Restraints and passenger containment

5.1 Passenger containment is provided only by a harness.

5.2 The drawings indicate a safe zone, but do not indicate the type of barrier to be adopted.

5.3 Padding around the trampolines provides some level of protection against getting entangled in the springs to the trampoline and some protection against impact with the perimeter frame of the trampoline.

5.4 Fabric details for the trampoline was not provided but the fabric needs to have minimum specifications as mentioned below.

Weight ASTM D 3776 8.1 oz/yd² Selvage Woven or slit

Grab tensile strength ASTM D 4632Warp: 224.53 kg

Fill: 197.31 kg

Burst strength ASTM D 3786 825 psi

Trap tear strength ASTM D 4533

Warp: 85.28 kg Fill: 83.91 kg

Abrasion resistance ASTM D 4886 95% strength retained

Puncture strength ASTM D 2 192 297,82 kg

UV resistance ASTM D G154 77% s

6.0 Civil Design Report

6.1 The device is designed as a mobile device and the loads are low, and therefore timber packers can be adopted on soft ground. The reactions determined were as follows

6.1.1 Based on being fully loaded, the max reaction was 7.4kN. We would recommend 250mmx250mm packers as a minimum.

6.1.2 We would recommend daily visual check of the legs to ensure excessive settlement does not occur.

7.0 Electrical Design Review Report.

7.1 By others

8.0 Control Systems Design Review Report

8.1 N/A

9.0 Software Design Review Report

9.1 N/A.

10.0 Physical Parameters, Ergonomics and Safety Clearances

10.1 Harness details have not been provided. The harness is provided in 3 sizes, small, medium and large. As minimum the harness should be CE marked and be rated to 600kg (this gives a FOS of 3 based on the 2g).

11.0 Manufacturers Operation and Maintenance Manual

HSG 175 – Appendix 3		Req.mt Met	Comments	Recommendation
Ref:	Requirement	Y/N		
Paragraph 3	Unique ID	N		Name plate to be placed on device.

	Manufacturers Details	Y	On cover of Operators Manual	-
	Controllers Details	Y	On cover of Operators Manual	To be recorded
Paragraph 6	Documents to be Kept With the Device/Controller			
	Documents to be kept with the ride			
	. DOC	Y		-
	. Risk Assessments	N		Operator to produce Risk Assessment
	. Operator Instructions	Y	Within manual.	
	. List of permitted Operators	N		To be noted.
	. Details of Daily/ Periodic Inspections.	N	Daily checks included manual.	Inspection sheets to be produced and included with manual.
	. Schedules of in-service inspections	N	As daily checks.	Inspection sheets to be produced and included with manual
	Mechanical Diagrams	Y	Drawing provided	
	Hydraulic	N/A		
	Electrical	N	Only electrical item is a winch.	
	Pneumatic	N/A		
	NDT	Y		NDT in Appendices of D
	Details of Any Safety Critical Modifications	N/A	None at the Moment.	Should any modifications be made, a record of the modification is to be retained.
	Details of Design review of Modifications	N/A	None at the Moment	DR of any future modification to be carried out and kept with the main DR document.
	Details of ACD of safety critical modification	N/A	None at the Moment	ACD of modification to be carried out.

	Details of Initial Test of Safety critical Modification	N/A	None at the Moment	Initial Test of modification to be carried out.
Paragraph 8	Information on Transport, Installation, Erection and Dismantling			
	Does the Manual Contain :-			
	Diagrams/ Instructions & procedures for Assembly & Dismantling	Y	Erection instructions included	
	Diagrams showing clearance envelope	N	Mobile device and there are no fixtures within the envelope of the device.	Adequate barrier to be adopted during operation.
	Key to Identify any special equipment required for assembly	N		Not Necessary.
	Diagram showing Applied Loads at Key packing Points	N/A		
	Electrical Requirements	N		
	Lightning Protection	N	Not to be operated during adverse weather conditions.	
	Checks/ Tests to Ensure device has been assembled correctly.	N/A		
Paragraph 9	Information on Safe Use			
	The Manual To Contain:			
	Description of Normal	Y		

	Functions of the device			
	The normal safe operating procedure and responsibilities of the operator.	Y		
	Details of operating speeds	N/A		
	Loading and unloading instructions	Y	In Manual	
	Limitations of Use – Weather conditions, age, size, etc	Y	Not to be operated in winds over 15m/s. and other adverse weather conditions. Minimum age of 4 years old, mentioned in manual.	
	Potentially Dangerous passenger behaviour	Y	Addressed in the operating manual.	
	Safe and unsafe operating practices.	Y	Addressed in the operating manual and training documents.	
	Faults and fault finding	N	To be added ASAP	
	Evacuation procedures	Y	Addressed in the Operators manual	
Paragraph 10	Instructions and Guidance on Any Maintenance and Inspection			
	. The information should cover :			
	Daily and Periodic Inspections. Details of part that require checking for	Y	Included in the Manual	

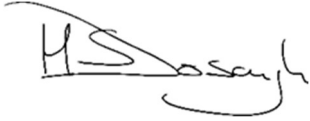
	wear and correct setting.			
	Parts that Require lubricating and frequency and suitable lubricants	N/A	Inspection of parts included in manual.	
	Parts that require regular replacement and their Specification	Y		

12.0 Conclusions & Recommendations

- 12.1 The brief to ASP Consulting (Melbourne) Ltd was to produce a Design Review in accordance with EN 13814.
- 12.2 In order to complete this task in a satisfactory manner risk assessments and calculations have been performed. These calculations were dependent on information retrieved from a site inspection.
- 12.3 The Client has offered their full co-operation in the verification process and has supplied or obtained requested information (where possible).
- 12.4 The structure forming the device has been assessed and has been found to be structurally adequate.
- 12.5 **We would recommend that the following:**
- 12.5.1 Minimum rope diameter to be 10mm**
- 12.5.2 Minimum steel cable to be 5mm with breaking load of 1380kg (min)**
- 12.5.3 Minimum pin diameter on shackles to be 12mm, with its capacity for working load and breaking being greater than applied unfactored and factored loads. If the 10mm shackles were adopted, whilst the applied load (based on 90kg rider) is greater than the working load, it is unlikely fail in the short term, however over time and depending on the working environment, it may become an issue.**
- For longevity and durability, the 12mm shackle would be better option.**
- 12.5.4 Adopting the same philosophy with the Eye nuts, the 14mm size has both the working load and breaking load capacity greater than applied loads. We would therefore recommend the minimum size is 14mm or with a working load capacity greater than 4.1kN (418kg)**
- 12.6 ASP Consulting Ltd affirms that all necessary Design Review work in regard to the “4in1 Bungee Trampoline Mobile Model” Amusement Device has been completed in a satisfactory manner.
- 12.7 The requirements listed throughout this report must be implemented.

Prepared by:

Hardev Dosanjh
231516-2



APPENDICES

Ref No	Hazard profiles EN ISO 12100 Hazards/Controls	Severity					Probability					Risk Rating	Risk: L/M/H	Comments	Measures/Substitute Measures		Severity					Probability					Risk Rating	Risk: L/M/H		
		1	2	3	4	5	1	2	3	4	5				Construction		Operation		1	2	3	4	5	1	2	3			4	5
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P								Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos			Pro	H/P
1	Structural/Mechanical Hazards due to:																													
	- Amusement device components:																													
	a) Shape																													
	b) Relative location																													
	c) Mass and stability																													
	d) Mass and speed				x					x		12	M	Failure of structural members	Structural check of components: Base plates, bolts, arms, wiring, seat	Periodical visual inspection of structural components. NDT checks as dictated by structural analysis											4	L		
	e) Inadequacy of structural/mechanical strength																													
	- Accumulation of energy inside the machinery e.g.:																													
	f) Elastic elements																													
	g) Liquid and gases under pressure				x					x		12	M	Failure of springs and fabric	All elements to be CE Approved for worldwide use.	Daily inspection of surfaces											4	L		
	h) The effect of vacuum																													
1.1	Crushing hazard											NA	NA													6	L			
1.2	Shearing hazard											NA	NA													6	L			
1.3	Cutting or severing hazard				x					x		9	M		Potential from poor surface finishes	Daily check of springs and fabric											6	L		
1.4	Entanglement hazard				x					x		9	M	Potential for limbs to get entangled between springs	Potential for limbs to get entangled between springs	Perimeter matting to beds to be checked daily for tears and tight fitting											6	L		
1.5	Drawing-in or trapping hazard											NA	NA													1	L			

Ref No	Hazard profiles EN ISO 12100 Hazards/Controls	Severity					Probability					Risk Rating	Risk: L/M/H	Comments	Measures/Substitute Measures		Severity					Probability					Risk Rating	Risk: L/M/H
		1	2	3	4	5	1	2	3	4	5						1	2	3	4	5	1	2	3	4	5		
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P				Construction	Operation	Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P		
1.6	Impact hazard			x					x			9	M	Potential for impact with surrounding areas	Adequate barriers to be provided and matting secure correctly.	Daily checks			x					x			6	L
1.7	Stabbing or puncture hazard											NA	NA														NA	NA
1.8	Friction or abrasion hazard		x						x			6	L	Potential for poor surface finishes		Daily inspection of surfaces		x						x			4	L
1.9	High pressure fluid injection or ejection hazard											NA	NA														NA	NA
2	Electrical hazards due to:																											
2.1	Direct contact of persons with wiring and electric parts supplied by voltage		x						x			4	L	Potential Hazard to Staff		Daily checks for loose cables.				x				x			4	L
2.2	Contact of persons with parts being energised due to fault conditions											NA	NA							x				x			8	L
2.3	Approaching of persons to electrical devices on high voltage											NA	NA							x				x			8	L
2.4	Electrostatic processes											NA	NA														NA	NA
2.5	Thermal radiation or processes such as spinning off of melting particles or chemical processes based on short circuits, overloading, etc.											NA	NA														NA	NA

Ref No	Hazard profiles EN ISO 12100 Hazards/Controls	Severity					Probability					Risk Rating	Risk: L/M/H	Comments	Measures/Substitute Measures		Severity					Probability					Risk Rating	Risk: L/M/H		
		1	2	3	4	5	1	2	3	4	5				Construction		Operation		1	2	3	4	5	1	2	3			4	5
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P								Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos			Pro	H/P
3	Thermal Hazards with the consequence of:																													
3.1	Burns and other injuries of persons by means of contact with very high temperature objects or materials, through flames, explosions and high temperature radiation.											NA	NA				x					x				2	L			
3.2	Damage caused to health by hot/cold working environment.	x						x				2	L	Satff Only		Controller to Enure that Health and Safety guidelines are adhered to	x						x				1	L		
4	Hazards due to noise with the consequence of:																													
4.1	Hearing loss (deafness), other physiological restrictions (e.g. loss of equilibrium, reduction of concentration)											NA	NA				x					x				2	L			
4.2	Interference with speech communication, acoustic signals, etc.											NA	NA													NA	NA			
5	Hazards due to vibration																													
5.1	Use of hand-held machines resulting in a variety of neurological and vascular disorders											NA	NA				x					x				4	L			
5.2	Whole body vibration, particularly when combined with poor postures											NA	NA			x						x				1	L			

Ref No	Hazard profiles EN ISO 12100 Hazards/Controls	Severity					Probability					Risk Rating	Risk: L/M/H	Comments	Measures/Substitute Measures		Severity					Probability					Risk Rating	Risk: L/M/H
		1	2	3	4	5	1	2	3	4	5				Construction	Operation	1	2	3	4	5	1	2	3	4	5		
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P						Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P		
6	Hazards due to radiation																											
6.1	Low frequency, radio frequency radiation, microwaves											NA	NA													NA	NA	
6.2	Infrared, visible and ultraviolet light.											NA	NA													NA	NA	
6.4	Alpha, beta rays, electron or ion beams, neutrons											NA	NA													NA	NA	
6.5	Lasers											NA	NA													NA	NA	
7	Hazards due to materials and substances (and due to their ingredients) used by the machinery																											
7.1	Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes, and dusts											NA	NA				x						x			2	L	
7.2	Fire or explosion hazard			x				x				6	L	Debris uner device	Inspection for accumulation of rubbish prior to operation	Suitable fire extinguisher beside attraction required		x						x			2	L
7.3	Biological or microbiological hazards (due to viruses or bacteria)											NA	NA													NA	NA	
8	Hazards due to neglecting ergonomic principles with the design of amusement device, such as hazards due to:																											

Ref No	Hazard profiles EN ISO 12100 Hazards/Controls	Severity					Probability					Risk Rating	Risk: L/M/H	Comments	Measures/Substitute Measures		Severity					Probability					Risk Rating	Risk: L/M/H		
		1	2	3	4	5	1	2	3	4	5				Construction		Operation		1	2	3	4	5	1	2	3			4	5
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P								Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos			Pro	H/P
8.1	Unhealthy postures or excessive effort		x					x				4	L	Riders not secured correctly in harness		Operators to be trained on correct use of harness	x						x				1	L		
8.2	Inadequate consideration of hand-arm or foot-leg anatomy											NA	NA						x				x				3	L		
8.3	Careless use of personal protection equipment											NA	NA							x			x				4	L		
8.4	Inadequate local lighting											NA	NA														NA	NA		
8.5	Inadequate design, location or identification of manual controls											NA	NA				x							x			2	L		
8.6	Inadequate design or location of visual display units											NA	NA					x						x			2	L		
9	Combination of hazards											NA	NA														NA	NA		
10	Unexpected start-up, over-run/over-speed from:																													
10.1	Breakdown / failure of the control system											NA	NA							x				x			3	L		
10.2	Restoration of energy supply after an interruption											NA	NA														NA	NA		

Ref No	Hazard profiles EN ISO 12100 Hazards/Controls	Severity					Probability					Risk Rating	Risk: L/M/H	Comments	Measures/Substitute Measures		Severity					Probability					Risk Rating	Risk: L/M/H		
		1	2	3	4	5	1	2	3	4	5				Construction		Operation		1	2	3	4	5	1	2	3			4	5
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P								Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos			Pro	H/P
10.3	External influences on electrical equipment											NA	NA													6	L			
10.4	Other external influences (gravity, wind, etc.)			x				x				6	L	Adverse weather conditions	Not to be Operated in Adverse conditions	Ride NOT to be operated in wind speeds > 15m/s											3	L		
10.5	Software error Errors made by the operator (due to mismatch of machinery with human characteristics and abilities. see 8.6)											NA	NA													6	L			
10.6	Software error Errors made by the operator (due to mismatch of machinery with human characteristics and abilities. see 8.6)											NA	NA													NA	NA			
11	Impossibility of stopping the amusement device in the best possible conditions											NA	NA													2	L			
12	Variations in the rotational speed											NA	NA													2	L			
13	Failure of the power supply											NA	NA													1	L			
14	Failure of the control circuit											NA	NA													1	L			
15	Errors of fitting			x				x				6	L	Induced forces due to error of fit		Design proven by calculation										2	L			

Ref No	Hazard profiles EN ISO 12100 Hazards/Controls	Severity					Probability					Risk Rating	Risk: L/M/H	Comments	Measures/Substitute Measures		Severity					Probability					Risk Rating	Risk: L/M/H		
		1	2	3	4	5	1	2	3	4	5						1	2	3	4	5	1	2	3	4	5				
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P				Construction	Operation	Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P				
16	Break-up during operation			x					x			9	M	Failure due to fatigue		Regular inspection as indicated in the maintenance manual and from the design review to be undertaken as required				x						x			6	L
17	Falling or ejected objects or fluids											NA	NA						x							x			6	L
18	Loss of stability/overturning of the amusement device				x				x			12	M	Inadequate structural design. Poor maintenance.	Design check	Device to be located on stable ground										x			8	L
19	Slip, trip and fall of persons (related to machinery)		x						x			4	L	Loading / Unloading area	Transient slip hazards removed, regular review of area to minimise possible trip hazards.	Operatives to ensure loading/unloading is done in a safe manner										x			2	L
20	Relating to the drive of the amusement device (e.g. train / vehicle , etc.)																													
20.1	Drive when starting the amusement device											NA	NA													x			4	L
20.2	Drive without an operator at the operator panel											NA	NA													x			6	L
20.3	Drive without all parts in a safe position											NA	NA													x			6	L
20.4	Excessive speed of barrier to control pedestrian movement											NA	NA																NA	NA
20.5	Excessive vibrations during the drive											NA	NA													x			4	L

Ref No	Hazard profiles EN ISO 12100 Hazards/Controls	Severity					Probability					Risk Rating	Risk: L/M/H	Comments	Measures/Substitute Measures		Severity					Probability					Risk Rating	Risk: L/M/H		
		1	2	3	4	5	1	2	3	4	5				Construction		Operation		1	2	3	4	5	1	2	3			4	5
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P								Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos			Pro	H/P
20.6	Insufficient ability of machinery to be slowed down, stopped and immobilised											NA	NA													3	L			
21	Linked to the work position at the amusement device																													
21.1	Fall of persons during access to (or at/from) the work position											NA	NA													4	L			
21.2	Exhaust gases/lack of oxygen at the work position											NA	NA													NA	NA			
21.3	Fire				x							12	M	All accumulations of rubbish removed	Suitable fire extinguisher beside attraction.											8	L			
21.4	Mechanical hazards at the work position:		x					x				4	L	Maintenance operations only	Maintenance procedures in place to minimise risk to personnel						x					1	L			
21.5	a) contact with moving parts											NA	NA													NA	NA			
21.6	b) rollover											NA	NA													NA	NA			
21.7	c) fall of objects, penetration by objects		x					x				4	L	Loose components of device	Daily inspection of device by operatives required to ensure all items on the device are secure						x					2	L			
21.8	d) break-up of parts rotating at high speed											NA	NA													NA	NA			

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		1	2	3	4	5	1	2	3	4	5						1	2	3	4	5	1	2	3	4	5		
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P				Construction	Operation	Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P		
21.9	e) contact of persons with machine parts or tools (pedestrian controlled machines)											NA	NA													NA	NA	
21.10	Insufficient visibility from the work positions											NA	NA													NA	NA	
22	Due to the control system																											
22.1	Inadequate location of manual controls											NA	NA	Check layout		x				x					2	L		
22.2	Inadequate design of manual controls and their mode of operation											NA	NA		Operator training to be regularly refreshed	x				x					2	L		
23	From handling the amusement device (lack of stability)			x						x		9	M	Correcty assembly by trained staff	Daily Inspection				x		x				8	L		
24	Due to the power source and to the transmission of power																											
24.1	Hazards from the engine and the batteries											NA	NA												NA	NA		
24.2	Hazards from transmission of power between machines											NA	NA	Checks in place	Inspection of electrical supply regularly	x					x				4	L		
24.3	Hazards from coupling and towing											NA	NA	Fixed Installation											NA	NA		
25	From/to third persons																											
25.1	Unauthorised start-up/use											NA	NA				x				x				3	L		
25.2	Drift of a part away from its stopping position											NA	NA												NA	NA		
25.3	Lack or inadequacy of visual or acoustic warning means											NA	NA												NA	NA		

Ref No	Hazard profiles EN ISO 12100 Hazards/Controls	Severity					Probability					Risk Rating	Risk: L/M/H	Comments	Measures/Substitute Measures		Severity					Probability					Risk Rating	Risk: L/M/H		
		1	2	3	4	5	1	2	3	4	5						1	2	3	4	5	1	2	3	4	5				
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P				Construction	Operation	Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P				
26	Insufficient instructions for the operator				x					x		12	M		Regular updates on training	Operatives to be trained and full understanding of Operational manuals					x						x		8	L
27	Mechanical hazards and hazard events due to lifting																													
27.1	from load falls, collisions, machine tipping caused by:																													
27.1.1	lack of stability				x					x		12	M	Structural checks	Site set-up to be on stable ground					x						x		8	L	
27.1.2	uncontrolled loading - overloading - overturning moments exceeded				x					x		9	M	Structural checks	Design check for imbalanced loading	Loading procedures in operators manual					x						x		6	L
27.1.3	uncontrolled amplitude of movements				x					x		9	M	Control system inadequacy	Design Check						x						x		6	L
27.1.4	unexpected/unintended movement of loads				x					x		9	M		Loading procedures in operator manual						x						x		6	L
27.1.5	Inadequate holding devices/accessories											NA	NA																NA	NA
27.1.6	collision of more than one machine											NA	NA																NA	NA
27.2	from access of persons to load support											NA	NA								x						x		3	L
27.3	from derailment											NA	NA																NA	NA

Ref No	Hazard profiles EN ISO 12100 Hazards/Controls	Severity					Probability					Risk Rating	Risk: L/M/H	Comments	Measures/Substitute Measures		Severity					Probability					Risk Rating	Risk: L/M/H		
		1	2	3	4	5	1	2	3	4	5				Construction		Operation		1	2	3	4	5	1	2	3			4	5
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P								Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos			Pro	H/P
27.4	from insufficient mechanical strength of parts			x					x			9	M		Structural analysis to prove adequacy	Regular maintenance of safety critical items as set by maintenance procedures and Design Review Requirements				x						x			6	L
27.5	from inadequate design of pulleys, drums											NA	NA																NA	NA
27.6	from inadequate selection of chains, ropes, lifting and accessories and their inadequate integration into the machine											NA	NA	Design requirement	Structural analysis to prove adequacy	Regular maintenance of safety critical items as set by maintenance procedures and Design Review Requirements													NA	NA
27.7	from lowering of the load under the control of friction break											NA	NA																NA	NA
27.8	from abnormal conditions of assembly/testing/use/maintenance			x					x			9	M	Design requirement	Maintenance procedures and replacement of parts to conformity to design				x						x			6	L	
27.9	from the effect of load on persons (impact by load or counterweight)											NA	NA																NA	NA
28	Electrical hazard																													
28.1	from lightning											NA	NA	Ride Earthed by contact with ground															NA	NA
28.2	From High Voltage											NA	NA																	
29	Hazards due to neglecting ergonomic principles																													

Ref No	Hazard profiles EN ISO 12100 Hazards/Controls	Severity					Probability					Risk Rating	Risk: L/M/H	Comments	Measures/Substitute Measures		Severity					Probability					Risk Rating	Risk: L/M/H		
		1	2	3	4	5	1	2	3	4	5				Construction		Operation		1	2	3	4	5	1	2	3			4	5
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P								Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos			Pro	H/P
29.1	insufficient visibility from the operator position		x					x				4	L		Excellent visibility from operators position	Cameras to be installed as required		x					x				2	L		
30	Mechanical hazards and hazardous events due to underground work due to:											NA	NA														NA	NA		
30.1	Failing accelerator or brake control of machinery running on rails											NA	NA														NA	NA		
30.2	Failing or lack of deadman's control of machinery running on rails											NA	NA														NA	NA		
31	Restricted movement of persons											NA	NA														NA	NA		
32	Fire and explosion				x				x			12	M	Site Specific		Evacuation procedure and training to staff				x			x				8	L		
33	Emission of dust, gases etc.											NA	NA														NA	NA		
34	Mechanical hazards and hazardous events due to lifting or moving of persons due to:																													
34.1	Inadequate mechanical strength - inadequate working coefficients				x				x			12	M	See Section 1	Design verification of structural members				x			x				6	L			

Ref No	Hazard profiles EN ISO 12100 Hazards/Controls	Severity					Probability					Risk Rating	Risk: L/M/H	Comments	Measures/Substitute Measures		Severity					Probability					Risk Rating	Risk: L/M/H
		1	2	3	4	5	1	2	3	4	5						1	2	3	4	5	1	2	3	4	5		
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P				Construction	Operation	Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P		
34.2	Failing of loading control			x				x				6	L	Possible overload		Clear Instructions to Riders			x			x					3	L
34.3	Failing of controls in person carrier (function, priority)			x					x			9	M	See Sec 1	Design checks			x			x					3	L	
34.4	Overspeed of person carrier											NA	NA													NA	NA	
35	Falling of person from person carrier											NA	NA													NA	NA	
36	Falling or overturning of person carrier											NA	NA					x				x				6	L	
37	Hazards arising from the intensity and duration of accelerations and jerks		x					x				4	L	Very smooth and short ride time, controlled by rider				x				x				2	L	
38	Hazards arising from the intensity and duration of force exerted by elements of the passenger containment		x					x				4	L	Theoretical 2.0g experienced by rider.				x				x				2	L	
38.1	Is the cushioning (seat/back/side/knee space/clamp) still in a fault-free condition?											NA	NA													NA	NA	
	Is this checked every day?											NA	NA													NA	NA	
39	Ejection of passengers																											
	Do the passenger seats and safety restraints comply with the condition of the initial testing?		x						x			6	L	Harness to be correctly fastened		Daily inspection			x				x				6	L

Ref No	Hazard profiles EN ISO 12100 Hazards/Controls	Severity					Probability					Risk Rating	Risk: L/M/H	Comments	Measures/Substitute Measures		Severity					Probability					Risk Rating	Risk: L/M/H		
		1	2	3	4	5	1	2	3	4	5				Construction		Operation		1	2	3	4	5	1	2	3			4	5
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P								Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos			Pro	H/P
40	Are operating experiences known (e.g. near-accidents), which suggest upgrading (e.g. seat hunch)?											NA	NA													NA	NA			
	Hazards from reasonable foreseeable behaviour of the passengers																													
	Do specific operating experiences exist?											NA	NA													NA	NA			
41	Are these systematically recorded? (e.g. in the daily reports)											NA	NA													NA	NA			
	Hazards from reasonable foreseeable operator error																													
	How are the operating experiences monitored?											NA	NA													NA	NA			
42	Who is responsible for updating the operating instructions?											NA	NA													NA	NA			
	Hazards associated with high winds																													
	Is the wind speed defined for decommission the amusement device?				x						x	16	H	Device not to be operated in poor weather conditions		Operatives procedure in place				x		x				8	L			
43	Is this wind speed known to the operator?											NA	NA													NA	NA			
	How and where is the wind speed measured?											NA	NA													NA	NA			
	Hazards associated with snow																													

Ref No	Hazard profiles EN ISO 12100 Hazards/Controls	Severity					Probability					Risk Rating	Risk: L/M/H	Comments	Measures/Substitute Measures		Severity					Probability					Risk Rating	Risk: L/M/H																				
		1	2	3	4	5	1	2	3	4	5				Construction		Operation		1	2	3	4	5	1	2	3			4	5																		
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P								Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos			Pro	H/P																		
	Is the operation of the amusement device permitted if its frosty? (e.g. freezing of sensitive parts)				x																											16	H	Device not to be operated in poor weather conditions		Operatives procedure in place											8	L
	Where is the information regarding this point recorded?																															NA	NA									NA	NA					
44	Lightning strike																																															
	Will the operation be stopped on approaching thunderstorms?				x																											16	H	Device not to be operated in poor weather conditions		Operatives procedure in place											8	L
45	Hazard associated with the need to evacuate passengers from remote locations (e.g. following ride breakdown)																																															
	Is a plan drawn up due to rescue?																															NA	NA									6	L					
	Will rescue drill be trained?																															NA	NA									6	L					
	In the case of rescue, will appropriately competent members of staff make the decision?																															NA	NA									NA	NA					
48	Injury by projectiles																																															
	Injury be expected due to the catapulting of objects e.g. due to acceleration?		x																													6	L	Passenger possessions & objects thrown by spectators		Operator Procedure in place regarding warning of loose possessions or unsecured objects and behaviour of spectators											2	L

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		1	2	3	4	5	1	2	3	4	5						1	2	3	4	5	1	2	3	4	5		
		Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P				Construction	Operation	Neg	Mar	Sig	Sev	Fat	V/U	Unl	Pos	Pro	H/P		
	Are indicating labels available?											NA	NA													NA	NA	
	Do specific operating experiences exist?											NA	NA													NA	NA	
49	Crushing due to crowd pressure																											
	Is there a real possibility of crushing?		x					x				4	L		None Identified			x				x				3	L	
50	Bottlenecks with evacuation																											
	Are there bottlenecks on the escape route		x					x				4	L		None Identified		x									NA	NA	
	Will there be a head count in the event of evacuation?											NA	NA													NA	NA	

Controller: - Unknown
Device: - EuroJumper – 4in1 Mobile Model
Date of Preparation: February 2023
Rev: - Date of Rev:

	Components/ Part of Device	Test method/ NDT Method	Frequency of Test	Level of Disassembly	Comments/ Additional Info.
-	Trailer	Magnetic Particle (MPI)	Annual	Nominal	Welds to Trailer chassis at outrigger connect to chassis.
-	Arm pins at base of arm	Ultrasound	Annual	None	
-	Trailer Frame	Visual	Annual	None	
-	Fixings – including turnbuckles, Dee Shackles, Eyes	Visual	Annual	None	
-	Ropes	Visual	Annual	None	ALL Ropes
-	Cables	Visual	Annual	None	ALL cables
-	Bungee	Visual	Annual	None.	ALL Bungee chords

The device as a whole requires 100% visual inspection.
Any defects to be recorded and AIB notified.

Any paint thicker than 50Microns to be removed prior to MPI testing.

The above schedule is not exhaustive and condition of the time of the examination, may require that further NDT techniques are applied.

Controller: - Unknown
Device: - EuroJumper – 4in1 Mobile Model
Date of Preparation: February 2023
Rev: - Date of Rev:

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