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Page
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Comparative tests of trampolines

Summary

A comparative test of 8 trampolines has been performed according to RISE's own test method. A summary with scores are shown in table 1 and a short summery description of each method in table 2 and 3.

The test program is reported in chapter 3 and test results in chapter 4. Table 1 presents the score for each subsection on a scale of 1-5 where 5 is the best possible score and 1 is the worst possible score. The total score is a summation of the 3 test parts where each part has a weight of 1/3 of the total score.

The test result is shown in chapter 4.

Table 1

	Berg Ultimate Favorit Regular 330	Berg Grand Champion 520	Biltema 14-4125	Jump King SPS Rectangular 14	North Pioneer 370 Rectangular	North Legend* Oval 500	Salta Premium Black Edition 366	Springfree Large Oval O92
Quality and assembly	4.0	4.2	2.6	1.9	4.8	4.9	3.3	2.2
Safety	3.4	3.6	2.0	4.1	4.9	5.0	3.5	4.0
Performance	3.6	4.5	3.4	3.0	3.8	5.0	3.5	2.5
Summery	3.67	4.1	2.67	3.0	4.5	4.97	3.43	2.90

*is called "Explorer" in some markets.

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Table 2

Berg Ultimate Favorit Regular 330	Berg Grand Champion 520	Biltema 14-4125	Jump King SPS Rectangular 14
A smaller and slightly harder trampoline with a good quality feel and high bounce on it. Prone to tipping and entrapment risk between the net and the padding.	Large and comfort-able to jump on. Entrapment risk between the net and the padding. Long assembly time and quality problems with safety net fastening in the bottom has lowered the ratings.	A stable trampoline with a hard bounce that is very quick to assemble. Poor sense of quality. Thin and poor padding with risk of foot entrapment. Risk of entrapment between the net and the padding.	Large trampoline with little risk of tipping over. Soft mat makes it tough to walk on and requires more energy to get the bounce going. Poor padding with entrapment risk and a very poor sense of quality lowers the rating considerably.

Table 3

North Pioneer 370 Rectangular	North Legend Oval 500	Salta Premium Black Edition 366	Springfree Large Oval O92
A smaller and slightly harder trampoline with good safety and a very good quality feel. Assembled quickly without tools.	Large and comfortable to jump on. Easy to assemble without tools and with very good safety and a very good sense of quality. Best choice of all tested trampolines.	Relatively quickly assembled. Hard and high bounce. Intermediate level of quality. The frame cannot withstand a higher load without local bending. Slightly prone to tipping.	Extremely difficult to assemble. Trampoline is meant to be left outside all year round. Hard mat edge and risk of entrapment and injuring yourself if you jump outside. Only comfortable to jump on in the middle. The springs turn sideways at the edges which feels uncomfortable.

Introduction

RISE has been commissioned by Avero AB to perform comparative tests of 8 trampolines. All performed tests have been according to RISE's own test method or with selected parts of various standards in accordance with the customer's wishes. A number of different tests have been carried out on each trampoline with a focus on bouncing ability, quality and safety. The tests that have been carried out can be found in table 4 and are briefly described under each test chapter.

1. Test objects

Designation/Item number:

Berg Ultimate Favorit Regular 330

Berg Grand Champion 520

Biltema 14-4125

Jump King SPS Rectangular 14

North Pioneer 370 Rectangular

North Legend Oval 500

Salta Premium Black Edition 366

Springfree Large Oval O92

Arrival of test objects: 2024-02-08 – 2024-02-15.

Selection of test objects: Performed by the client without RISE's assistance.

**Picture 1 Berg Ultimate Favorit Regular 330****Picture 2 Berg Grand Champion 520****Picture 3 Biltema 14-4125****Picture 4 Jump King SPS Rectangular 14****Picture 5 North Legend Oval 500****Picture 6 North Pioneer 370 Rectangular****Picture 7 Salta Premium Black Edition 366****Picture 8 Springfree Large Oval O92**

2. Test method

Test method: RISE’s own test method in accordance with the customer's wishes. The tests that have been performed are briefly described under each test chapter.

Test dates: 2024-02-12 - 2024-02-26.

Place of testing: All tests were performed at RISE’s test laboratory in Borås by the division, Chemistry and Applied Mechanics - Transport and Product Safety.

Table 4 Test program

Part	
1	Quality and assembly
	Assembly
	Quality on frame, mat, safety net, and entrance
	Warranty
	Water on the mat
2	Safety
	Refuge area
	Entrance and ladder
	Entrapment
	Safety net quality and fastening at the top
	Safety net quality against sticks
	Stability
	Paddings attachment
	Safety against the spring of the mat
	Step through protection on padding
	Heavy load on the frame
3	Performance
	Bounce ability
	Softness of the bounce
	Heavy load on mat

3. Results from tests

All results presented in this report only refer to the tested samples.

4.1 Quality and Assembly

4.1.1 Assembly

When you have bought a trampoline or before and after winter want to mount/demount the trampoline you want it to be easy and quick without using a lot of tools.

The manual was read before and during assembly and the trampoline was assembled according to the manual. The time for the assembly is an approximate time for 2 people during the assembly time. Following things where assessed: Difficulty to assemble, manual, tools included and other notes.

Table 5

Assembly	Berg 330	Berg 520	Biltema	Jump King
Time assembly	3 Hour, 15 minutes	4 Hour, 7 minutes	1 Hour, 31 minutes	4 Hour, 30 minutes
Difficulty assembly	6/10. Easier than Jump King but time consuming.	4/10. Was reasonably easy to assemble, but extra tools such as a rubber mallet to knock the frame together were required.	6/10. The legs for the frame were easy to assemble, but the frame was a little more difficult because the pieces often became loose. The frame does not stick together properly until you assemble the mat and springs.	7/10. Not the most difficult but physically demanding to pull the steel poles together and very time consuming.
Manual	Very unclear, pictures do not show which way the legs should be placed, no clear explanation which parts were to be assembled (e.g. can use numbers or letters to make it easier for the customer).	Fairly clear pictures in the manual but the spring assembly instructions spanned several layouts which may lead to mistakes.	The manual was relatively easy to follow but could use larger pictures as some were difficult to read.	Ok, but unclear how certain parts should fit together. Incorrect on the final image and not the correct number of parts at one point.
Tools included	Yes, simple tools such as small wrenches were included. Screwdrivers are recommended to be able to assemble the trampoline in a safe and stable way.	Yes, tools were included but were replaced with other more practical tools that made assembly easier.	Yes, tools were provided for the trampoline but there were no tools for the ladder.	Yes, to attach the springs but nothing to tighten the screws.
Other notes	The attachment for the net and padding was simple in theory but a little complicated to perform.	Quite easy to assemble, even just one person can assemble it, just takes a bit more time. Buckle to net broke during assembling. Takes a very long time to assemble.	Fairly easy to assemble as one person could assemble the entire trampoline, except to flip the frame.	A bit problematic when tensioning straps are needed to prevent the frame from collapsing before the mat is installed and hold the frame together.
Total weight [kg]	83	153	70	155

Table 6

Assembly	North 370	North 500	Salta	Springfree
Time assembly	1 Hour, 18 minutes	1 Hour, 50 minutes	2 Hour, 2 minutes	2 Hour, 55 minutes
Difficulty assembly	2/10. No screws needed, the entire construction is pushed together. Had to use a rubber mallet when fitting legs to the frame. Problems fitting the net poles.	4/10. No screws needed, the entire construction is pushed together.	6/10. Relatively easy to assemble.	10/10. Very impractical to install, requires at least three full grown men to attach the mat to the frame with their special springs. The springs are really hard to mount even for a strong person.
Manual	Simple and comprehensive.	No information that the legs were different sizes, could have helped by numbering the parts of the frame, other than that it was good and clear.	Detailed and quite easy to follow.	Very unclear, the pictures in the paper manual. For example it does not show how the net should be attached. An app can be downloaded to get a 3D view of how the trampoline should be built, but is unclear even during the steps. Well shown with colours on the steel beams and in the manual to make it easier to see and understand how everything should fit together.
Tools included	Yes (Handle for Spring Mount).	No, no tools needed.	Yes, hex key, spring assembly tool and a bad socket wrench.	Yes, tools included but were replaced with real tools for easier and safer assembly.
Other notes	No complications, easy to assemble.	No complications, easy to assemble.	Relatively easy to assemble.	Very difficult trampoline to assemble. Requires more people than assigned and takes longer than expected. High risk of injury during installation of the mat. Their unique springs are really hard and can easily snap back to the face and body when they are bent.
Total weight [kg]	98	144	89	101

4.1.2 Quality on frame, mat, safety net, and entrance

When you buy a trampoline you want it to last as long as possible. As it stands outside in the sun, rain and hail which breaks down all the materials on the trampoline. And what about the rest of the impression of the quality and how its put together. Assessment of the quality impression is made on the materials, constructions of the frame, mat, safety net, entrance and warranty. For example, what happens if you shake the trampoline. Does the frame wobble? Does the trampoline have sharp edges, thin materials etc. Does the material give the impression that they will withstand weather and wind for a long time, etc.?

Table 7

Quality	Berg 330	Berg 520	Biltema	Jump King
Frame	Galvanized frame feels sturdy and gives a good impression when it comes to welding and machining. Legs feel somewhat tight.	Galvanized frame with lacquered legs. Makes a solid impression. Mounted with carriage bolts and spring washers.	Galvanized frame, legs and poles. Good surface considering the price. Feels wobbly.	Incipient rust on some pieces, porous unsightly welds. Phillips head screws for assembly and disassembly. Can make disassembly after exposure to weather more difficult. Lacquered legs.
Mat	Feels well made with nothing to complain about.	High quality feel and has color-coded rings for easy assembly.	Feels good with acceptable finish. Slightly slippery jumping surface.	Feels ok, maybe a bit cheap feeling with loose threads spreading out at the bottom of the edge.
Safety net	The net material consists of thin threads that are perceived as prone to damage. Neatly sewn together with solid edging. Does not seal tightly against padding and leaves gaps large enough for small children to crawl out. Net's lower buckles feel weak. The net must be replaced every 5 years. Minus on the attachment of net poles which is perceived as weak and complicated.	The net material is perceived as high quality and is equipped with strong edge bands and a secure upper attachment. The fastening of the lower edge is perceived as insufficient. The buckles are of poor quality. A buckle broke during installation. The design of the attachment leaves large gaps against padding where even an adult can squeeze through. Net poles feels solid.	The net material consists of thin threads and feels prone to damage. Stable upper attachment with fiberglass rods between posts. The lower attachment cannot be tightened sufficiently and leaves gaps against the padding.	Feels weak and resembles strawberry netting, the manufacturer writes that the safety net must be replaced <u>every year!</u> Instable net poles

Table 8

Quality	Berg 330	Berg 520	Biltema	Jump King
Entrance	The entrance is clearly colour marked and feels safe. Minus for the obvious tripping risk when stepping out as it is difficult to get a proper foothold outside the net before taking a step down on the ladder.	The entrance is clearly colour marked and feels safe. Minus for the obvious tripping risk when stepping out as it is difficult to get a proper foothold outside the net before taking a step down on the ladder.	The entrance is clearly colour-marked and it is possible to stand on the edge protection outside for safe movement to the ladder. Minus for zipper, which allows for carelessness.	The entrance is good, clearly colour-marked, it is possible to stand outside on the edge protection for safe movement to the ladder.
Warranty	Frame (not rust) 5 years, Padding 2 years, Mat 2 years, Springs 2 years, Net 2 years, Ladder 2 years.	Frame (not rust) 10 years, Padding 2 years, Mat 2 years, Springs 5 years, Net 2 years, Ladder 2 years.	According to the Consumer Purchase Act (Sweden), up to 3 years.	Frame 5 years, Padding 2 years, Springs 2 years, Mat 2 years, Net 1 year.
Other notes	Feels like a good product basically. But losing points due to the various safety net related design problems.	Feels like a good product basically. But losing points due to the various safety net related design problems.	Feels like a cheap product. Much thanks to the ugly raspy padding. But otherwise quite okay for the money.	The padding feels like a cheap wear-and-throw product. Padding does not cover the frame and springs completely. Padding feels like a cheap raspy tarp.



Picture 9 Raspy padding (Jump King)

Table 9

Quality	North 370	North 500	Salta	Springfree
Frame	Galvanized frame with lacquered legs and good finish.	Galvanized frame with lacquered legs gives a solid impression of quality.	Lacquered frame with a nice finish.	Stylish lacquered frame with good finish feels sturdy.
Mat	Feels high quality and nicely made with edge that covers the springs under edge protection.	Feels good with slightly higher friction on the jumping surface than other mats. Feels very safe with the safety net that snaps together with the padding. Doesn't look so good on the underside with threads and canvas material stands out of the edge band.	Feels good with perfectly ok finish, slightly slippery jumping surface.	Feels qualitative, but there is a high risk of incorrect assembly and failure as the fasteners for the torsion springs tend to loosen and disappear into the sewn channel during assembly.
Safety net	The net material consists of thin threads that feel somewhat prone to damage. Neatly sewn in with solid edge bands and a well dimensioned attachment to the frame. Net poles do not have the same finish and feel a little instable.	The net feels high quality. Upper attachment feels solid. Lower attachment with zippers against padding feels very safe and smooth during assembly. Net poles slightly instable. Easy assembly/disassembly.	The net material consists of thin threads and feels prone to damage. Stable upper attachment with fiberglass rods between the poles. The lower attachment cannot be tightened sufficiently and leaves gaps against the padding. Instable tops of net poles. Pipe dimensions are perceived to be somewhat thin.	The mesh material feels high quality. The meshes are just big enough for children's finger to get entrapped. Thin composite net poles give an instable impression.

Table 10

Quality	North 370	North 500	Salta	Springfree
Entrance	The entrance is clearly marked with contrasting colour and is positioned so that entry and exit can be done safely.	The entrance is clearly marked with contrasting colour and is positioned so that entry and exit can be done safely.	The entrance is clearly colour-marked and it is possible to stand on the padding outside for safe movement to the ladder. Minus for zipper, which allows for carelessness.	The entrance feels safe for getting in and out with a low risk of tripping. There is a risk of crushing at the springs if someone jumps at the same time the other goes in or out. Zipper in contrasting colour. A little more colour could have made the opening clearer. Minus for zipper, which allows for carelessness.
Warranty	Frame 7 years, Mat and springs 5 years, Padding 2 years, Net 2 years.	Frame 10 years, Mat 5 years, Springs 5 years, Padding 2 years, Net 2 years	Frame 5 years, Padding 2 years, Springs 2 years, Mat 2 years, Net 2 years.	If you register with the manufacturer, it gives a guarantee on the Frame 8 years, Mat 2 years, Poles 2 years, Safety net 2 years. Otherwise half time in case of unregistered purchase.
Other notes	Feels like a good product. Maybe a little instable.	Feels like a good and safe product of high quality and nice finish.	Feels like a cheap product that has been made up with attributes from more expensive mats, Stylish padding etc.	Feels high quality but overcomplicated with risk of pinching and an extremely hard to assembly with imminent risk of injury.

4.1.3 Water on the mat

After raining or the night dew have fallen you want to get up and jump as soon as possible without getting wet or slipping on the mat. To simulate that, 1 dl of water was poured on the mat. After 1 hour in room temperature a blotting paper was used to dry up the remaining water. The blotting paper was measured before and after drying up the water with paper and the weight difference is noticed as the remaining water after 1 hour.

Table 11

Water on mat	Berg 330	Berg 520	Biltema	Jump King
Weight dry paper [gram]	6	6	5	6
Weight wet paper [gram]	46	8	45	6
Remaining water absorbed [gram]	40	2	40	0

Table 12

Water on mat	North 370	North 500	Salta	Springfree
Weight dry paper [gram]	6	6	6	6
Weight wet paper [gram]	40	6	47	7
Remaining water absorbed [gram]	34	0	41	1

4.1.4 Grading the results from quality and assembly

All the facts from the assessments and tests of quality and assembly are scored from 1 to 5 where 5 is the highest score. Highest quality and fastest assembly gives the highest score

Table 13 Scores Quality and assembly

	Berg Ultimate Favorit Regular 330	Berg Grand Champion 520	Biltema 14-4125	Jump King SPS Rectangular 14	North Pioneer 370 Rectangular	North Legend Oval 500	Salta Premium Black Edition 366	Springfree Large Oval O92
Score	4	4,2	2,6	1,9	4,8	4,9	3,3	2,2

4.2 Safety

Trampolines are fun to jump on but awareness of safety is key on the trampoline and also when entering and exiting it. When jumping it's not uncommon that you bounce off the mat or slip, especially if you are 2 persons on the trampoline. It's recommended to only be one person at the time but it's not uncommon to be two persons and it can also be more fun. If so it's good to have a refuge area. The trampolines safety is assessed with its entrance and ladder and how to get on and off it, the safety net and its quality and attachment. The padding is assessed with its fixation, coverage and ability for not stepping through. The risk of entrapment is assessed on the basis of small children and that they can get stuck with their heads and become suspended and be strangled especially between the safety net and the mat or padding. The risks of slipping under the padding and getting stuck between the springs or being pinched is also assessed. How stable is the trampoline if you bounce to the safety net or leaning towards it. And how does the frame cope with some people sitting on the frame. Does it collapse or deform.

4.2.1 Refuge area

Even though you only shall jump 1 person at the same time it's not uncommon that 2 persons jump at the same time and it could also be more fun. If there are 2 persons at the same time it's good to have a quick access to a refuge area if one person quickly needs to get of the jumping area to not to be part of the jumps or to take a breath.

Table 14

	Berg 330	Berg 520	Biltema	Jump King
Refuge area.	There is a stable padding to stand on. Not in the corners where the safety net goes over the entire padding.	There is a stable padding to stand on. Not in the corners where the safety net goes over the entire padding.	A little area on the padding.	None.

Table 15

	North 370	North 500	Salta	Springfree
Refuge area.	There is a stable padding around the mat to stand on.	There is a stable padding around the mat to stand on.	There is a stable padding around the mat to stand on.	None.

4.2.2 Entrance and ladder assessment

Safety around the entrance and how to enter and exit is important since many accidents happens there. Climbing a ladder and enter the mat and the other way around in a safe way is assessed. Many nets have a zipper that is forgotten to be closed with the risk of falling out. A safety net with a tunnel construction is better and means that the safety net is always closed and the risk of falling out through an unclosed zipper disappears.



Picture 10 Tunnel entrance (North 500)



Picture 11 Tunnel entrance (Jump King)



Picture 12 Entrance with zipper (Salta)



Picture 13 Low entrance with zipper (Springfree)

Table 16

	Berg 330	Berg 520	Biltema	Jump King
Entrance and ladder assessment	Tunnel construction with a padding to stand on when coming up and walking through the tunnel. Good with a safety net pole at the entrance to hold on to when going up and down ladders and in and out of tunnels. However, the padding to stand on when you come up is small and narrow.	Tunnel construction with a padding to stand on when coming up and walking through the tunnel. Good with a safety net pole at the entrance to hold on to when going up and down ladders and in and out of tunnels. However, the padding to stand on when you come up is small and narrow.	Quite a small entrance with a zipper and an padding to stand on when coming up. Good with a net pole at the entrance to hold on to when going up and down the ladder and in and out of the entrance.	Tunnel construction with padding to stand on when coming up and walking through the tunnel. Good with a safety net pole at the entrance to hold on to when going up and down the ladder and thorough the tunnel. However, the tunnel runs at the joint between the padding and the trampoline, which makes it difficult to walk on.

Table 17

	North 370	North 500	Salta	Springfree
Entrance and ladder assessment	Tunnel construction with a padding to stand on when coming up and walking through the tunnel. Good with a safety net pole at the entrance to hold on to when going up and down ladders through the tunnel.	Tunnel construction with a padding to stand on when coming up and walking through the tunnel. Good with a safety net pole at the entrance to hold on to when going up and down ladders and through the tunnel.	Entrance with zipper and a padding to stand on when you get up. Good with a safety net pole at the entrance to hold on to when going up and down the ladder and in and out of the entrance.	Low entrance that does not need a ladder to get in and out for youth and adult. Entrance with zipper.

4.2.3 Entrapment Safety net. Head, neck and foot

Trampolines shall be constructed so that no openings create head and neck entrapment hazards either by head first or feet first passage. If so there is a risk you can get hung up, be able to crawl out and fall down. This is tested for the head and neck according to EN 71-14, chapter 5.4.2 with small and large head probe. If the small head probe passes under the net, the large head probe shall also pass and if the big probe not passes its consider to have an entrapment risk. For foot its assessed if the net has any risk of entrapment.



Picture 14 Entrapment risk (Springfree)

Table 18

	Berg 330	Berg 520	Biltema	Jump King
Entrapment Safety net	Not ok, large probe gets entrapped.	Not ok, large probe gets entrapped.	Not ok, large probe gets entrapped.	Ok

Table 19

	North 370	North 500	Salta	Springfree
Entrapment Safety net	Ok	Ok	Ok, but right on the verge of the big probe getting entrapped.	Possible to step outside the mat into the net and possibly get entrapped.

4.2.4 Safety net quality and fastening at the top

It's not uncommon that children jump up and grab the top of the safety nets lining and clings to it with the results of failure on the net or the fastening of it. To test the quality of the net and fastening of it in the top, a force of 50 kg are pulled downward from the top attachment of the net to the pole. Note, Springfree safety net poles are so soft so the net lays down before the force of 50 kg is achieved.



Picture 15 Broken safety net (Jump King)

Table 20

	Berg 330	Berg 520	Biltema	Jump King
Safety net attachment	Burst at the seams. 50 kg achieved.	Ok	Burst at the seams. 50 kg achieved.	Not ok, bursts at around 40 kg

Table 21

	North 370	North 500	Salta	Springfree
Safety net attachment	Ok	Ok	Burst a little at the seams. 50 kg achieved.	Force not achieved because of too flexible poles

4.2.5 Safety net quality against sticks

A common problem with the safety net is that they will break. Especially when children play around with wooden sticks and punch a hole in the safety net. To simulate a wooden stick a 12 mm test probe is used to push against the safety nets mesh until it breaks and then the failure force is noticed [N]. Note, Springfree has big mesh holes in the safety net and almost no force are noticed. With big mesh holes it's a risk for children's fingers to get entrapped.

Table 22

	Berg 330	Berg 520	Biltema	Jump King
Safety net quality against sticks.	203 N	359 N	223 N	203 N

Table 23

	North 370	North 500	Salta	Springfree
Safety net quality against sticks.	283 N	286 N	227 N	4 N. Big mesh holes in the safety net.

4.2.6 Stability

When you jump normally you might get outside the mat and bounce against the net. Or just leaning against the safety net while catching our breath. Then it's important that the trampoline is stable. To test the stability against leaning and bouncing against the net a test person bouncing/swinging against the net and see if the trampoline will lift from the ground or risk tipping.

Table 24

	Berg 330	Berg 520	Biltema	Jump King
Stability	When you lean outwards in the net and swing, the trampoline wants to lift off the ground. Feels prone to tipping on the long side where the net goes out to the edge and the trampoline is narrow.	Feels stable with little risk of tipping over.	Stable, the frame legs go outside the frame.	Feels stable with little risk of tipping over.

Table 25

	North 370	North 500	Salta	Springfree
Stability	When you lean outwards in the net and swing, the trampoline wants to lift a little off the ground.	When you lean outwards in the net and swing, the trampoline wants to lift a little off the ground.	When you lean outwards in the net and swing, the trampoline wants to lift a little off the ground.	Relatively stable with little tipping risk.

4.2.7 Paddings attachment

It's important that the padding has an good attachment so it keeps its task to protect injury against the frame, springs and etc. The padding is pulled with 150 N towards the centre of the mat according to EN71-14, 6.2.4. The padding is assessed by whether it is still attached, if any part of the frame is exposed, if the attachment comes loose or breaks. Note, Springfree has an construction without padding.



Picture 16 Frame exposed (Berg Favorit)

Table 26

	Berg 330	Berg 520	Biltema	Jump King
Paddings attachment	Ok, but frame exposed by test or standing on the edge of padding.	Ok	Ok	Ok

Table 27

	North 370	North 500	Salta	Springfree
Paddings attachment	Ok	Ok	Ok	Has no padding.

4.2.8 Safety against the springs of the mat

Trampolines have springs of different kinds that can pinch you if you get in touch with them. There could also be a risk of being entrapped between the springs. Best way is to protect the accessibility to them and not to be reachable from the mat.

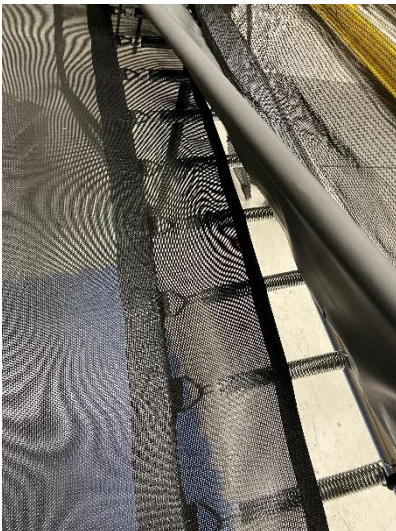
The trampoline is assessed of its accessibility to the springs and if there are any entrapment risk.



Picture 17 No net over springs
(Berg Favorit)



Picture 18 Gap between the stitches, entrapment risk
(Jump King)



Picture 19 Part coverage of springs
(North 370)



Picture 20 Full coverage of springs and net stitched to padding
(North 500)



Picture 21 Entrapment risk on the side (Springfree)

Table 28

	Berg 330	Berg 520	Biltema	Jump King
Safety against the spring of the mat	Padding overlaps about 9-10 cm over the mat and has no protection over the springs.	Padding overlaps about 11-12 cm over the mat and has no protection over the springs.	Padding overlaps about 8 cm over the mat and has no protection over the springs. Very thin padding.	Net sewn together with net. However, there is a risk of getting entrapped with the foot in the holes that are between where they are sewn together.

Table 29

	North 370	North 500	Salta	Springfree
Safety against the spring of the mat	Net overlaps 17 cm from mat in over the springs and padding overlaps 5 cm over the mat. Minimal risk of injury.	Net blocks the access to the springs and is stitched to the padding. Not possible to access the springs.	Padding overlaps about 10-13 cm over the mat and has no protection over the springs.	Possible to step outside the mat into the net and possibly get hurt. Risk to entrapped with children's fingers in the big mesh in the net.

4.2.9 Step through test of padding

If the trampoline has a padding it is important that it is rigid and doesn't sink down if you step on it. Also it shall have a good coverage and not have unprotected areas. To test step through protection, a hinged plate of 50 x 100 mm was loaded at the worst point of the padding with a force of 100 kg. Generally the worst point is considered to be at the joint seam between the damping materials in the padding. For some trampolines the safety net had to be dismantled to be able to access with the load. During or after the test, it was checked whether any damage had occurred.



Picture 22 Entrapment risk (Biltema)



Picture 23 Hole in inner corner (Jump King)



Picture 24 Small holes at the poles and frame exposed (Jump King)



Picture 25 No padding (Springfree)

Table 30

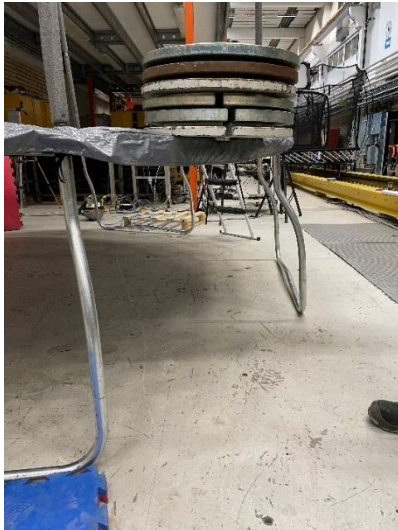
	Berg 330	Berg 520	Biltema	Jump King
Step through protection on padding	OK	OK	Sinks far down between the springs with entrapment risk. The frame becomes exposed.	The net is sewn together with the mat. Risk of children running around on the outside of the padding. Padding does not cover the inner corners and smaller holes are also found at the net poles with frame exposed.

Table 31

	North 370	North 500	Salta	Springfree
Step through protection on padding	OK	OK	OK	Has no padding.

4.2.10 Frames rigidity

It's not uncommon that young or adult people jump up and sit on the side of the frame and the frame can get bent or it can tip over. An weight of 303 kg is placed and balanced on the frame between the legs where the legs are not connected with a beam in the bottom. The load is held for 10 minutes before unloading. The distance from the floor up to the frame is measured before and after the test and the difference is calculated to see if there are any residual deformation left.



Picture 26 300 kg on the frame



Picture 27 Frame tube a little bent (Salta)

Table 32

	Berg 330	Berg 520	Biltema	Jump King
Frame height before load	855	918	728	852
Frame height after load	855	917	723	852
Deformation [mm]	0	1	5	0
Results	Ok	OK	Small remaining deformation.	Ok

Table 33

	North 370	North 500	Salta	Springfree
Frame height before load	840	858	751	530
Frame height after load	839	857	741	530
Deformation [mm]	1	1	10	0
Results	Ok	OK	Frame tube was slightly bent.	Ok

4.2.11 Grading the results from Safety

All the facts from safety testing are assessed and are scored from 1 to 5 where 5 is the best score. To achieve highest value you need as to have as good safety as possible and as few remarks as possible.

Table 34 Scores Safety

	Berg Ultimate Favorit Regular 330	Berg Grand Champion 520	Biltema 14-4125	Jump King SPS Rectangular 14	North Pioneer 370 Rectangular	North Legend Oval 500	Salta Premium Black Edition 366	Springfree Large Oval O92
Score	3,4	3,6	2	4,1	4,9	5	3,5	4

4.3 Performance

When jumping on a trampoline you want to have a high jump and also a soft jump. That combination is not that easy to achieve, especially when your mind says something else than the measured value. To get physical data on jump height and g-values on the softness a test body with an instrumented accelerometer in the form of a hemisphere with a diameter of 270 mm and a mass of 45.95 kg was dropped from a height of 2.0 m from the mat. The acceleration was measured and the rebound was filmed. The film was replayed and, at the turning point of the 1st rebound, the height was read optically with reference to a measuring rod mounted behind the released specimen. 3 drop tests were performed.

An adult person jumped on the trampoline documented their experience on the trampoline. Then the trampoline was loaded with a weight of 500 kg for 30 minutes and inspected for eventually damage and etc.

3 drop tests were done again after the load to see if the trampoline deteriorated. Then the trampoline was loaded once again with 500 kg for 10 minutes but now with an offset of 10 cm from edge of the jumping mat to see how the trampoline copes with an overload near the edge that will show the quality of the springs and the mat. The values reported in appendix are average values of the tests. The rebound test height was measured optically from a distance with a high speed camera with a fixed position and it can only be used for comparing the trampolines in this test. The value is not specified in any particular unit, it's just a reference to each other for comparison.



Picture 28 Hemisphere ready to be dropped



Picture 29 500kg in the middle (Jump King)



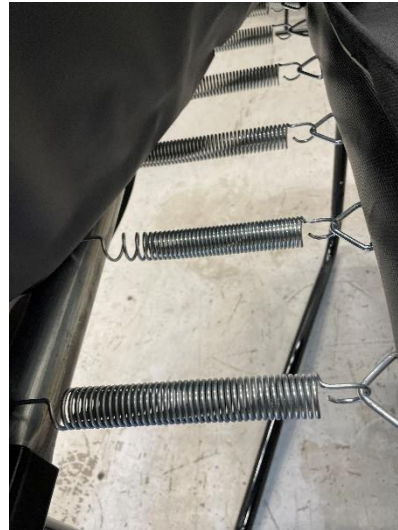
Picture 30 500kg in the middle (Jump King)



Picture 31 500kg at the side (Jump King)



Picture 32 500kg at the side (Jump King)



Picture 33 One spring stretched (North Pioneer)



Picture 34 500kg at the side (Springfree)



Picture 35 500kg at the side (Springfree)

Table 35

Performance	Berg 330	Berg 520	Biltema	Jump King
Drop sphere from 2.0m				
Maximum height to reference rod	209	168	188	164
Maximum g-force first bounce [g]	10,58	8,33	10,89	8,73
Perceived feeling	Smaller and a little harder to jump on.	Big and comfortable to jump on.	Smaller and a little harder to jump on.	Soft and tough to walk on. Gotta work to get the bounce going.
500 kg load 30 minutes in centre of mat				
Inspection for damage	None.	None.	None.	None.
Drop sphere from 2.0m				
Maximum height to reference rod	209	169	186	165
Maximum g-force first bounce [g]	10,71	8,41	11,48	8,78
500 kg load 10 minutes 10cm from mat edge. Inspection for damage	None.	None.	None.	None.

Table 36

Performance	North 370	North 500	Salta	Springfree
Drop sphere from 2.0m				
Maximum height to reference rod	149	182	194	165
Maximum g-force first bounce [g]	10,07	9,02	10,66	9,72
Perceived feeling	Smaller and a little harder to jump on.	Big and comfortable to jump on.	Smaller and a little harder to jump on.	Only nice to jump on in the middle. Hard against edges and strange feeling when springs turn the mat sideways.
500 kg load 30 minutes in centre of mat				
Inspection for damage	None.	None.	None.	None.
Drop sphere from 2.0m				
Maximum height to reference rod	220	182	195	163
Maximum g-force first bounce [g]	10,03	8,85	10,72	10,01
500 kg load 10 minutes 10 cm from mat edge. Inspection for damage	Significant increase in bounce height.			

4.3.1 Scoring the results from performance

All the facts from jump height and softness of the jump including the experience of the jump are assessed and are scored from 1 to 5 where 5 is the best score. To achieve highest value you need as high and soft jump as possible at the same time as the jump shall feel as good and soft as possible. Focus on results after the load of 500 kg that more show how the trampoline are after a while when its "broken in" and becomes softer.

Table 37 Scores Performance

	Berg Ultimate Favorit Regular 330	Berg Grand Champion 520	Biltema 14-4125	Jump King SPS Rectangular 14	North Pioneer 370 Rectangular	Nort Legend Oval 500	Salta Premium Black Edition 366	Springfree Large Oval O92
Score	3,6	4,5	3,4	3	3,8	5	3,5	2,5

5 Measurement uncertainty

The total calculated measurement uncertainty for the acceleration $< 3\%$, and length measurement $< 2\%$

Reported uncertainty corresponds to an approximate 95 % confidence interval around the measured value. The interval has been calculated in accordance with EA-4/16 (EA guidelines on the expression of uncertainty in quantitative testing), which is normally accomplished by quadratic addition of the actual standard uncertainties and multiplication of the resulting combined standard uncertainty by the coverage factor $k=2$.

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