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## Crash testing of a Netti S - 16" rear wheels according to ISO 7176-19, section 5.2.

(4 appendices)

### Note

In this revision 1 dated 2020-01-24 the seat depth has changed from 400 mm to 450 mm, corrected by the customer.

### Summary

A crash test of a Netti S - 16" rear wheels wheelchair has been performed. The wheelchair was loaded with a small adult female 59 kg crash test dummy and crash tested at 48,4 km/h, with a 15 g pulse for > 40 ms and 20 g for > 15 ms duration.

Section	Reference	Comment	Fulfilment of requirement
5.2.1a	Horizontal excursion	OK	Yes
5.2.1b	Knee vs. WC excursion	4.66	Yes
5.2.1c	Battery movement	-	-
5.2.2a	ATD torso angle < 45°	< 2°	Yes
5.2.2b	Securement points	OK	Yes
5.2.2c	Separation of < 100 grams	OK	Yes
5.2.2d	Sharp edges radius > 2 mm	OK	Yes
5.2.2e	Load carrying components	OK	Yes
5.2.2f	Tilt-in space locking	OK	Yes
5.2.2g	Removal of ATD, no tools	OK	Yes
5.2.2h	WC removal, no tools	OK	Yes
5.2.2i	Post height diff < 20 %	4 %	Yes
5.2.2j	No webbing failure	OK	Yes

The test object fulfilled the requirements in ISO 7176-19:2008, section 5.2.

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## 1. Introduction

RISE Research Institutes of Sweden AB has on assignment of Alu Rehab AS performed a crash test of a Netti S - 16" rear wheels wheelchair according to ISO 7176-19:2008. The purpose of the test was to evaluate if the wheelchair fulfilled the crash test requirements with a small adult female 59 kg crash test dummy.

## 2. Description of the test object

Manufacture:	Alu Rehab AS
Wheelchair name:	Netti S - 16" rear wheels
Wheelchair serial no:	115-00....
Seat width:	400 mm
Seat depth:	450 mm
Seat height:	460 mm
Wheel base:	Netti S
WC weight:	32.9 kg (measured by RISE)
Seat angle:	12° backwards
Back rest angle:	100°
Back rest type:	Netti S / Netti Dynamic S fixed
Back rest height:	380 mm seat plate - top of Velcro + 100 mm for back extender
Arm rest:	Netti S / Netti Dynamic S fixed
Leg rest/Foot plate:	Netti Angle adjustable
Calf pads:	Standard
Heel straps:	No
Drive/Rear wheel:	16"
Wheel attachment:	QR
Castor wheel:	6"
Castor wheel fork:	For 6" wheels
Castor Stem:	QR
Headrest:	Netti Mini A
Pelvic belt:	No
Antitip device:	Yes, Netti S turned upward
Occupant restraint system:	Unwin
4-point tie down system:	Unwin
Occupant weight range:	>57 to 75 kg
Test object arrival at RISE:	2020-01-17
Selection of test object:	The test object has been selected by the client without RISE's assistance.

### 3. Test method and performance

Test method:	ISO 7176-19:2008, section 5.2
Test date:	2020-01-21
Test facility:	RISE Safety - Mechanics Research crash laboratory in Borås.
Ambient temperature:	20,1 °C RISE inv. no: 403553
Crash pulse:	15 g for > 40 ms, 20 g for > 15 ms, 48-50 km/h.
Pulse measurement:	Two accelerometers mounted on the sled, the graph can be found in appendix 1. RISE inv. nos. BX42667 and BX42669.
Velocity measurement:	Optical time sensors measuring the time for the sled to travel a distance of 0,5 meters just before impact. RISE inv. no. 900081.
Excursion measurement:	The excursion values were measured from the high-speed film by the film analysis program, TEMA, with an accuracy of $\pm 5$ mm.
Film camera:	Photron Fastcam SA4, 1000 frames per second, with a TamronSP-AF/28-75mm-F/28 XR Di lens.
Crash test dummy:	Small adult female 59 kg.
Occupant restraint system and manufacture:	Unwin
4-point tie down system and manufacture:	Unwin
Photographs:	Photos were taken before and after the test and can be found in appendix 2.

The test object was mounted in a forward facing direction on the impact sled and attached with the 4-point tie-down restraint. A small adult female 59 kg crash test dummy, was positioned in the test object and fixed with the 3pt occupant restraint.



**Photo 1. Test setup**

## 4. Test results

The sled was accelerated to a speed of 48,4 km/h before impact.

**Table 1 Test results**

Standard section	Reference	Requirement	Result/ Comment	Requirement fulfilment
5.2.1a	Horizontal excursion: Head forward	< 550 mm	453 mm	Yes
5.2.1a	Horizontal excursion: Head rearward	< -400 mm	-381 mm	Yes
5.2.1a	Horizontal excursion: Knee forward	< 375 mm	163 mm	Yes
5.2.1a	Horizontal excursion: Wheelchair point forward	< 200 mm	35 mm	Yes
5.2.1b	Knee vs. WC excursion: $X_{knee} / X_{wc}$	> 1,1	4.66	Yes
5.2.1c	Batteries of powered wheelchairs shall: - not move completely outside the wheelchair footprint - not move into the wheelchair user's legs space	-	-	-
5.2.2a	The wheelchair shall remain in an upright position on the test platform. The ATD shall be retained in the wheelchair in a seated posture, as determined by the ATD torso being oriented at no more than 45° to the vertical.	< 2°		Yes
5.2.2b	The wheelchair securement points shall not show visible signs of material failure.	OK		Yes
5.2.2c	Components, fragments or accessories of the wheelchair with a mass in excess of 100 grams shall not have completely separated from the wheelchair.	OK		Yes
5.2.2d	Wheelchair components that may contact the occupant shall not fragment or separate in a manner that produces sharp edges, as defined by having a radius less than 2 mm.	OK		Yes
5.2.2e	Primary load carrying components of the wheelchair shall not show visible signs of failure.	OK		Yes
5.2.2f	Locking mechanisms of tilt-in-space seat adjusters shall not show signs of failure.	OK		Yes
5.2.2g	Removal of ATD from the wheelchair shall not require the use of tools.	OK		Yes

5.2.2h	Release of wheelchair from the tie-down system shall not require the use of tools.	OK	Yes
5.2.2i	The post-test height of the average of left and right ATD H-points relative to the wheelchair ground plane shall not have decreased by more than 20 % from the pre-test height.	4 %	Yes
5.2.2j	The wheelchair and its components shall not cause partial or complete failure of the webbing of any of the WTORS assemblies during the test.	OK	Yes

The test object fulfilled the requirements according to ISO 7176-19:2008, section 5.2. The test results showed in this report refer only to the tested object.

## 5. Measurement uncertainty

The measurement uncertainty for the deceleration pulse is less than 1,5 %.  
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  $k=2$ .

### **RISE Research Institutes of Sweden AB** **Safety - Mechanics Research**

Performed by

Examined by

Per Bodin

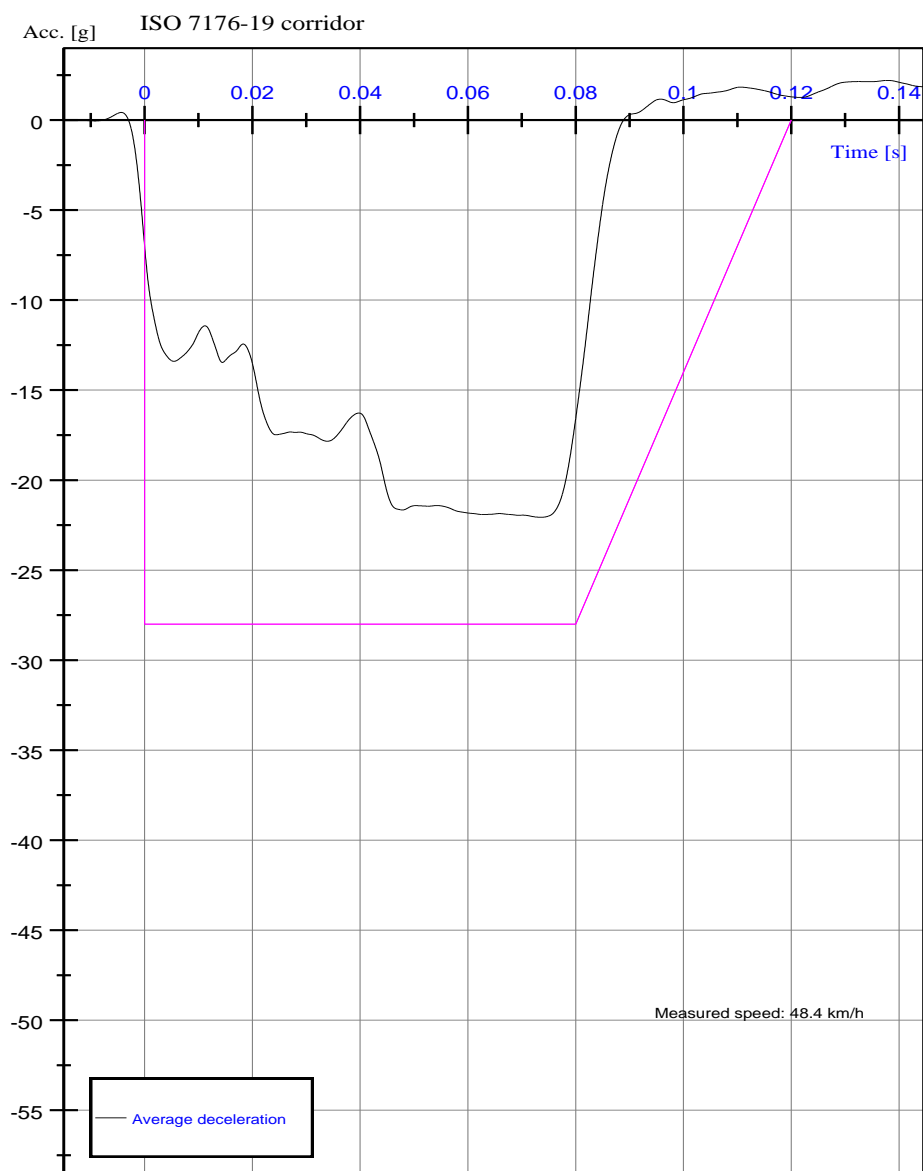
Magnus Andersson

### **Appendices**

- Appendix 1: Deceleration graph (1 page)
- Appendix 2: Photos (4 pages)
- Appendix 3: Drawing Netti S 35cm no:608524 dated 02-04-2019.
- Appendix 4: Part listing for wheelchair model: Netti S - 16" rear wheels.

### Appendix1

## Sled deceleration, Average pulse, CFC 60



**Customer:** Alu Rehab AS

**Test object:** Netti S - 16, Hybrid III, small adult female 59 kg

**Standard:** ISO 7176-19

**Test date:** 2020-01-21

**Test:** 1

## Appendix 2



Photo 1. Before test



Photo 2. Before test

### Appendix 2



**Photo 3. Before test**



**Photo 4. Before test**

## Appendix 2



Photo 5. After test



Photo 6. After test

## Appendix 2



Photo 7. After test

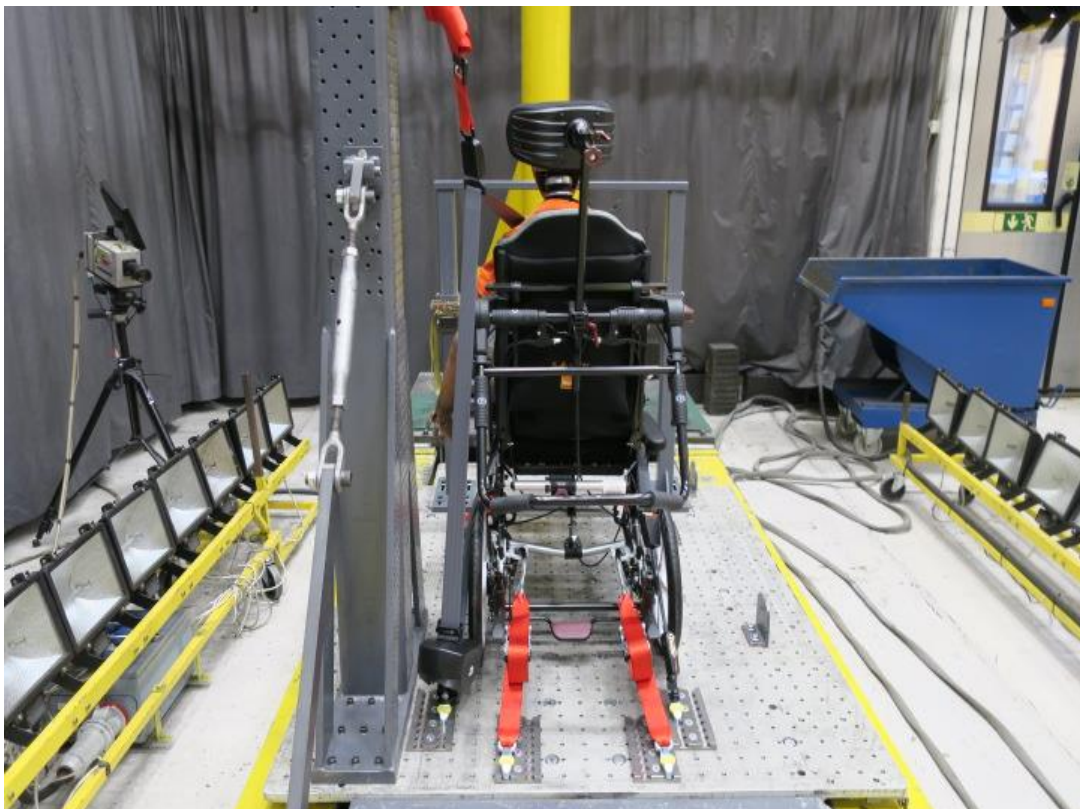
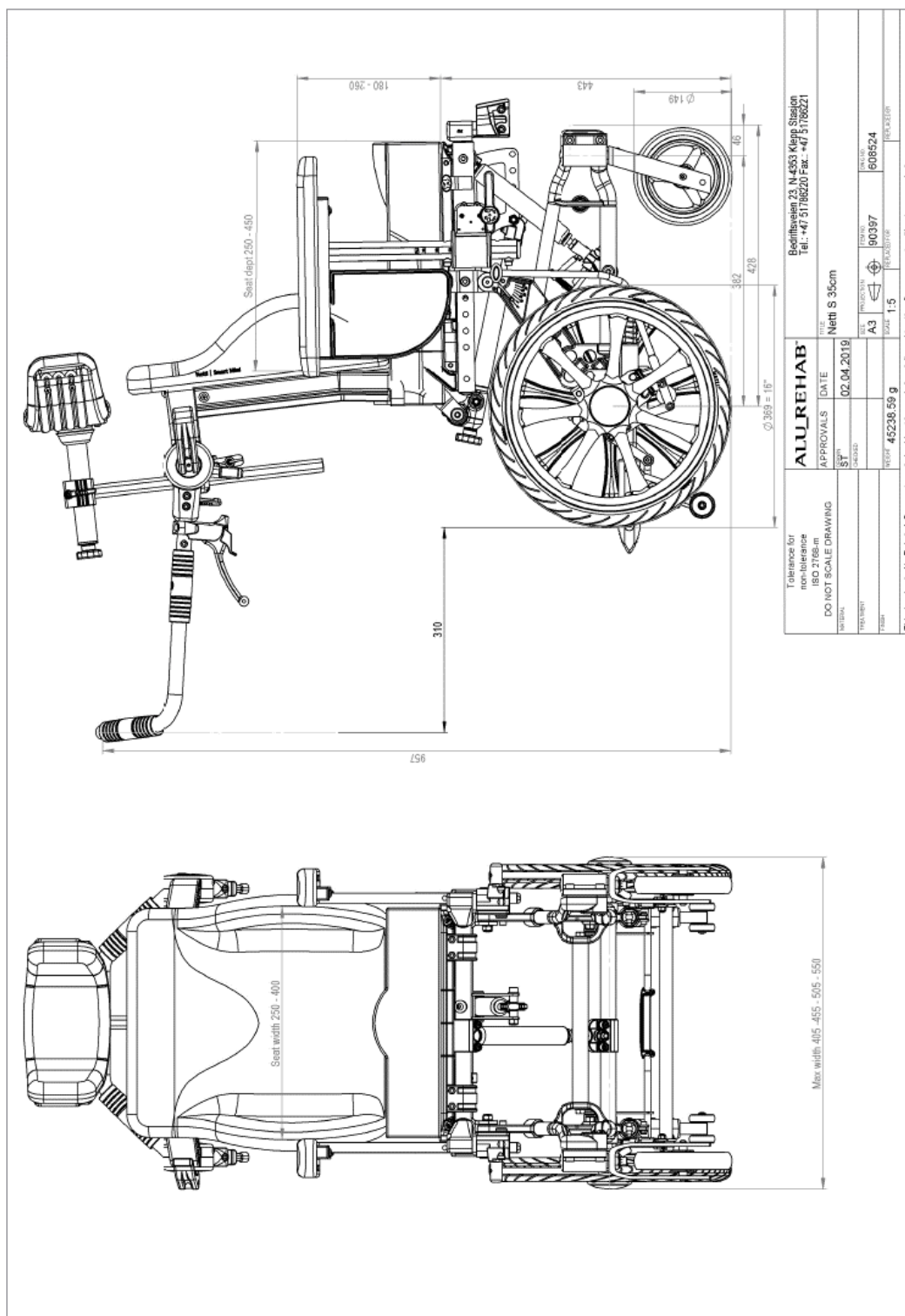


Photo 8. After test

## Appendix3



### Appendix 4

Wheelchair for testing			
Type of test:	Crash test ISO 7176-19:2008 amm 2014	Test load (dummy weight): 59 kg	Max approved load: 75kg
Test institute:	RISE Borås Sweden	small female	
Contact person:	Magnus Andersson & Per Bodin		
Date:	21.01.2020		
AR personnel attending:	Oddvar Kverme and Signun Peerstær-Kotthaus		
Motivation for testing:	12183:2014, used as seat in a car ISO 7176:19		
	Netti S w 16" wheel kit - new seat width = 400mm, wheelchair frame aluminum tube quality 6061		
Configuration / parts	Model (number)	Position / how mounted	Position for test
Netti S w 16" main wheels kit	Wheelchairs delivered from ARX		
SW 400 mm weight ca 25 kg incl cushions	Serial number SN 115-001292 and 115-001293	Art nr	
Main WHEELS	16"		
Front castors	6" - upside down QR		Turned backwards
Anti-tippers	Standard		Turned up
LEG supports	V-reg	Max extension -	Locked downwards
Foot plates	Foot plates		Horizontal
Frame extensions pieces for leg support	Standard, identical to Netti Dynamic S, front cloth protector removed		Pulled out 50 mm
Netti S arm supports	Netti Dynamic S		Turned upward as shown on picture
Pushbow	Netti A - 500 mm vertical pole		Pulled up - 23 cm from the adapter
HEAD support	Standard		Slightly angled forward
Head support adapter			72 degree backwards
Tilt	Mounted horizontal in the rear around bearing house in the front		Locked
CAR fixing	Fixed - w 3 extension seat plate parts Seat depth 450		
SEAT plate 40 cm	Netti Uno sit-40x45cm		
Seat cushion	Velcro + back extension	fixed in threaded hole with screw holding the back Velcro	Locked, 90 degree to seat plate
Back			
Chair back extender	Yes		
Back cushion	Smart 40		
Calf pad upholstery	No		
Gas cylinder 600N			
Fixation:			
Straps for rear part	Unwin		45° (to 55°) angle in the rear
Straps for front part	Unwin		60° angle by the front castors. Belts fixed around the bearing house - pulled slightly outward
Restrain system for the user, needs to comply with ISO 10542-1:2012 under car transport	Unwin - Alu Rehab: Order belts each time!		
Belts for holding the dummy			3-point belt. The belt to follow parallel to a line from the 45° fixation of the wheelchair.
			
<p>* Anti-tip - recommended to be kept well of the ground</p> <p>Wheelchair restraints - preferably wider than the wheelchair.</p> <p>** Head rest - low - missing the lower back of head of the dummy the head rest. Dummy head movement to be as small as defined in the standard.</p> <p>Netti Dynamic S sw 350 mm tested 2017-12</p> <p>Observation after test 2019-10: Pass w 23" wheels</p> <p>Observation after test 2020-01-21 Pass sw 40, sd 45</p>			