

Handled by, department
Mikael Suurkula
Building Technology and Mechanics
+46 10 516 50 36, Mikael.Suurkula@sp.se

Invacare Deutschland GmbH
Kleiststrasse 49
324 57 Porta Westfalica
Germany

Crash test of Zephyr docking station according to ISO 10542-1 (2 appendices)

Assignment

Crash testing of an Invacare docking station for the Zephyr electrical wheelchair according to ISO 10542-1:2001, section 6.2.

Summary

The Zephyr electrical wheelchair with a weight of 180 kg was attached to the sled by a docking station and crash tested in 48-50 km/h. A Hybrid III-dummy, 75 kg, was positioned in the wheelchair during the test.

Section		Comment	Fulfilment of requirement
6.2.1a	ATD shall be retained in the seat		Yes
6.2.1b	The wheelchair shall remain upright		Yes
6.2.1c	No detachment of anchorage components		Yes
6.2.1d	No tools required to release the wheelchair		Yes
6.2.1e	No tools required to release the ATD		Yes
6.2.1f	No visible signs of failure of load-bearing parts		Yes
6.2.1g	No sharp edges of the tiedown system		Yes
6.2.1h	Opening force < 60 N for the restraint and tiedown		Yes
6.2.2a	Horizontal excursion		Yes
6.2.2b	Knee vs. WC excursion		Yes

Conclusion

The test object fulfilled the requirements according to ISO 10542-1:2001, section 6.2.

SP Technical Research Institute of Sweden

<i>Postal address</i>	<i>Office location</i>	<i>Phone / Fax / E-mail</i>
SP	Västeråsen	+46 10 516 50 00
Box 857	Brinellgatan 4	+46 33 13 55 02
SE-501 15 Borås	SE-504 62 Borås	info@sp.se
SWEDEN	SWEDEN	

Laboratories are accredited by the Swedish Board for Accreditation and Conformity Assessment (SWEDAC) under the terms of Swedish legislation. This report may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

**Client**

Invacare Deutschland GmbH

Arrival of test object

The test object arrived at SP on March 29, 2007.
The test object has been selected by the client without SP's assistance.
The test results showed in this report refer only to the tested object.

Test object

Invacare docking station for the Zephyr electrical wheelchair.
The weight of the wheelchair was 180 kg.
The dummy was secured with a 3-point belt from Unwin, system 1390.

Test date

The test was performed on March 29, 2007.

Measuring

The deceleration was measured by two accelerometers mounted on the sled. The graph can be found in appendix 1.

The test was filmed with a high-speed camera (1000 frames per second).
The measurement uncertainty when determining the deceleration was $\pm 5\%$.

The excursion values were measured from the film with the film analysis program TEMA with an accuracy of ± 5 mm.

Requirements

According to ISO 10542-1:2001, section 6.2

6.2.1 Post-test acceptance criteria

- a) The ATD shall be retained in the wheelchair.
- b) The wheelchair shall be in an upright position on the impact sled.
- c) No anchorage components or securement end fittings shall be detached or separated.
- d) Release of the wheelchair from the tiedown system shall not require the use of tools.
- e) Release of the ATD from the occupant restraint shall not require the use of tools.
- f) No part of the tiedown system shall exhibit visible signs of tearing, fragmentation, fracture or complete failure of any load-bearing part, unless such parts are intended to fail in a manner that limits the forces on the occupant.

- g) The tiedown system shall exhibit no dangerous roughness, sharp edges, or protrusions likely to increase the risk of injury to the occupant.
- h) The force required to open the buckle of any tiedown or occupant restraint components shall not exceed 60 N.

6.2.2 Dynamic performance requirements during the test

- a) The horizontal excursion of the ATD and the wheelchair with respect to the impact sled shall not exceed the values given in the table below.

Horizontal excursion	Requirement
Knee	375 mm
Head forward	650 mm
Wheelchair point	200 mm

- b) The tiedown system shall prevent the wheelchair from imposing forward loads on the occupant, as indicated by the ATD knee excursion exceeding the wheelchair point P excursion by 10% or more.

$$X_{knee} / X_{wc} \geq 1,1$$

Testing

The docking station was attached to the sled and the electrical wheelchair was docked to the system facing forward. A Hybrid III-dummy 50 %-ile, 75 kg, was positioned in the wheelchair and restrained by a 3-point seatbelt from Unwin.

The sled was accelerated to a speed of 50,0 km/h before impact.

Pulse: 15g during 40 ms, 20g during 15 ms, 48-50 km/h (pulse id: 72).

See appendix 1 for deceleration graph.

Results

According to ISO 10542-1:2001, section 6.2

Section 6.2.1a

Requirement fulfilled

6.2.1b

Requirement fulfilled

6.2.1c

Requirement fulfilled

6.2.1d

Requirement fulfilled

6.2.1e

Requirement fulfilled

6.2.1f

Requirement fulfilled

6.2.1g

Requirement fulfilled

6.2.1h

Requirement fulfilled

Section 6.2.2a

Requirement fulfilled

Horizontal excursion	Requirement	Result	Fulfilment of requirement
Knee	375 mm	199 mm	Yes
Head forward	650 mm	391 mm	Yes
Wheelchair point	200 mm	7 mm	Yes

6.2.2b

Requirement fulfilled

$$X_{\text{knee}} / X_{\text{wc}} = 3,0$$

The system fulfilled the requirements according to ISO 10542-1:2001, section 6.2



Before test



Before test



Before test, front attachment



Before test, rear attachment



After test



After test

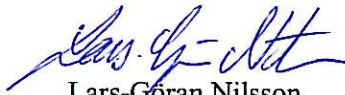


After test, front attachment



After test, rear attachment

SP Technical Research Institute of Sweden
Building Technology and Mechanics - Solid Mechanics and Structures



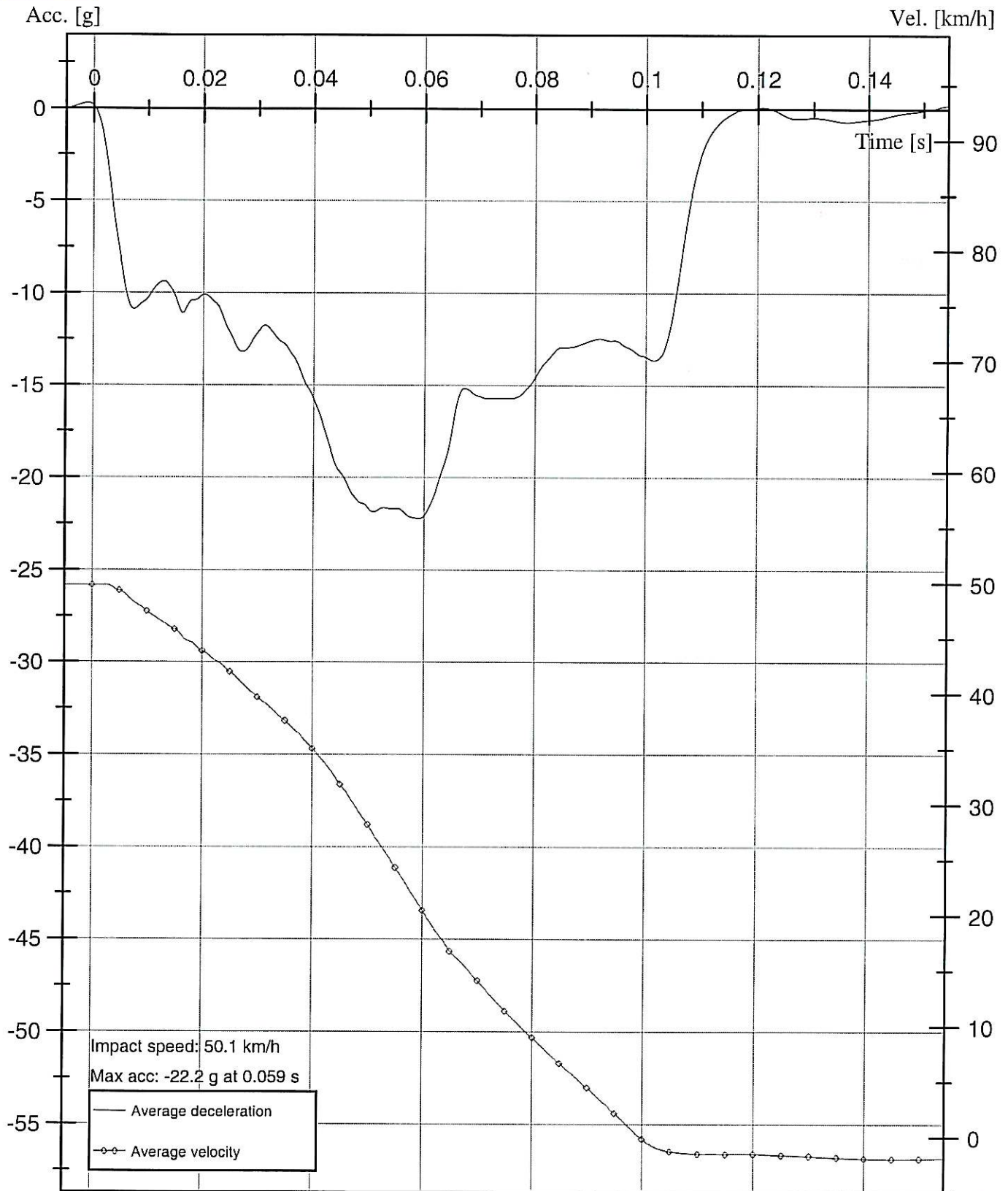
Lars-Göran Nilsson
Technical Manager



Mikael Suurküla
Technical Officer

Appendices:
1: Deceleration graph
2: Drawings

Sled deceleration, Average pulse, CFC 60



Customer:	Invacare Germany
Test object:	Zephyr docking station
Standard:	ISO 10542
Test date:	2007-03-29
Test:	2

Montagehinweise

IS 05 246	Berfest. Docking Station mit Hubmotor kurz	part description
IS 05 143	Flügelteil Hfl. 121271	actuator pl. 121271
IS 05 207	Berfest. Docking Station mit Hubmotor lang	part description
IS 05 144	Flügelteil Hfl. 121271	actuator pl. 121271

von Pos. 9 bis 24 in Zeichnung nicht dargestellt
from pos. 9 to 24 not shown in the drawing

Pos.	Art.-Nr.	Benennung	part description	Werkstoff	Stk.
1	31.01.01	Schraubstock	hand vice		1
2	31.01.01	Schraube M10 x 20	screw M10 x 20		1
3	31.01.01	Winkel 90°	angle 90°		1
4	31.01.01	Winkel 45°	angle 45°		1
5	31.01.01	Winkel 30°	angle 30°		1
6	31.01.01	Winkel 15°	angle 15°		1
7	31.01.01	Winkel 7,5°	angle 7,5°		1
8	31.01.01	Winkel 3,75°	angle 3,75°		1
9	31.01.01	Winkel 1,875°	angle 1,875°		1
10	31.01.01	Winkel 0,9375°	angle 0,9375°		1
11	31.01.01	Winkel 0,46875°	angle 0,46875°		1
12	31.01.01	Winkel 0,234375°	angle 0,234375°		1
13	31.01.01	Winkel 0,1171875°	angle 0,1171875°		1
14	31.01.01	Winkel 0,05859375°	angle 0,05859375°		1
15	31.01.01	Winkel 0,029296875°	angle 0,029296875°		1
16	31.01.01	Winkel 0,0146484375°	angle 0,0146484375°		1
17	31.01.01	Winkel 0,00732421875°	angle 0,00732421875°		1
18	31.01.01	Winkel 0,003662109375°	angle 0,003662109375°		1
19	31.01.01	Winkel 0,0018310546875°	angle 0,0018310546875°		1
20	31.01.01	Winkel 0,00091552734375°	angle 0,00091552734375°		1
21	31.01.01	Winkel 0,000457763671875°	angle 0,000457763671875°		1
22	31.01.01	Winkel 0,0002288818359375°	angle 0,0002288818359375°		1
23	31.01.01	Winkel 0,00011444091796875°	angle 0,00011444091796875°		1
24	31.01.01	Winkel 0,000057220458984375°	angle 0,000057220458984375°		1

Pos.	Art.-Nr.	Benennung	part description	Werkstoff	Stk.
1	IS 05 246	Berfest. Docking Station	Berfest. Docking Station		1
2	IS 05 143	Flügelteil Hfl. 121271	actuator pl. 121271		1
3	IS 05 207	Berfest. Docking Station mit Hubmotor lang	Berfest. Docking Station mit Hubmotor lang		1
4	IS 05 144	Flügelteil Hfl. 121271	actuator pl. 121271		1
5	IS 05 143	Flügelteil Hfl. 121271	actuator pl. 121271		1
6	IS 05 144	Flügelteil Hfl. 121271	actuator pl. 121271		1
7	IS 05 143	Flügelteil Hfl. 121271	actuator pl. 121271		1
8	IS 05 144	Flügelteil Hfl. 121271	actuator pl. 121271		1
9	IS 05 143	Flügelteil Hfl. 121271	actuator pl. 121271		1
10	IS 05 144	Flügelteil Hfl. 121271	actuator pl. 121271		1
11	IS 05 143	Flügelteil Hfl. 121271	actuator pl. 121271		1
12	IS 05 144	Flügelteil Hfl. 121271	actuator pl. 121271		1
13	IS 05 143	Flügelteil Hfl. 121271	actuator pl. 121271		1
14	IS 05 144	Flügelteil Hfl. 121271	actuator pl. 121271		1
15	IS 05 143	Flügelteil Hfl. 121271	actuator pl. 121271		1
16	IS 05 144	Flügelteil Hfl. 121271	actuator pl. 121271		1
17	IS 05 143	Flügelteil Hfl. 121271	actuator pl. 121271		1
18	IS 05 144	Flügelteil Hfl. 121271	actuator pl. 121271		1
19	IS 05 143	Flügelteil Hfl. 121271	actuator pl. 121271		1
20	IS 05 144	Flügelteil Hfl. 121271	actuator pl. 121271		1
21	IS 05 143	Flügelteil Hfl. 121271	actuator pl. 121271		1
22	IS 05 144	Flügelteil Hfl. 121271	actuator pl. 121271		1
23	IS 05 143	Flügelteil Hfl. 121271	actuator pl. 121271		1
24	IS 05 144	Flügelteil Hfl. 121271	actuator pl. 121271		1

