REPORT
issued by an Accredited Laboratory

Date 2007-04-17
Reference P701631B
Page 1 (6)

1002
ISO/IEC 17025

Handled by, department
Mikael Suurküla
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.

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 ± 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**

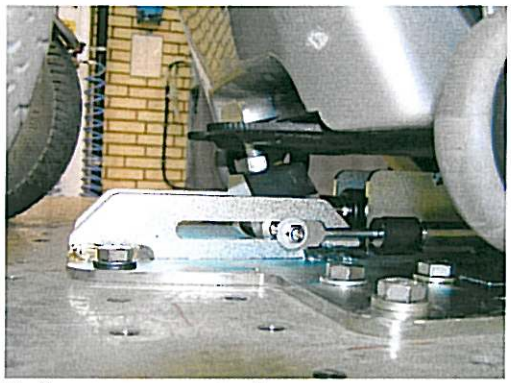
6.2.2b
Requirement fulfilled
$X_{knee} / X_{wc} = 3,0$

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

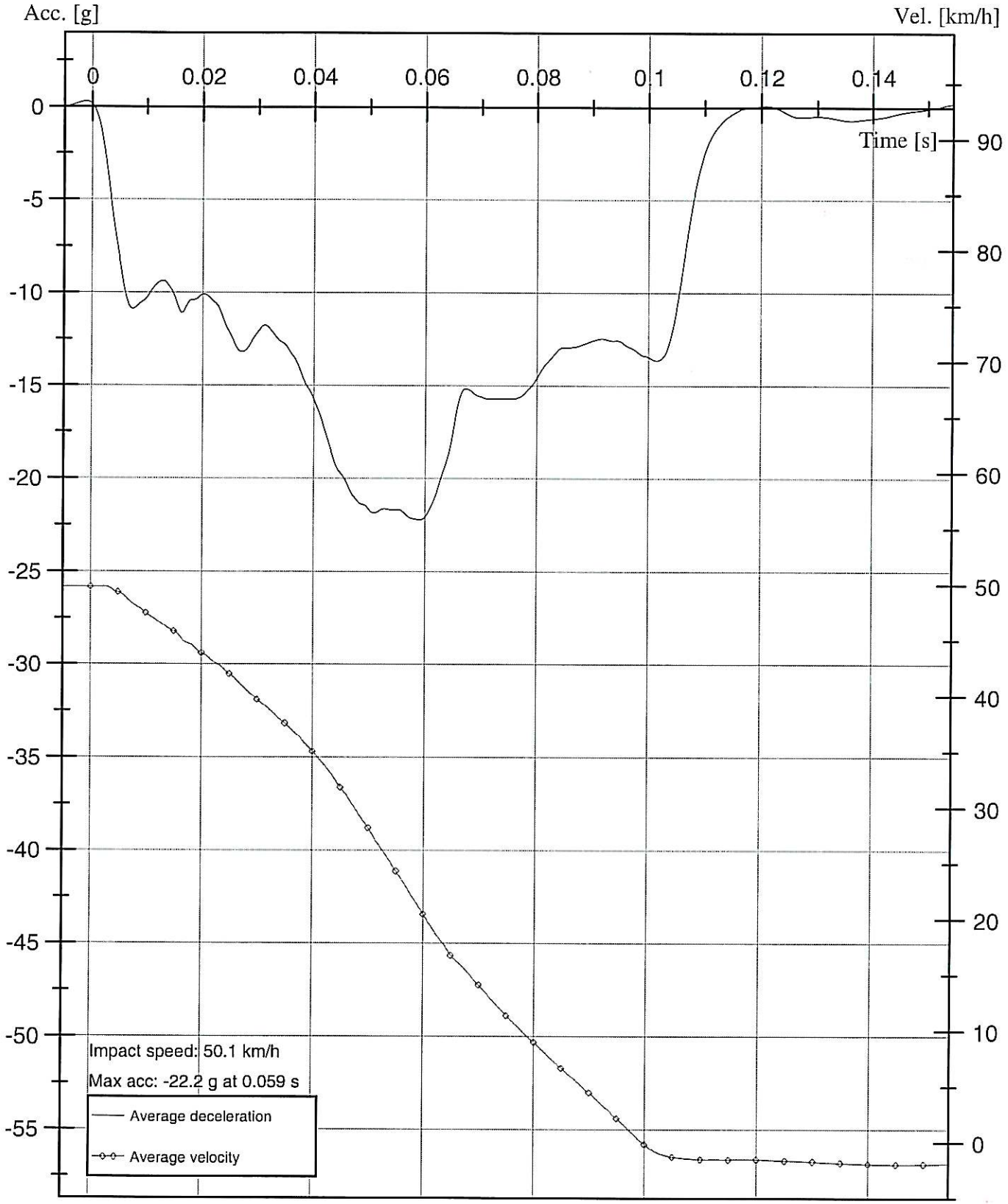
SP Technical Research Institute of Sweden
Building Technology and Mechanics - Solid Mechanics and Structures

Lars-Göran Nilsson
Technical Manager

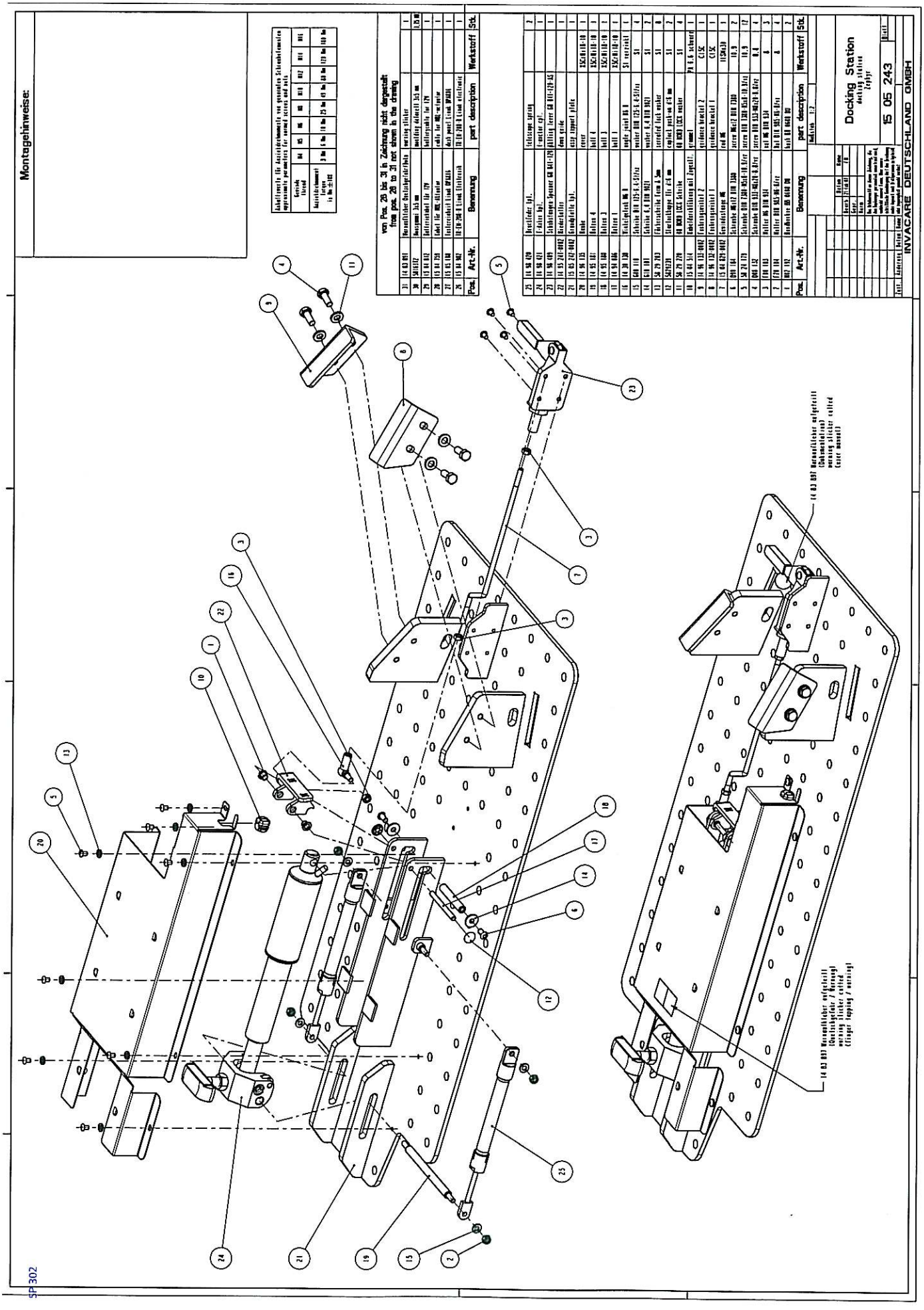
Mikael Suurküla
Technical Officer

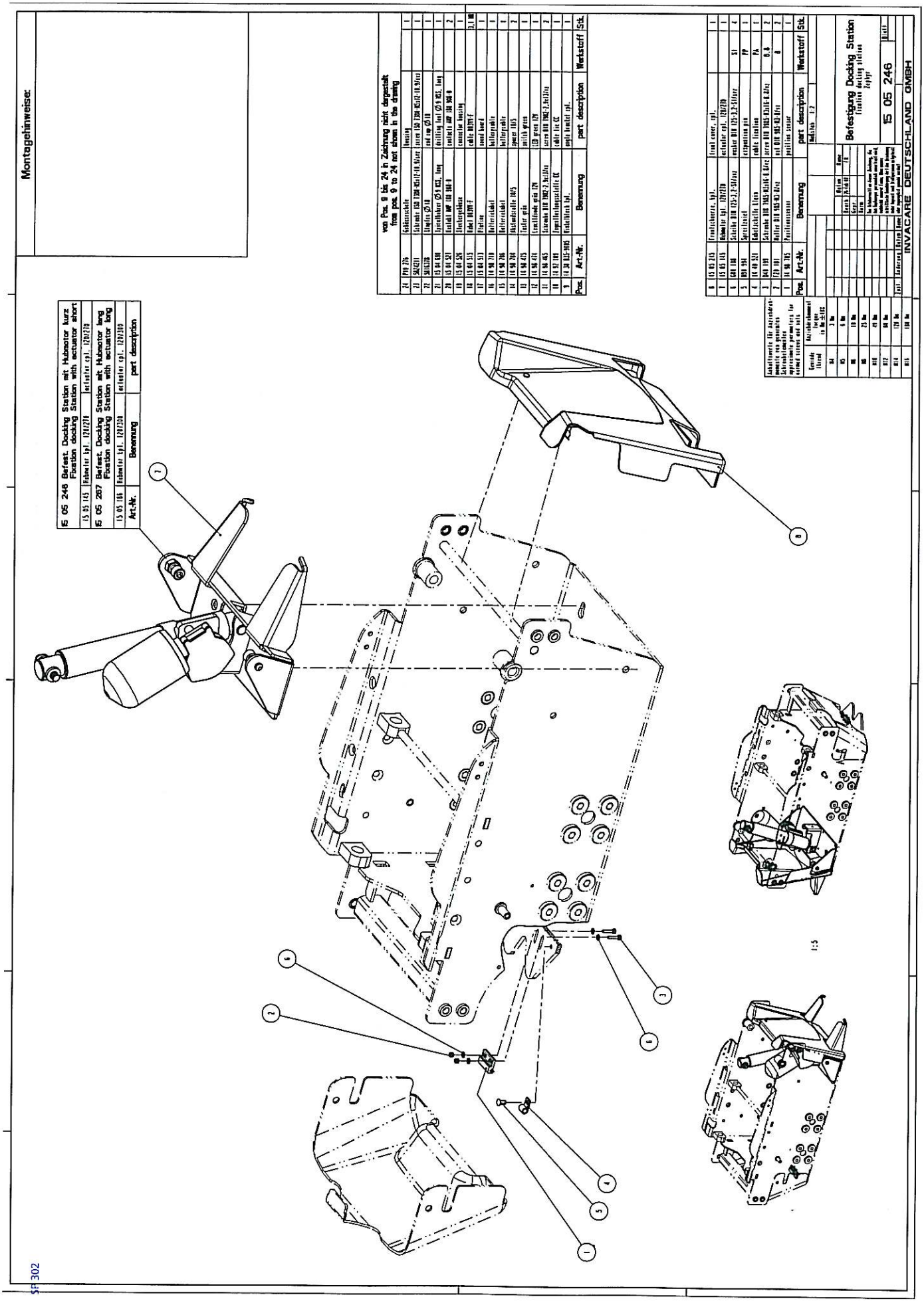
Appendices:
1: Deceleration graph
2: Drawings

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:
Docking Station
15 05 243
INVACARE DEUTSCHLAND GMBH


Montagehinweise:
15 05 246 Befest. Docking Station mit Hubmotor kurz
Fixation docking Station with actuator short
15 05 143 Hubmotor kpl. 120/270 actuator cpl. 120/270
15 05 297 Befest. Docking Station mit Hubmotor lang
Fixation docking Station with actuator long
15 05 186 Hubmotor kpl. 120/350 actuator cpl. 120/350
Art.-Nr. Benennung part description
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.
Pos. Art.-Nr. Benennung part description Werkstoff Stk.
INVACARE DEUTSCHLAND GMBH
Befestigung Docking Station
15 05 246
1:3