



TNO Certification report

CERTI 07.21107

Inspection report relating to the determination of static and dynamic stability of electrically powered wheelchairs and scooters according to ISO 7176-1 and ISO 7176-2, concerning the product with trade mark: Permobil and type: C500 equipped with a robot manipulator trade mark: Exact Dynamics and type: iArm.

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Project number P 07.21107

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Abstract

The electrically powered wheelchair, trademark: Permobil, type: C500, equipped with an Exact Dynamics iArm, has been tested according to the international wheelchair standard ISO 7176-1 [1] and ISO 7176-2 [2].

Auszug

Der elektrisch angetriebene Rollstuhl, Warenzeichen: Permobil, Typ: C500 mit iArm, wurde gemäss der internationale Norm ISO 7176-1 [1] und ISO 7176-2 [2] geprüft.

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1 Introduction

1.1 Purpose

The tests have been performed in order to establish the static and dynamic stability of the product according to the international wheelchair standard ISO 7176-1 [1] and ISO 7176-2 [2].

1.2 Description of the sample(s)

General	
Manufacturer	Permobil AB and Exact Dynamics BV
Trademark	Permobil and Exact Dynamics

Table 1: Description of the sample(s)

Sample number	Trademark	Type	Serial number
07.21107-1	Permobil	C500	15200015
	Exact Dynamics	iArm	505.913.3.0.600

For a more detailed description of the sample is referred to Appendix A.

The sample was submitted on 28 November 2007. The samples were test worthy.

1.3 Sampling procedure

The samples have been submitted by the manufacturer.
The test house has had no influence on the selection of the sample.

1.4 Application

The request for testing was submitted by Exact Dynamics BV, on 16 November 2007.
Order number: not applicable.

1.5 Method of testing

All applicable tests have been performed according to the international wheelchair standard ISO 7176-1 [2] and ISO 7176-2 [2].

The weight of the robot manipulator (13.4 kg) + payload (1.5 kg) has been compensated with a contra-weight (25.8 kg) positioned just above the back wheels.

The robot manipulator was set in a worst case position during the tests.

2 Test results

For detailed test results is referred to Appendix C.

3 References

- 12 International Standard ISO 7176-1, Second Edition, 1999-10-01
Wheelchairs – Part 1: Determination of static stability.
ISO (International Organization for Standardization), Geneva, Switzerland

- 2 International Standard ISO 7176-2, Second Edition, 2001-06-15
Wheelchairs – Part 2: Determination of dynamic stability of electric wheelchairs
ISO (International Organization for Standardization), Geneva, Switzerland

4 Signature

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Project Leader	
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Project Manager	
Approved by Mr. W.L.H. Vaassen, BSc.	Signature b/a 
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Appendix A Product identification

Manufacturer	Permobil AB and Exact Dynamics BV
Trademark wheelchair	Permobil
Type wheelchair	C500
Trade mark robot manipulator	Exact Dynamics
Type robot manipulator	iArm
Max. user weight	tested on 100 kg
Set-up	standard as delivered by the client
Input control device, trade mark	PGDT
Input control device, type	PM80 Pilot+
Direct steering	no

Appendix B Photo sheet



Figure 1: Photograph of the tested sample, trademark: Permobil, type: C500, with robot manipulator trade mark: Exact Dynamics, type: iArm

Appendix C Detailed test results

According to table 4 of ISO 7176-1 [1].

Forward	- Forward static stability, least and most stable, with front wheels locked or unlocked	least stable, locked. most stable, locked.	>15° 15°
Rear	- Rearward static stability, least and most stable, with rear wheels locked or unlocked - Rearward stability with anti tip device:	least stable, unlocked. most stable, unlocked. least stable most stable	>15° 15° n.a. n.a.
Sideways	- Sideways stability, least and most stable	right least stable right most stable left least stable left most stable	>15° 15° >15° 15°

According to Annex B of ISO 7176-2 [2].

Test	Anti-tip devices	Method of retardation	Stability score				Comments
			0°	3°	6°	10°	
Rearward Dynamic Stability							
8.2 Starting forwards	With		n.a.	n.a.	n.a.	n.a.	
	Without		3	3	3	n.a.	
8.3 Stopping after travelling forwards	With	R Release	n.a.	n.a.	n.a.	n.a.	
		P Power off	n.a.	n.a.	n.a.	n.a.	
		A Applying reverse	n.a.	n.a.	n.a.	n.a.	
	Without	R Release	3	3	3	n.a.	
		P Power off	3	3	3	n.a.	
		A Applying reverse	3	3	3	n.a.	
8.4 Braking when travelling backwards	With	R Release	n.a.	n.a.	n.a.	n.a.	
		P Power off	n.a.	n.a.	n.a.	n.a.	
		A Applying reverse	n.a.	n.a.	n.a.	n.a.	
	Without	R Release	3	3	3	n.a.	
		P Power off	3	3	3	n.a.	
		A Applying reverse	3	3	3	n.a.	
Forward Dynamic Stability							
9.2 braking when	n.a.	R Release	3	3	3	n.a.	
		P Power off	3	3	3	n.a.	

Test	Anti-tip devices	Method of retardation	Stability score				Comments
			0°	3°	6°	10°	
travelling forwards		A Applying reverse	3	3	3	n.a	
9.3 Travelling forward down a slope onto a horizontal surface	n.a.	n.a.	3	3	3	n.a	
Dynamic Stability in Lateral Directions							
10.2 Turning on a slope	n.a.	n.a.	3	3	3	3	
10.3 Turning in a circle at max. speed (min. Diameter, in metres)	n.a.	n.a.	1.52	n.a	n.a	n.a	
10.4 Turning suddenly at max. speed (Yes/No)	n.a.	n.a.	Yes	n.a	n.a	n.a	

Test	Kerb climbing devices	Method of retardation	Stability score Step height (mm)					Comments
			12	25	50	75	xx	
Rearward Dynamic Stability								
8.5 Travelling forward up a step transition from standing start	With		n.a.	n.a.	n.a.	n.a.	n.a.	
	Without		3	3	3	n.a	n.a	
8.6 Travelling backward down a step transition from a standing start	n.a.		3	3	3	n.a	n.a	
Forward Dynamic Stability								
9.4 Travelling forward up a step transition at amx. Speed	With		n.a.	n.a.	n.a.	n.a.	n.a.	
	Without		3	3	3	n.a	n.a	

Test	Kerb climbing devices	Method of retardation	Stability score					Comments
			Step height (mm)					
			12	25	50	75	xx	
9.5 Travelling forward down a step transition from a standing start	n.a.		3	3	3	n.a	n.a	
Dynamic Stability in Lateral Directions								
10.5 One side of the wheelchair drops down a step transition	n.a.		3	3	3	n.a	n.a	60 mm

n.a. = not applicable

-- = not possible

Appendix D Remarks on the test results

Sample nr: Test nr.	07.21107-1	Type:	C500 Remark	
			No remarks	