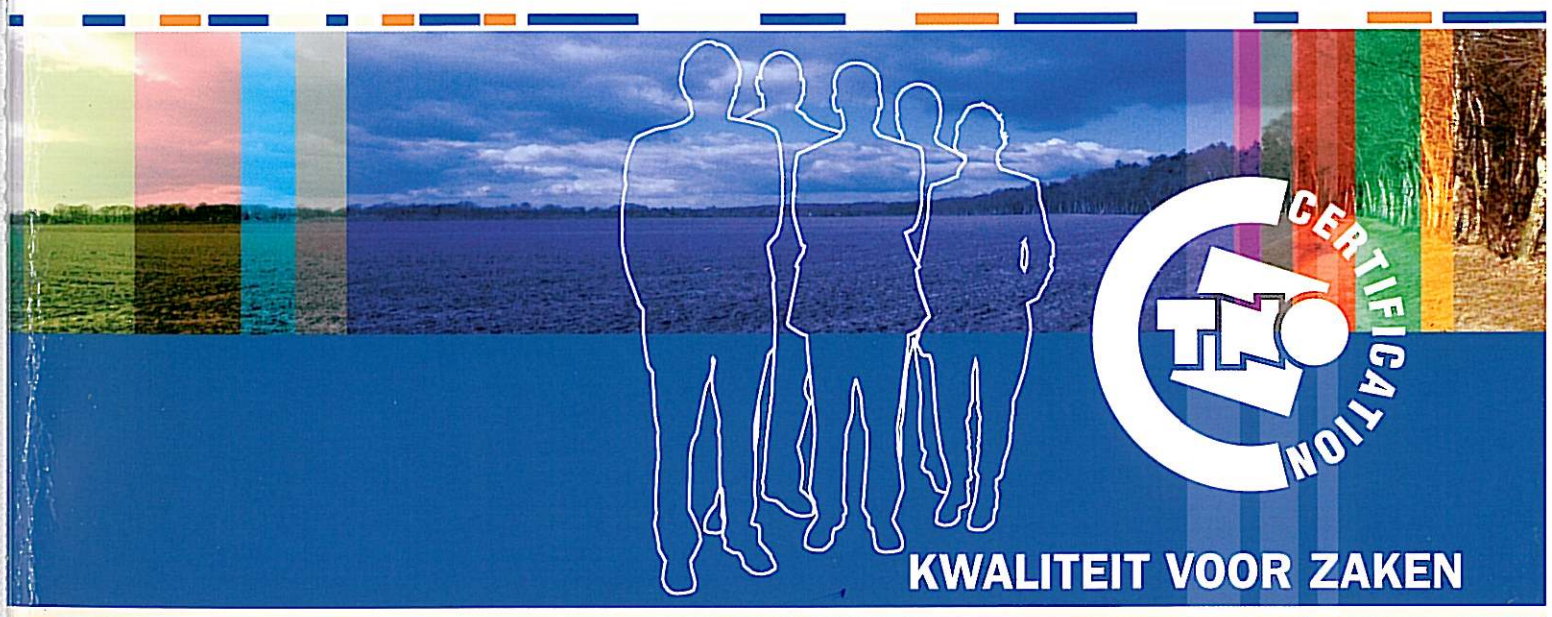
TNO Certification report

CERTI 06.20686
Inspection report relating to the crash safety of wheelchairs according to ISO 7176-19, concerning the wheelchair with trade mark: Invacare, type: Zephyr.



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INSPECTION
RvA I 053

TNO Certification report

CERTI 06.20686

Inspection report relating to the crash safety of wheelchairs according to ISO 7176-19, concerning the wheelchair with trade mark: Invacare, type: Zephyr.

Date	30 March 2007
Author(s)	T.R. Cruijff
Research period	Week 4 – 2007
Client	Invacare Deutschland GmbH Kleiststrasse 49 D – 32457 Porta Westfalica Germany
Project name	Invacare Zephyr
Project number	06.20686

Abstract

The manually propelled wheelchair, trade mark: Invacare, type: Zephyr, version: -- has been tested according to the international standard ISO 7176-19 [1].

The tests have been performed in order to judge whether or not the product meets the requirements of the above-mentioned standard. The conclusion is that the above-mentioned product shows compliance with the applicable requirements of this standard.

Auszug

Der handgetriebene Rollstuhl, Warenzeichen: Invacare, Typ: Zephyr, Version(en): --, wurde gemäß der Norm ISO 7176-19 [1] geprüft.

Die Tests wurden durchgeführt um herauszufinden, ob der Rollstuhl den entsprechenden Anforderungen der oben genannten Norm entspricht. Die Tests haben gezeigt, dass das Produkt diese Anforderungen erfüllt.

Contents

1 Introduction

1.1 Purpose

The tests have been performed in order to establish whether or not the product meets the applicable requirements of ISO 7176-19 [1].

1.2 Description of samples

Table 1

General	
Manufacturer	Invacare Deutschland GmbH
Trademark	Invacare

Table 2

Sample number	Type	Version	Serial number
20.686-01	Zephyr	--	Proto 1

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

The product has been handed in on 01-12-2006.
The product, which has been handed in, was test worthy.

1.3 Sampling procedure

The product has been handed in by the manufacturer.
The test house has had no influence on the selection of the sample(s).

1.4 Application

The request for testing was submitted by Mr. D. Hoffmann.
Order number: not applicable.

1.5 Method of testing

All applicable tests have been performed according to ISO 7176-19 [1].

1.6 Put out to contract

The crash simulation test was performed by TNO Crash Safety Laboratory, Delft, The Netherlands.

2 Test Results

Table 3

Requirement	Description	Pass/Fail/n.a.
4	**Design requirements**	
4.1	Wheelchair securement	pass
4.2	Wheelchair-anchored occupant belt restraints	not applicable
5	**Performance requirements**	
5.1	Wheelchair-anchored occupant belt restraints	not applicable
5.2	Frontal impact	pass
5.3	Accessibility of securement points intended for use with four-point strap-type tiedowns	pass
6	**Identification, labelling, user instructions, warning and disclosure requirements**	
6.1	Identification and labelling	pass
6.2	Presale literature	pass
6.3	User and maintenance instructions	pass

For detailed test results is referred to Appendix C.

3 Conclusion

The manually propelled wheelchair, trade mark: Invacare, type: Zephyr, version: --, shows compliance with the applicable requirements as stated in ISO 7176-19 [1].

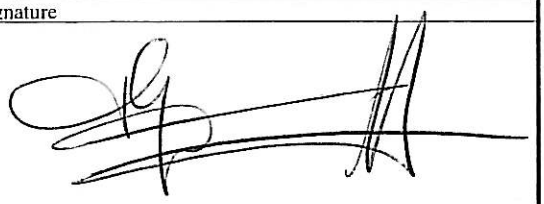
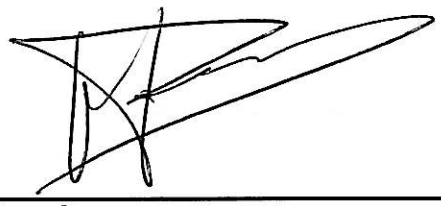
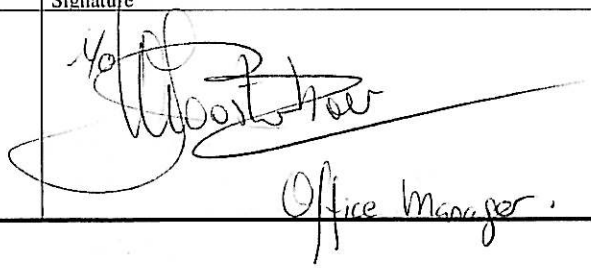
The test results exclusively relate to the inspected object.

4 References

1 ISO 7176-19:2001,
Wheelchairs-Part 19: Wheeled mobility devices for use in motor vehicles,
International Organization for Standardization, Geneva, 2001.

5 Signature

Signatures

Author	Signature
Mr. T.R. Cruijff Project Manager	
Peer review	Signature
Mr. H. Post Project Leader	
Approved by	Signature
Mr. R.G.M. van Melick, Pharm. D. Reg. Pharmacist Managing Director	

Appendix A Product identification and set up

Identification	
Manufacturer	Invacare Deutschland GmbH
Trademark	Invacare
Type	Zephyr
Version	--
Kind of wheelchair	front wheel drive
Standard product or with any adaptation	Standard + 4 restraint points
Maximum occupant mass	125 kg
Dummy mass during test	76 kg

Test set up	
Angle to the vertical of the back rest	16°
Angle to the horizontal of the seat	4°
Tiedown system handed in by the manufacturer of the wheelchair	-- (See Remark below)

Remark
There was no wheelchair tie down system provided by the manufacturer of the wheelchair.
As suggested by TNO, a surrogate tie down system was used according to Annex E of ISO 7176-19 [1]. (Such a dummy tie down system is also recommended in the standard if the mass of the wheelchair exceeds 85 kg). This system consisted of 2 metal bars at the rear of the wheelchair and safety belt webbing at the front.

Appendix B Photo sheets

Figure 1: Photograph of the tested sample, trademark: Invacare, type: Zephyr, version: --. Before the test.

Figure 2: Photograph of the tested sample, trademark: Invacare, type: Zephyr, version: --. Before the test.

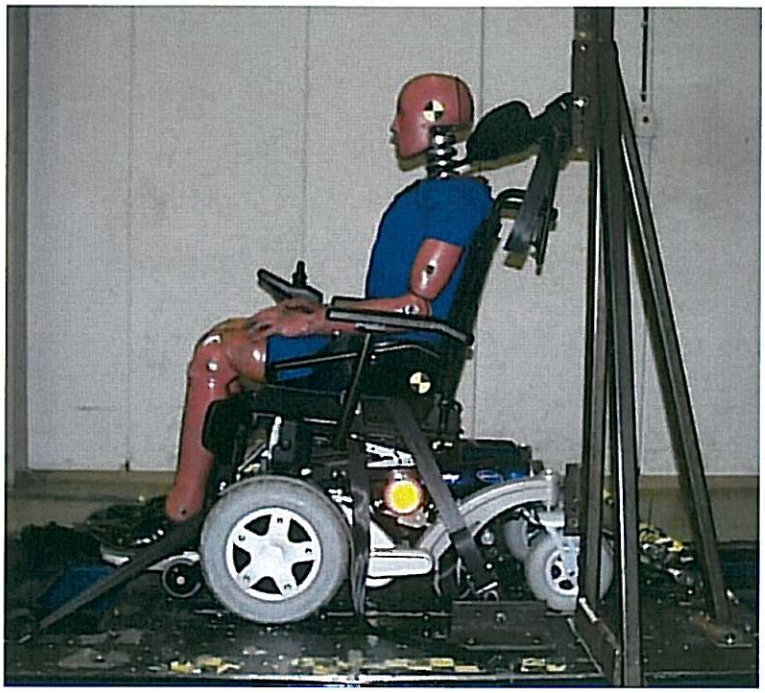


Figure 3: Photograph of the tested sample, trademark: Invacare, type: Zephyr, version: --. Before the test.

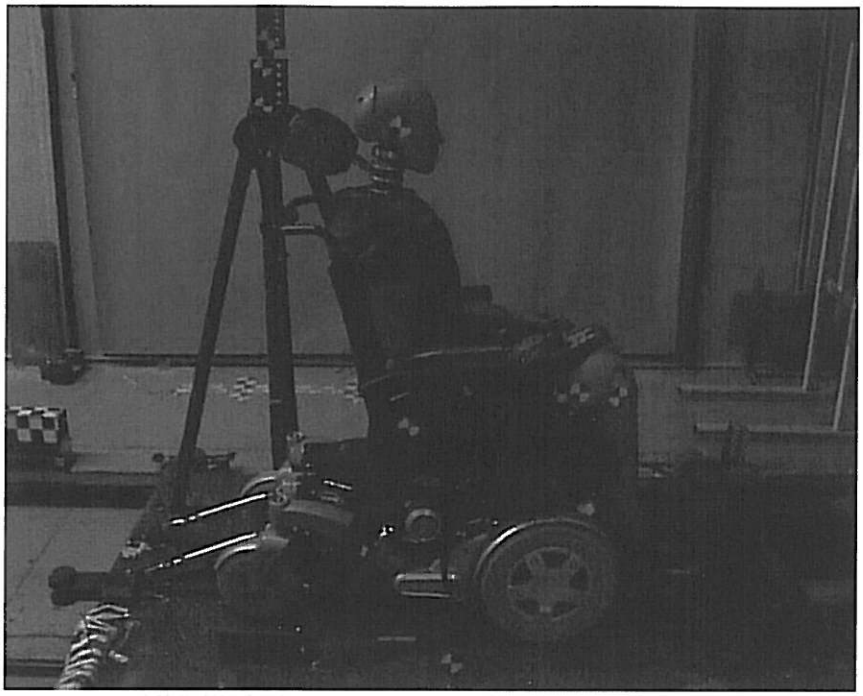


Figure 4: Photograph of the tested sample, trademark: Invacare, type: Zephyr, version: --. Before the test.

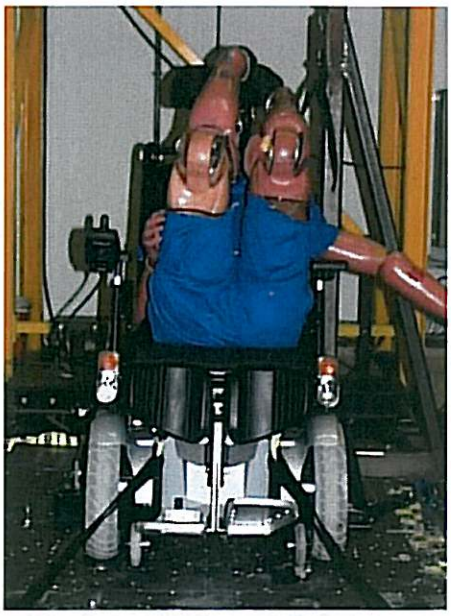


Figure 5: Photograph of the tested sample, trademark: Invacare, type: Zephyr, version: --. After the test.

Figure 6: Photograph of the tested sample, trademark: Invacare, type: Zephyr, version: --. After the test.

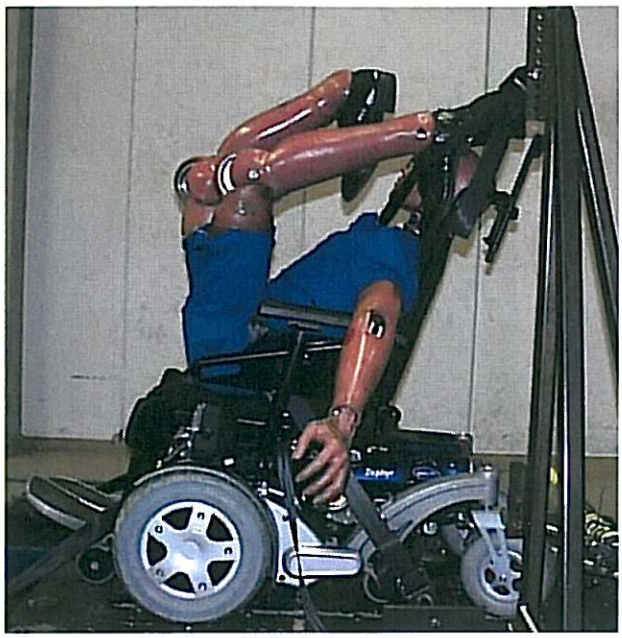


Figure 7: Photograph of the tested sample, trademark: Invacare, type: Zephyr, version: --. After the test.

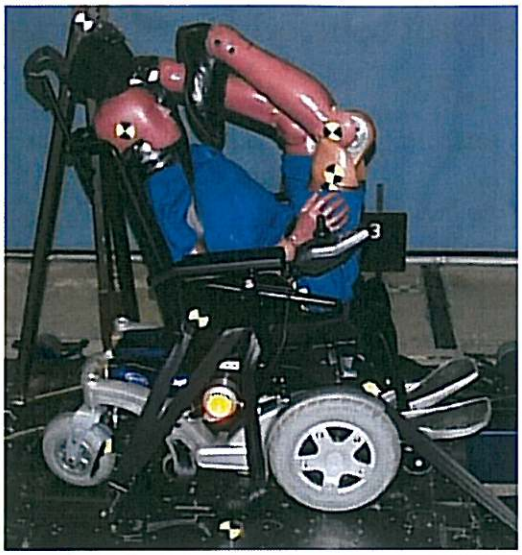


Figure 8: Photograph of the tested sample, trademark: Invacare, type: Zephyr, version: --. After the test.

Appendix C Detailed test results

Each under-mentioned requirement states only a very short description of the complete text in the applicable standards.

Sample: 20.686-01	Type: Zephyr, version: --		
Req. nr.	**Description of the requirement**	**Measured value**	**Pass/fail/n.a.**
4	**Design requirements**		
4.1	**Wheelchair securement**		
4.1.a	Wheelchair suitable for 1 or more types of tie down systems according to ISO 10542		Pass
4.1.b	Minimum of 2 securement points in the front and 2 in the rear		Pass
4.2	**Occupant restraint**		
4.2.1	Wheelchair-anchored pelvic belt		
4.2.1a	Wheelchair-anchored pelvic belt between 30 and 75°		n.a.
4.2.1b	Adjustment of belt 200 mm from nominal set-up		n.a.
4.2.1c	Rear-view projected angles of pelvic belt within zones shown in Figure 3		n.a.
4.2.2	Wheelchair-anchored shoulder belt		
4.2.2a	Fit over shoulder/chest as illustrated in Figure 4		n.a.
4.2.2b	Upper anchor or guide point at or above shoulder of the ATD		n.a.
4.2.2c	Range of adjustment (increasing 200 mm, decreasing 300 mm, from normal set-up)		n.a.
4.2.2d	Junction of shoulder and pelvic belts of 3-point belts located not less than 150 mm from the ATD centreline		n.a.
4.2.3	Accommodation of vehicle or tiedown-anchored occupant belt restraints: unobstructed fitting of belts to the occupant		Pass
5	**Performance requirements**		
5.1	**Wheelchair-anchored belt restraints**		
5.1.a	All belt parts in conformity with applicable subsections of ECE 16 or FMVSS 209 or 77/541/EEC		n.a.
5.1.b	Burning rate webbing <100 mm/min		n.a.
5.2	**Frontal impact test**		
5.2.1	**During the test**		
5.2.1a	Horizontal excursions		
	• Wheelchair point P ≤ 200 mm	124 mm	Pass
	• ATD knee ≤ 375 mm	342 mm	Pass
	• ATD front of head ≤ 650 mm	365 mm	Pass
	• ATD rear of head ≤ 400 mm	354 mm	Pass
5.2.1b	Knee excursion exceeding point P excursion as knee/P: ≥ 1.1	2.75	Pass
5.2.1c	Excursions of batteries (if applicable)		
	• not outside footprint wheelchair	No excursion	Pass
	• not against ATD back of legs	No excusrion	Pass
5.2.2	**After the test**		
5.2.2a	Wheelchair upright, on the sled platform	Yes	Pass
5.2.2a	ATD torso angle ≤ 45°	45°	Pass
5.2.2b	No visible signs of material failure on securement points	No signs	Pass

Sample: 20.686-01 Req. nr.	Type: Zephyr, version: -- Description of the requirement	Measured value	Pass/fail/n.a.
5.2.2c	No completely separated parts > 100 g	No	Pass
5.2.2d	No sharp edges with R= < 2	No	Pass
5.2.2e	Primary load carrying components no visible signs of failure	No signs	Pass
5.2.2f	Locking mechanisms of tilt-in-space adjusters no signs of failure	No signs	Pass
5.2.2g	ATD removable without tools	Yes	Pass
5.2.2h	Wheelchair releasable without tools	Yes	Pass
5.2.2.i	Decrease of average height of ATD H-points to platform < 20%	9.28 %	Pass
5.3	**Accessibility of securement points intended for use with four-point strap-type tie downs with hook-type end-fittings**		
5.3a	Allowance of one-handed attachment and engagement within 10 s	Yes	Pass
5.3b	Allowance of one-handed disengagement and removal of the same hook gauge within 10 s	Yes	Pass
6	**Identification, labelling, user instructions, warning and disclosure requirements**		
6.1	**Identification and labelling (on the wheelchair)**		
6.1a	Securement point symbol • total height of symbol ≥ 12mm • line widths ≥ 10% - ≤ 20% of height • sufficient contrast to the background		 Pass Pass Pass
6.1b	Markings and/or wording to indicate location and type of any additional tiedown (besides the four-point strap-type)		Pass
6.1c	Indication of conformity with ISO 7176-19:xxxx (wheelchair)		Pass
6.1d	Indication of conformity with ISO 7176-19:xxxx (occupant restraints)		n.a.
6.1e	Indication that postural support belts which are not intended as restraint, should not be used as such		Pass
6.2	**Presale literature**		
6.2a	Statement about forward facing when used in a motor vehicle and about the accordance with ISO 7176-19:xxxx		Pass
6.2b	Description of suitable tie down systems		Pass
6.2c	Statement about effecting accessibility by size and turning radius of wheelchair		Pass
6.2d	Statement if wheelchair is tested with any wheelchair-anchored occupant restraint belts		n.a.
6.3	**User and maintenance instructions**		
6.3.1	**User instructions shall include following statements**		
6.3.1a	Statement about forward facing only		Pass
6.3.1b	Statement of conformity with ISO 7176-19:xxxx (wheelchair)		Pass
6.3.1c	Statement about transferring to vehicle seat, if possible		Pass
6.3.2	**User instructions shall include descriptions of/ information on**		
6.3.2a	Suitable tiedown systems		Pass
6.3.2b	Locations of tiedown securement points and the marking used to identify them		Pass
6.3.2c	For wheelchair-anchored occupant restraints: location of anchor		

Sample: 20.686-01 Req. nr.	Type: Zephyr, version: -- Description of the requirement	Measured value	Pass/fail/n.a.
	points and specifications of hardware		n.a.
6.3.2d	Locations of all wheelchair securement points as used during the frontal impact test		Pass
6.3.2e	Description of how wheelchair is to be secured in a vehicle		Pass
6.3.2f	Description of compatible tie down systems and fittings (if applicable)		Pass
6.3.2g	Correct positioning of occupant restraints on the user • pelvic belt low as possible, angle between 45-75°, as shown in Figure 3 • a steeper angle within the zone is desirable • belt against body (not against wheelchair parts), with illustration similar to that of Figure 6 • upper torso belts should fit over shoulders and across the chest as illustrated in Figure 4 • restraints adjusted tightly as possible • belt webbing not worn twisted		Pass Pass Pass Pass Pass Pass Pass
6.3.2h	Recommended settings for any adjustable parts, including where applicable seat and back rest positions, when the wheelchair is in use in a motor vehicle		Pass
6.3.3	**User instructions shall include illustrations of**		
6.3.3a	Incorrect belt restraints using Figure 6 as an example		Pass
6.3.3b	Correct placement of belt restraints using Figure 7 as an example		Pass
6.3.4	**User instructions shall include statements/warnings (using at least 12-point font)**		
6.3.4a	Statement about forward facing only and secured by tiedowns in accordance to WTORS instructions		Pass
6.3.4b	Wheelchair suitable for use in vehicles, it has met the performance requirements for travelling forwards-facing in frontal impact conditions, other configurations are not tested		Pass
6.3.4c	Wheelchair tested forward facing with ATD restrained by pelvic and shoulder belt		Pass
6.3.4d	Both pelvic and shoulder belt should be used to reduce possible head and chest impacts with vehicle components		Pass
6.3.4e	That wheelchair-mounted trays should • be removed and secured OR • be secured to the wheelchair, away from the occupant, with energy-absorbing padding in between		Pass Pass
6.3.4f	Auxiliary equipment secured to the wheelchair or removed and secured to the vehicle		Pass
6.3.4g	Postural supports and belts may be used as restraints but only reliable if labelled as such		Pass
6.3.4h	Wheelchair should be inspected by the manufacturer before reuse following involvement in any type of vehicle impact		Pass
6.3.4i	No alterations/substitutions to securement points without consulting the manufacturer of the wheelchair		Pass
6.3.4j	Recommendation about using spill-proof batteries		Pass

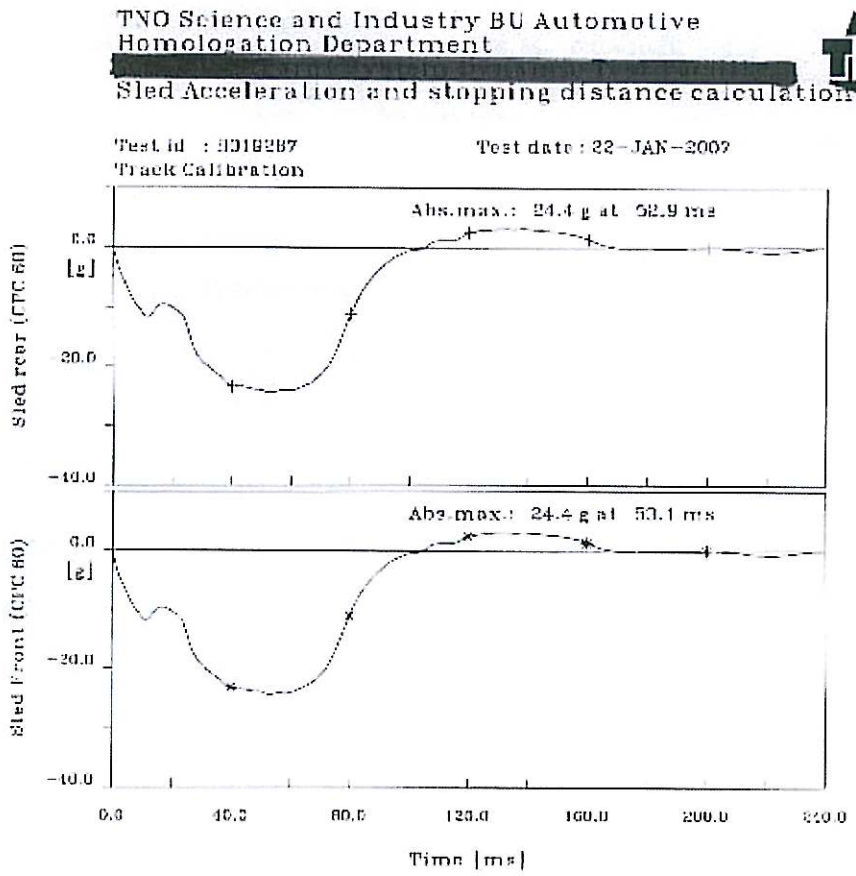
Appendix D Remarks on the test results

Sample: 20.686-01	Type: Zephyr	Version: --	
Req. nr.	**Description of the requirement**	**Remark**	
		No remarks	

Appendix E Test specifications

Subject	Value
Attachment method	Dummy tiedown system TNO according to ISO 7176-19
Crash Simulator	EBS crash simulator sled
Orientation	Forward facing
ATD	Hybrid II
ATD mass	78 kg
Test number	EO 19288
Test date	23-01-2007

Appendix F Sled deceleration or acceleration and velocity



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