

## Test Report

Customer

Vehicle / Part ID

Ergo Pro

ISO7176-19:2022

CareCo

Transit and Self-Propelled Variants

Test

23/1218

**Millbrook Project Number** 

Millbrook Report Number

PRJPG105132

Author

2000

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**Approved For Issue** 

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Date

09/08/2023

### **Executive Summary**

- This report relates to a series of simulated frontal impacts to the requirements laid out in BS ISO 7176-19:2022 to dynamically test a wheelchair loaded with an appropriately sized crash-test dummy using a 48km/h crash pulse.
- The wheelchairs were subjected to a longitudinal acceleration pulse that exceeded 20g for at least 15ms, 15g for a continuous time period of 40ms and has a total duration of at least 75ms, with a total Δv of 48km/h (+2 -0).

### Distribution

Organisation	Format	Recipient
1, Turing Court Great Notley	Electronic (PDF)	W.Harrison
Braintree CM77 7AT		
Millbrook Proving Ground Station Lane Bedford MK45 2JQ	Electronic (PDF)	P.Woskett

## **Revision History**

Rev.	Description	Date	Author	Approver	Page(s)
0	Initial release	09/08/2023	Philip Woskett	Sam Eccles	All

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## Abbreviations and Acronyms

- ATD Anthropomorphic Test Device
- %ile Percentile
- Δv Change in velocity
- ms millisecond

#### References

1. BS ISO 7176-19:2022

### Objectives

- 1. To perform a series of tests on the Ergo Pro wheelchair range that meet the requirements of BS ISO 7176-19:2022.
- 2. To perform tests on the Ergo Pro wheelchair model range to check the dynamic response and structural soundness during and after a simulated frontal impact to ISO 7176-19:2022.
- 3. To ensure all criteria outlined in ISO 7176-19:2022 are met.

#### Conclusions

- 1. The test conditions set out in ISO 7176-19:2022 were met on each of the four tests carried out.
- 2. All four variants of the Ergo Pro chair that were tested met the dynamic requirements of ISO 7176-19:2022.
- 3. Interpolating results from the tests using the largest available chairs (20"/22") using the 50<sup>th</sup> %ile ATD and the smallest available chairs (16") using the 5<sup>th</sup> %ile ATD, it is determined that the 18" and 20" variants of the Ergo Pro would meet the requirements outlined in ISO 7176-19:2022.

#### Disclaimers

All test results only relate to the items tested. Unless otherwise stated, Millbrook Proving Ground Ltd. shall make no pass or fail conclusions regarding this test. Any determinations shall be made solely by the customer.

## Test Facility and Dates

The tests were performed in the ServoSled facility at Millbrook Proving Ground on the following dates:

S18176	20/06/2023
S18177	20/06/2023
S18197	07/07/2023
S18252	31/07/2023

Address: Millbrook Proving Ground Station Lane Millbrook Bedford MK45 2JQ

Contact: Philip Woskett – Test Engineer 01525 408 385 philip.woskett@utac.com

#### Test Parts / Vehicle Details

Item		Part No./Name	Condition on Receipt	Test Mass (kg)
Wheelchair	Ergo Pro	16" Self-Propelled	No defects	14
Wheelchair	Ergo Pro	16" Transit	No defects	13
Wheelchair	Ergo Pro	20" Self-Propelled	No defects	14
Wheelchair	Ergo Pro	22" Transit	No defects	13
Restraint systems (x4)	Koller	Excel 120 Combined	No defects	6

 Table 1 – Test Parts Details

## **Test Procedure**

The dynamic test was carried out to the customer requirements, using the Millbrook Proving Ground Sled.

The Sled, manufactured by Seattle Safety is a 1.4MN reverse acting linear shock tester. The sled system utilises a hydraulic servo brake acting directly on the sled carriage to control the acceleration of the sled. By this means the sled carriage, on which the test material is mounted, is accelerated in the manner required by the customer.

The rig and wheelchairs loaded with apprpriately sized ATDs were mounted on the sled carriage in a forward direction in order to simulate a frontal impact collision as outlined in ISO7176-19:2022.

The analogue transducer signal is digitised by the data acquisition system and acquired at a sampling rate of 10kHz over a period of 1100 milliseconds.

Test no.	Wh	eelchair	Restraints		
	Name	Variant	Tie-downs	Occupant	
S18176	Ergo Pro	Transit 22"	Koller Excel 120 Combined		
S18177	Ergo Pro	Self-Propelled 20"	Koller Excel	120 Combined	
S18197	Ergo Pro	Transit 16"	Koller Excel	120 Combined	
S18252	Ergo Pro	Self-Propelled 16"	Koller Excel 120 Combined		

The table below shows the running order of the test series for the Ergo Pro chair:

#### Table 2 – Test running order

The table below shows the ATD occupancy of each chair in the test series for the Ergo Pro chair:

Test no	Wh	eelchair	Occupant		
	Name	Variant	ATD Type	ATD Mass (kg)	
S18176	Ergo Pro	Transit 22"	HIII 50 <sup>th</sup> %ile	77	
S18177	Ergo Pro	Self-Propelled 20"	HIII 50 <sup>th</sup> %ile	77	
S18197	Ergo Pro	Transit 16"	HIII 5 <sup>th</sup> %ile	56	
S18252	Ergo Pro	Self-Propelled 16"	HIII 5 <sup>th</sup> %ile	56	

Table 3 – Test Occupancy

### Appendices

Graphical results, pre/post-test photography and a summary of results for S18176 are included in Appendix A.

Graphical results, pre/post-test photography and a summary of results for S18177 are included in Appendix B.

Graphical results, pre/post-test photography and a summary of results for S18197 are included in Appendix C.

Graphical results, pre/post-test photography and a summary of results for S18252 are included in Appendix D.

High-speed films were recorded and are included in the "Films" directory in the data pack.

All pre and post-test photographs are included in the "Stills" directory in the data pack.

Electronic copies of each item in appendices are included in the data pack for each test.

#### Instrumentation

The same sled accelerometer was used on each test.

Chan No.	Channel Description	Transducer Make	Transducer Model	Trans. No.	CFC	CAC	Calibration Date	In Cal?
1	Primary Sled Accel X	Endevco	2262C-200	ZR34	1000	200	23/12/2022	Y

 Table 4 – Instrumentation Equipment Details

#### Photographic

Three high-speed cameras were positioned to provide overall coverage of the dynamic response of the wheelchairs and occupants. The high-speed cameras (nominal 1000 frames per second) used for the tests are as detailed below:

Camera Position	Camera	Lens
Onboard LH Total	IDT	IDT 6mm
Onboard Rear View	IDT	IDT 6mm
Offboard Overhead	IDT	IDT 12.5mm

 Table 5 – Camera Equipment Details



System: X-Crash 8.4 based on DIAdem 20.10, Macro: CAS\_ISO\_7176\_19\_Sled.vbc 1.1, Layout: CAS\_LA01\_20, Evaluated at: 2023-08-10 15:36:34

Laboratory: UTAC, Contact: Tomasz Szling, Customer: CareCo, Test Title: ISO 7176-19 Transit 22



System: X-Crash 8.4 based on DIAdem 20.10, Macro: CAS\_ISO\_7176\_19\_Sled.vbc 1.1, Layout: CAS\_LA03\_20, Evaluated at: 2023-08-10 15:36:36

Laboratory: UTAC, Contact: Tomasz Szling, Customer: CareCo, Test Title: ISO 7176-19 Transit 22





#### Post Test Stills



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# **Test Report**



#### Test Results Summary ISO 7176-19:2022

Test No	):	S18176	
Test Da	ite:	20/06/2023	
Test Fa	cility:	Servosled at UTAC Millbrook Proving Ground	
Manufa	cturer:	CareCo	<b>RESULTS</b>
Model:		Ergo Pro Transit 22"	NEOOE10
Mass (k	(g):	13.0kg	
Occupa	ant:	HIII 50 <sup>m</sup> %ile (Uninstrumented)	
Tie Dov	vn Restraint:	Koller Excel 120 Combined	
a)	Did the wheeld deformation or	chair securement points show any sign of material failure other than r yielding	PASS
b)	Did any secure wheelchair tie-	ement point deformation or distortion prevent manual removal of the down system	PASS
c)	Was the whee	Ichair in an upright position on the test platform	PASS
d)	Did the ATD re	emain in a seated posture at the end of the test (with a torso angle	
	less than 45° t	to the vertical when viewed from any direction)	PASS
e)	Did any rigid c detatch during	omponents, parts, equipment or accessories in excess of 150g the test (related to the test article)	PASS
f)	Did any occup less than 2mm	ant contactable components fragment or separate with an edge	PASS
g)	Did any of the structural failu	e primary load carrying parts and components show visible signs of re other than deformation or loading	PASS
h)	Horizontal ATI	D wheelchair excursion limits as per limits shown in table 3 of 5.3.2:	PASS
· · · ·	i) Was the ho 200mm (±5mm	rizontal movement of the test wheelchair P-Point (Xwc) less than n)	45
	ii) Was the hol (±5mm)	rizontal movement of the dummy knee (Xknee) less than 375mm	362
	iii) Was the ho (±5mm)	rizontal movement of the dummy head (Xheadf) less than 650mm	413
	iv) Was the re	ar head excursion (Xheadr) less than -450mm (±5mm) N/A as amended in EN12183	N/A
i)	Was the ratio	Xknee/Xwc > 1.1	8 04
j)	Did any lockin	g mechanisms of tilt seating systems release or have structural	PASS
k)	Was the avera	age decrease of H-Point height relative to the wheelchair platform	PASS
I)	Did the seating	g insert (seat or back support) detatch from the wheelchair during	PASS
n)	Did any of the	tiedown and occupant restrainst system fail due to interaction with r or its components during the test	PASS
o)	Did all secure	ment hooks remain attached to the wheelchair's securement points e test and remain attached at the end	PASS
p)	Did the wheel disconnect at	chair-anchored belt restraints become detatched at anchorages, buckles, or show complete failure	PASS
		ISO 7176-19:2022 Crash Test criteria fullfilled	

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System: X-Crash 8.4 based on DIAdem 20.10, Macro: CAS\_ISO\_7176\_19\_Sled.vbc 1.1, Layout: CAS\_LA01\_20, Evaluated at: 2023-08-10 15:36:39

Laboratory: UTAC, Contact: Tomasz Szling, Customer: CareCo, Test Title: ISO 7176-19 Self Propelled 20



System: X-Crash 8.4 based on DIAdem 20.10, Macro: CAS\_ISO\_7176\_19\_Sled.vbc 1.1, Layout: CAS\_LA03\_20, Evaluated at: 2023-08-10 15:36:40

Laboratory: UTAC, Contact: Tomasz Szling, Customer: CareCo, Test Title: ISO 7176-19 Self Propelled 20

Pre Test Stills





Post Test Stills



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# **Test Report**



#### Test Results Summary ISO 7176-19:2022

Test No	):	S18177	
Test Da	ite:	20/06/2023	
Test Fa	cility:	Servosled at UTAC Millbrook Proving Ground	
Manufa	cturer:	CareCo	RESULTS
Model:		Ergo Pro Self Propelled 20"	RECOLIC
Mass (k	(g):	14.2kg	
Occupa	int:	HIII 50 <sup>th</sup> %ile (Uninstrumented)	
Tie Dov	vn Restraint:	Koller Excel 120 Combined	
a)	Did the wheeld deformation or	chair securement points show any sign of material failure other than r yielding	PASS
b)	Did any secure wheelchair tie-	ement point deformation or distortion prevent manual removal of the down system	PASS
c)	Was the whee	Ichair in an upright position on the test platform	PASS
d)	Did the ATD re	emain in a seated posture at the end of the test (with a torso angle	
	less than 45° t	to the vertical when viewed from any direction)	PASS
e)	Did any rigid c detatch during	omponents, parts, equipment or accessories in excess of 150g the test (related to the test article)	PASS
f)	Did any occup less than 2mm	ant contactable components fragment or separate with an edge	PASS
g)	Did any of the structural failu	e primary load carrying parts and components show visible signs of re other than deformation or loading	PASS
h)	Horizontal ATI	D wheelchair excursion limits as per limits shown in table 3 of 5.3.2:	PASS
· · · ·	i) Was the ho 200mm (±5mm	rizontal movement of the test wheelchair P-Point (Xwc) less than n)	45
	ii) Was the hol (±5mm)	rizontal movement of the dummy knee (Xknee) less than 375mm	304
	iii) Was the ho (±5mm)	rizontal movement of the dummy head (Xheadf) less than 650mm	406
	iv) Was the real	ar head excursion (Xheadr) less than -450mm (±5mm) N/A as amended in EN12183	N/A
i)	Was the ratio	Xknee/Xwc > 1.1	6.76
j)	Did any lockin components t	g mechanisms of tilt seating systems release or have structural hat released during the test	PASS
k)	Was the avera	age decrease of H-Point height relative to the wheelchair platform	PASS
I)	Did the seating	g insert (seat or back support) detatch from the wheelchair during	PASS
n)	Did any of the the wheelchai	tiedown and occupant restrainst system fail due to interaction with r or its components during the test	PASS
o)	Did all secure throughtout th	ment hooks remain attached to the wheelchair's securement points e test and remain attached at the end	PASS
p)	Did the wheel disconnect at	chair-anchored belt restraints become detatched at anchorages, buckles, or show complete failure	PASS
		ISO 7176-19:2022 Crash Test criteria fullfilled.	

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System: X-Crash 8.4 based on DIAdem 20.10, Macro: CAS\_ISO\_7176\_19\_Sled.vbc 1.1, Layout: CAS\_LA01\_20, Evaluated at: 2023-07-07 14:46:13

Laboratory: UTAC, Contact: Phil Woskett, Customer: CareCo, Test Title: Ergo Pro 16" Transit



System: X-Crash 8.4 based on DIAdem 20.10, Macro: CAS\_ISO\_7176\_19\_Sled.vbc 1.1, Layout: CAS\_LA03\_20, Evaluated at: 2023-07-07 14:46:15

Laboratory: UTAC, Contact: Phil Woskett, Customer: CareCo, Test Title: Ergo Pro 16" Transit

#### Pre Test Stills





Post Test Stills



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# **Test Report**



#### Test Results Summary ISO 7176-19:2022

Test No:		S18197		
Test Date:		07/07/2023		
Test Facility:		Servosled at UTAC Millbrook Proving Ground		
Manufacturer:		CareCo		
Model:		Ergo Pro Transit 16"	RESULTS	
Mass (kg):		13kg		
Occupant:		HIII 5 <sup>th</sup> %ile (Uninstrumented)		
Tie Dov	vn Restraint:	Koller Excel 120 Combined		
a)	Did the wheeld deformation or	chair securement points show any sign of material failure other than vielding	PASS	
b)	Did any secure wheelchair tie-	ement point deformation or distortion prevent manual removal of the down system	PASS	
c)	Was the wheelchair in an upright position on the test platform		PASS	
d)	Did the ATD re	emain in a seated posture at the end of the test (with a torso angle		
- /	less than 45° t	o the vertical when viewed from any direction)	PASS	
e)	Did any rigid c detatch during	omponents, parts, equipment or accessories in excess of 150g the test (related to the test article)	PASS	
f)	Did any occup less than 2mm	ant contactable components fragment or separate with an edge	PASS	
g)	Did any of the structural failu	primary load carrying parts and components show visible signs of re other than deformation or loading	PASS	
h)	Horizontal AT	D wheelchair excursion limits as per limits shown in table 3 of 5.3.2:	PASS	
	i) Was the ho 200mm (±5mn	rizontal movement of the test wheelchair P-Point (Xwc) less than n)	22	
	ii) Was the hor (±5mm)	rizontal movement of the dummy knee (Xknee) less than 375mm	236	
	iii) Was the ho (±5mm)	rizontal movement of the dummy head (Xheadf) less than 550mm	450	
	iv) Was the rea	ar head excursion (Xheadr) less than -400mm (±5mm) N/A as amended in EN12183	N/A	
i)	Was the ratio	Xknee/Xwc > 1.1	10.73	
j)	Did any lockin components the	g mechanisms of tilt seating systems release or have structural nat released during the test	PASS	
k)	Was the avera less than 20%	ge decrease of H-Point height relative to the wheelchair platform of the pre test height	PASS	
I)	Did the seating the test	g insert (seat or back support) detatch from the wheelchair during	PASS	
n)	Did any of the the wheelchai	tiedown and occupant restrainst system fail due to interaction with r or its components during the test	PASS	
o)	Did all secure throughtout th	ment hooks remain attached to the wheelchair's securement points e test and remain attached at the end	PASS	
p)	Did the wheel disconnect at	chair-anchored belt restraints become detatched at anchorages, buckles, or show complete failure	PASS	
ISO 7176-19·2022				
Crash Test criteria fullfilled.				

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System: X-Crash 8.4 based on DIAdem 20.10, Macro: CAS\_ISO\_7176\_19\_Sled.vbc 1.1, Layout: CAS\_LA01\_20, Evaluated at: 2023-07-31 15:26:22

Laboratory: UTAC, Contact: Daniel Balan, Customer: CareCo, Test Title: ISO7179-19



System: X-Crash 8.4 based on DIAdem 20.10, Macro: CAS\_ISO\_7176\_19\_Sled.vbc 1.1, Layout: CAS\_LA03\_20, Evaluated at: 2023-07-31 15:26:24

Laboratory: UTAC, Contact: Daniel Balan, Customer: CareCo, Test Title: ISO7179-19

#### Pre Test Stills





Post Test Stills



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# **Test Report**



#### Test Results Summary ISO 7176-19:2022

Test No	o: \$18252			
Test Da	ate: 31/07/2023			
Test Fa	acility: Servosled at UTAC Millbrook Proving Ground			
Manufa	acturer: CareCo			
Model:	Ergo Pro Self Propelled 16"	RECOLIC		
Mass (	kg): 14kg			
Occup	ant: HIII 5 <sup>th</sup> %ile (Uninstrumented)			
Tie Dov	wn Restraint: Koller Excel 120 Combined			
a)	Did the wheelchair securement points show any sign of material failure other than deformation or yielding	PASS		
b)	Did any securement point deformation or distortion prevent manual removal of the wheelchair tie-down system	PASS		
c)	Was the wheelchair in an upright position on the test platform			
d)	Did the ATD remain in a seated posture at the end of the test (with a torso angle less than 45° to the vertical when viewed from any direction)	PASS		
e)	Did any rigid components, parts, equipment or accessories in excess of 150g detatch during the test (related to the test article)			
f)	Did any occupant contactable components fragment or separate with an edge less than 2mm			
g)	Did any of the primary load carrying parts and components show visible signs of structural failure other than deformation or loading	PASS		
h)	Horizontal ATD wheelchair excusrsion limits as per limits shown in table 3 of 5.3.2:	PASS		
	<ul> <li>i) Was the horizontal movement of the test wheelchair P-Point (Xwc) less than 200mm (±5mm)</li> </ul>	41		
	ii) Was the horizontal movement of the dummy knee (Xknee) less than 375mm (±5mm)	188		
	<ul><li>iii) Was the horizontal movement of the dummy head (Xheadf) less than 550mm (±5mm)</li></ul>	366		
	iv) Was the rear head excursion (Xheadr) less than -400mm (±5mm) N/A as amended in EN12183	N/A		
i)	Was the ratio Xknee/Xwc > 1.1	4.59		
j)	Did any locking mechanisms of tilt seating systems release or have structural components that released during the test	PASS		
k)	Was the average decrease of H-Point height relative to the wheelchair platform less than 20% of the pre test height	PASS		
I)	Did the seating insert (seat or back support) detatch from the wheelchair during the test	PASS		
n)	Did any of the tiedown and occupant restrainst system fail due to interaction with the wheelchair or its components during the test	PASS		
o)	Did all securement hooks remain attached to the wheelchair's securement points throughtout the test and remain attached at the end	PASS		
p)	Did the wheelchair-anchored belt restraints become detatched at anchorages, disconnect at buckles, or show complete failure	PASS		
ISO 7176-19:2022 Crash Test criteria fullfilled.				

**Commercial in Confidence** 

--- End of report ---