

# TEST REPORT

**Applicant :**

**BENOITSYSTEMES**  
7 Rue du Pont  
21450, Billy-Lès-Chanceaux

**Date of order:**

19/11/2019 – Customer Order N°2019/15510

**Subject :**

Safety tests on a wheelchair motorization system according with ISO 7176-14 standard

NOTE Software testing is not addressed in this edition of this part of ISO 7176, due to its impracticability.

**Reference documents :**

Tests have been carried out in accordance with ISO 7176-14 (February 2008)  
(Power and control systems for electrically powered wheelchairs)

**Identification of the sample :**

Minotor<sup>2</sup> wheelchair motorization system

**Serial Number :**

1217MIH003

**Characteristics of the device :**

Weight of the motorization : 8.8Kg  
Dimensions 510x300x275mm  
Maximal slope : 11%

Maximal patient load: 120kg / Max speed: 10km/h  
Batterie: lithium-ion (24.8V, 12A/h)

**Date of tests :**

From 16 December, 2019 to 16 January, 2020

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## 1. PURPOSE OF THE TEST

The Laboratoire National de Métrologie et d'Essais (LNE) was requested by Benoit Systemes to control the conformity of the wheelchair motorization system, in accordance with requirements of the **ISO 7176-14:2008** standard.

The system was exposed to environmental conditions that are expected in normal use, storage and transportation. It was then visually and functionally inspected to demonstrate that it meets the requirements described in the standard.

### 1.1 SPECIMENS SUBMITTED

- Minotor<sup>2</sup> wheelchair motorization system  
Serial Number: 1217MIH003



General Overview

Wheelchair model used during tests to support the motorization:  
- Model Otto Bock



**Equipment marking plate**



**Personal box controller**

Personal box controller :  
Reference : PG DRIVES TECHNOLOGY  
Model : D51571.01  
Sn : BL19070948



**Electrical motor Controller :**

Electrical motor Controller :  
Reference : VR2 PG DRIVES TECHNOLOGY  
Model : D51425.03  
Sn : CP19090727



**Motor**

Motor reference : GR 63SX55  
Voltage : 24VDC  
Continuous current : 5.8A



## Battery

Battery

Identification Number : 19R120831

Working Voltage : 24,8 Vdc

Capacity: 12Ah

Maximum Charge Voltage : 29,2 Vdc

Maximum Allowed Temperature : 50°C



### Battery power supply

Battery power supply : Mascot battery charger

Type :2440

Identification Number : 2440 2950 00

Output Voltage: 29.4VDC

Input Voltage: 100-240VAC,50-60Hz 1.6A



➤ Instruction manual : Reference : V20.01

**BENOIT SYSTEMES**  
Motorisez-vous.



# Manuel d'utilisation

## Minotor<sup>2</sup>

### Mini Minotor<sup>2</sup>

### Maxi Minotor<sup>2</sup>

Consultez nos vidéos explicatives sur la chaîne  
YouTube de Benoit Systemes

<p>7 rue du Port 21400-BILLY-VALE-CHAMPEAUX FRANCE</p> <p>APRÈS 10 ANS DE DÉVELOPPEMENT UNE SOCIÉTÉ</p> <p>100% CAPITAL FRANÇAIS - CAPITAL DE 200 000 € N° TVA Intracommunautaire FR234030954</p> <p>Tel +33 (0) 3 80 96 91 35 Fax +33 (0) 3 80 96 53 57</p> <p><a href="mailto:contact@benoit-systemes.com">contact@benoit-systemes.com</a> <a href="http://www.benoit-systemes.com">www.benoit-systemes.com</a></p> <p><b>V20.01</b></p>	<p>Ce manuel DOIT être remis à l'utilisateur du produit. Lire ce manuel AVANT d'utiliser ce produit, et le conserver en cas de besoin.</p>
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## 2. TABLE RESULTS

P: Meets this requirement of the reference document

F: "Unsatisfactory" or "Non-compliant": Does not meet this requirement of the Registration Document

N / A: This requirement does not apply

N / E: This requirement is not performed

Prescriptions	Observations	Results
<b>§ 7 : Single fault safety</b>		-
§ 7.2.3.2 : Open –circuit test	See Annex : 7.2.3.2	P
§ 7.2.3.3 Short-circuit test	See Annex : 7.2.3.3	P
§ 7.2.3.4 Leakage current test	In conformity with the PG drives technology Also TUV Certificate of compliance in accordance with 7176/14 standard	P
<b>§ 7.3 Controller output device failure</b>		-
§ 7.3.3.2 Open-circuit test	In conformity with the PG drives technology Also TUV Certificate of compliance in accordance with 7176/14 standard	P
§ 7.3.3.3 Short-circuit test	In conformity with the PG drives technology Also TUV Certificate of compliance in accordance with 7176/14 standard	P
§ 7.4 Ability to stop when power is removed	In conformity with the PG drives technology Also TUV Certificate of compliance in accordance with 7176/14 standard	P
<b>§ 8 Design</b>		-
§ 8.1 On/off switch	Personal box controller	P
§ 8.2 Current consumption while switched off	Measured 7.8mA when the wheelchair is switched off	P
§ 8.3 Control signal at switch on	In conformity with the PG drives technology Also TUV Certificate of compliance in accordance with 7176/14 standard	P
§ 8.4 Safe operation as the battery set becomes depleted	No certification of the battery in accordance with 62133-2	P

§ 8.5 Over-discharge protection	Certification of the battery in accordance with 62133-2	P
§ 8.6 Controller over-voltage protection	Certification of the battery in accordance with 62133-2	P
§ 8.7 Switch-off while driving	No hazardous situation during tests	P
§ 8.8 Measuring devices	In conformity with the PG drives technology Also TUV Certificate of compliance in accordance with 7176/14 standard	P
§ 8.9 Drive inhibit during charging	No movement when the chair is in off state during charging	P
§ 8.10 Charging connection voltage drop	Battery charger is certified 60601-1	P
§ 8.11 Non-powered mobility	Benoit Systeme have two handles to apply the system on wheels Frequired to start the chair= $0.65+(0.6*120)=72.65\text{N}$ Measured=26N Fleft handle=22N Fright handle=37N	P
§ 8.12 Brakes	Exclude mechanical components used in the transmission, such as the rotors of the drive motors, shafts, gears and belts	P
§ 8.13 Battery enclosures	It is possible to mount and unmount the And also open for inspection and service operations as recommended by the manufacturer	P
§ 8.14 Symbols	labels with address of the manufacturer, sn ref etc on the device only on the battery pack it is possible to remove or exchanger the battery pack	P
§ 8.15 Safety of moving parts	Design of moving parts is the responsibility of the manufacturer including design, risk management file Also all requirements of EN 12182	N / E
§ 8.16 Use in combination with other devices	No other devices for use in combination or equipment that would be electrically connected to the battery submitted during tests	N / A
<b>§ 9 Protection against electric shock, burns, fire and explosion</b>		-
§ 9.1 Electrical isolation	Measured 0 mA	P

§ 9.2 Protection from non-insulated electrical parts	No accessible or non insulated electrical parts	P
§ 9.3 Circuit protection	Certification of the battery in accordance with 62133-2. A circuit breaker is included in the battery	P
§ 9.4 Stalled condition protection	In conformity with the PG drives technology Also TUV Certificate of compliance in accordance with 7176/14 standard	P
§ 9.5 Surface temperatures	In this case No parts from BENOITSYSTEMES come into constant direct contact with the patient in the area mentioned in the norm	N / A
§ 9.6 Disconnection of battery system	Easy to disconnect and remove the battery Easy to reconnect the battery	P
§ 9.7 Resistance to ignition	In conformity with certificate	P
§ 10 Ergonomics	In conformity with the PG drives technology Also TUV Certificate of compliance in accordance with 7176/14 standard	P
§ 10.1 User interface	Personal box controller use visual indicators In accordance with TUV Certificate of compliance in accordance with 7176/14 standard	P
§ 10.2 Operating forces	Force :1.5-2N to operate Push button and keypad switches  TUV Certificate of compliance in accordance with 7176/14 standard	P
§ 10.3 Display position	Display can be positioned	P
§ 10.4 On/off indicator	Box controllers are power up with lights when the system is ready	P
§ 10.5 Connectors	It is possible to connect and disconnect the Third person Box controller	P
§ 10.6 Audible noise	Absence of noise  At max speed :45 dBa	P
§ 10.7 Acoustic warning device	Klaxon Frequency: 2500 Hz Measured Decibels: up to 85 dBa	P
<b>§ 11 Durability</b>		-

§ 11.1 Control devices	PG drives technology TUV Certificate of compliance in accordance with 7176/14 standard	P
§ 11.2 Switches	PG drives technology TUV Certificate of compliance in accordance with 7176/14 standard	P
§ 11.3 Connectors	PG drives technology TUV Certificate of compliance in accordance with 7176/14 standard	P
<b>§ 12 Electrical connections</b>		-
§ 12.1 Interchangeability	Labeling of wires	P
§ 12.2 Wire routing	Wires are well connected	P
§ 12.3 Wire colours	Apply for wires between motor and control box	P
§ 12.4 Intermediate battery connection power drains	No intermediate battery	N / A
<b>§ 13 Environmental</b>		-
§ 13.1 Substance/liquid ingress (in)	In accordance with LNE IP TEST "P194097	P
§ 13.2 Leakage of substances (out)	Minor risk management file Réf : 17-000-04	P
§ 13.3 Electromagnetic compatibility	In accordance with LNE IP TEST "P190800 - DE3_ABO3	P
<b>§ 14 Misuse and abuse</b>		-
§ 14.1 Reversed polarity at the battery set	Impossible to willingly reverse the battery	P
§ 14.2 Integrity of enclosures	Certification of the battery in accordance with 62133-2. A circuit breaker is included in the battery	P
<b>§ 15 Information provided with the wheelchair related to control systems</b>		-
§ 15.1 General	user manual is in accordance with the system.	P
§ 15.2 Battery connection and circuit protection diagram	Batteries are enclosed in a box	N / A
§ 15.3 Operation of wheelchair	Include in the manual	P

### 3. LIST OF DEVICES USED FOR TESTS

Measurement / testing	Testing / measuring equipment / material used	Range used
Accessible parts	Jointed test finger n° 1012506	-
	Rigid test finger n° 1012507	-
Legibility of markings	Luxmeter testo 545 n° 1053258	-
Durability of markings	Timer n° 1037690	-
Working voltage	Power supply ITECH IT7324 n° 1062294	-
	Voltmeter Fluke 287 n° 1053002	-
Impedance	Ground bond tester SCI n° 1062293	
	Voltmeter Fluke 287 n° 1053002	-
Leakage current	Thermo Recorder TR-73U n° 1037673	Auto
	Power supply ITECH IT7324 n° 1062294	-
	Scope Fluke 124 n° 1037682	-
	Voltmeter Fluke 287 n° 1053002	-
	Medical device n° 1038055 and Resistor 1kΩ (measured with Fluke 287 n° 1053002)	-
Mechanical test	Meter : n°1053003	-
	Inclinometer n°1037693	-

## 4. CONCLUSION

The Minotor<sup>2</sup> wheelchair motorization system satisfies all conditions and requirements of the 7176-14 standard.

Trappes, January 16, 2019



Tested by  
**N. MARTINEZ**  
Engineer

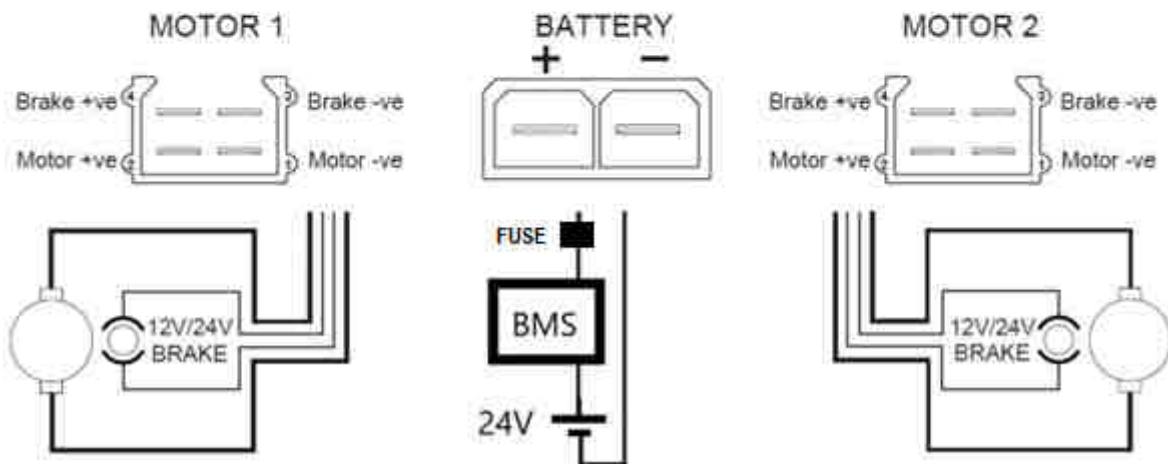
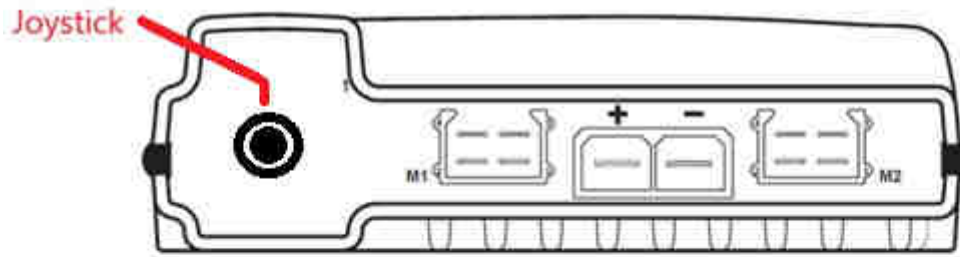
Results mentioned are applicable only to samples, products or materials submitted to LNE and as defined in this document.

# Appendix



APPENDIX 1 : WIRING DIAGRAM

VR2 POWER MODULE CONNECTIONS



**APPENDIX 2 : 7.2.3.2 OPEN CIRCUIT TEST**

The wheelchair is positioned on a 6 ° inclined plane

The elements listed below are each disconnected in turn when the speed of the carriage reaches the speed, of  $(0,5 \pm 0,05) \cdot v = 5\text{km/h}$  (1.38 m/s) on the inclined plane.

With  $v$  (max speed) = 8.7km / h

$L_i$  is the Maximum stopping distance at  $(0,5 \pm 0,05) \cdot v = 4.35\text{km/h} = (1.20 \text{ m/s})$

In case of an electrical problem:

The wheelchair must stop at a distance of  $5 \times L_i$ , after open-circuit or short.  
 $5 \times 1.20 = 6\text{m}$

DISCONNECTED COMPONENTS	BRAKING DISTANCE (m)	VERDICT
Battery +	1.9m<6m	S
Motor 1	1.9m<6m	S
Motor 2	1.9m<6m	S
Joystick First Box Controller	1.9m<6m	S
Joystick Optional third person box controller	1.9m<6m	S

**Conclusion:**

Open circuit test is compliant with requirement 7.2.3.2

**APPENDIX 3 : 7.2.3.3 SHORT-CIRCUIT TEST**

The wheelchair is positioned on a 6 ° inclined plane

The elements listed below are each disconnected in turn when the speed of the carriage reaches the speed, of  $(0,5 \pm 0,05) * v = 5\text{km/h}$  (1.38 m/s) on the inclined plane.

With  $v$  (max speed) = 8.7km / h

$L_i$  is the Maximum stopping distance at  $(0,5 \pm 0,05) * v = 4.35\text{km/h}$  = (1.20 m/s)

In case of an electrical problem:

The wheelchair must stop at a distance of  $5x L_i$ , after open-circuit or short.  
 $5 * 1.20 = 6\text{m}$

Nota:

If the wheelchair does not stop within a distance of  $5 x L_i$ , repair any damage and reset and/or replace any circuit protection devices that have operated, then repeat the test method, except close the switch before the marker is reached. When the marker is reached, put the control device to its stop position.  
 Measure along the centerline of the track of the driving wheels the distance taken to stop to an accuracy of  $\pm 100$  mm.

Short circuit	BRAKING DISTANCE (m)	VERDICT
Brake +ve/Brake –ve+control device to its stop position	1.9	S
Brake +ve/Motor +ve+control device to its stop position	1.9	S
Brake +ve/Motor -ve+control device to its stop position	1.9	S
Brake -ve/Motor +ve+control device to its stop position	1.9	S
Brake -ve/Motor -ve+control device to its stop position	1.9	S
Motor +ve/motor –ve+control device to its stop position	1.9	S

**Conclusion:**

Short circuit testing is compliant with requirement 7.2.3.3