

E200 on RENAULT MASTER ZE with 10 kWh battery pack

TEST RESULTS



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Renault Master ZE owned by Petit Forestier
E200 MAX with 10KWh 12V Master Volt battery pack
13m3 box.
Shown at the IAA



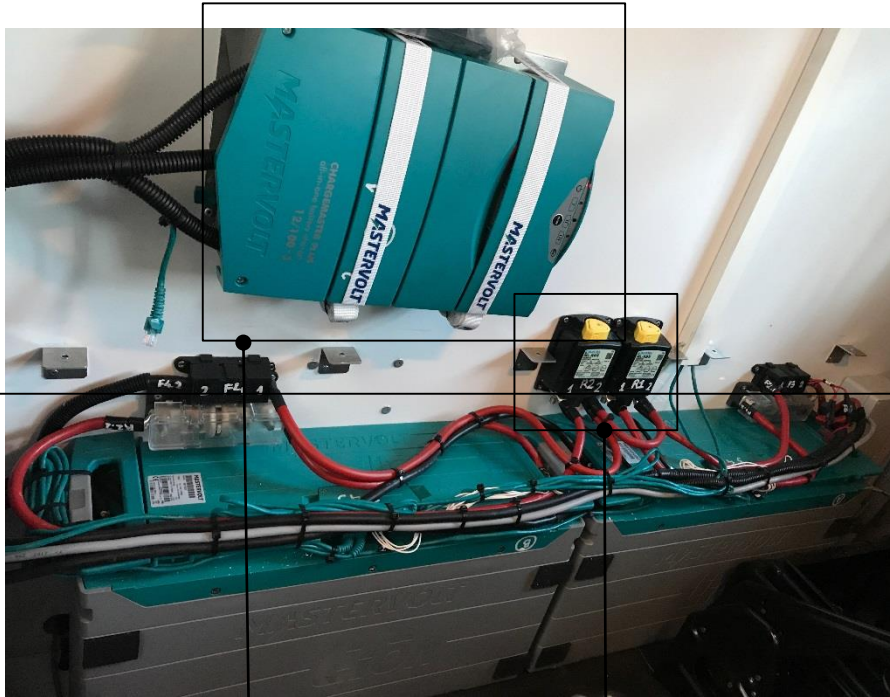
E200 on RENAULT MASTER ZE with 10 kWh battery pack

LIST OF ACTIVITIES CARRIED OUT

- Vehicle was received on Dec 5th 2018.
- Old version of E200 unit (IAA level) was swapped by a new pre-serial unit of E200.
 - Both condenser and evaporator units were swapped.
 - New software level was flashed to the controller and inverter.
- New unit was tested.
- Measurements were carried out according different user profiles provided by PF.
 - Temperatures, power and battery consumption were monitored during all tests.
 - Results provided in this document.
- Measurements of batteries charging time were carried out.
 - Results provided in this document
- Vehicle was shipped to Petit Forestier Lyon CORBAS on Jan 7th 2019.

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BATTERY PACK



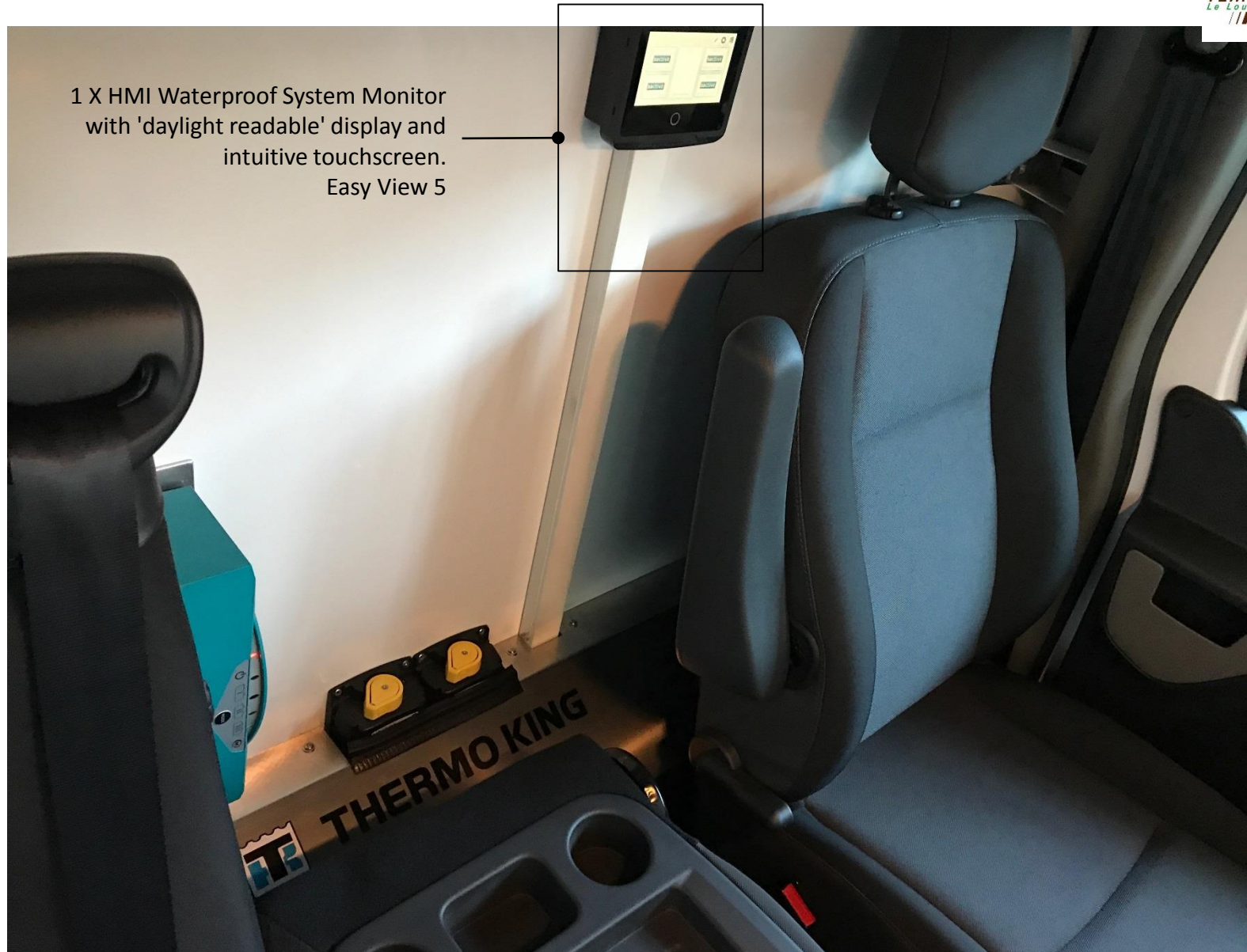
Batteries are protected with an aluminum box to prevent electrical hazard. Safety relays and smart charger are accesible.

1 X Smart Charger
ChargeMaster Plus 12/100-3

2 X Lithium Ion 5kWh batteries
(MLI Ultra 12/5000)

2 X safety relay 12 volt

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BATTERY SPECIFICATIONS

The system includes 2 x 5KWh Lithium Ion batteries.
The specifications of the batteries can be found here below:



General specifications

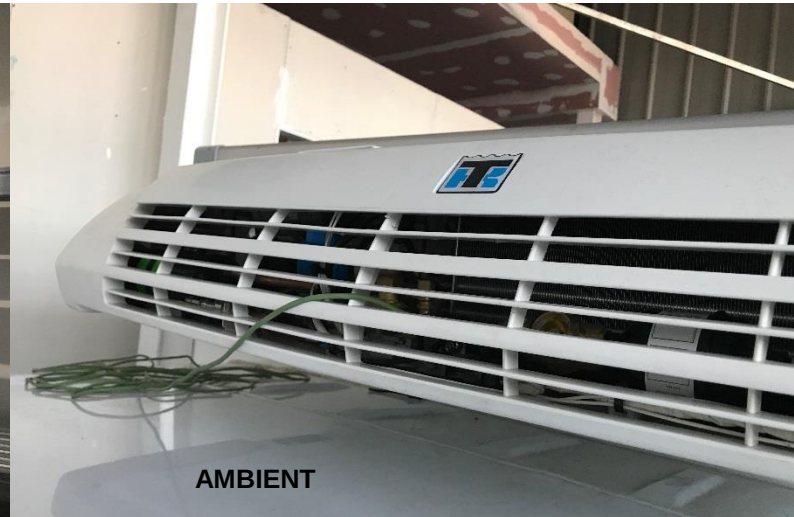
Nominal battery voltage	13.2 V
Nominal battery capacity	360 Ah
Nominal battery energy capacity	5000 Wh
Cycle life	3500 cycles at 80 % DOD at 25 °C, max. C3 charge and C2 discharge (for batteries produced from December 2017)
Max. charge current	500 A (1,4 C)
Continuous discharge current	500 A (1,4 C)
Peak discharge current	1800 A (5 C) for 10 s
Battery monitoring	integrated
MasterBus communication	yes
Battery terminals	M8
Mounting position	upright or either long side
Max. outer dimensions (incl. terminals/grip handles), l x w x h	622 x 197 x 355 mm 24.5 x 7.8 x 14.0 inch
Weight	58 kg 127.9 lb

Technical specifications

Battery chemistry	Lithium Iron Phosphate
Protection degree	IP65 (electronics cabinet)
Parallel connection	yes, unlimited
Series connection	yes, up to 10 batteries (series balancing up to 2 batteries)
Protections	over voltage, under voltage, over temperature
Safety relay	to be added mandatorily, product code 7700-BSS
Safety relay controls	integrated

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LOCATION OF TEMPERATURE SENSORS

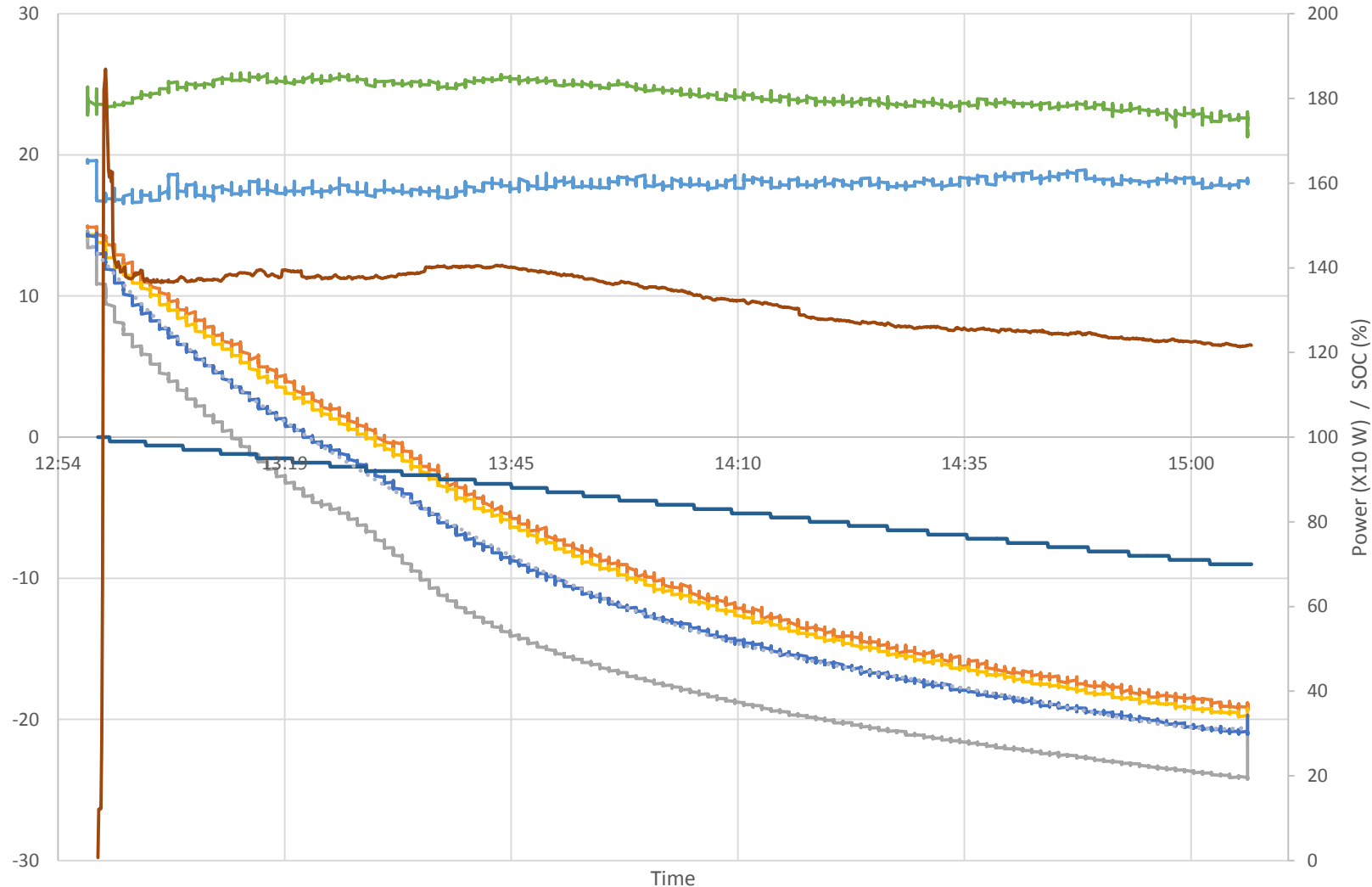


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PULL DOWN

Renault Master ZE Petit Forestier Pull Down -20



BOX = 13 m³

18°C amb

2h 7' pull
down time

30% of 8KWh =
2,4 KWh

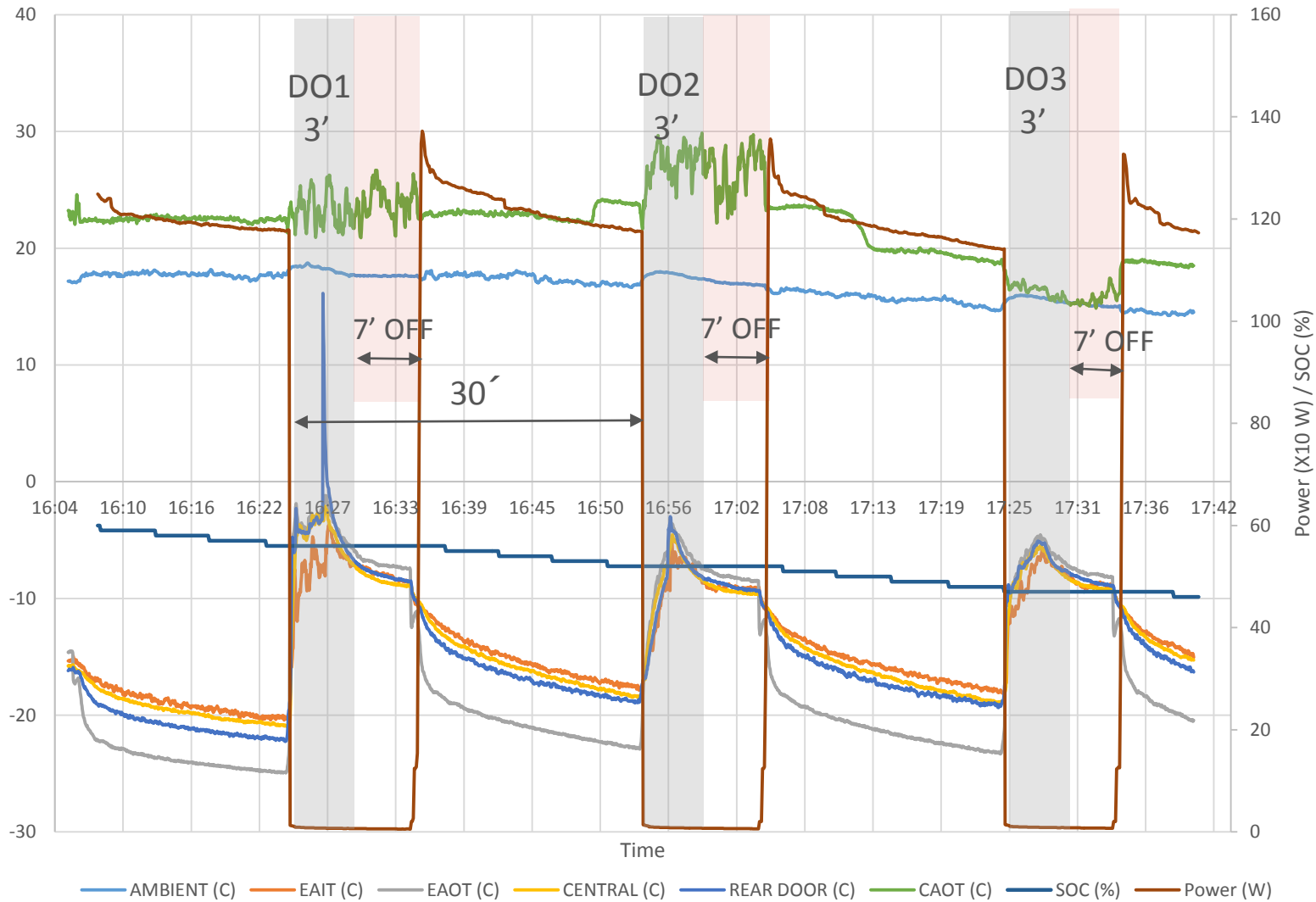
SP -20°C

— AMBIENT — EAIT — EAOT — CENTRAL — REAR DOOR — CAOT — SOC — Power (W) Poly. (REAR DOOR)

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SP -20°C 2 drops/h

Renault Master ZE Petit Forestier Openings -20



BOX = 13 m³

18°C amb

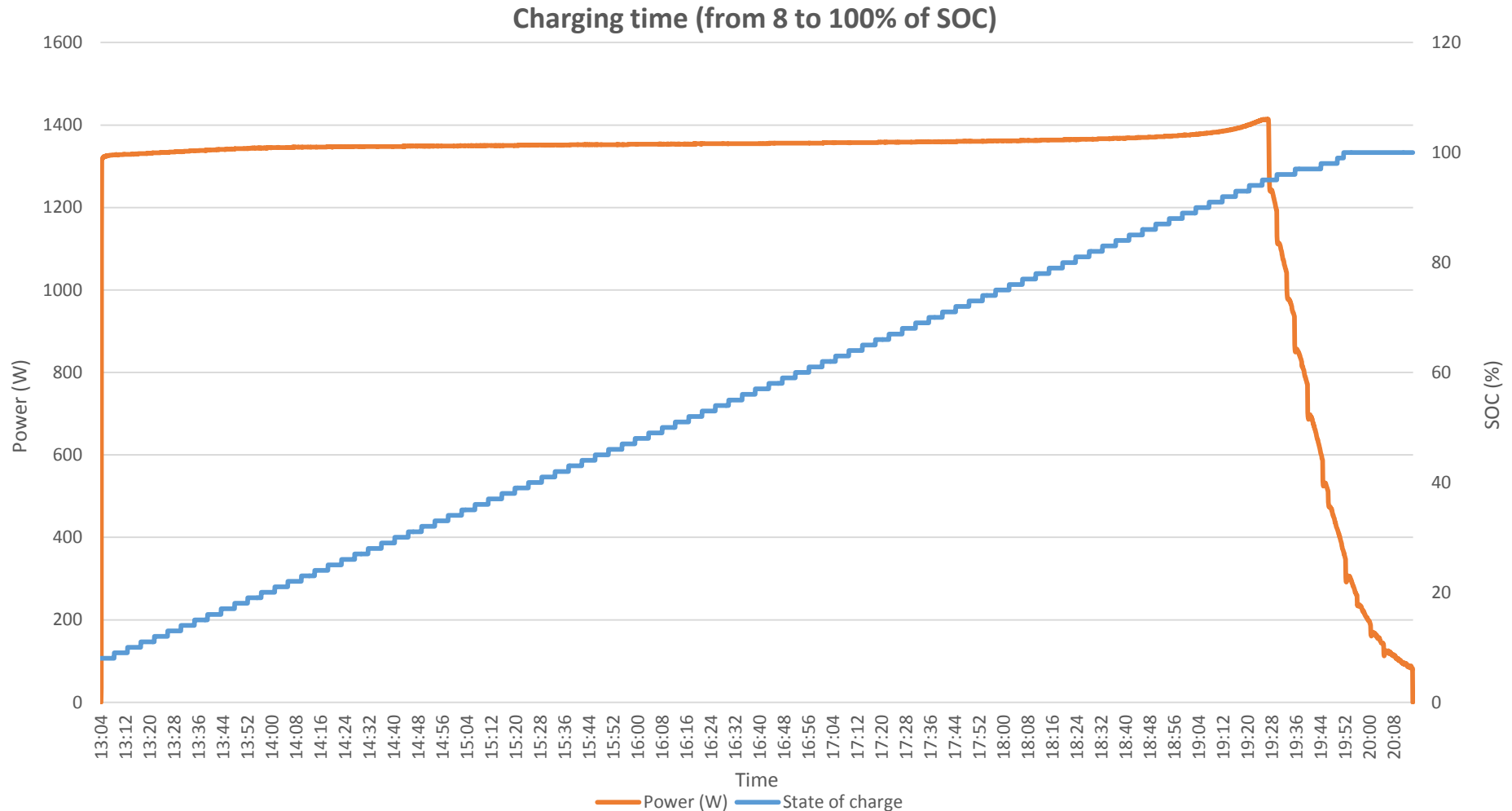
14% of 8KWh =
1,12 KWh
(1h33')

(8h = 6KWh)

SP -20°C

Tests à -20°C de consigne par environ 18°C d'ambiance avec ouverture des portes 3 mins toutes les 30 minutes

E200 on RENAULT MASTER ZE with 10 kWh battery pack

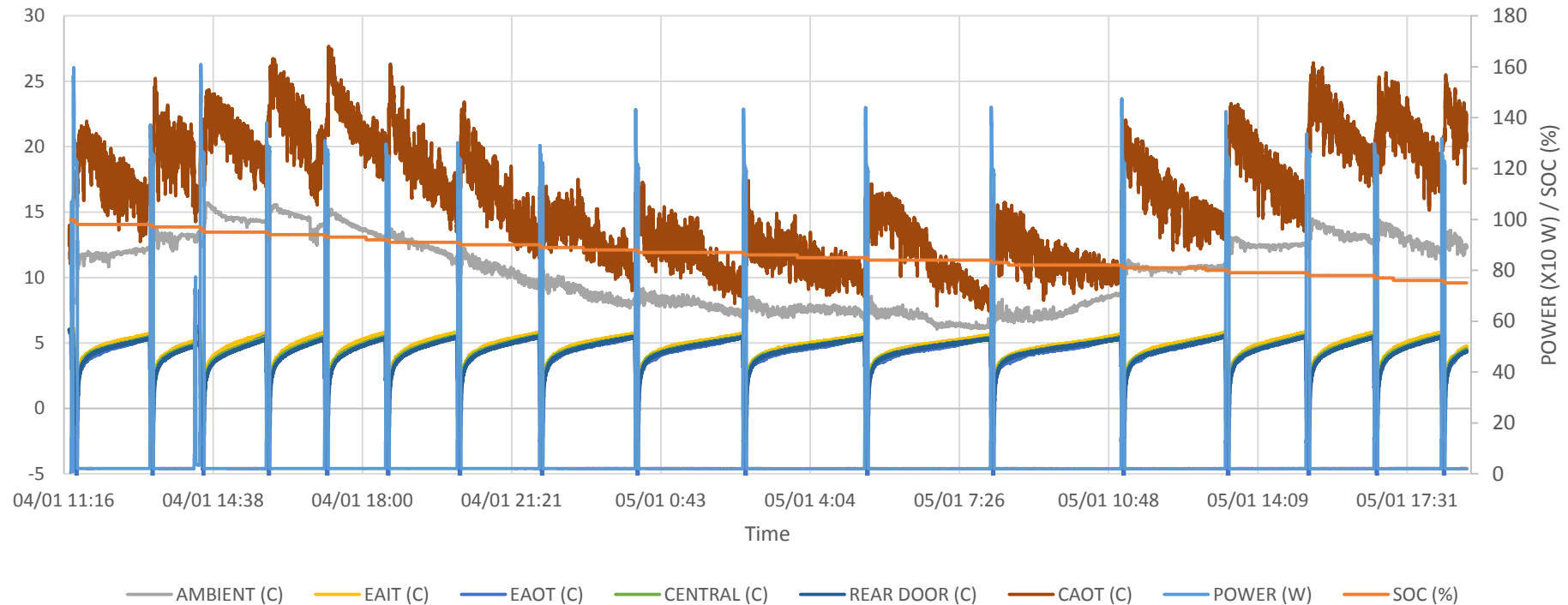


Tests de durée de rechargement des batteries sans fonctionnement du groupe

Charging time from 8 to 100% SOC = 7h 10' (1,10 KW/h)

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SP 2°C No drops (sans ouvertures de portes). Endurance test



Set Point : 2°C

Ambient Temperature : Barcelona. Jan 2019. (Ranging from 6°C to 15°C)

No door openings

Duration of the test : 31h28' (from Jan 4th 11h23 until Jan 5th 18h51)

Battery consumption : 25% (from 100% SOC to 75% SOC)

The battery pack (Nominal 10KWh / Real 8KWh) is able to operate the E200 without interruption during 127h (5,3 days) under these conditions.

CONCLUSIONS I

- Pull down from 18°C to -20°C
 - Required time: 2h 7'. This time is expected to be reduced to approx 1h52' with next SW updates.
 - Energy required: 2,4 kWh (30% of battery capacity)
- Measurements at -20°C SP with 18°C ambient temperature. Rear doors open during 3' every 30' (2 drops/hour). *Tests à -20°C de consigne par environ 18°C d'ambiance avec ouverture des portes 3 mins toutes les 30 minutes.*
 - E200 is not able to recover entirely the set point (-20°C) after each door opening (temperature measured at a central point of the box around -19°C).
 - 1,12 kWh of energy are required to support this user profile during 1h33' (14% of battery capacity)
 - The energy stored in the batteries (8 kWh) are able to keep this profile during 11h.
- Measurements at +2°C SP with 28°C ambient temperature. Rear doors open during 1' every 10' (6 drops/hour). *Tests à +2°C de consigne par environ 28°C d'ambiance avec ouverture des portes 1 min toutes les 10 minutes.*
 - This profile could not be tested as climatic chamber was not available for reaching 28°C.
- Endurance test at +2°C SP with ambient temperature ranging from 6°C to 15°C. No door openings.
 - The battery pack (Nominal 10kWh / Real 8kWh) is able to operate the E200 without interruption during 127h (5,3 days) under these conditions.

CONCLUSIONS II

- Measurements of batteries charging time. *Tests rechargement des batteries*
- Batteries charging time without refrigeration unit operation. *Tests de durée de rechargement des batteries sans fonctionnement du groupe.*
 - Charging time from 8 to 100% SOC = 7h 10' (1,10 kW/h)
- Batteries charging time with refrigeration unit working at -20°C/+2°C SP without door openings *Tests de durée de rechargement des batteries avec fonctionnement du groupe à -20°C sans ouvertures de portes .*
 - When E200 is connected to the shore power, batteries charge and refrigeration unit operates simultaneously. **Batteries charging duration is not affected by refrigeration unit operation.**
 - Batteries charging requires 1,35 kW (13,36V @ 99,32 A).
 - Refrigeration unit operation requires up to 1,45 kW (13,1V @ 111 A).
 - Shore power has to be minimum **2,8 kW** for charging and operating unit simultaneously.

