Submitted by the expert from UK

Informal document GRPE-75-13
75th GRPE, 6-9 June 2017,
Agenda item 5

Department for Transport

UNECE GRPE 75

Reg 85: Measurement of Net Power

Effects of Thermal Loading on the Determination of Net Power for Electric Motors

Informal document GRPE-75-13
75th GRPE, 6-9 June 2017,
Agenda item 5

Department for Transport

Electric Motor Power

Definitions from Regulation 85

2.3. ***"Net power"*** *means the power obtained on a test bench at the end of the crankshaft or its equivalent at the corresponding engine or motor speed with the auxiliaries listed in table 1 of annex 5 or in annex 6 to this Regulation, and determined under reference atmospheric condition.*

2.4. ***"Maximum net power"*** *means the maximum value of the net power measured at full engine load.*

2.5. ***"Maximum 30 minutes power"*** *means the maximum net power of an electric drive train at DC voltage as defined in paragraph 5.3.1. of this Regulation, which a drive train can deliver over a period of 30 minutes as an average.*

Informal document GRPE-75-13
75th GRPE, 6-9 June 2017,
Agenda item 5

Department for Transport

Electric Motor Power (2)

"5.3.1. DETERMINATION OF THE NET POWER

5.3.1.1.The motor and its entire equipment assembly must be conditioned at a temperature of 25°C ± 5°C for a minimum of two hours.

*5.3.1.2.The net power test shall consist of a run at **full setting of the power controller**.*

*5.3.1.3.Just before beginning the test, the motor shall be run on the bench for **three minutes** delivering a power equal to **80 per cent of the maximum power** at the speed recommended by the manufacturer.*

5.3.1.4.Measurements shall be taken at a sufficient number of motor speeds to define correctly the power curve between zero and the highest motor speed recommended by the manufacturer. The whole test shall be completed within 5 minutes."

Informal document GRPE-75-13
75th GRPE, 6-9 June 2017,
Agenda item 5

Department for Transport

Electric Motor Power (3)

"5.3.1. DETERMINATION OF THE NET POWER

5.3.1.1.The motor and its entire equipment assembly must be conditioned at a temperature of 25°C ± 5°C for a minimum of two hours.

5.3.1.2.The net power test shall consist of a run at ***full setting of the power controller****.*

5.3.1.3.Just before beginning the test, the motor shall be run on the bench for ***three minutes*** *delivering a power equal to* ***80 per cent of the maximum power*** *at the speed recommended by the manufacturer.*

5.3.1.4.Measurements shall be taken at a sufficient number of motor speeds to define correctly the power curve between zero and the highest motor speed recommended by the manufacturer. The whole test shall be completed within 5 minutes."

Maximum net power, or
Maximum 30 minute power?

Informal document GRPE-75-13
75th GRPE, 6-9 June 2017,
Agenda item 5

Department for Transport

Electric Motor Power (4)

- Operating at 80% of maximum net power would require ~80% of the maximum **current** that the motor can sustain. High current results in significant **resistive heating** in the motor.
- **Air cooled** motors are limited by motor temperature. A 3 minute warm-up at 80% maximum net power results in a **high thermal load.** The motor reverts to a restrictive thermal protection mode which **limits the power**.
- The parameters for 30 minute power are chosen so that the temperature **does not exceed the thermal limits** during a 30 minute test sequence.
- Therefore, running at maximum 30 minute power might only require ~40% of the maximum current = significantly less heating.

Informal document GRPE-75-13
75th GRPE, 6-9 June 2017,
Agenda item 5

Department for Transport

Electric Motor Power (5)

- A 3 minute warm-up at 80% maximum power results in the declared net power figures being much lower than the actual power of the motor.
- In real world use, operating above 80% maximum net power is only expected for a **very short time**. Most driving is expected to be in the 30 minute power range.
- This could be misleading and potentially unsafe for the consumer.

Informal document GRPE-75-13
75th GRPE, 6-9 June 2017,
Agenda item 5

Department for Transport

Electric Motor Power (3)

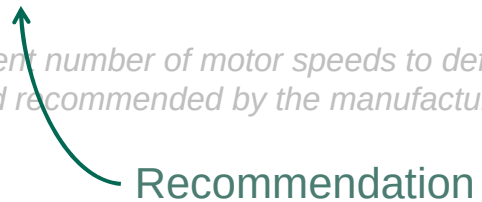
"5.3.1. DETERMINATION OF THE NET POWER

5.3.1.1.The motor and its entire equipment assembly must be conditioned at a temperature of 25°C ± 5°C for a minimum of two hours.

5.3.1.2.The net power test shall consist of a run at ***full setting of the power controller****.*

5.3.1.3.Just before beginning the test, the motor shall be run on the bench for ***three minutes*** *delivering a power equal to* ***80 per cent of the maximum 30 minute power*** *at the speed recommended by the manufacturer.*

5.3.1.4.Measurements shall be taken at a sufficient number of motor speeds to define correctly the power curve between zero and the highest motor speed recommended by the manufacturer. The whole test shall be completed within 5 minutes."



Informal document GRPE-75-13
75th GRPE, 6-9 June 2017,
Agenda item 5

Department for Transport

Thank you for your attention.

Duncan Kay
UK Head of Delegation
duncan.kay@dft.gov.uk

James Bell
UK Senior Engineer
james.bell@dft.gov.uk