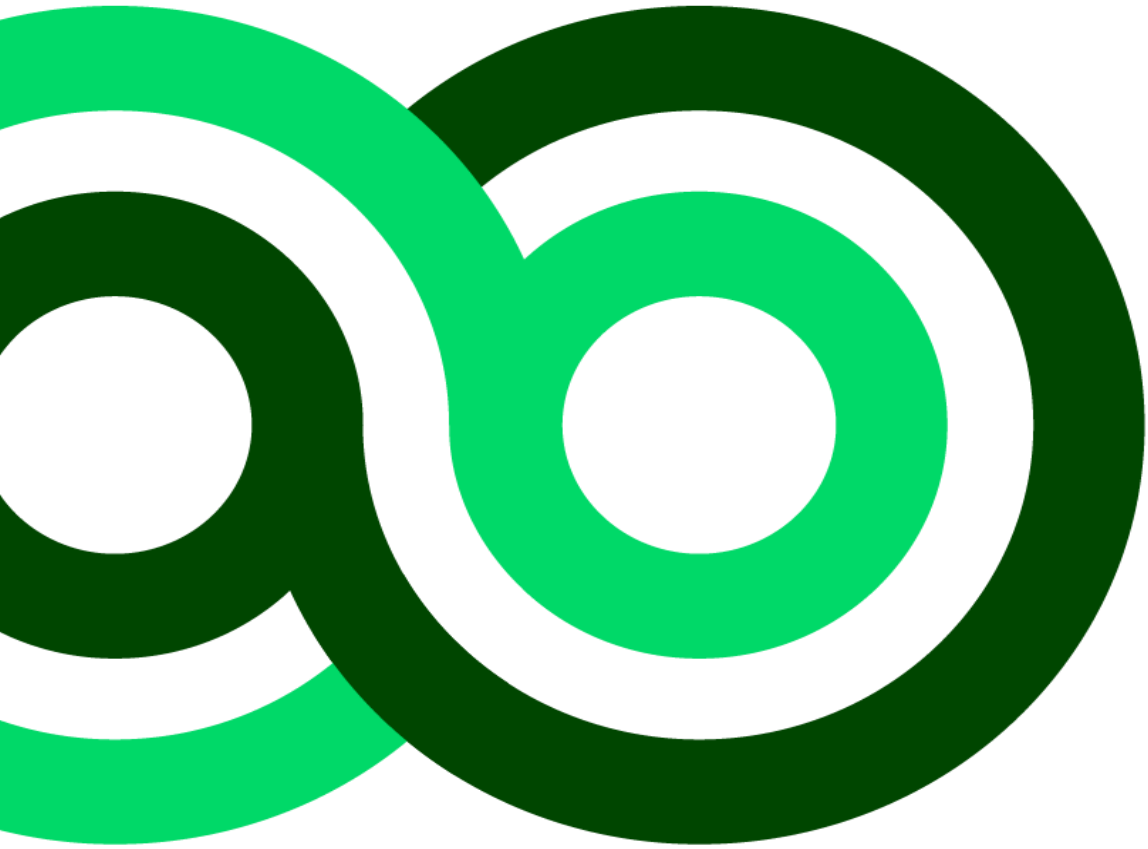


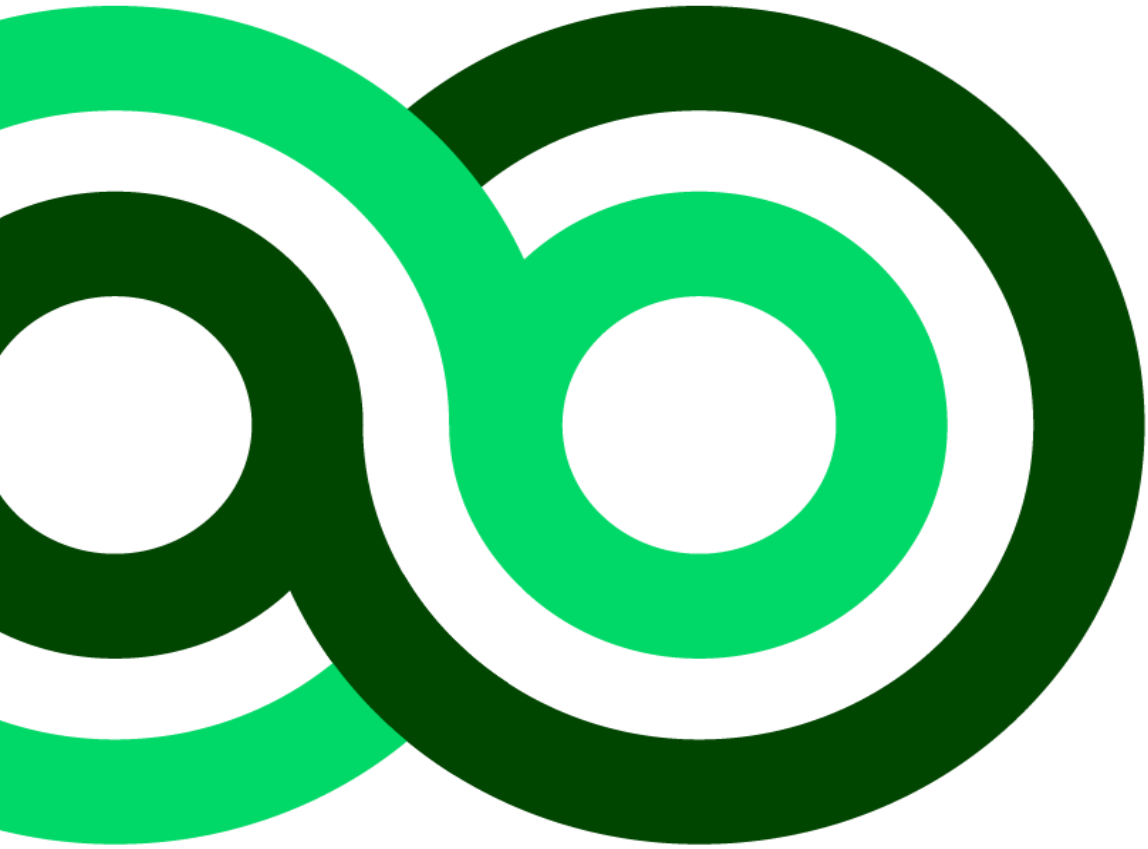
TEST PROCEDURE

WLTC+ CAT (Cold Ambient Temperature)

Version 2.0.0 February 2022

Disclaimer: Currently this test procedure is not applicable to Plug-In Hybrid (PHEV) Electric Vehicles.

Version 2.0.0 February 2022



Version 2.0.0 February 2022

GNT WLTC+ CAT procedure

This document describes the procedure for determining the levels of emissions of gaseous compounds, particulate matter, particle number, CO2 emissions, fuel consumption, electric energy consumption and electric range from light-duty vehicles under cold ambient temperature (CAT) conditions.

The cold ambient temperature test procedure follows the standard GNT_WLTC+_Test_Procedure with some cold ambient temperature specific modifications to the standard procedure. The amendments necessary are listed below, always referenced to the GNT_WLTC+_Test_Procedure.

The following summary shows the major differences/similarities between the standard WLTC+ test and the cold ambient temperature test:

- The target road loads for the cold ambient temperature chassis dyno adaptation are calculated according to the provisions of this document
- The same reference fuel, as described in ***GNT_WLTC+_Test_Procedure***, has to be used for the cold ambient temperature tests. No fuel changes are made between the standard 23°C tests and the cold ambient temperature test. A corresponding certification document has to be provided with the measurement results.
- Target room temperature in the emissions laboratory is -7 °C +/- 3 °C during soak phases, the start of the test and during the test.
- The test cell humidity must not be controlled, but measured continuously.
- The usage of auxiliaries is identical with the standard WLTC+ procedure
- The air condition (manual or automatic) is operated according to ***GNT_WLTC+_Test_Procedure***, Point 1.2.4.2.1.3
- As for vehicles with several operating modes to choose from, measurements are performed in the mode automatically activated after starting. Where a pre-set mode should be maintained, the most ecological mode shall be selected.
- The low voltage REESS (12V) shall be charged before the test except for PEVs and OVC-HEVs. For PEVs and OVC-HEVs the soak phase shall start after the normal charging procedure with the vehicle disconnected to the grid.
- The soak time shall be minimum 12 hours to assure a proper cool down. A representative engine temperature measurement shall be used to define the end of the soak phase.

Amendments to GNT_WLTC+_Test_Procedure

ANNEX XXI

6.1 Limit values for emissions shall be those specified for cold ambient temperature testing in ***GNT_Rating_Sheet_Master.***

ANNEX XXI

6.2 (c) The appropriate reference fuel as described in Annex IX of Regulation 2017/1151 shall be used; no special winter grade fuels need to be used for the cold ambient temperature test.

ANNEX XXI, Sub-Annex 4

2.4 f_0, f_1, f_2 are the road load coefficients provided by the vehicle´s certificate of conformity (CoC) document used in the modified road load equation for cold ambient temperature testing at -7°C.

$$F_{LowTemp} = f_0 + f_1 \times v + 1.10 \times f_2 \times v^2$$

f_0 is the constant road load coefficient and shall be rounded to one place of decimal, N;

f_1 is the first order road load coefficient and shall be rounded to three places of decimal, N/(km/h);

f_2 is the second order road load coefficient and shall be rounded to five places of decimal, N/(km/h)².

1.10 is the modifier for f_2 to compensate the temperature differences in the road load calculation by coast down.

ANNEX XXI, Sub-Annex 5

3.3.1.3. The connecting tube shall satisfy the following requirements:

(a) Be less than 6.1 metres long and heat-insulated. Its internal diameter shall not exceed 105 mm; the insulating materials shall have a thickness of at least 25 mm and thermal conductivity shall not exceed 0.1 $W/m^{-1}K^{-1}$ at 400 °C. The tube shall be heated to a temperature above the dew point. This may be assumed to be achieved if the tube is heated to 70 °C;

ANNEX XXI, Sub-Annex 6

1.2.2.2.1.1. The test cell shall have a temperature set point of -7 °C. Ambient temperature levels encountered by the test vehicle shall average -7 °C +/-3 °C . The temperature may not fall below -10 °C, or exceed -4 °C for more than three consecutive minutes.

The test cell humidity must not be controlled

1.2.2.2.1.2.

Humidity shall be measured continuously at a minimum frequency of 1 Hz.

1.2.2.2.1.3.

1.2.2.2.2. The soak area shall have a temperature set point of -7 °C and the tolerance of the actual value shall be within ± 3 °C on a 5 minute running arithmetic average and shall not show a systematic deviation from the set point. The temperature shall be measured continuously at a minimum frequency of 1 Hz. The temperature may not fall below -10 °C, or exceed -4 °C for more than three consecutive minutes.

1.2.7.2. The vehicle shall be soaked for a minimum of 12 hours and a maximum of 36 hours with the engine compartment cover closed. Accelerated cooling systems shall not be used.

1.2.8.1. The test cell temperature at the start of the test shall be -7 °C ± 3 °C measured at minimum frequency of 1 Hz.

1.2.8.2. The test vehicle shall be pushed onto a dynamometer. If vehicle is exposed to temperatures > -4.0 °C, it must be re-stabilized in the test cell for six times the period it was exposed to the warmer temperature.

ANNEX XXI, Sub-Annex 6 (WLTC+ test procedures and test conditions)

1.2.6.2. REESSs charging

The low voltage REESS (12V) may be charged before each cold start of official testing except for PEVs and OVC-HEVs.

3.2.1.2. Calculation of the NO_x humidity correction factor

A correction factor of KH=1 shall be applied for the NOx calculation at cold ambient temperature (no humidity dependent NOx correction)

ANNEX XXI, Sub-Annex 8 – Appendix 4 (Preconditioning, soaking and REESS charging conditions of PEVs and OVC-HEVs)

2.2.2. The soak phase shall start after the normal charging procedure of the traction REESS with the vehicle disconnected to the grid.