Transmitted by the Expert from OICA

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agenda item 1.1.)

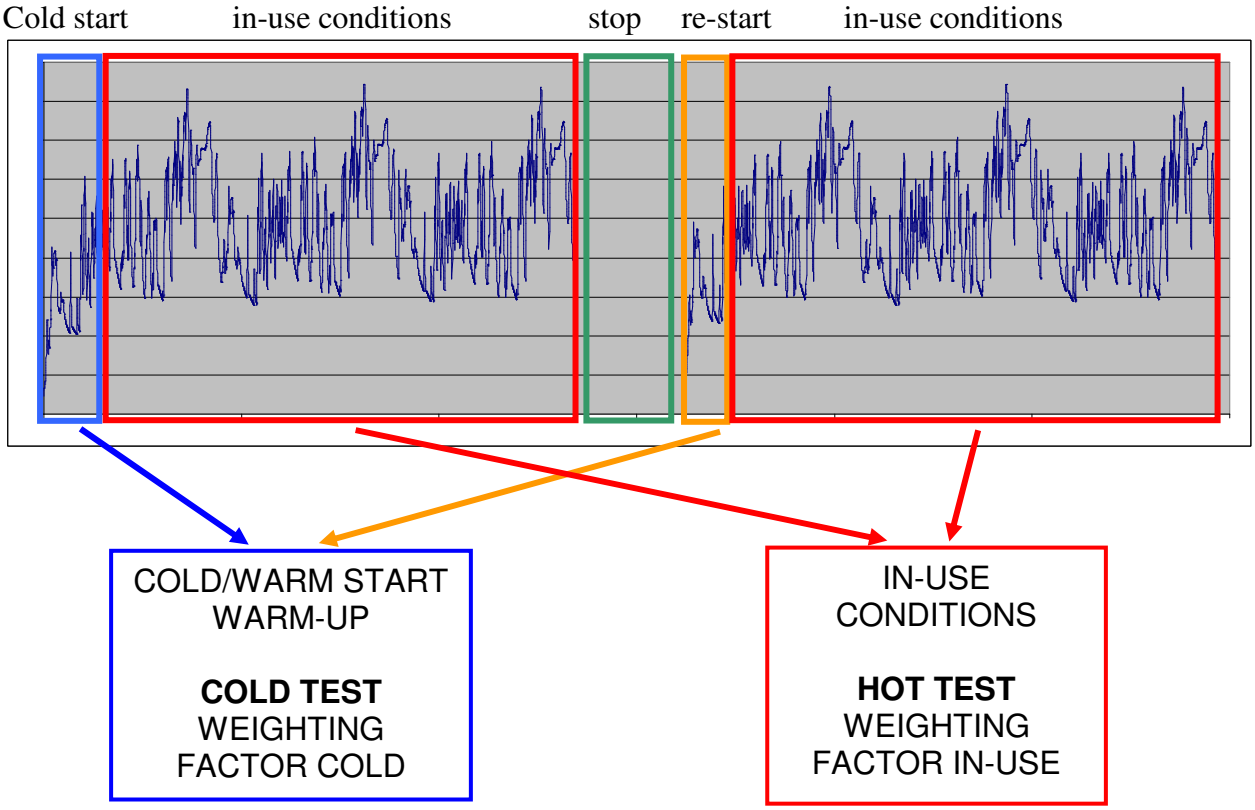
DRAFT GLOBAL TECHNICAL REGULATION (gtr)
ON WORLD-WIDE HEAVY-DUTY CERTIFICATION (WHDC)

OICA Comment on ECE/TRANS/WP.29/GRPE/2006/9,
Chapters 7.8.3.2. (Hot Soak Procedure) and 7.8.3.3. (Hot Start Test)

The development and validation of the WHDC test procedures has been carried out with a hot (rated speed and load) preconditioning before the emission test cycles (WHTC and WHSC). In 2005 a cold test has been introduced as requested by the USA-EPA. At the same time a 20 min soak period between the cold and 'hot' test has been introduced, as it is currently in use with the US test procedures. The 20 minutes interval between two tests has originally been introduced for bag analysis of the first test, so purely for purpose of testing needs, some 25 years ago. Today data evaluation systems as used for the WHDC such a 20 minute period is no longer required. Apart from that, with the introduction of temperature dependent aftertreatment systems, exhaust temperature conditions have become significant.

OICA does not challenge the cold test, but proposes to introduce a defined conditioning of the engine system in front of the hot test for the following reasons.

Example of exhaust temperature during real driving conditions of a vehicle:



The example shows typical driving conditions consisting of cold start, re-start, warm-up and in-use conditions. Translating these conditions into the emission test procedure, the cold WHTC should cover cold start, warm start and warm-up conditions. The weighting factor does take care

of the importance of the cold start and should be based on the analysis of real vehicle data. On the other hand, the in-use conditions should be represented by the hot WHTC (normal in-use conditions) and a weighting factor correlating with field data. A 20 minute soak period in front of the hot test does not represent such in-use conditions.

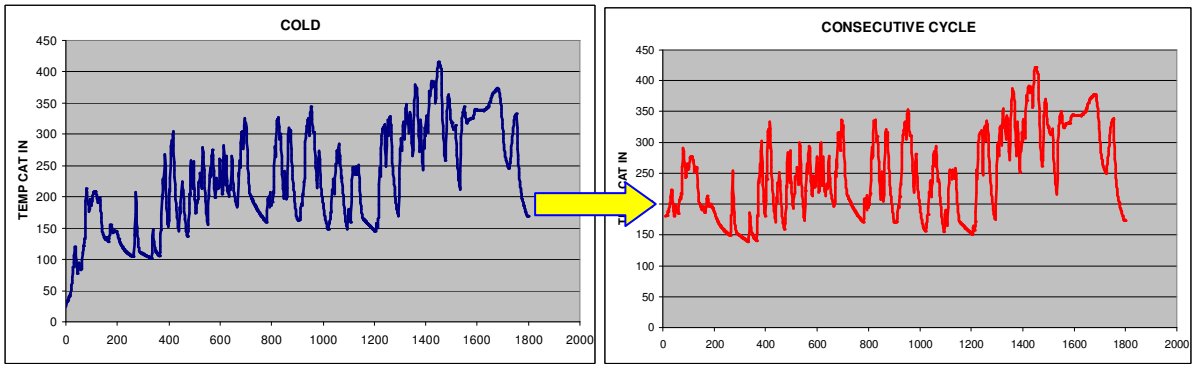
For the purpose of test management, still a certain interval between two tests is needed, typically in the range of 5 to 10 minutes.

For better understanding of the temperature conditions at the catalyst inlet, different tests have been carried out and are explained below.

Cold test followed by hot test without any interval

The aim of this test is to demonstrate the real 'in-use' conditions in the second test, following the previously explained principle. The hot test starts at exactly the same temperature conditions as the first test ended. As there is idle at the end and beginning of any test (again for test management reasons), there is a short cooling-down phase. As this consecutive testing is not manageable, an engine-conditioning has to be defined for the hot test.

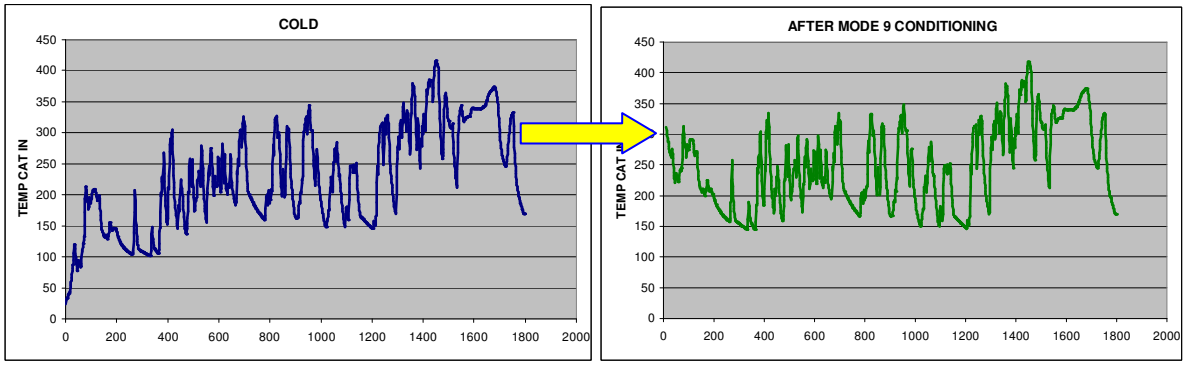
Cold test hot test



Cold test followed by hot test with conditioning at WHSC mode 9

It has been found that preconditioning at WHSC mode 9 (medium speed and medium load) of max 10 minutes provides conditions for good repeatability and reproducibility and represents in-use conditions (not taking into account the idling periods needed for test purpose only)

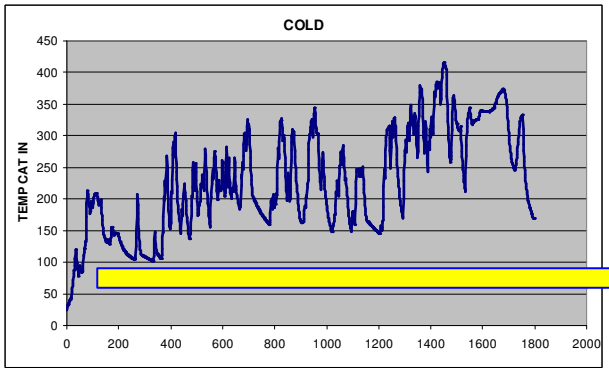
Cold test hot test after mode 9 conditioning



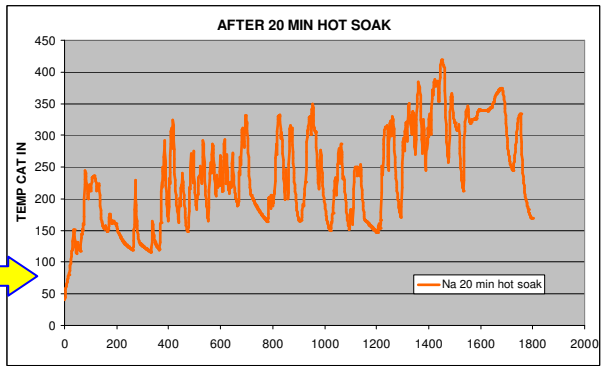
Cold test followed by 20 minutes soak and hot test

The conditions as proposed by the US-EPA have been run with the same engine system. As it can be seen, the 'hot' test performs the same way as the cold test up to more than 400 seconds of the test and is therefore no representative if in-use driving conditions. As mentioned before, the influence of cold and warm start is to be dealt with by the cold start weighting factor.

Cold test

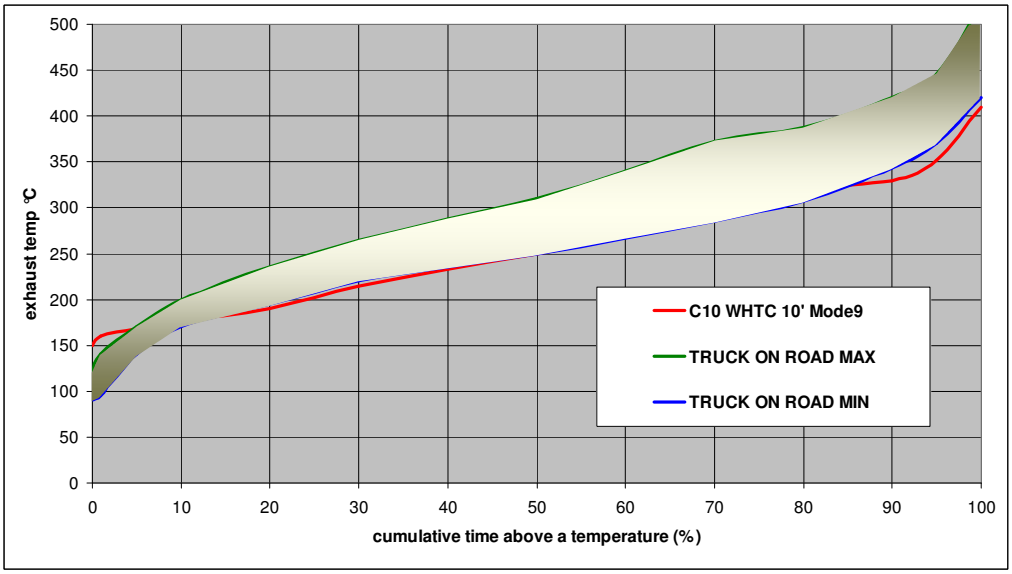


'hot' test after 20 min soak



Comparison with vehicle in-use data

Typical truck driving behaviour has been re-evaluated and compared, from a temperature profile point of view, with a 10 minute WHSC mode 9 preconditioned WHTC. The truck data includes city, rural, highway and freeway driving conditions. The mode 9 preconditioned WHTC follows for 90% of the cumulative time the min temperature profile and it can be concluded, that still the worst condition for the aftertreatment system is being tested when preconditioning the engine system for 10 minutes at mode 9 in front of the hot test.



Conditioning of the WHSC

It is proposed to apply the same conditioning procedure to the WHSC, which means max. 10 minutes at WHSC mode 9.

<u>OICA proposal</u>

It is proposed and supported by data, that for the hot WHTC and the standard WHSC a preconditioning of the engine system of max. 10 minutes at WHSC mode 9 is introduced in the WHDC test protocol. Weighting factors of cold and hot test should be defined based on field data.