



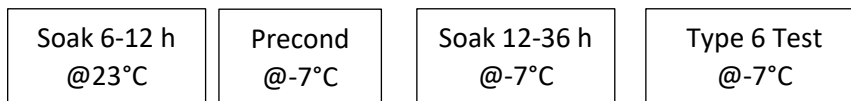
Why a soak at -7°C before preconditioning is necessary for the Type 6 test

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Considering that:

1. Only when AdBlue (solution of water and urea) is injected and urea is hydrolysed, ammonia is formed.
2. SCRs can be *preloaded* with ammonia (i.e., unreacted ammonia stored in the catalytic zeolites). A common approach among OEMs.
3. If an SCR is large enough, the *preloaded* ammonia would be able to reduce NOx emissions during one WLTC. If the SCR is large enough and *preloaded* with ammonia, it could potentially reduce 98% of NOx emissions.
4. NOx and ammonia react on the SCR also at cold temperatures.
5. Most SCR technologies do not inject Adblue when the vehicle and its components are at cold temperatures (not the ambient temperature, but the vehicle temperature).
6. The most advanced after-treatment technologies require the use of burners to heat the AdBlue solution to be able to have an adequate temperature to produce ammonia at cold temperatures.

Case 1. Vehicle tested at -7°C with soak at 23°C



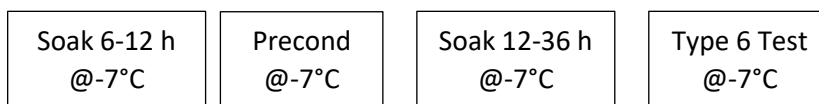
Under these conditions, if a vehicle is not able to inject AdBlue at cold temperatures:

-The vehicle and its components are not cold. During preconditioning the vehicle injects AdBlue and *preloads* the SCR with ammonia.

-During the Type 6 Test the *preloaded* ammonia will react with NOx. So, NOx emissions will be reduced.

-If SCR is large enough and *preloaded*, up to 98% NOx reduction.

Case 2. Vehicle tested at -7°C with soak at -7°C



Under these conditions, the same vehicle that is not able to inject AdBlue at cold temperatures:

-The vehicle and its components are cold. During preconditioning the vehicle does not inject AdBlue. Without AdBlue injection, there will be no ammonia. Without ammonia, *preloading* of the SCR with ammonia is not possible.

-During the Type 6 Test, without ammonia *preloaded* in the SCR, less NOx will be reduced. Therefore, higher NOx emissions than in **Case 1**.

References:

Yezerets et al. 2014 System and apparatus for enhancing exhaust aftertreatment startup emissions control.

Harris et al. 2019 Modeling of Close-Coupled SCR Concepts to Meet Future Cold Start Requirements for Heavy-Duty Engines.

Suarez-Bertoa and Astorga 2018 Impact of cold temperature on Euro 6 passenger car emissions.