ERRATUM:
TCR Turbocharger Boost Pressure Monitoring Method

This document corrects tipping errors in the Monitoring Method published in the TCR Technical Bulletin no. 4/2019. Changes are highlighted.

1. Conditions

Each of the following conditions has to be met to discard meaningless results

- Engine speed is within the rpm range that is defined for the p_{boost} check by the relevant Bulletin.

- Throttle pedal position is at least at 90% of its total travel.

- No gearshift window is active.
  A gearshift window is defined as a time span of maximum 300ms starting by the 1st detected overboost within 1000ms after gear upshift.

- Lap time of the car is ≤ 107% of the fastest lap time of the monitored session or of the fastest simultaneously driven lap time (in sessions with changing weather conditions).

If one of these conditions is not met, the monitoring method is not considering the actual boost pressure value. All previous values are kept for continuing the monitoring after the conditions are met again.

If each of these conditions are met, the corresponding boost sensor value at each sampling time is considered a valid data point.

For the upshift detection, two methods are in place:

a. Consider an rpm drop of more than 200rpm within 20ms. This drop indicates a gear upshift. The actual point in time for the upshift is considered the one at which the rpm curve has its inflection towards positive incline.

b. Reliable information (e.g. CAN signal, gear potentiometer, etc.) on the Scrutineering Data Logger on the time of operated gear upshift will be preferred.

2. Boost Pressure Monitoring Method

2.1 Description

The boost pressure is measured with the official TCR Sensor using 1mbar resolution and a sampling rate of 100Hz.
The monitoring method itself is composed of steps that are described below and executed with the same sampling frequency as the boost pressure sensor is captured. It is not applied before 50 boost pressure samples has been measured that met the conditions given above and not for the last 25 boost pressure samples of each measuring period:

Smoothing the boost sensor raw value

The smoothing of the boost sensor raw value is performed by applying a rolling average algorithm to the boost sensor values. The rolling average algorithm is performed on 50 equally weighted samples. Initially the 50 samples are set to zero (0mbar). The samples are collected in a so-called circular buffer where the oldest sample is replaced by the latest sample at each sampling point.

Evaluating the Overboost (OB) Condition

The OB is detected by subtracting the maximum permitted boost pressure from the result of the rolling average calculation (pBoostavg (i)). Only results greater 0mbar will be considered for the next steps. The maximum permitted boost pressure is dependent on rpm and has to be derived from the relevant TCR Technical Bulletin. The relevant rpm value for each evaluation is the one that was captured 25 samples before the current sample point. In the equation below this is term is defined as $pBoostlim(rpm_{i-25})$.

$$OB(i) = pBoostavg\ (i) - (pBoostlim(rpm_{i-25}) + \text{intake temperature compensation})$$

For the first valid data point after an upshift OB(i) is set to zero. The intake temperature compensation is calculated as $(Tmanifold-40)*cFactor$. The value for cFactor is given in the BoP Bulletin.

High (HOB) and Low Overboost (LOB) Detection

Thresholds are used to classify OB(i) into two cases:
- HOB Threshold (HOT): 100mbar
- LOB Threshold (LOT): 30mbar

Accepted Limit Violations

Tolerances for LOB and HOB data points are applied:
- 0.3% of the total valid data points may be higher as LOB limits but still lower as HOB limits: $LOB \leq OB(i) < HOB$
- 0.1% of the total valid data points may be higher as HOB: $OB(i) \geq HOB$

These tolerances are subject to modification though TCR Technical Bulletin (also brand specific).

2.2. Block Diagram

The diagram on next page shows the entire boost pressure monitoring method including all conditions for verification (corrected values according to the description).
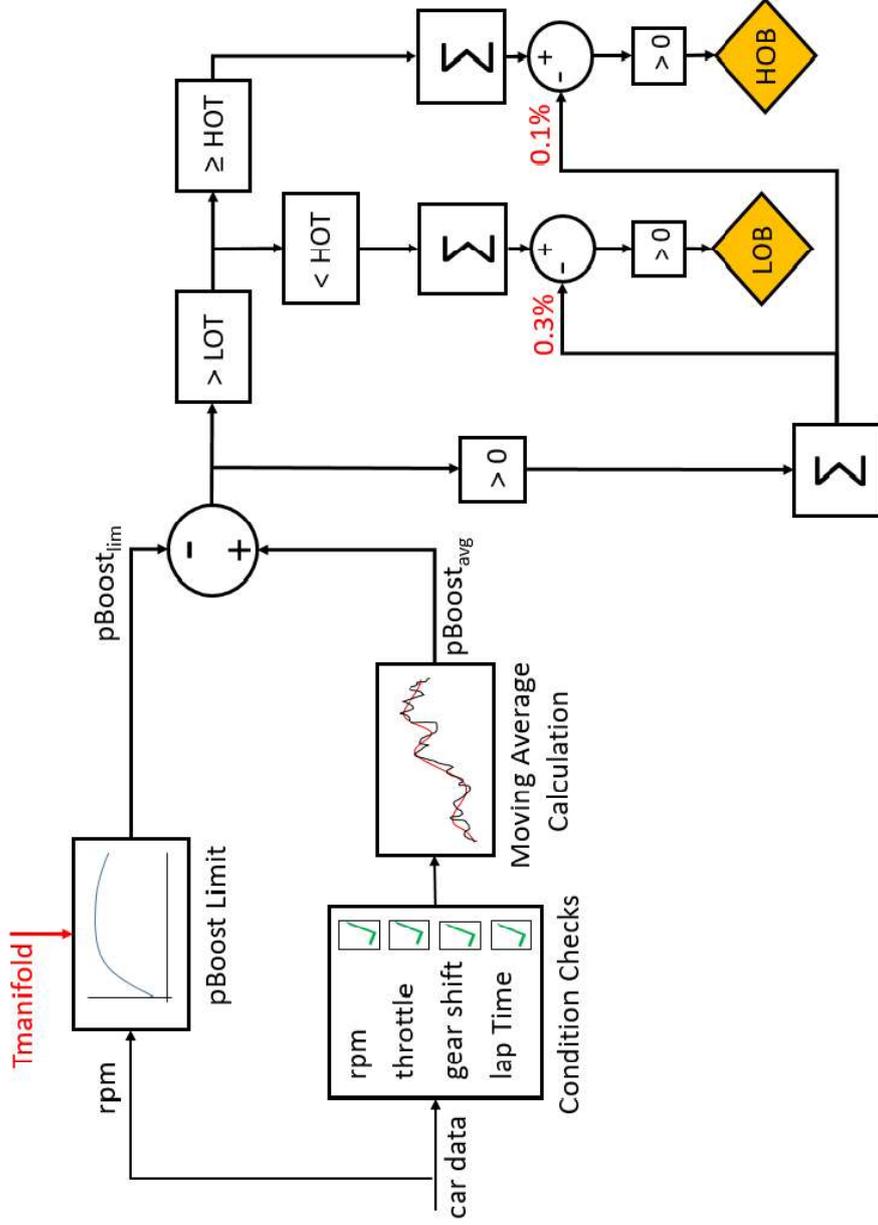
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