12.   OXIDATION CATALYST DOWNSTREAM TEMPERATURE SENSOR

System Description

The exhaust after-treatment layout & downstream oxidation sensor location is shown in Figure: Exhaust aftertreatment temperature sensor locations – Exhaust Temperature Sensors 3. The raw value of exhaust gas temperature downstream of oxidation catalyst is read using an analog to digital converter (ADC). The acquired value is checked for signal range and transformed to the physical value using transformation curve; after which a plausibility signal check is performed against a model.

Signal range check

If the raw voltage is less than the SRC-Min or is greater than SRC-Max detection threshold, an error is reported to the DSM. The raw voltage is transformed to the physical temperature value using a transformation curve.

SRC check is done only if the release condition is satisfied. For the release condition to be TRUE the following conditions to be satisfied:
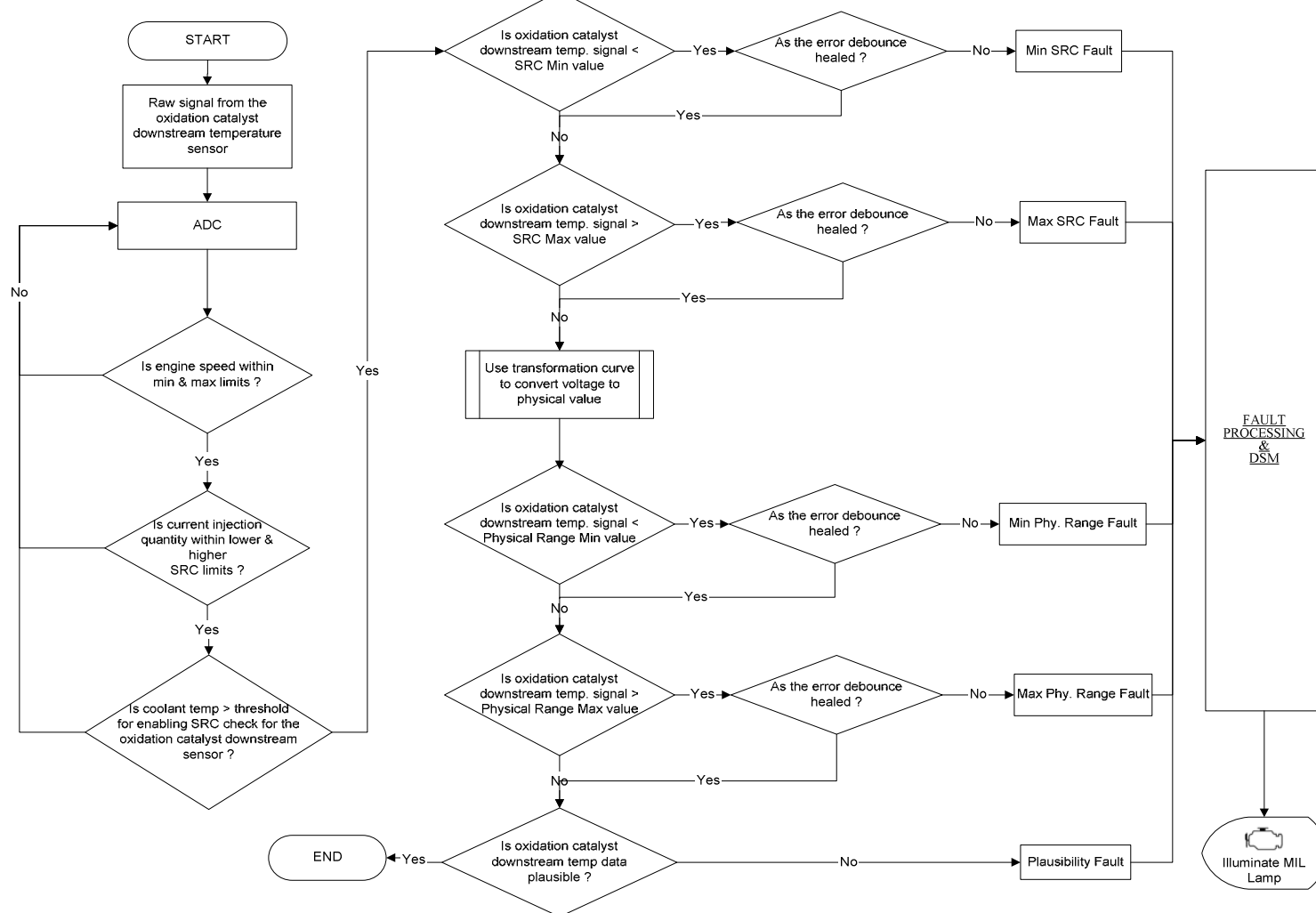
- Engine speed should be within the min and max speed limit to enable SRC condition.
- Current injection quantity should be within the lower & higher injection SRC limits.
- Engine coolant down stream temperature should be greater than the temperature threshold for enabling SRC check for the oxidation catalyst downstream temperature sensor.

- For SRC Max following conditions have to be met in addition:
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  → Temperature upstream of downstream oxidation catalyst sensor has to be above the higher temperature threshold for a set time delay.

OR

  → Temperature sensor upstream of downstream oxidation catalyst sensor is defective or engine is running for a maximum set time delay.

Physical Range Check

If the oxidation downstream temperature sensor signal is smaller than the minimum physical range check for the debounce duration, then a physical range check low error is debounced and low range error is reported to the DSM. If the oxidation downstream temperature sensor signal is greater than the minimum physical range check for the debounce duration, then the physical range check low error is healed.

If the oxidation downstream temperature sensor signal is greater than the maximum physical range check for the debounce duration, then a physical range check high error is debounced and high range error is reported to the DSM. If the oxidation downstream temperature sensor signal is less than physical range check for the high error, for a debounce duration then the physical range check high error is healed.

Flowchart: Temperature downstream of Oxidation Catalyst

Modeled plausibility check

The model based plausibility check is not performed if the following conditions are not present:-
▪ Oxidation catalyst downstream temperature plausibility monitor is inhibited;
▪ Exhaust gas treatment is active or the lockout time is over since the deactivation of EGT;
▪ Engine has not run in normal operation for a calibrated length of time i.e. debounce time to allow for transition in the engine state.

If the difference between the sensed oxidation catalyst downstream temperature and the modeled temperature is less than the threshold decided by the "negative-deviation-curve" or above the threshold decided by the "positive-deviation-curve", for a duration greater than the debounce time, then the oxidation catalyst downstream temperature sensor diagnostic fault check status for plausibility reports an error. The error is healed if the difference is within the tolerance limit for the debounce duration. The monitoring is interrupted if a permanent defect occurs with the sensor i.e. plausibility check stops.

In addition the monitoring is locked when the engine is not in "Running" state. This is to ensure that no error is reported due to model inaccuracies during the heating phase (when the engine is in start mode). When the engine-state changes to the running mode a timer is started. After the applicable debounce duration as completed since the change of engine-state to normal, the monitoring is released.

DTC Table: Oxidation catalyst downstream temperature sensor

Fault Code	Monitoring Strategy	Fault Detection Criteria	MIL Activation criteria	Secondary Parameters	Preconditioning	Demonstration test
P042D	SRC High for TOxiCatDs Temperature	Voltage Input outside limits, debounced.	3rd Cycle	Engine running, requires speed load conditions to be met. >49 c coolant .12mg inj fuel for > 35s >1000rpm	Two Type 1 Cycles	One Type 1 Cycles
P042C	SRC Low for TOxiCatDs Temperature	Voltage Input outside limits, debounced.	3rd Cycle	Engine running, requires speed load conditions to be met. >49 c coolant .12mg inj fuel for > 35s >1000rpm	Two Type 1 Cycles	One Type 1 Cycles

Oxidation catalyst downstream temperature sensor operation	
Monitor execution	Continuous for range and plausibility checks, 100 ms per loop.
Monitor Sequence	None
Monitoring Duration	Typically <5 seconds to register a malfunction