MSS54

module description

tank ventilation "functional check" TEFC

(V416)

	Department	Date	name	Filename
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1 General

The diagnosis is designed to check the function of the tank ventilation based on the engine reaction

1.1 Method

Two-stage process:

1. **TEA measurement:**
   Adaptation factor tea_f_1/2 below a threshold (load level)
   If not OK, then:
2. **LL measurement:**
   Actively opening and closing the TEV and observing the reaction of the idle controller (target air mass) and the idle speed
   In parallel, the TEA measurement continues to be carried out.

As soon as a criterion is met, the functional check is considered OK.

2 Functional description

The function runs in 200ms increments.

General prerequisites for TEA and LL measurement:

- electrical diagnosis TEV OK (B_TEV_FAILURE)
- No error idle speed control (B_ZWD_FEHLER)
- No error EDK (SK_EGAS_ZUSTAND < 2)
- No HFM error (B_HFM_FAILURE)
- No Vanos error (B_VAN_FEHLER)
- No secondary air injection (B_SLP_ON)
- No catalytic converter heating
- After engine start, the time **K_TEFC_DELAY** must have expired
- TEV must be in B_TE_NORM
  This means that the lambda controller must be active and all its conditions must be met.

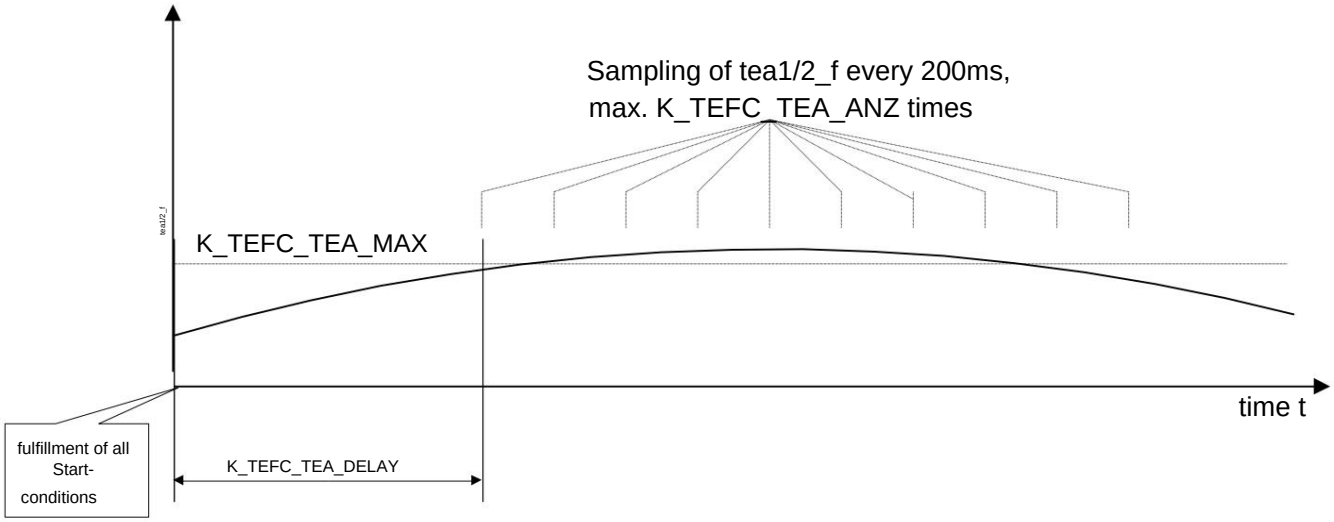
2.1 Checking the tank ventilation adaptation factor TEA (TEA measurement)

Additional conditions for TEA measurement:

- Operating range within a window **(K_TEFC_N_MIN, K_TEFC_N_MAX, K_TEFC_RF_MIN, K_TEFC_RF_MAX)**
- not too large dynamics n, rf (B_N_DYNAMIK, B_RF_DYNAMIK), can be excluded with **K_TEFC_CFG** become

Once the preconditions have been met, the time **K_TEFC_TEA_DELAY** is waited for.
With each sampling (every 200ms), the counter tefc_tea_ok is increased by one if the values of tea1_f or tea2_f are less than or equal to **K_TEFC_TEA_MAX .** If the value of tefc_tea_ok reaches the threshold **K_TEFC_TEA_OK,** the diagnosis is evaluated as OK and terminated. However, if the number of samples reaches the value of **K_TEFC_TEA_ANZ** without **K_TEFC_TEA_OK** being reached, the LL measurement is started.
At the same time, the TEA measurement is restarted without any waiting time.

If the conditions are violated, the diagnosis is aborted. After all conditions have been met and the waiting time **K_TEFC_TEA_DELAY** has expired again , the diagnosis is continued with the frozen values of tefc_tea_cnt and tefc_tea_ok.



2.2 Reaction of idle speed / idle speed adjuster LL (LL measurement)

Additional conditions for the LL measurement:

- TEA measurement first run not successful
- Idle condition (PWG = 0, idle speed regulated +/- **K_LFR_DN_EINGEREGELT,** no traction)
- No idle speed controller stop at rf_min or tetv_min
- small steering angle change **(K_TEFC_LRW_DELTA)**
- No air conditioning compressor circuit
- No ignition angle intervention
- Speed = 0

Level 2 actively intervenes in the tank ventilation:

The LL measurement goes through the following steps:

1. The time **K_TEFC_LL_DELAY** from the fulfillment of all start conditions is waited.
2. The TEV is closed with the **K_TEFC_RAMPE** and the lambda controller is switched off
3. After the time **K_TEFC_LL_DAUER** the values ml_soll and n are converted into tefc_ll_ml_alt and tefc_ll_n_alt respectively noticed.
4. The TEV is regulated to the value **K_TEFC_TETV_MAX** using the ramp **K_TEFC_RAMPE .**
   If the motor reaction | tefc_ll_delta | >= **K_TEFC_LL_DELTA,** tefc_ll_ok is increased by one and the values ml_soll and n are stored in tefc_ll_ml_alt and tefc_ll_n_alt respectively. If tefc_ll_ok >= **K_TEFC_LL_OK,** the LL measurement and thus the TEV is OK and the TEA measurement is aborted, otherwise the system jumps to point 6.

5. After the time **K_TEFC_LL_DAUER** the values tefc_ll_ml and n are compared with the values tefc_ll_ml_alt and tefc_ll_n_alt respectively:
   If | tefc_ll_delta | >= **K_TEFC_LL_DELTA,** tefc_ll_ok is increased by one and the sizes ml_soll and n are stored in tefc_ll_ml_alt and tefc_ll_n_alt respectively.
   If tefc_ll_ok >= **K_TEFC_LL_OK,** the LL measurement and thus the TEV is ok and the TEA measurement is aborted.

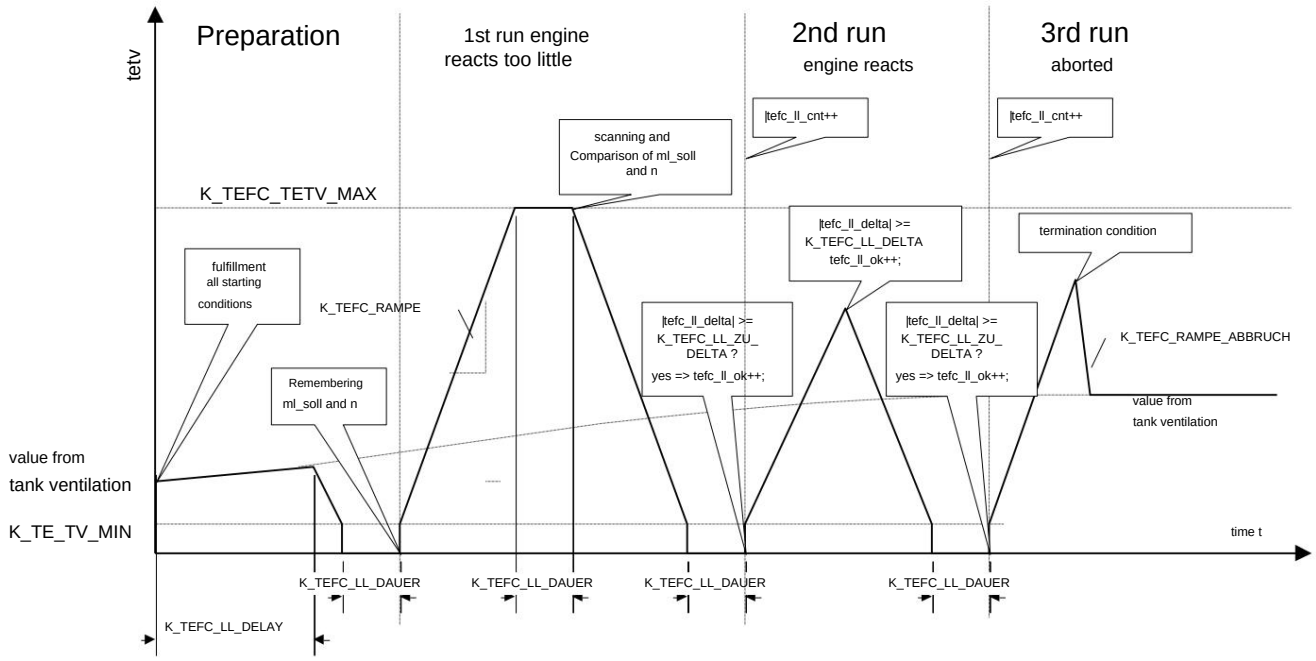
6. The TEV is closed with the ramp **K_TEFC_RAMPE .**

7. After the time **K_TEFC_LL_DAUER** the counter tefc_ll_cnt is increased by one and the values ml_soll and n are compared with the values tefc_ll_ml_alt and tefc_ll_n_alt respectively.
   If | tefc_ll_delta | >= **K_TEFC_LL_ZU_DELTA,** tefc_ll_ok is increased by one.
   The sizes ml_soll and n are stored in tefc_ll_ml_alt and tefc_ll_n_alt respectively.
   If tefc_ll_ok >= **K_TEFC_LL_OK,** the LL measurement and thus the TEV is ok and the TEA measurement is aborted.

   If the counter tefc_ll_cnt reaches the value **K_TEFC_LL_ANZ,** the TEA measurement is aborted and the LL measurement is terminated with DEFECT, otherwise a new run is started again from point 4.
8. At the end of the LL measurement, the function is transferred back to the TE and the lambda controller takes the regulation again.

2.2.1 Timing of diagnosis:

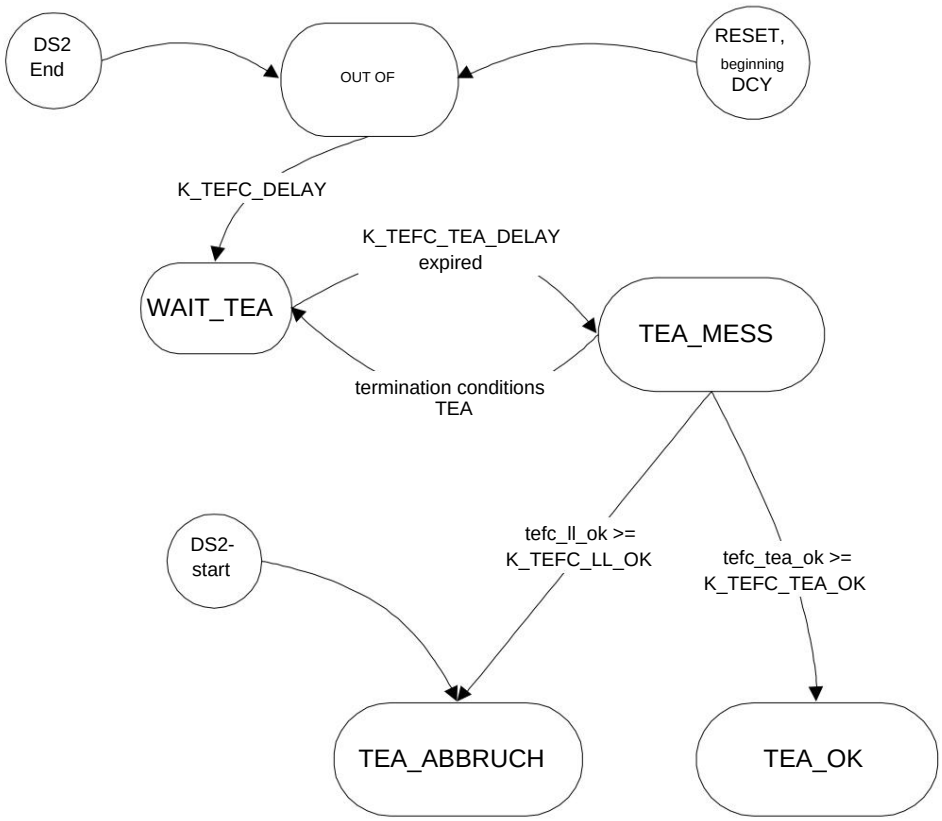
(Example)



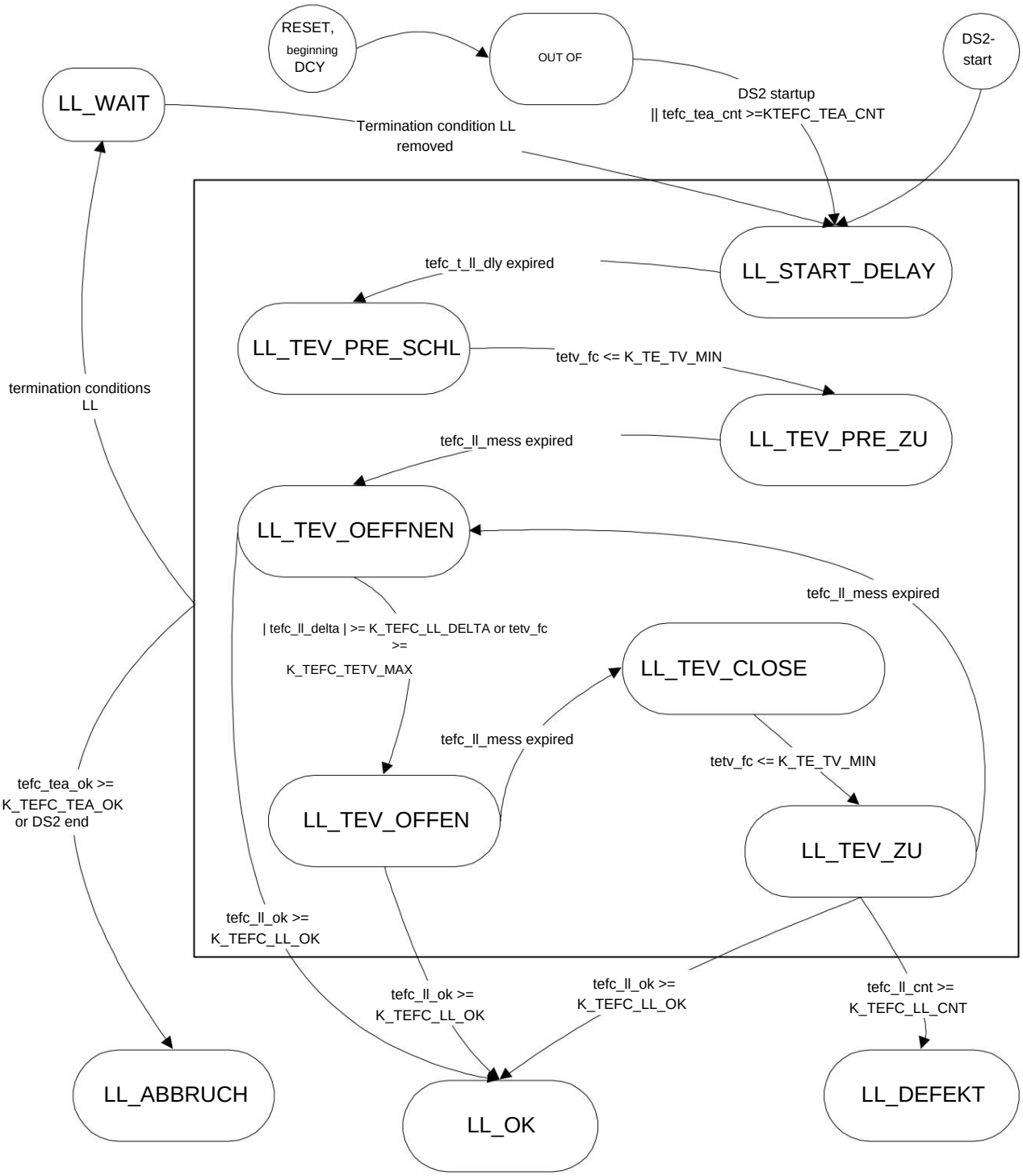
2.2.2 Calculation of the engine reaction:

$$tefc\_ll\_delta = \frac{tefc\_ll\_ml\_alt}{ml\_soll} - \frac{tefc\_ll\_n\_alt}{n}$$

2.2.3 State diagram TEA measurement:



2.2.4 State diagram LL measurement:



During Level 2 the following must be blocked:

- Idle adaptation
- Idle synchronization
- Freeze the I part of the LLR
- Ignition angle intervention of the idle speed controller

3 Description of the identifiers

3.1 Application sizes:

name	Meaning:
K_TEFC_CFG	Configuration whether TEA measurement should be aborted at n/rf-DYNAMIK
K_TEFC_DELAY	Delay after engine start until release of the functional check
K_TEFC_N_MIN	Minimum speed for TEA measurement
K_TEFC_N_MAX	Maximum speed for TEA measurement
K_TEFC_RF_MIN	Minimum filling for TEA measurement
K_TEFC_RF_MAX	Maximum filling for TEA measurement
K_TEFC_TEA_DELAY	Delay of TEA measurement after fulfillment of all release conditions
K_TEFC_TEA_MAX	Threshold above which a tea1/2_f sample is counted as OK
K_TEFC_TEA_OK	Number of tea1/2_f samples <= K_TEFC_TEA_MAX, from which the FC is concluded as OK
K_TEFC_TEA_ANZ	Maximum number of tea1/2_f samples in one run
K_TEFC_LL_DELAY	Delay of LL measurement after fulfillment of all release conditions
K_TEFC_LRW_DELTA	Maximum permissible steering angle change during the LL measurement
K_TEFC_RAMPE	Ramp with which the TEV is opened and closed by the FC
K_TEFC_RAMPE_ABBRUCH Ramp	used to switch from tetv_fc to tetv_func = value from TE when the FC is aborted
K_TEFC_TETV_MAX	Maximum value to which the TEV is opened
K_TEFC_LL_DAUER	Settling time after reaching “0” or K_TEFC_TETV_MAX until sampling of n and ml_soll takes place
K_TEFC_LL_DELTA	Minimum change of tefc_ll_delta from which tefc_ll_ok is incremented
K_TEFC_LL_ZU_DELTA	Minimum change of n from which tefc_ll_ok is incremented
K_TEFC_LL_ANZ	Maximum number of LL measurement runs performed
K_TEFC_LL_OK	Value of tefc_ll_ok from which the FC is completed as OK

3.2 Process variables:

Name	Meaning:
tefc_tea_st	state of the tea1/2_f measurement
tefc_ll_st	state of the idle measurement
tefc_flags	Internal control flags
tefc_t_tea_dly	Start delay of the TEA measurement after fulfillment of all release conditions
tefc_t_ll_dly	Start delay of the LL measurement after fulfillment of all release conditions
tefc_ll_mess	Settling time of the LL measurement in the OPEN or CLOSED states
tefc_tea_ok	Counter of samples with tea1/2_f <= **K_TEFC_TEA_MAX**
tefc_tea_cnt	Counter of the samples taken by tea1/2_f
tetv_fc	Duty cycle TEV when LL measurement is active
tefc_ll_cnt	Number of LL measurement runs performed
tefc_ll_ok	Numerator of the “good” reaction of n and lls_tv_aq of the LL measurements
tefc_lws_lrw_start	steering angle at the beginning of the LL measurement
tefc_ll_n_alt	flag of the sampled speed
tefc_ll_ml_alt	marker for ml_soll
tefc_ll_delta	Engine response to TEV change: = tefc_ll_ml_alt /ml_soll - tefc_ll_n_alt / n
tefc_ed	error memory variable

3.3 Meaning of the control flags:

B_TEFC_START_DS2	tefc_flags, BIT0	= TEV check initiated via DS2
B_100MS_OVER	tefc_flags, BIT1	= Wait flag, toggle every 100ms
B_TEFC_LL_ABBRUCH	tefc_flags, BIT2	= LL abort, switch to tetv_func!
B_KKOS_CAN_OLD	tefc_flags, BIT3	= Air conditioning compressor status marker
B_S_KO_OLD	tefc_flags, BIT4	= Air conditioning compressor requirement flag
	tefc_flags, BIT5	= free
	tefc_flags, BIT6	= free
	tefc_flags, BIT7	= free

4 Application instructions:

Before the functional check is applied, all factors influencing tea1/2_f as well as the idle control should be largely applied.

4.1 TEA measurement

If possible, the TEA measurement should already produce an OK result, because then there is no need to actively intervene in the TEV function.
The ranges n /rf for the TEA measurement should be where **tea1/2_f** is as meaningful as possible.
The **K_TEFC_TEA_DELAY** should be at least as long as the factors **tea1/2_f** need to react after entering the rinsing phase.
K_TEFC_TEA_MAX should be selected such that, in case of a defective TEV and active TEA measurement, the factors **tea1_f** and **tea2_f** just do not reach this threshold.
If dynamic influences disturb the factors **tea1/2** in the relevant n/rf range, they can be corrected with **K_TEFC_CFG** lead to termination of the evaluation. Dynamics are detected for the duration of **K_RF_DYN_T_TEFC** when the thresholds **K_RF_DYN_DELTA_TEFC** or **K_N_DELTA_DYN are exceeded.**

4.2 LL measurement:

K_TEFC_LL_DELAY describes the settling time of n and ml_soll for stable idling from the condition of the idle controller "idling regulated with **K_LFR_DN_EINGEREGELT"**

K_TEFC_LL_DELTA should be at least as large as the typical engine reaction to non-interrupting disturbances, such as switching on the rear window heating.
If **K_TEFC_LL_DELTA** is chosen to be smaller, the number of required OK measurements should be **K_TEFC_LL_OK** and the number of permissible runs **K_TEFC_LL_ANZ** must be selected so that the probability of OK detection of a defective TEV remains low.
K_TEFC_LL_ZU_DELTA describes the engine reaction to the closing of the TEV and should ideally be chosen to be smaller than **K_TEFC_LL_DELTA.** The reaction when closing is not as constant as when opening, since the different opening before closing and the normal idle fluctuations overlap.

K_TEFC_TETV_MAX must be chosen to be large enough that a functioning TEV is detected under all circumstances (under various environmental conditions such as AKF loads, air pressures, idle air requirements). The risk that the engine idling at full AKF will be significantly disturbed is low, since even negative reactions (ie a drop in speed) immediately initiate the closing of the TEV.

Termination conditions:
In principle, the observation of the idle stability can best be done via the calculated value **tefc_ll_delta**
However, the value is only calculated during active idle measurement. By changing the **K_TEFC_LL_RAMPE** to 0 and starting the LL measurement (overwriting **tefc_tea_st** to "OFF"), the value **tefc_ll_delta** can be observed as long as the **te_st** is in NORM .

K_TEFC_LRW_DELTA should represent the steering angle change at which an idle disturbance occurs, visible in **tefc_ll_delta .**