Project: MSS54

Module: Acceleration Enrichment

1st release conditions for acceleration enrichment

1.1 General Release Conditions

- Condition engine running must be met **(B_ML)**
  Acceleration enrichment can be triggered in all engine states
- the torque reduction after START must be completed **(!B_MD_NACHSTART)**
- the speed threshold **K_BA_AKTIV_SCHWELLE** must not be exceeded
- no partially fired operation available **(!B_SKS_TIEINGRIFF)** - to protect the catalyst

1.2 Release of a negative / positive acceleration enrichment

Whether a positive or negative acceleration enrichment must be triggered is determined by the "delta air mass - dam" measure.

"Dam" refers to the change in air mass flow relative to one cylinder.

This value is also normalized using the speed. The calculation is carried out in the segment task.

damROH = d_ml_720 / ml_720_min

d_ml_720 = mlx - ml(x-720°KW)
ml_720_min = max[ml, K_HFM_ML_SEG_MIN]

dam = damROH * $_{\text{nNORM}}$

dam = [-3 .. 3] (nNORM normalized to 1024 rpm)

negative *dam* occurs when the valve is closed
positive *dam* occurs when the flap is opened

1.2.1 positive acceleration enrichment

- a positive *dam* has occurred
- the change in air mass flow *dam* exceeds the applicable threshold
  KF_BA_POS_TMOT_N(tmot,n)
- the relative opening cross-section **aq_rel_delta** changes by more than the value
  KL_BA_AQ_DELTA_POS(aq_rel)

If all of these trigger conditions are met, the raw value of the BA factor is determined. For this purpose, the **difference dam_delta** is determined from the actual dam value and the threshold KF_BA_POS_TMOT_N. This difference is the **input value** in the characteristic curve **KL_BA_DAM_POS(dam_delta),** from which the **raw factor ba_fak_roh_signed** is determined.

1.2.2 negative acceleration enrichment

- a negative *dam* has occurred

- the change in air mass flow (amount) *dam* exceeds the applicable threshold
  KF_BA_NEG_TMOT_N(tmot,n)

- the relative opening cross-section **aq_rel_delta** (sign is negative for a neg. BA) changes by more than the value
  KL_BA_AQ_DELTA_NEG(aq_rel)

- Overrun cut-off is not active **(!B_SA).**

If all of these trigger conditions are met, the raw value of the BA factor is determined. For this, the absolute value of the **difference dam_delta** is determined from the actual dam value and the threshold KF_BA_NEG_TMOT_N. This value is the **input value** in the characteristic curve **KL_BA_DAM_NEG(dam_delta),** from which the **raw factor ba_fak_roh_signed** is determined.

2. Calculation of the factor 'ba_f_ti'

When a trigger is detected, a factor is calculated segment-synchronously.

The determined raw factor ba_fak_roh_signed is corrected with

- a TMOT/TAN dependent factor **(KF_BA_FAKT_TMOT_TAN(tmot,tan))**

- a speed / RF factor, depending on whether it is a positive or negative BA.: neg. BA:
KF_BA_FAKT_RF_N_NEG(rf,n)
pos. BA: **KF_BA_FAKT_RF_N(rf,n)**

- a reinstatement factor to compensate for the wall film degradation during SA
The input variable in the characteristic curve **KL_BA_FAKT_ZEIT** is the dwell time in overrun cut-off. This factor only comes into effect for a time **K_BA_ZEIT_WIEDEREINSETZEN** after re-engagement.

The offset value determined in this way is added to the neutral value “1”. This new factor is limited to a minimum **K_BA_FAKT_MIN** and a maximum **K_BA_FAKT_MAX .**

3. retriggering and starting the control

Initial state: BA control is inactive and

- Trigger positive BA => Start of the POS-BA control and transfer of the just determined factor into ba_berech

- Trigger negative BA => Start of the NEG-BA control and transfer of the just determined factor into ba_berech

Initial state: POS-BA control is active and

- Trigger positive BA => if the newly determined factor is larger, the value is taken over in ba_berech

- Trigger negative BA => Switching to NEG-BA control and adoption of the new factor in ba_berech

Initial state: NEG-BA control is active and

-Trigger negative BA => if the newly determined factor is smaller, the value is taken over in ba_berech

- Trigger positive BA => Switching to POS-BA control and adoption of the new factor in ba_berech

Each time the new factor is adopted in ba_berech, the adjustment or BA factor reduction function initialized.

4th up- or down-regulation function of the BA factor

The regulation up or down is done in 3 stages - a distinction is also made between positive and negative BA:

1. Output of the calculated factor ba_berech in ba_f_ti for the time **KL_BA_IGN_POS/_NEG_TMOT** (for a certain number of ignitions)

ba_f_ti = ba_berech

2. Output of a reduced BA factor in ba_f_ti for the time **KL_BA_IGN_RED_POS/_NEG_TMOT** (for a certain number of ignitions)

ba_f_ti = (ba_berech - 1) * KL_BA_FAKT_RED_TMOT(tmot) + 1

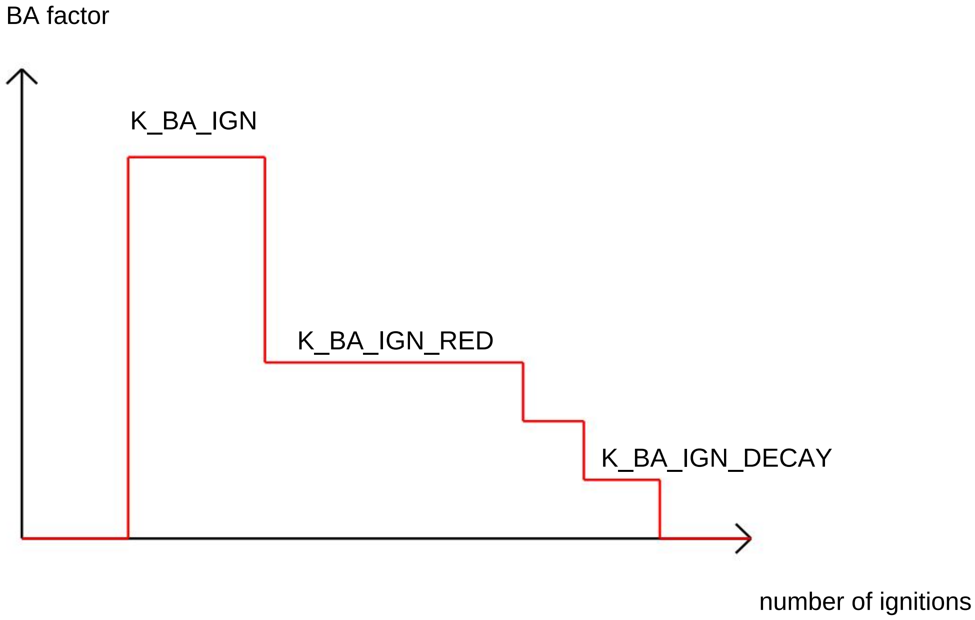
3. Reduction of the BA factor ba_f_ti via a staircase with a staircase width **K_BA_IGN_DECAY_POS/_NEG** (for a certain number of ignitions)

positive control - reduction to ba_f_ti = 1:

ba_f_tiNEU = ba_f_tiOLD - KF_BA_FAKT_RED_POS_TMOT_N(tmot,n)

neg. control - control to ba_f_ti = 1:

ba_f_tiNEU = ba_f_tiALT + KF_BA_FAKT_RED_NEG_TMOT_N(tmot,n)



4. BA - Abort in idle

In general, acceleration enrichment is triggered in all engine operating conditions.
However, problems can occur at idle (mixture too rich). Therefore, an active positive BA is aborted when entering idle.

5th switching off the lambda controller

If the calculated acceleration enrichment leaves a certain window, the lambda control is switched off.

If **ba_f_ti > K_LA_BA_OFF_POS**

or **ba_f_ti < K_LA_BA_OFF_NEG**

=> **Switching off the lambda controller** (la_st_aus - BIT7)

6th variables and constants

name	type	Meaning
ba_regel_count	-	counter for 1st control stage
ba_regel_count_red	-	counter for 2nd control stage
ba_regel_count_decay	-	counter for 3rd control stage
ba_berech	-	intermediate value of the BA factor
ba_tmot	-	TMOT correction factor
ba_fakt_time	-	correction factor according to SA
ba_red_tmot	-	reduction factor for up/down control
ba_dam_neg _threshold	-	DAM threshold for neg. BA
ba_dam_pos _threshold	-	DAM threshold for positive BA
ba_aq_delta_neg	%/segment	AQ-REL threshold for neg. BA
ba_aq_delta_pos	%/segment	AQ-REL threshold for pos.BA
ba_st	-	status variable
ba_f_ti	-	BA factor
K_BA_ZEIT_WIEDEREINSETZEN	K	time for map switching
K_BA_AKTIV_SCHWELLE	K	speed threshold above which BA is switched off
KL_BA_IGN_POS/_NEG_TMOT	K	Number of ignitions for f_ti_ba
KL_BA_IGN_RED_POS/_NEG_TMOT K		Number of ignitions for f_ti_ba reduced
K_BA_IGN_DECAY_POS/_NEG	K	Number of ignitions for f_ti_ba in throttle-down process
K_BA_FAKT_MIN	K	minimum f_ti_ba factor (always positive)
K_BA_FAKT_MAX	K	maximum f_ti_ba factor
K_LA_BA_OFF_POS	K	At Pos BA, from a certain point factor of the LA controller switched off
K_LA_BA_OFF_NEG	K	With NEG BA, from a certain point onwards factor of the LA controller switched off
KL_BA_AQ_DELTA_NEG	KL=f(aq_rel)	AQ_REL - threshold for neg. BA
KL_BA_AQ_DELTA_POS	KL=f(aq_rel)	AQ-REL - threshold for pos. BA
KL_BA_DAM_POS	KL=f(dam_delta) raw factor for pos. BA depending on dam_delta	
KL_BA_DAM_NEG	KL=f(dam_delta) raw factor for neg. BA depending on dam_delta	
KL_BA_FAKT_ZEIT	KL=f(time)	time since reinstatement
KL_BA_FAKT_RED_TMOT	KL=f(tmot)	Factor as f(tmot) for reduced factor
KF_BA_FAKT_TMOT_TAN	KF=f(tmot,tan)	factor as f(tmot,tan)
KF_BA_POS_TMOT_N	KF=f(tmot,n)	DAM threshold for positive BA

KF_BA_NEG_TMOT_N	KF=f(tmot,n)	DAM threshold for neg. BA
KF_BA_FAKT_RF_N_NEG	KF=f(rf,n)	Weighting factor as f(tmot,n) for neg. BA
KF_BA_FAKT_RF_N	KF=f(rf,n)	Weighting factor as f(load,n) for pos. BA
KF_BA_FAKT_RED_NEG_TMOT_N	KF=f(tmot,n)	Red factor as f(tmot,n) for neg. BA
KF_BA_FKAT_RED_POS_TMOT_N	KF=f(tmot,n)	Red. Factor as f(tmot,n) for pos. BA

status variable:

bast status byte for BA
Bit 0: Triggering on pos. BA
Bit 1: Triggering on neg. BA
Bit 2: Control pos. BA
Bit 3: Control neg. BA
Bit 4: ---
Bit 5: ---
Bit 6: ---
Bit 7: ---