JAMA Proposal on Cold Start weighting for HDDE in Japan

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Prepared for 23rd WHDC MEETING

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Background

- In Japan, the needs for HDDE cold start testing is studied and will be discussed among authorities in this year.
- Japan Automobile Manufactures Association proposes the following calculation logics will be the base for the discussion.
- The same logics and the same databases are already applied for the determination of chassis-dynamo emissions testing for LDT and PC with 1:3 cold/hot ratio.

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Method of Cold Start Weighting

•Fleet operation analysis of trucks based on national surveillance statistical report and JCAP research program (average trip length, times and soak period distributions for both fleet company and private owners.)

• Actual measurement of engines coolant temperature time history during soak period.

•Introduction of "Equivalent Cold Start concept" which is similar to Emission Factor model (EMFAC) by the CARB, and takes into account coolant temperature at the end of soak period. When the soak period is short and temp. is high, lighter weighting is applied.
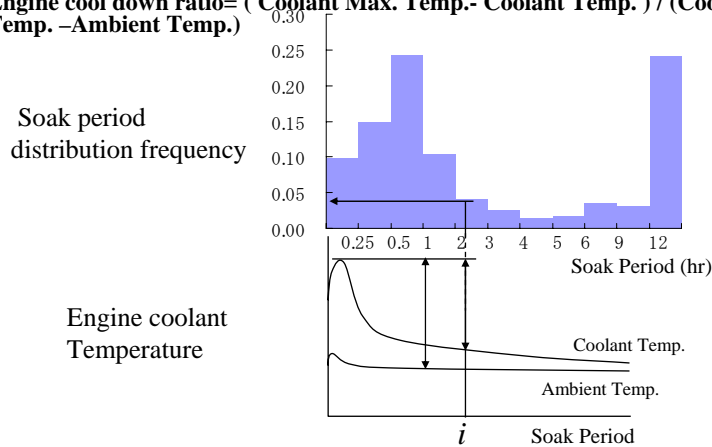
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Equivalent Cold Start Ratio

Equivalent cold start ratio (ECR) can be calculated by the following equation.

ECR= Σ (Soak period frequency)i * (Engine cool down ratio)i

Where:

Engine cool down ratio= (Coolant Max. Temp.- Coolant Temp.) / (Coolant Max. Temp. –Ambient Temp.)

Soak period
distribution frequency

Engine coolant
Temperature

Coolant Temp.

Ambient Temp.

i   Soak Period

Soak Period (hr)

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Calculation of Equivalent Cold Start Ratio (Trucks; 1997-1998)

ID No	Soak Period Distribution					Engine Cooldown Ratio				ci*Ei
	a	b — No. of start events			c	A	B	C	E	
i	Soak Period(hr)	Fleet Company	Private	Total	bi/Σbi	Coolant Temp. (deg.C)	Ambient temp. (deg.C)	A−B	Engine Cooldown Ratio	
1	0~0.25	207	46	253	0.10	80.1	26.0	54.1	0.006	0.001
2	0.25~0.5	325	57	382	0.15	77.9	25.4	52.5	0.036	0.005
3	0.5~1.0	508	110	618	0.24	68.3	24.9	43.4	0.203	0.049
4	1~2	202	65	267	0.10	56.5	24.2	32.4	0.404	0.042
5	2~3	72	31	103	0.04	49.0	24.3	24.8	0.545	0.022
6	3~4	48	17	65	0.03	44.5	25.9	18.6	0.658	0.017
7	4~5	19	17	36	0.01	41.5	26.4	15.1	0.722	0.010
8	5~6	21	23	44	0.02	39.0	25.5	13.5	0.752	0.013
9	6~9	39	49	88	0.03	35.5	24.0	11.5	0.789	0.027
10	9~12	59	19	78	0.03	31.0	24.0	7.0	0.871	0.027
11	>12	303	311	614	0.24	**	**	0.0	0.963	0.232
Total		1803	745	2548	1.00					0.446
								Equivalent Cold Starts Ratio	Σ(ci*Ei)	0.446

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Cold Start Weighting for Japan JAMA Proposal

- Based on National surveillance statistical report for truck transportation in 2003

    average trip mileage; 146.99km/day

    average trip frequency; 2.12 times/day

- Estimated cold start frequency;

    2.12*0.446=0.95 times/day

- Representing JE05 test cycle(13.89km) for 1 trip, total trip cycle number is 146.99/13.89=10.58 times/day

    Cold start weighting becomes ;

    0.95/10.58=0.09

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