Transmitted by the expert
from India

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Feasibility study for Chassis dynamometer based Emission testing procedure as an alternative to HILS for Heavy Duty Hybrid Electric Vehicles (HD-HEV)

BACKGROUND:

During 60th session of GRPE in June, 2010, Terms of Reference document (GRPE-60-11) prepared by informal group after deliberations in 1st and 2nd IG meeting was adopted.

Point no 6 of Terms of Reference document calls for the assessment of feasibility for Chassis dynamometer based Emission testing procedure as an alternative to HILS for HD-HEV's.

PROPOSAL:

Terms of References sr. no. 2 calls for verification procedure on Chassis dynamometer for Engine cycle output of the model, which in turn will need to define the chassis dynamometer specifications. Broad level comparison given in Annexure I indicates that following are the major parameters required for chassis dynamometer based procedure.

1. Driving cycle
2. Reference Mass
3. Gear shifting pattern
4. Specification of chassis dynamometer
5. Test cell condition
6. Emission measurement procedure
7. Emission calculations

All above parameters once developed / decided for HILS can be directly used for Chassis dynamometer procedure. Thus it clearly shows that chassis dynamometer procedure does not require additional work. We would like to propose this group that it is feasible to develop Chassis dynamometer based procedure along with HILS.

JUSTIFICATION:

1. The broad level comparison in Annexure I shows that parameters once decided / developed for HILS procedure, they can be directly used for chassis dynamometer, whereas for HILS will need following additional parameters to be developed / decided.
    a. Component level testing, equipments and detailed procedure
    b. Acceptance criteria for model after Evaluation on chassis dynamometer

ANNEXURE I

Comparision of major parameters required for HILS and Chassis Dynamometer procedure			
Parameter	**HILS**	**Chassis Dynamometer**	**Remark**
Driving Cycle	WHVC	Same as HILS	
Reference mass	work item	Same as HILS	
Rolling and Air resistance coeff.	work item	Same as HILS	
Mathematical model providing Engine cycle output	work item	Not required	
Gear shifiting pattern	work item	Same as HILS	
Model / Vehicle family detais	work item	Same as HILS	
HILS model development			
Component level testing, equipments and detailed procedure	work item	Not required	
Specification of test equipment for components	work item	Not required	
Development of code for model	work item	Not required	
integrating all system level models	work item	Not required	
HILS model verification on Chassis Dyno and testing of vehicle on chassis dyno			
Specifications of chassis dyno	work item	Same as HILS	
Measurement of Engine cycle (Torque & Speed)	work item	Same as HILS	
Model acceptance criteria	work item	Not required	
Testing			
Test cell conditions	Inline with GTR No. 4 (clause No. 6)	Same as HILS. Inline with GTR No. 4 (clause No. 6)	Engine Air intake requirements as per clause 6.1 of GTR can be maintained for Chassis Dynamometer
Emission measurement procedure	Inline with GTR No. 4 (clause No. 7) Raw and CVS	Same as HILS Inline with GTR No. 4 (clause No. 7) Only CVS	GTR mentiones that both the procedures are equivalent, but being CVS followed for chassis dynamometer in smaller vehicles, we can start with CVS.
Emissions Calculations			
Results in g/test	Inline with GTR No. 4 (clause No. 4)	Same as HILS	
Evaluation of total workdone (kWh) at system output shaft for calulating specific emissions in g/kWh	work item	Same as HILS	Results obtained in g/test will be devided by system level kWh and results can be declared in g/kWh

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