Family definitions – Proposal for amendment
Annex 4 – Open Issues Task Force

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Observed issues in family definitions
## Family definition analysis
### Results matrix – Principle

<table>
<thead>
<tr>
<th>Characteristics/ Detailed definition</th>
<th>Uncertainties/ Issues</th>
<th>One column for each family in GTR 15, R83, EC No 1151/2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Combustion process</td>
<td>• Identical</td>
<td>• n/a</td>
</tr>
<tr>
<td>• Fuel system</td>
<td>• Identical</td>
<td>• n/a</td>
</tr>
<tr>
<td>• EGR type</td>
<td>• Identical</td>
<td>• n/a</td>
</tr>
<tr>
<td>• n/v ratios</td>
<td>• n/a</td>
<td>• Delta n/v ≤ 8%</td>
</tr>
<tr>
<td>• ...</td>
<td>• ...</td>
<td>• ...</td>
</tr>
</tbody>
</table>
Family definition analysis
Observed issues

- **Undefined terms, e.g.**
  - ‘Engine technology’; ‘Combustion type’...

- **Multiple terms for similar characteristics, e.g.**
  - ‘Engine displacement’ vs ‘Engine volume’ vs ‘Cylinder capacity’...

- **Ambiguous definitions, e.g.**
  - EGR type defined as
    - ‘With/without, cooled/uncooled’ (ATCT family)
    - ‘With/without, cooled/uncooled, LP/HP, internal/external’ (PEMS test family)

- **Reference values not defined or unclear, e.g.**
  - Catalyst volume +/- 10% (Ki family), Temperature at reference speed (Ki family)...

- **Various levels of detail and grouping**
  - ‘Type of internal combustion engine’ comprises e.g. fuel type, engine displacement
  - Other families uses these terms as separate characteristics
Proposal for amendment
Proposal for amendment

Goals of the proposal

Goals:

- The family definitions shall be
  - Robust, i.e. unambiguous, complete and consistent
  - Technology neutral
- The developed methodology and structure shall be suitable for all family definitions
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Initially 2 approaches were considered

Approach 1:
Harmonize and clarify the terms used for the definition of the families

Approach 2:
Define the functionality of each family and specify measurable parameters to determine if a vehicle belongs to the family or not

Considering the advantages and drawbacks

Proposed Approach:
• Define the currently used terms for family definitions:
  • Where fitting, harmonize
  • Otherwise differentiate
• Complement the family definition by adding the functionality of the family
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Advantages of proposed approach

Advantages

- When the family reference vehicles are known it can easily be checked if a vehicle can be member of this family or not
- Vehicles with technologies not yet known can be assigned to the family when fulfilling the family functionality
- Both the functionality of the family as well as the justification for a family membership are transparent
Proposal for amendment: Example: Road load family

<table>
<thead>
<tr>
<th>Family name</th>
<th>Road load family</th>
</tr>
</thead>
</table>
| **Functionality** | • The road load parameters of any member of the road load family shall be determinable by linear interpolation between two reference vehicles in such a way that the cycle energy derived from the interpolated road load parameters is expected to be equal or higher than the actual cycle energy of the respective vehicle.  
• If tested, the ratio of the cycle energy derived from the interpolated road load parameters and the actual cycle energy of the respective vehicle shall be ≥ [0.xx] |

<table>
<thead>
<tr>
<th>The family functionality is considered fulfilled if at least the following characteristics meet the matching requirements</th>
<th>Characteristics*</th>
<th>Matching requirement*</th>
</tr>
</thead>
</table>
| • Transmission type and model  
• n/v ratios  
• Number of powered axles  
• Electrical machines | • Same or lower power losses  
• delta n/v to most commonly installed transmission is ≤ 25 % for all transmission ratios  
• Identical  
• Identical... |

• Vehicles with technologies not covered by the list above can be grouped in the family if the manufacturer can demonstrate that the vehicle fulfills the family functionality

* As currently used in the regulation. Harmonization and detailed definitions of the terms required.
Proposal for amendment:

Status

Proposal was presented to Annex 4 Task Force on Sept 6\textsuperscript{th} 2017

It was decided to bring the following request to IWG

Request to Informal Working Group

- Approve the proposed approach for the GTR in principle
- Confirm that the detailed proposals for each family should be reviewed and refined by experts
Other observed issues

Differences in GTR15 and EC 2017/1151 (EU-WLTP)

- Criteria emissions of interpolation family:
  - GTR15 – ICE: Arithmetic average of vehicle L and H (OR can be omitted)
  - GTR15 – HEV’s: Maximum value of vehicle L and H (and M if applicable)
  - EU-WLTP – ICE/HEV: Maximum value of vehicle L and H

- Interpolation and vehicle classes:
  - GTR15: Vehicles may belong to different vehicle classes
  - EU-WLTP: Vehicles must belong to same vehicle class
Thank you very much for your attention!

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