Research on M3 sub-categories of R51-03
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M3 category in China with new energy

- Totally 491,709 buses and coaches sold in year 2016.
  - Mainly contain M2 and M3 categories.
  - Within which, nearly 123,000 belong to new energy vehicles, which take nearly 25% percent.
  - Within which, nearly 172,000 belongs to M3 categories.

*Data from: <Automotive Information>, www.autoinfo.org.cn

- Example: Tianjin City
  - Planned to purchase 1000 buses and coaches from 2013 to 2016, within which more than 40% are EV, Hybrid, LNG & CNG, and totally have more than 10,000 buses and coaches.
  - More than 1846 EV buses and coaches are purchased from 2012 and is running now.

*Data from: www.tjbus.com, www.tj.xinhuanet.com
An example of M3 category EV

<table>
<thead>
<tr>
<th>Kerb mass</th>
<th>12445kg</th>
<th>Front axle</th>
<th>4340kg</th>
<th>Rear axle</th>
<th>8105kg</th>
<th>Test mass</th>
<th>12550kg</th>
<th>Length</th>
<th>12000mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross vehicle mass</td>
<td>19000kg</td>
<td>Front axle</td>
<td>7000kg</td>
<td>Rear axle</td>
<td>12000kg</td>
<td>Payload</td>
<td>0</td>
<td>Locked or non</td>
<td>Non-locked</td>
</tr>
</tbody>
</table>

![dB(A) vs. km/h graph]

- 75.1-80.9 dB(A)
- Acceleration
- Cruise
- Coast down
Problems for new technology

| Rated power | 124 | Rated power (Motor) | 110 | Peak power (Motor) | 220 | Torque | 3000 N.m | S | 1250rpm |

1. The rated engine power of EV and hybrid buses are always half of diesel engine.
2. The acceleration of EV is always higher than the diesel engine during the test, even the rated engine power of diesel engine is higher.

This bus belongs to the sub-category with P_n no more than 150kW, so:
1. 1.76dB(A) from 2016;
2. 2.74 dB(A) from 2020;
3. 3.73 dB(A) from 2020.
## Existing problems (diesel engine)

<table>
<thead>
<tr>
<th>Vehicle category</th>
<th>Vehicles used for the carriage of passengers</th>
<th>Limit Values (dB(A))</th>
<th>Length</th>
<th>$P_n$</th>
<th>GVM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Phase 1</td>
<td>Phase 2</td>
<td>Phase 3</td>
<td></td>
</tr>
<tr>
<td>$M_1$</td>
<td>PMR $\leq$ 120</td>
<td>72</td>
<td>70</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td></td>
<td>120 $&lt;$ PMR $\leq$ 160</td>
<td>73</td>
<td>71</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PMR $&gt; 160$</td>
<td>75</td>
<td>73</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PMR $&gt; 200$, no. of seats $\leq 4$, R-point</td>
<td>75</td>
<td>74</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td></td>
<td>height $&lt; 450$mm from the ground</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$M_2$</td>
<td>$M \leq$ 2.5 t</td>
<td>72</td>
<td>70</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.5 t $&lt;$ $M \leq$ 3.5 t</td>
<td>74</td>
<td>72</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$M &gt; 3.5$ t; $P_n \leq 135$ kW</td>
<td>75</td>
<td>73</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$M &gt; 3.5$ t; $P_n &gt; 135$ kW</td>
<td>75</td>
<td>74</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$P_n \leq 150$ kW</td>
<td>76</td>
<td>74</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>$M_3$</td>
<td>$150$ kW $&lt;$ $P_n \leq 250$ kW</td>
<td>78</td>
<td>77</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$P_n &gt; 250$ kW</td>
<td>80</td>
<td>78</td>
<td>77</td>
<td></td>
</tr>
</tbody>
</table>

Products parameters of China M3

There will still be problems with the sub-categories level of rated engine power, even we only consider the traditional buses and coaches.

*See details: GRB-64-24 - (China) Implementation of the 03 series of amendments to Regulation No. 51 in China*
1. We are making limit value for M3 buses and coaches, but not for diesel engine with certain exhaust level only.
2. The test engine speed percentage and sub-categories based on the rated power of diesel engines will always meet problems for other engine types.
Suggestions

● Add some new vehicle sub-categories.
  - Set different rated engine power sub-categories for gasoline, EV, Hybrid, LNG & CNG.

● Use some new definition for engine power
  - Do not use the rated engine power for EV, but use the peak power.

● Not only use the engine power but also use complete vehicle parameters for sub-categories
  - If the engine power can not cover all situation of M3 categories, some other stable parameters of complete vehicle can also be considered together.

● Build up new regulation for new technology
  - Build up new regulation systems for EV separately, with considering pass-by noise, high frequency noise, QRTV, ASEP......
Thanks for your attention

Web site: www.catarc.org.cn