vibration-test for RESS

1. quantification the load of different vibration profiles with a test specimen

2. proposal for a test-profil
evaluated profiles for vibration test

- vibration signal of a car on proving ground (example)
- random vibration ISO 12405 vertical
- 8g-Sweep UN 38.3
- 2g-Sweep proposal

Strain gage
Load direction
The vibration shall be a sinusoidal waveform with a logarithmic sweep between 7 Hz and 200 Hz and back to 7 Hz traversed in 15 minutes. This cycle shall be repeated 12 times for a total of 3 hours for each of three mutually perpendicular mounting positions of the RESS.

**UN 38.3 8g-sweep**

from 7 Hz to a peak acceleration of 1 gn is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 8 gn occurs (approximately 50 Hz). A peak acceleration of 8 gn is then maintained until the frequency is increased to 200 Hz.

**Proposal 2g-sweep**

from 7 Hz to a peak acceleration of 1 gn is maintained until 18 Hz is reached. The amplitude is then maintained at 0.8 mm (1.6 mm total excursion) and the frequency increased until a peak acceleration of 2 gn occurs (approximately 25 Hz). A peak acceleration of 2 gn is then maintained until the frequency is increased to 200 Hz.
power spectral density (PSD) of test-profiles

vibrationsignal from proving-ground (example)
random vibration ISO12405 vertical
8g-sweep UN38.3
2g-sweep proposal
load of test specimen

- vibrationsignal from proving-ground (example)
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**max. strain on test specimen**

- Measuring point 15Hz
- Measuring point 30Hz
- Measuring point 75Hz

![Graph showing max. strain on test specimen](image-url)
load of test specimen

-relative fatigue damage on test specimen, relative to vibration signal from proving-ground

extrapolated to target

measuring point 15Hz
measuring point 30Hz
measuring point 75Hz

vibration signal from proving-ground (example)
random vibration ISO12405 vertical
8g-sweep UN38.3
2g-sweep proposal
measured accelerations, power spectral density

range of measured accelerations (vertical) on car body, approx. 50 different cars

- micro compact car
- luxury sedan
- roadster
- SUV
- ...
measured accelerations
frequency spectrum FFT

- no significant response upwards 50 Hz
- highest peaks for micro compact car
RESS vibration test proposal

- maximum acceleration $10\text{m/s}^2$ (1g), maximum frequency 50 Hz
- sinusoidal waveform with a logarithmic sweep

<table>
<thead>
<tr>
<th>frequency [Hz]</th>
<th>acceleration [g]</th>
<th>acceleration [m/s$^2$]</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 - 18</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>18 - 30</td>
<td>0.5</td>
<td>5</td>
</tr>
<tr>
<td>30 - 50</td>
<td>0.2</td>
<td>2</td>
</tr>
</tbody>
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At the request of the manufacturer, a higher acceleration level as well as a higher maximum frequency can be conducted. In the case of a higher maximum frequency, the lowest frequency can be greater than 5 Hz, but shall not exceed 10% of the highest frequency.

At the request of the manufacturer a test profile determined by the vehicle manufacturer, verified to the vehicle application and agreed by the Technical Service can be used as a substitute of the frequency - acceleration correlation of the proposal.