

# EVS-GTR vibration load proposal

EVS-GTR 16th

China

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## EVS GTR No.20 vibration test—Derive from UN38.3 is unreasonable logic

(From Addendum 20: Global Technical Regulation No. 20, para.130/132 )

130. The purpose of this test is to verify the safety performance of the REESS under a vibration environment which the REESS would likely experience **during the normal operation of the vehicle.**

**Vibration profile should come from vehicle measurement data during its normal operation.**

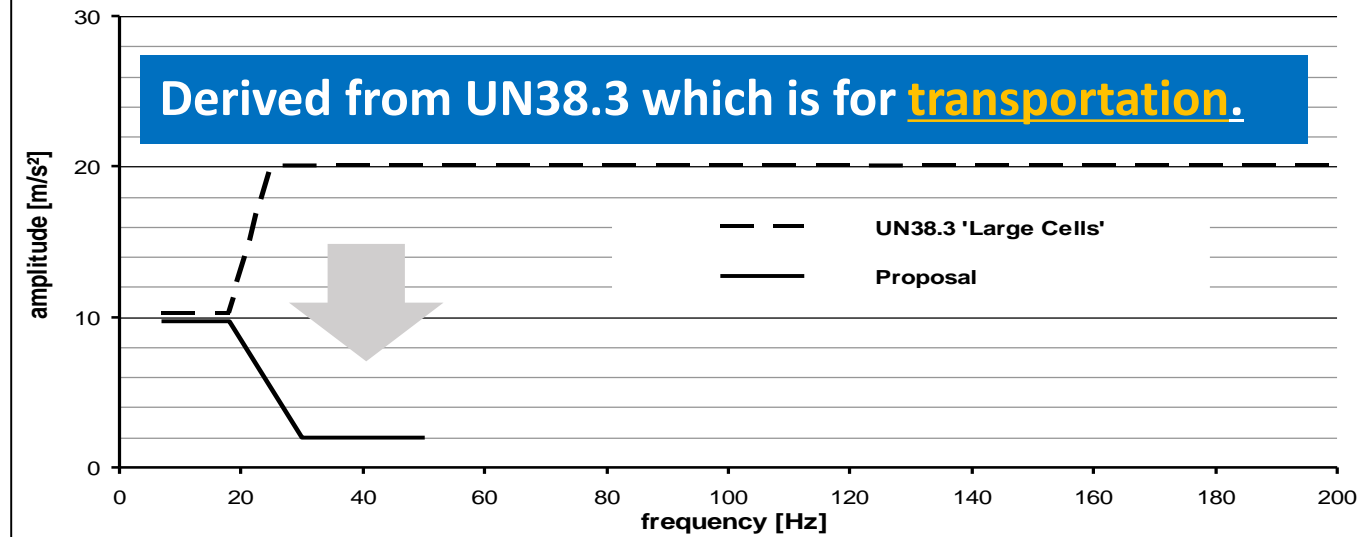
131. A vibration load spectrum for lithium cells and batteries including lithium ion cells/batteries and lithium polymer cells/batteries is already defined as a **type approval test** procedure of dangerous goods of class 9 in the Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, paragraph **38.3.4.3. (Test T3: Vibration)**, with an amplitude sweep ranging from 7 Hz to 200 Hz.

132. As Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria sign-off **may often also be mandatory for types of REESS** (such as lithium metal batteries, lithium ion batteries and lithium polymer batteries) subject to this regulation, having the opportunity to cover this test with test T3, **is seen as an efficient approach.**

**Vibration profile should be derived from UN38.3 which is to simulate the load during its transportation.**

# EVS GTR No.20 vibration test—Derive from UN38.3 is unreasonable logic

amplitude sweep (sinusoidal waveform)



To sum up, for saving test resources, in order to be covered by UN38.3, current profile is not from real vehicle measurement data, while it is derived from UN38.3, a transportation regulation. UN38.3 is to simulate transportation working load, not for normal operation. So it is **totally conflicted with the original purpose.** **So this logic should be changed**

*NHTSA rationalised that the random vibration profile proposed by the U.S. instead of the sine vibration profile is more representative of the vibrations experienced by the REESS in real life*

*EVS-08-29e : Draft Meeting Minutes of the 8th Meeting of the Informal Group on Electrical Vehicle Safety - Global Technical Regulation*

**During the 8<sup>th</sup> meeting in Washington DC, this problem have already been proposed by NHTSA, and in the 10<sup>th</sup> meeting in Tokyo, according to its meeting minute: The current vibration profile is acceptable for Phase 1. The profile will be re-visited in Phase 2.**

# **EVS GTR No.20 vibration load spectrum—Several unreasonable aspects**

➤ **UN38.3 is a regulation for battery transportation not for normal operation**

The purpose of EVS GTR is to **verify the safety performance of vehicle during normal operation**. While UN38.3 is for battery transportation, which does not match the purpose of EVS GTR at all.

➤ **Load curve should be derived from measured data**

In order to be covered by UN38.3, load curve is also derived from UN38.3 without any measured data. So we don't have any measured data to support the relationship of EV's real-life application and load curve in EVS GTR No.20.

➤ **Random vibration profile is more reasonable than sinus sweep vibration profile for EVS GTR No.20**

Typically, sinus sweep vibration profiles are used to simulate vibration load caused by periodic motion, for example combustion, while random vibration profiles are used to simulate the load stimulated from road surfaces. So, **random vibration profile** is closer to the operational load of EV battery and should be adopted in EVS GTR No.20.

➤ **Except for the Z direction, vibration load from X and Y direction should not be ignored**

From measured data, we found that vibration loads in x and y directions are almost 80% of the loads in z direction, which should not be ignored

# Comparison among EVS GTR No.20, ISO 6469-1(DIS) and new GB

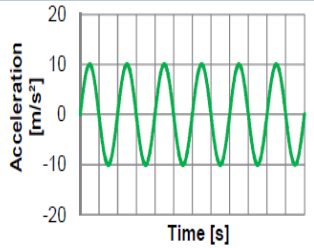
	<b>EVS GTR No.20</b>	<b>ISO 6469-1 DIS</b>	<b>New GB</b>	<b>Remark</b>
<b>Type of vibration load</b>	Sinus weep, <b>Derived from UN38.3</b>	Random vibration PSD	Random vibration PSD	<b>Random vibration is closer to the practical application of EVs and should be used in EVS-GTR.</b>
<b>Directions</b>	Z <b>Derived from UN38.3</b>	Z,Y,X	Z,Y,X	<b>Vibration from three directions should be considered.</b>
<b>Amplitude of load</b>	No obvious evidence	From measured data	From measured data	<b>Should be derived from vehicle measured data</b>
<b>Profile corner points</b>	18 Hz <b>Derived from UN38.3</b>	From measured data	From measured data	<b>Should be derived from vehicle measured data</b>
<b>Duration</b>	3 hours, <b>Derived from UN38.3</b>	12 hours	12 hours	<b>The duration of test should be derived based on miner's rule and equivalent damage principle</b>
<b>Classification of vehicle</b>	No classification	No classification	Passenger, commercial	<b>Different loads among various vehicle categories should be considered.</b>

## Comment:

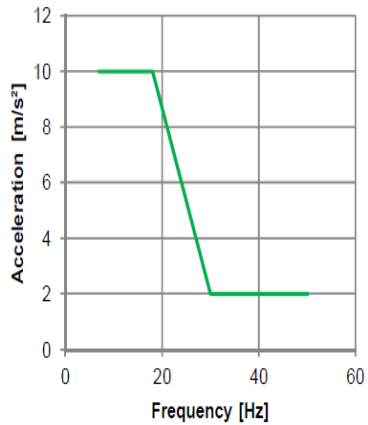
EVS GTR No.20 Should refer to the methods, experience and data from ISO 6469-1 and new GB. They have same methodology: collecting data from vehicles, using random vibration profile, test procedures with three directions and 12 hours.

# Comparison among EVS GTR No.20, ISO 6469-1(DIS) and new GB

## EVS-GTR No.20 /ECE R100

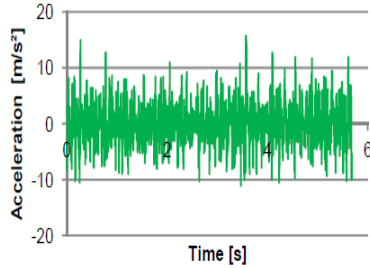


Sinus sweep

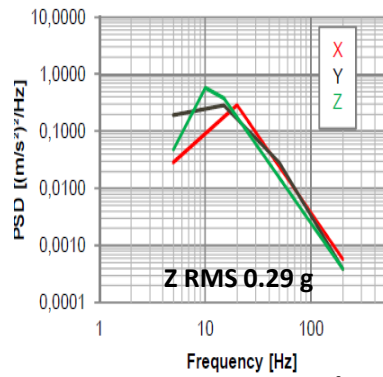


Duration: 3 h  
Direction: Z

## ISO 6469-1 DIS

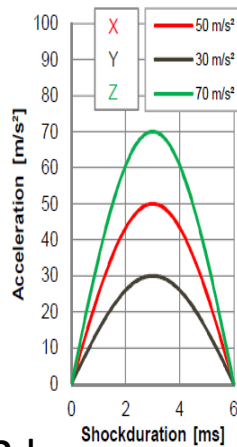


Noise

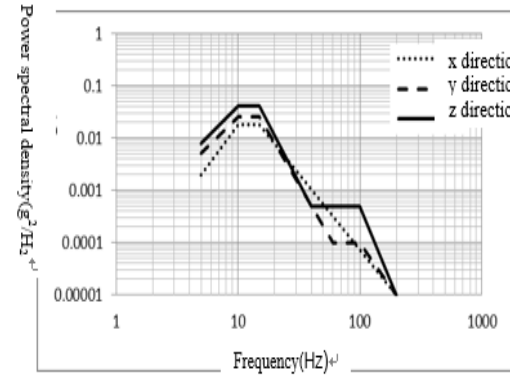


Duration: 12 h  
Direction: Z,X,Y

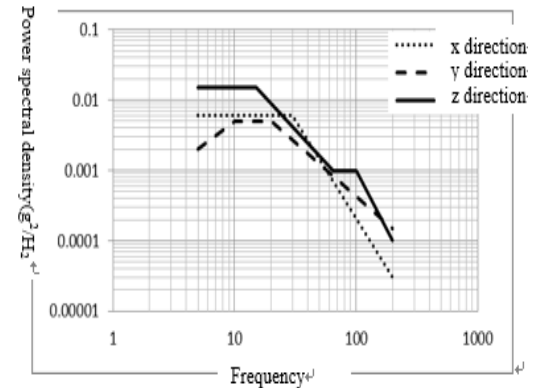
Mechanical shock



## New GB



Commercial vehicle



Passenger car

Random						
Directions	Z-axis		Y-axis		X-axis	
Vehicle category	Passenger car	Commercial vehicle	Passenger car	Commercial vehicle	Passenger car	Commercial vehicle
RMS	0.64 g	0.73 g	0.45 g	0.57 g	0.50 g	0.52 g
Time	12 h	12 h	12 h	12 h	12 h	12 h
Constant Frequency						
Amplitude	±1.5 g	±1.5 g	±1.0 g	±1.5 g	±1.0 g	±2.0 g
Frequency	24 Hz	20 Hz	24 Hz	20 Hz	24 Hz	20 Hz
Time	1h	2 h	1h	2 h	1h	2 h

Direction: Z,X,Y

# **Proposal for vibration test of EVS GTR No.20**



Proposal

## **To sum up:**

- **EVS GTR vibration profile's purpose is to simulate vehicle normal operation;**
- **EVS GTR vibration profile should be created from real measurement data, instead of being derived from UN38.3;**
- **Two versions of vibration profile (new GB and ISO6469-1) are both coming from real measurement data;**
- **New GB and ISO 6469-1 mainly have the same logic and methodology;**
- **China propose new GB as a proposal for next EVS GTR vibration profile;**



**Thanks for your attention!**