

Introduction

The standard ISO 20283-5 (formerly ISO 6954) provides guidelines for the measurement, reporting and evaluation of vibration with regard to habitability on passenger and merchant ships. It is applicable for all rooms where persons may stay.

The evaluation of low frequency vibration leading to kinetosis is not covered by this standard.

ISO 20283-5 refers to ISO 8041 for human vibration meters and ISO 2631-1/-2 for whole-body vibration measurement.

The human vibration meter VM31 in combination with the triaxial accelerometer KS823B is suitable for this type of measurement.



Measuring Method

Measuring locations need to be selected in sufficient numbers on all decks where persons may stay.

The measurement is performed in three axes.

First measurements should be made preferably during acceptance inspection of the ship.

Precondition for the collection of comparable measuring values are uniform conditions:

- Clear run and straight course
- Constant typical propulsion power
- Sea state not more than 3
- Propeller completely under water
- Depth of water at least five times the draft of the ship

On each deck at least two triaxial measurements (X / Y / Z) have to be made. For additional measuring locations it is sufficient to measure only vertically (Z).

All three axes are weighted by the combined filter W_m to ISO 2631-2 (Figure 1). The frequency range of interest is 1 to 80 Hz.

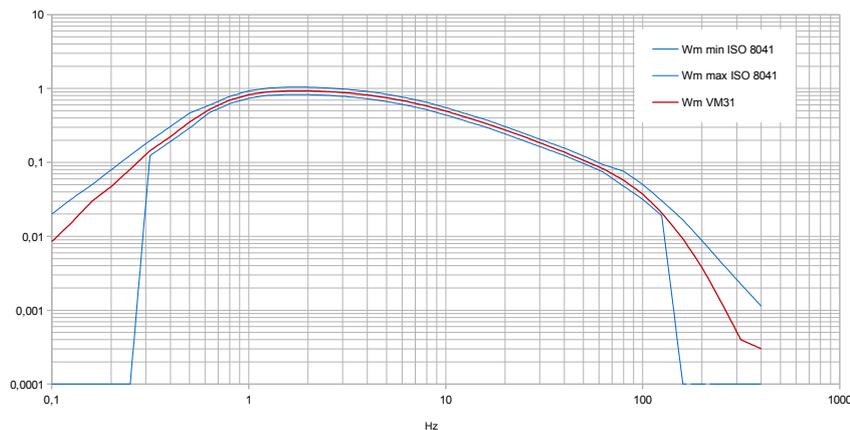


Figure 1: Frequency response of the weighting filter W_m

For evaluation the interval RMS value of vibration acceleration, integrated over the entire measuring time, is used.

The minimum measuring time is 1 Minute. At dominant frequencies below 2 Hz the measuring time should be at least 2 minutes.

The highest one of the three axis values is used for evaluation.

Evaluation

The following table shows guideline values of acceptable vibration according to ISO 20283-5 measured as acceleration with weighting filter Wm. A restricted number of measurements may exceed the guideline values. The table also includes their maximum percentage and exceedance.

Type of occupied space	Guideline value	Max. ratio of measurements exceeding	Max. exceedance
<i>Crew spaces</i>			
Crew accommodation	0.125 m/s ²	10 %	0.036 m/s ² (0.018 m/s ²)*
Work spaces	0.214 m/s ²		
Offices	0.161 m/s ²		
Open-deck recreation spaces	0.161 m/s ²		
Navigation bridge and engine control room	0.179 m/s ²	no exceedance allowed	
<i>Passenger spaces</i>			
Cabins and public spaces	0.125 m/s ²	10 %	0.036 m/s ² (0.018 m/s ²)*
Open-deck recreation spaces	0.161 m/s ²		

* The shown exceedance is applicable for at least 10 measurements in the same type of occupied space. If only 5 to 9 measurements are taken a maximum exceedance of 0.018 m/s² is allowed for one location only. No exceedance is granted for Navigation bridge and engine control room.



Figure 2: Vibration meter VM31

Measurement with the VM31

The vibration meter VM31 (Figure 2) in combination with the triaxial accelerometer KS823B (Figure 3) is well suited for the measurement of ship vibration.

Vibration measurement to ISO 20283-5 is performed as follows:

1. Switch on the instrument by pressing ON/OFF.
2. If not done before, connect the sensor now. It will be detected as “No TEDS”¹ transducer. You will be prompted to enter the sensitivities for the directions X/Y/Z successively. The digits are changed by the arrow keys. The decimal point can be moved by key F1. This is only necessary after connecting the sensor. Later you may check the entered sensitivities in the menu “Device settings” / “Sensor calibration”.
3. Open the main menu by key F3 and select “Measuring mode” / “Human vibration” / “Whole-body ISO 2631” / “Comfort” / “Building”. The instrument shows the selected weighting filters (Wm) and the multiplying factors (1.0) for some seconds. Now the VM31 is ready for ship vibration measurement. These settings will be loaded automatically when you switch on the instrument next time.
4. Place the sensor and start a measurement by pressing the ► key (reset). The results are valid when the measurement timer in the upper right corner changes from red to white color after 1 minute.
5. Relevant for evaluation is the highest one of the three axis values X/Y/Z.
6. Measurements can be saved by pressing the key ▼.
7. For a deeper examination of the vibration you may use “Frequency analysis” from the main menu.



Figure 3: KS823B



Figure 4: Tripod floor plate Mod. 729

Useful accessories for the measurement of ship vibration may be the tripod floor plate Model 729 (Figure 4) and the magnetic base Model 508.

Verification of the Instrument

According to ISO 20283-520283-5 the instrument should be checked before and after each measurement. This can be done in an efficient way by the vibration calibrator VC21 from Metra (Figure 5). It supplies two vibration signals in the Wm filter range at 15.92 Hz and 40 Hz.

At least after two years a re-calibration should be performed. It can be done by specialized calibration labs or by the manufacturer.

Please read also the VM31 instruction manual.



Figure 5: Vibration calibrator VC21

¹ TEDS = Transducer Electronic Data Sheet
 Manfred Weber