

Guidelines for Overall Evaluation of Vibration in Accommodation Part of Merchant Ships

1. Scope

This Japanese Industrial Standard specifies the guidelines for overall evaluation of vibration in the accommodation space of merchant ships in the sea trial condition.

- Remarks:**
1. This standard is not intended to specify standards for the acceptance tests and inspection of machinery and equipment for marine use.
 2. Ships considered in this standard are merchant ships with a length of 100 m or more irrespective of the type of propulsion machinery.
The applicable frequency range shall be within 1 ~ 100 Hz.
 3. This standard gives guidelines for relative evaluation of vibration, and does not specify permissible values.

2. Definitions

For the purpose of this standard, the following definitions apply in addition to those specified in **JIS B 0153** and **JIS F 0012**:

- (1) **Peak value** The maximum value from among plural amplitudes (acceleration, velocity or displacement) obtained for each frequency component through frequency analyses.
- (2) **Narrow band analysis** Frequency analysis using analyzing equipment with a narrow band width.

3. Measuring Methods for the Evaluation of Vibration

3.1 Measuring Conditions Measuring conditions shall be as follows:

- (1) **Ship's conditions** A ship running straight in sea trials on a calm water, which is either in ballast or in a full load condition.
- (2) **Operating condition of machinery** Propulsion machinery running at its rated normal output with essential auxiliary machinery for propulsion and miscellaneous other equipment which is used continuously in ordinary navigation operated normally. Equipment which is used on an intermittent mode of operation should preferably be kept out of operation when measurements of vibration are being taken.

3.2 Measuring Instruments For vibration measurements, well calibrated analogue instruments of known measuring accuracy, whose outputs proportional to acceleration, velocity or displacement are linear within the range of frequencies to be measured for evaluation.

3.3 Measuring Points and Procedure Measurements of vibration should preferably be taken in vertical, longitudinal and transverse directions at spaces normally occupied by crew members (wheel room, living quarters, dining room, engine control room, etc.).

3.4 Vibration Measurements and Presentation of Measured Values The measurements of vibration and presentation of measured values shall be as follows:

- (1) **Measurements** It is recommended that measurements be taken for at least 30 seconds, preferably for approximately one minute.
- (2) **Presentation of measured values** The presentation of measured values shall be made by the peak values of each frequency component obtained through frequency analyses. When measurements are taken using a frequency analyzer, narrow band analyses shall be carried out, in which the measuring period of processed data shall be limited to 2 to 4 seconds for the entire measuring period (approximately one minute).

4. Standard for Evaluating Vibration

The evaluation standard nomogram for hull vibration shall be as shown in **Figure**.

If there are vertical, longitudinal and transverse vibration existing concurrently depending on the ship's condition when vibration measurements are taken, the nomogram in **Figure** shall be applied individually for evaluation to respective vibration components in each direction.

The three regions shown in Figure represent, in the ascending order, the “environment of hull vibration which is highly likely to cause complaints for living comfort”, “environment of hull vibration which is normally experienced and is acceptable”, and “environment of hull vibration which is least likely to cause complaints for living comfort.”

Remark: In this nomogram, the presentation of the intensity of vibration is made in terms of vibration velocity (V), in which the relationship between displacement (D) and acceleration (A) is expressed by the following equation using a parameter of frequency (f):

$$V = 2\pi f D = \frac{A}{2\pi f}$$

where

V : vibration velocity (mm/s)

f : frequency (Hz)

D : displacement (mm)

A : acceleration (mm/s²)

Even in cases where the measured value involves displacements or acceleration, it is therefore possible that evaluation of vibration is made by using this equation converting them into velocity, or direct evaluation of vibration is made by using the nomogram shown in the figure, in which displacements are evaluated by the right-hand up diagram, and accelerations by the right-hand down diagram.

Reference Standards:

JIS B 0153 — Glossary of Terms Used in Mechanical Vibration and Shock.

JIS F 0012 — Glossary of Terms for Shipbuilding (Hull Part-Construction)

Related Standards:

JIS F 0905 — Measurement of Noise Level on Board Vessels (Accommodation Part)

JIS F 0906 — Allowable Value of Vibration for Ships Machinery

ISO 2631/1 — Evaluation of human exposure to whole-body vibration — Part 1: General requirements

ISO 4867 — Code for the measurement and reporting of shipboard vibration data

ISO 4868 — Code for the measurement and reporting of local vibration data of ship structures and equipment

ISO 6954 — Mechanical vibration and shock — Guidelines for the overall evaluation of vibration in merchant ships