International Standard 6954

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

Vibrations et chocs mécaniques — Principes directeurs pour l'évaluation globale des vibrations à bord des navires de commerce

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 6954 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration and shock*.

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

0 Introduction

Shipboard vibration is considered objectionable when it results in excessive stresses in structural or mechanical components, adversely affects the reliability or maintainability of machines or equipment installed aboard ships or results in interference with crew duties or reduced comfort to the crew.

The need exists for a set of guidelines for the overall evaluation of merchant ships based on hull vibration. This International Standard reflects the current technology (what is representative of the hull vibration performance of similar ship types) giving due regard to the overall acceptability judgments available based on technical as well as human performance/discomfort criteria.

These guidelines apply to the overall evaluation of the vibration of ship structures. Evaluation of vibration exposure specifically with respect to human safety, performance capability and comfort experienced by crew members should be based on vibration measurements specified in ISO 2631/1 (see the annex).

1 Scope and field of application

This International Standard specifies severities of vibration which may be used as references for the relative evaluation of:

a) hull and superstructure vibration in normally occupied spaces;

b) shipboard vibration data, useful for the development and improvement of hull vibration reference amplitudes.

It is applicable to both turbine and diesel-driven merchant ships of length between perpendiculars 100 m or greater.

It is not intended to establish vibration criteria for acceptance or testing of machinery or equipment.

The applicable frequency range is 1 to 100 Hz.

2 References

ISO 2631/1, *Guide for the 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.*

3 Interim guidelines

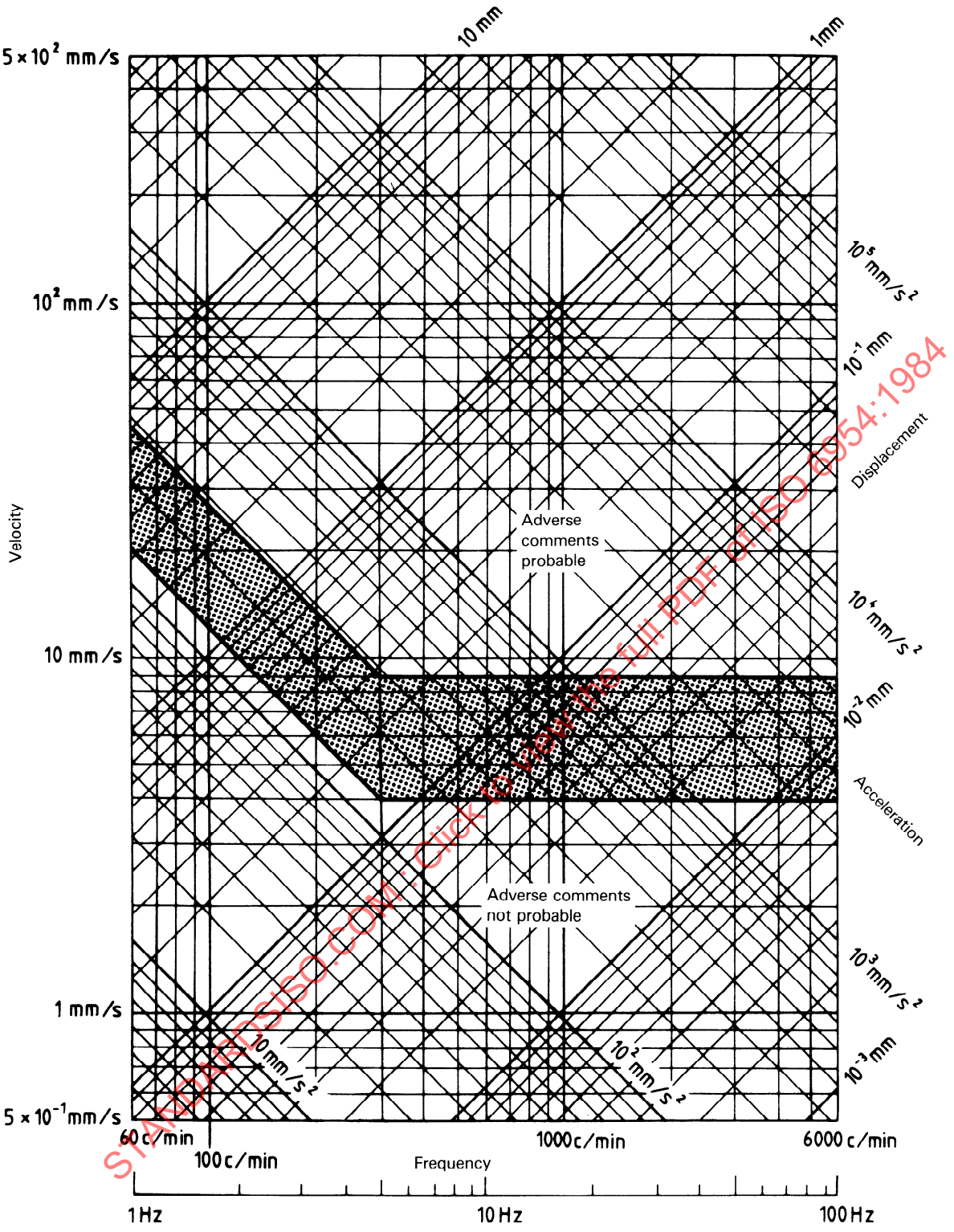
Shipboard vibration data, gathered generally in accordance with the procedures later outlined in ISO 2631/1, ISO 4867 and ISO 4868, are the basis for the overall evaluation curves presented in the figure and given in the table accompanying the figure. The figure reflects the assessment of the limited shipboard vibration data currently available. The ranges outlined constitute a composite with respect to technical as well as human occupancy criteria, and apply to each single frequency component of vertical, fore-and-aft and athwartship vibration which should be assessed separately. The stippled zone reflects the shipboard vibration environment commonly experienced and accepted.

NOTE — The measurement procedures defined in ISO 4867 and ISO 4868 form the basis of the curves shown in the figure and it is intended that this International Standard is interpreted accordingly. However, time averaged r.m.s. values are often measured instead of maximum repetitive values. In such cases, the bandwidth and time-averaging period should be specified and the r.m.s. values converted, by using the conversion equation given below, to the equivalent maximum repetitive values for comparison with the figure. The appropriate conversion factor, C_F, should either be determined by measurement or assumed to have the tentative value $C_F = 1{,}8$.

$$\text{Maximum repetitive value} = (C_F\sqrt{2}) \times \text{r.m.s. value}$$

where

$C_F\sqrt{2}$ is equivalent to the crest factor ($C_F = 1{,}0$ implies pure stationary sinusoidal vibration).



Curve	Frequency range	
	1 to 5 Hz	5 to 100 Hz
Upper	Peak acceleration[1] = 285 mm/s²	Peak velocity[1] = 9 mm/s
Lower	Peak acceleration[1] = 126 mm/s²	Peak velocity[1] = 4 mm/s

Figure — Guidelines for the evaluation of vertical and horizontal vibration in merchant ships (peak values)[1]

1) Peak value is the maximum repetitive value, see ISO 4867.

Annex

Compatibility with ISO 2631/1

Shipboard vibration generally approximates to narrow-band vibration and a crest factor of 2,5 is commonly encountered. In these circumstances, the maximum repetitive vibration is more appropriate than r.m.s. value with regard to evaluation of overall ship vibration.

This International Standard evaluates overall shipboard vibration in terms of maximum repetitive values and, for comparison with r.m.s. values, the crest factor shall be taken into account.

In ISO 2631/1, the effect of vibration on human beings is evaluated by reference to curves of r.m.s. acceleration, taking the evaluation to apply over a wide range of crest factors.

If the vibration value is below the guidelines specified in this International Standard, it will also satisfy the guidelines in ISO 2631/1 with respect to crew exposure to whole-body vibration.

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