इंटरनेट मानक

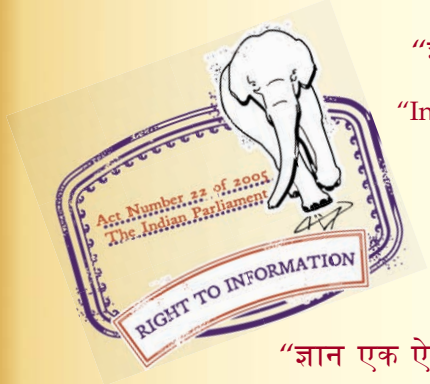
Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS/ISO 6954 (2000): Mechanical vibration - Guidelines for the measurement, reporting and evaluation of vibration with regard to habitability of passenger and merchant ships [MED 28: Mechanical Vibration and Shock]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

IS/ISO 6954 : 2000
(Superseding IS 14733 : 1999)

भारतीय मानक

यॉंत्रिक कंपन — यात्री और व्यापारिक जलपोत पर रहने संबंधी कंपन का मापन, रिपोर्टिंग और मूल्यांकन

Indian Standard

MECHANICAL VIBRATION — GUIDELINES FOR THE MEASUREMENT, REPORTING AND EVALUATION OF VIBRATION WITH REGARD TO HABITABILITY ON PASSENGER AND MERCHANT SHIPS

ICS 17.160; 47.020

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

September 2007

Price Group 4

NATIONAL FOREWORD

This Indian Standard which is identical with ISO 6954 : 2000 'Mechanical vibration — Guidelines for the measurement, reporting and evaluation of vibration with regard to habitability on passenger and merchant ships' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Mechanical Vibration and Shock Sectional Committee and approval of the Mechanical Engineering Division Council.

This standard supersedes IS 14733 : 1999 'Mechanical vibration and shock — Guidelines for the overall evaluation of vibration in merchant ships'.

The text of ISO Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain terminology and conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker in the International Standards, while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their respective places, are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 2631-1 : 1997 Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 1: General requirements	IS 13276 (Part 1) : 2000 Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration: Part 1 General requirements (*first revision*)	Identical
ISO 2631-2 : 2003 Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 2: Vibration in buildings (1 Hz to 80 Hz)	IS/ISO 2631-2 : 2003 Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration: Part 2 Vibration in buildings (1 Hz to 80 Hz)	do
ISO 8041 : 2005 Human response to vibration — Measuring instrumentation	IS/ISO 8041 : 2005 Human response to vibration — Measuring instrumentation	do

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

MECHANICAL VIBRATION — GUIDELINES FOR THE MEASUREMENT, REPORTING AND EVALUATION OF VIBRATION WITH REGARD TO HABITABILITY ON PASSENGER AND MERCHANT SHIPS

1 Scope

This International Standard contains guidelines for the evaluation of vibration with regard to habitability on a passenger or merchant ship, as well as requirements for the instrumentation and the method of measurement in normally occupied spaces.

Assessment of low-frequency ship motion which may result in motion sickness is covered by other International Standards.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 2631-1:1997, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 1: General requirements.*

ISO 2631-2, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 2: Vibration in buildings (1 Hz to 80 Hz).*

ISO 8041, *Human response to vibration — Measuring instrumentation.*

3 Instrumentation

3.1 General requirements

Measurements in accordance with this International Standard may be carried out using different types of measuring and recording equipment, e.g. instruments of analog, digital, spectral or time-based type. The measuring instrumentation shall meet the requirements of ISO 8041.

It is acceptable to use instruments manufactured in accordance with ISO 8041 that have frequency indications above 80 Hz provided that the filter characteristics comply with ISO 2631-2 (see annex A).

The compliance of the instrumentation system with the requirements of ISO 8041 shall be verified at least every second year. The date of the last verification shall be recorded.

3.2 Calibration

Each channel of the instrumentation shall be checked after installation to ensure proper functioning. Calibration of the instrumentation shall be checked before and after the measurements.

4 Measurement location and direction

4.1 Transducer locations

Transducer locations shall be selected on the decks of occupied spaces in sufficient quantity in order to characterize satisfactorily the vibration of the ship with respect to habitability.

4.2 Transducer orientation

The transducer orientation shall correspond to the three translational axes of the ship: longitudinal, transversal and vertical.

5 Measurement conditions

Measurement data shall be obtained, in the first instance, during the acceptance or performance trial of the ship. The collection of consistent and accurate vibration data requires the following uniform and favourable measurement conditions:

a) free-route test on a straight course;[1)]

b) constant representative engine output;

c) sea state 3 or less;

d) full immersion of the propeller;

e) water depth not less than five times the draught of the ship.

Any deviation from the above measurement conditions shall be clearly stated in the test report.

6 Measurement procedure

Measurements are required in all three directions at a minimum of two locations on each deck. At other locations, measurements are only required in the vertical direction.

The combined frequency weighting curve according to ISO 2631-2 shall be applied to all measurements irrespective of their direction.

NOTE One-third-octave band values of the combined frequency weighting curve and a graphical presentation are given in annex A for information.

The frequency range to be evaluated is 1 Hz to 80 Hz.

The measurement duration shall be at least 1 min. If significant frequency components exist in the range below 2 Hz, a measurement duration of at least 2 min is required.

The result of each measurement shall be the overall frequency-weighted r.m.s. value as defined for acceleration in ISO 2631-1:1997, 6.4.2. A similar procedure is applicable for the frequency weighting of velocity spectra. The highest value in any direction shall be used for the evaluation of habitability, using the guidance given in clause 7.

If further data analysis is required following the measurement analysis as described above, the measurement data should be recorded with an electronic system which produces permanent records, e.g. on magnetic tape or computer disk.

---

1) Free route is the condition maintained when the ship is proceeding at constant speed and course with rudder angles restricted to less than 2° port and 2° starboard.

7 Evaluation of habitability

It is recommended that the classification to be applied to the various areas of a ship be agreed between the interested parties (e.g. shipbuilder and shipowner) prior to any assessment of the habitability.

Table 1 contains guidelines for the values above which adverse comments are probable, and values below which adverse comments are not probable. The values are expressed in terms of the overall frequency-weighted r.m.s. acceleration (mm/s^2) and overall frequency-weighted r.m.s. velocity (mm/s) in the range 1 Hz to 80 Hz. The human sensitivity curve on which the frequency-weighting curves are based is shown for deeper understanding in annex B.

Table 1 — Overall frequency-weighted r.m.s. values from 1 Hz to 80 Hz given as guidelines for the habitability of different areas on a ship

	Area classification					
	A		B		C	
	mm/s^2	mm/s	mm/s^2	mm/s	mm/s^2	mm/s
Values above which adverse comments are probable	143	4	214	6	286	8
Values below which adverse comments are not probable	71,5	2	107	3	143	4
NOTE The zone between upper and lower values reflects the shipboard vibration environment commonly experienced and accepted.						

Three different classification areas are presented:

— Classification A;

— Classification B;

— Classification C.

NOTE For guidance, Classification A can be passenger cabins, Classification B crew accommodation areas, and Classification C working areas.

8 Test report

The test report shall, as a minimum, contain the following information and data:

a) reference to this International Standard;

b) place and date of the test; identification of persons and organizations performing the test;

c) principal ship design characteristics;

d) actual conditions of ship and environment experienced during the test;

e) locations and orientations of the transducers;

f) recording equipment and calibration procedure;

g) results of the measurements.

An example of a report is shown in annex C.

Annex A
(informative)

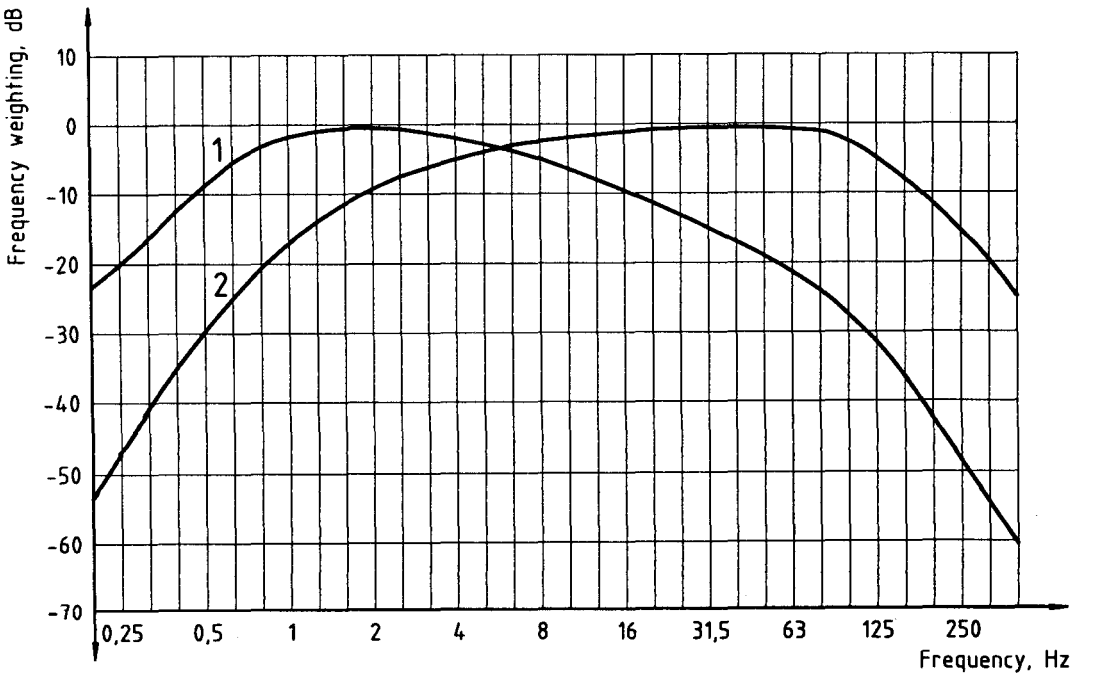
Frequency-weighting curves

The frequency weighting to be used is the combined frequency weighting as defined in ISO 2631-2. It is given in Table A.1 and shown schematically in Figure A.1.

Table A.1 — Combined frequency weighting, defined from 1 Hz to 80 Hz, in one-third-octave bands (calculated using the true mid-frequencies, band limitation included)

Frequency band number[a]	Frequency		Acceleration as input quantity		Velocity as input quantity	
	Hz					
x	Nominal	True	Factor W_a	dB	Factor W_v	dB
−7	0,2	0,1995	0,0629	−24,02	0,00221	−53,12
−6	0,25	0,2512	0,0994	−20,05	0,00439	−47,14
−5	0,315	0,3162	0,156	−16,12	0,00870	−41,21
−4	0,4	0,3981	0,243	−12,29	0,0170	−35,38
−3	0,5	0,5012	0,368	−8,67	0,0325	−29,77
−2	0,63	0,6310	0,530	−5,51	0,0589	−24,60
−1	0,8	0,7943	0,700	−3,09	0,0979	−20,19
0	1	1,000	0,833	−1,59	0,147	−16,68
1	1,25	1,259	0,907	−0,85	0,201	−13,94
2	1,6	1,585	0,934	−0,59	0,260	−11,68
3	2	1,995	0,932	−0,61	0,327	−9,71
4	2,5	2,512	0,910	−0,82	0,402	−7,91
5	3,15	3,162	0,872	−1,19	0,485	−6,28
6	4	3,981	0,818	−1,74	0,573	−4,83
7	5	5,012	0,750	−2,50	0,661	−3,59
8	6,3	6,310	0,669	−3,49	0,743	−2,58
9	8	7,943	0,582	−4,70	0,813	−1,80
10	10	10,00	0,494	−6,12	0,869	−1,22
11	12,5	12,59	0,411	−7,71	0,911	−0,81
12	16	15,85	0,337	−9,44	0,941	−0,53
13	20	19,95	0,274	−11,25	0,961	−0,35
14	25	25,12	0,220	−13,14	0,973	−0,23
15	31,5	31,62	0,176	−15,09	0,979	−0,18
16	40	39,81	0,140	−17,10	0,978	−0,20
17	50	50,12	0,109	−19,23	0,964	−0,32
18	63	63,10	0,0834	−21,58	0,925	−0,67
19	80	79,43	0,0604	−24,38	0,844	−1,48
20	100	100,0	0,0401	−27,93	0,706	−3,02
21	125	125,9	0,0241	−32,37	0,533	−5,46
22	160	158,5	0,0133	−37,55	0,370	−8,64
23	200	199,5	0,00694	−43,18	0,244	−12,27
24	250	251,2	0,00354	−49,02	0,156	−16,11
25	315	316,2	0,00179	−54,95	0,0995	−20,04
26	400	398,1	0,000899	−60,92	0,0630	−24,02

[a] Index x is the frequency band number according to IEC 61260.



Key

1 Based on acceleration as input quantity

2 Based on velocity as input quantity

Figure A.1 — Combined frequency-weighting curves, band limitation included (schematic)

Annex B
(informative)

Human sensitivity curve

The human sensitivity curve on which the frequency-weighting curves are based is shown in Figure B.1.

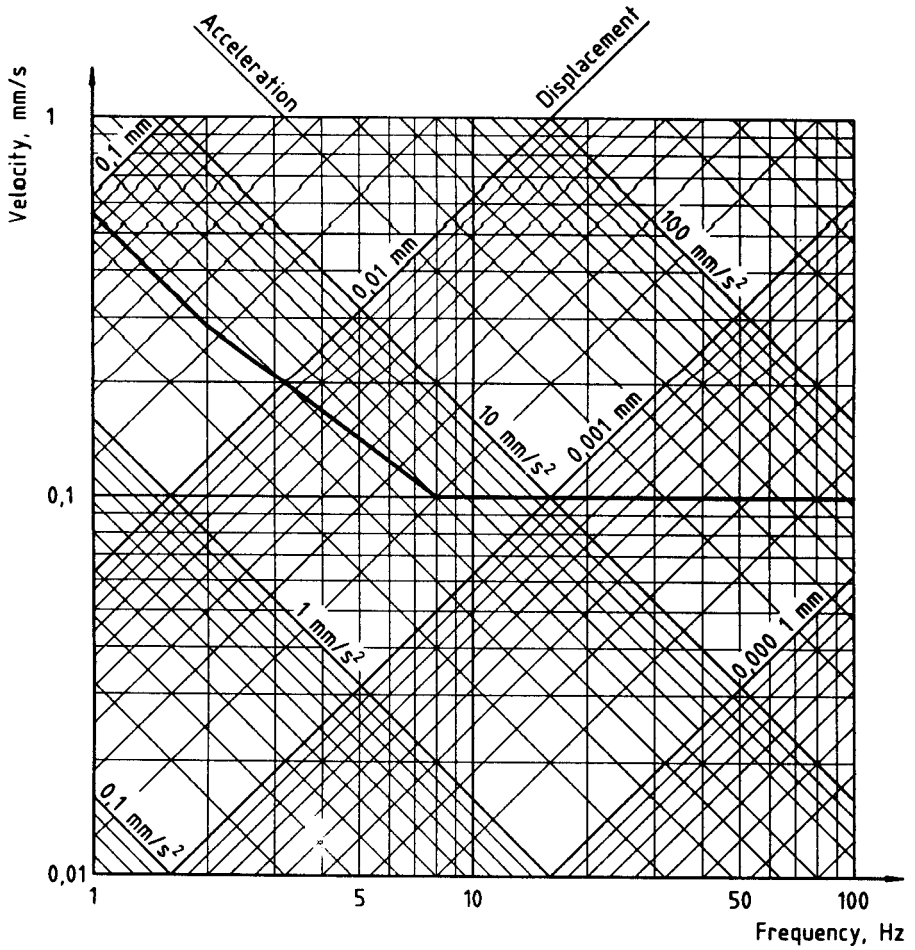


Figure B.1 — Human sensitivity curve

Annex C
(informative)

Example of report for evaluation of habitability of ships in accordance with ISO 6954

Place of test			Date:
Name of organization responsible for the test:			
Name of person performing the test:		Telephone:	Fax:
Name of ship:		Owner:	
Type of ship:	Location:	Yard and yard number:	Date built:

Hull particulars **Main engine particulars**

Length between perpendiculars, m:		Type:	Number of cylinders:
Breadth moulded, m:	Draught, m:	Number:	Power, kW:
Depth, m:	Dead weight, t:	Speed, r/min:	Reduction ratio:

Propeller particulars **Measurement conditions**

Number and type:	Number of blades:	Sea state:	Wind speed and direction:
Diameter, m:	Skew in degrees:	Draught forward, m:	Mean draught, m:
Speed, r/min:		Draught aft, m:	Depth of water, m:
Remarks:			

Type and characteristics of measuring instrumentation

Transducers, type:	Frequency range:	Sensitivity:	Mounting method:
Data recorder, type:	Frequency range:		
Analyser, type:	Analysis frequency range:	Sampling frequency:	Blocksizes:
Sampling window:	Anti-alias filter:	Calibration check:	

Measurement results

Transducer location	Direction	*Overall frequency-weighted* r.m.s. values	
		Acceleration mm/s^2	Velocity mm/s
1.			
2.			
3.			
....			
....			
....			

Bibliography

[1] ISO 2041, *Vibration and shock — Vocabulary.*

[2] IEC 61260, *Electroacoustics — Octave-band and fractional-octave-band filters.*

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc: No. MED 28 (0899).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *website* : www.bis.org.in

Regional Offices:

		Telephones
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002	2323 7617, 2323 3841
Eastern	: 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi, KOLKATA 700054	2337 8499, 2337 8561, 2337 8626, 2337 9120
Northern	: SCO 335-336, Sector 34-A, CHANDIGARH 160022	260 3843, 260 9285
Southern	: C.I.T. Campus, IV Cross Road, CHENNAI 600113	2254 1216, 2254 1442, 2254 2519, 2254 2315
Western	: Manakalaya, E9 MIDC, Marol, Andheri (East), MUMBAI 400093	2832 9295, 2832 7858, 2832 7891, 2832 7892

Branches: AHMEDABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW. NAGPUR. PARWANOO. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM. VISAKHAPATNAM.

Printed at Simco Printing Press, Delhi