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**Whole-body vibration —
Part 1: Measuring instrumentation**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal of establishing a Japanese Industrial Standard from The Japan Society of Mechanical Engineers (JSME) / Japanese Standards Association (JSA), with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law. In light of the present situation that **JIS C 1510** vibration level meters and **JIS C 1511** vibration level meters for forehand tools have covered the measuring instrument of vibration levels, between which **JIS C 1510** is employed for measurement and assessment of environmental vibrations, as establishment of International Standard is progressed for measuring instrument of vibration to human body, necessity of such standard relating to measurement of human body vibrations is arising also in Japan.

This Standard has been made based on **ISO/DIS 8041:2003, Human response to vibration — Measuring instrumentation** for the purposes of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard. Taking into account the circumstances of the former JIS, the contents of the original ISO are included, divided into two JIS standards of measuring instrumentation for whole body vibration and for hand-transmitted vibration. Further, other standards relevant to these instrumentations such as of measuring meters and of their measuring methods are grouped into separate sections respectively.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

JIS B 7760:2004 consists of the following 2 parts under the general title Safety of machinery — Electrical equipment of machines;

Part 1: Measuring instrumentation

Part 2: General requirements for measurement and evaluation method

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In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

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Whole-body vibration — Part 1: Measuring instrumentation

Introduction This Japanese Industrial Standard has been prepared based on **ISO/DIS 8041**, *Human response to vibration — Measuring instrumentation*, published in 2003 as the draft International Standard of measuring instruments for human response to vibration, from which are selected the matters relevant to wholebody vibration, with some modifications of the technical contents. The rest relevant to hand-transmitted vibration are covered by **JIS B 7761-1**.

Portions underlined with dots in this Standard are the matters modified from the original draft International Standard. A list of modifications with the explanations is given in annex 6 (informative).

Annexes 4 and 5 show, supplementarily to the original draft International Standard for information, vibration assessment and concept of time-domain digital filtering respectively.

1 Scope This part of **JIS B 7760** specifies instruments (hereafter referred to as “measuring instruments”) designed to measure frequency weighted r.m.s acceleration value in a specific frequency range for the purpose of assessing human response to vibration.

NOTE : The International Standard corresponding to this Standard is as follows:

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and JIS are **IDT** (identical), **MOD** (modified), and **NEQ** (not equivalent) according to **ISO/IEC Guide 21**.

ISO/DIS 8041:2003, *Human response to vibration — Measuring instrumentation (MOD)*

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. If the indication of the year of coming into effect or the year of publication is given to these referred standards, only the edition of the indicated year constitutes the provision of this Standard but the revision and amendment made thereafter do not apply. The normative references without the indication of the year of coming into effect or the year of publication apply only to the most recent edition (including amendments).

JIS B 0153 *Glossary of terms used in mechanical vibration and shock*

JIS B 7760-2 *Whole-body vibration — Part 2: General requirements for measurement and evaluation method*

Remarks : **ISO 2631-1:1997**, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 1: General requirements* is identical with the said standard.

JIS C 1514 *Electroacoustics — Octave-band and fractional-octave-band filters*

Remarks : **IEC 61260:1995**, *Electroacoustics — Octave-band and fractional-octave-band filters* is identical with the said standard.

JIS Z 8131 *Mechanical vibration and shock — Human exposure — Vocabulary*

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

ISO 2631-4 *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 4: Guidelines for the evaluation of the effects of vibration and rotational motion on passenger and crew comfort in fixed-guideway transport systems*

3 Symbols and definitions

3.1 Symbols For the purposes of this Standard, the symbols given in **JIS B 0153** and **JIS Z 8131** apply, and the rest of the symbols are as follows;

<i>MTVV</i>	maximum transient vibration value
<i>VDV</i>	vibration dose value
<i>N</i>	1/3 octave band number

3.2 Terms and definitions For the purposes of this Standard, the main terms and definitions given in **JIS B 0153** and **JIS Z 8131** apply, and the rest of the terms are as follows:

- a) **band-limiting frequency weighting** component of a frequency weighting defined by the high and low pass band-limiting filters
- b) **nominal frequency range** frequency range defined in table 1
- c) **frequency weighted acceleration value** Frequency weighted r.m.s acceleration values reflecting the human response. To be expressed in m/s² (see annex 4)
 - 1) **time-average weighted acceleration value** Frequency weighted r.m.s acceleration value for a duration of measurement. To be expressed in m/s² or rad/s² as defined by the following :

$$a_w = \left[\frac{1}{T} \int_0^T a_w^2(t) dt \right]^{\frac{1}{2}} \dots\dots\dots (1)$$

where, $a_w(t)$: translational or rotational weighted instantaneous acceleration magnitude

T : duration of the measurement (s)

- 2) **running r.m.s acceleration value** Linear averaged time weighting, which is the frequency weighted r.m.s acceleration value at the instantaneous time of observation, $a_w(t_0)$. To be expressed in m/s² as defined by the following ;

$$a_w(t_0) = \left[\frac{1}{\tau} \int_{t_0-\tau}^{t_0} a_w^2(t) dt \right]^{\frac{1}{2}} \dots\dots\dots (2)$$

where, $a_w(t)$: (frequency) weighted instantaneous acceleration magnitude

τ : integral time of running average (s)

t : time (integrating conversion)

t_0 : observation time (instantaneous time)

Exponential time averaging may be used for the running r.m.s method, as an approximation of the linear time averaging. It is defined as follows :

$$a_w(t_0) = \left[\frac{1}{\tau} \int_{-\infty}^{t_0} a_w^2(t) \exp\left(\frac{t-t_0}{\tau}\right) dt \right]^{\frac{1}{2}} \dots\dots\dots (3)$$

- 3) **maximum transient vibration value (MTVV)** maximum value (m/s²) of the running r.m.s. acceleration value, $a_w(t_0)$, when the integral time equals to 1 s:

$$MTVV = \max [a_w(t_0)] \dots\dots\dots (4)$$

- 4) **vibration dose value (VDV)** integral of the fourth power of the weighted instantaneous acceleration, $a_w(t)$. To be expressed in m/s^{1.75} as defined by the following:

$$VDV = \left[\int_0^T a_w^4(t) dt \right]^{\frac{1}{4}} \dots\dots\dots (5)$$

where, $a_w(t)$: translational or rotational weighted instantaneous acceleration magnitude

T : duration of measurement(s)

- 5) **motion sickness dose value (MSDV)** integral of the squared weighted instantaneous acceleration, $a_w(t)$. To be expressed in m/s^{1.5} as defined by the following equation:

$$MSDV = \left[\int_0^T a_w^2(t) dt \right]^{\frac{1}{2}} \dots\dots\dots (6)$$

where, $a_w(t)$: frequency weighted instantaneous acceleration

T : total period during which motion could occur(s)

- 6) **vibration total value** the combined vibration value from three axes of translational vibration, as defined by the following :

$$a_w = \sqrt{k_x a_{wx}^2 + k_y a_{wy}^2 + k_z a_{wz}^2} \dots\dots\dots (7)$$

where,

a_{wx}, a_{wy}, a_{wz} : vibration values in the axes of x, y and z

k_x, k_y, k_z : constants depending on the measurement application

- d) **tone burst** one or more complete cycles of a sinusoidal signal, that start and end at a zero crossing of the waveform.
- e) **under-range and over-load** function to indicate that the input vibration signal has exceeded the upper or lower boundary of the linear operating range. Under-range occurs when the vibration value is below the lower boundary and over-load occurs when the upper boundary is exceeded.
- f) **reference measurement range** level range specified for testing the characteristics of the vibration instrumentation. This range is that used for measuring the reference vibration.

- g) **reference vibration signal** sinusoidal vibration signal, the magnitude and frequency of which is specified for testing the performance of a whole-body vibration meter.
- h) **calibration check frequency** individual frequency or frequency range for providing a check of the vibration sensitivity of the instrument
- i) **linear operating range** on each measurement range, the range between lower and upper boundaries over which the linearity errors are within the applicable tolerance limits specified in this Standard.
- j) **sensitive axis** direction in which the vibration transducer has the maximum sensitivity

NOTE : The response of sensitive axes defined in this Standard complies with each frame of reference relating to the main human body positions as shown in attached figure 1. Therefore, the *z* axis is not always in the vertical.

4 Rating conditions

4.1 Operation temperature range The operation temperature range shall be $-10\text{ }^{\circ}\text{C}$ to $50\text{ }^{\circ}\text{C}$ in ambient and measurement surface temperatures. For those of indoor purpose, the temperature may be restricted to $5\text{ }^{\circ}\text{C}$ to $30\text{ }^{\circ}\text{C}$. Within the operation temperature range, the sensitivity variation shall be within $\pm 4\%$.

4.2 Operation humidity range The operation humidity range shall be at most 90 % in relating humidity.

The sensitivity variation under the relative humidity range of 30 % to 90 % without dew formation shall be within $\pm 4\%$.

4.3 Nominal frequency ranges The nominal frequency range, by every frequency weighting for each whole body vibration defined in 5.1, shall be as given in table 1.

Table 1 Frequency weighting and nominal frequency range

Frequency weighting	Nominal frequency range Hz
$W_b, W_c, W_d, W_e, W_j, W_k$	0.50 to 80
W_m	1 to 80
W_f	0.1 to 0.5

5 Performance

5.1 Frequency weighting The frequency weighting in every sensitive axis shall be as follows:

- a) **Frequency weighting W_b** Frequency weighting for vertical (*z*-axis) whole body vibration of a vehicle crew member or passenger in seated, standing or recumbent position as defined in **ISO 2631-4**, the reference frequency response and tolerance of which are as given in annex 1 attached table 1 and annex 1 attached figure 1.

- b) **Frequency weighting W_c** Frequency weighting for horizontal (x-axis) whole body vibration on the backrest of seated person defined in **JIS B 7760-2**, the reference frequency response and tolerance of which are as given in annex 1 attached table 2 and annex 1 attached figure 2.
- c) **Frequency weighting W_a** Frequency weighting for horizontal (x- or y- axis) whole body vibration of a seated, standing or recumbent person defined in **JIS B 7760-2**, the reference frequency response and tolerance of which are as given in annex 1 attached table 3 and annex 1 attached figure 3.
- d) **frequency weighting W_e** Frequency weighting for rotational whole body vibration in all the coordinate axes of a seated person defined in **JIS B 7760-2**, the reference frequency response and tolerance of which are as given in annex 1 annex table 4 and annex 1 attached figure 4.
- e) **frequency weighting W_f** frequency weighting for vertical (z-axis) motion sickness vibration of a person in seated or standing position defined in **JIS B 7760-2**, the reference frequency response and tolerance of which are as given in annex 1 attached table 5 and annex 1 attached figure 5.
- f) **frequency weighting W_j** frequency weighting for vertical (z-axis) head vibration of a person in recumbent position defined in **JIS B 7760-2**, the reference frequency response and tolerance of which are as given in annex 1 attached table 6 and annex 1 attached figure 6.
- g) **frequency weighting W_k** frequency weighting for vertical (z-axis) whole body vibration of a person in seated, standing or recumbent position defined in **JIS B 7760-2**, the reference frequency response and tolerance of which are as given in annex 1 attached table 7 and annex 1 attached figure 7.
- h) **frequency weighting W_m** frequency weighting for whole body vibration in all the coordinate axes in buildings defined in **ISO 2631-2**, the reference frequency response and tolerance of which are as given in annex 1 attached table 8 and annex 1 attached figure 8.

5.2 Transverse sensitivity of transducer For a vibration transducer alone having a sensitivity to one sensitive axis, the sensitivity in 90° direction to the axis, when tested by 7.2.2, shall not exceed 5 % of that in the sensitive axis for all over the frequency range applicable.

5.3 Cross-talk Where an instrument provides signal inputs for more than one channel. The response on any channel to a signal on any of the other input channel, when tested by 7.2.3, shall not exceed 0.5 % of the input signal magnitude for all over the frequency range applicable.

5.4 Indication and display

5.4.1 Switch error of measurement range control The switching error of measurement range control, when tested by 7.2.4, shall be within ± 5 % at the reference frequency, reference acceleration and weighted acceleration given in table 2.

5.4.2 Accuracy of indications The accuracy of indications, when tested by 7.2.5, shall be as follows:

- a) **Accuracy of indications** The indication error tolerance shall be $\pm 5\%$ at the reference frequency, reference acceleration and reference measurement range given in table 2.
- b) **Error in frequency weighted switch** When switching each frequency weighting at the reference frequency, reference acceleration and reference measurement given in table 2, the error tolerance of displayed result shall be $\pm 3\%$.
- c) **Error tolerance in time weighting switch** The tolerance of difference in displayed results between the linear time averaging equation (2) and exponential time averaging equation (3), at the reference frequency, reference acceleration and reference measurement range given in table 2, shall be $\pm 2\%$.

Table 2 Reference frequency and reference acceleration

Frequency weighting	Reference frequency Hz	Reference acceleration m/s ²	Weighted acceleration m/s ²
W_b	15.915 (100 rad/s)	1.0	0.812 6
W_c			0.514 5
W_d			0.126 1
W_e			0.062 87
W_j			1.019
W_k			0.771 8
W_m			0.336 2
W_r	0.397 9 (2.5 rad/s)	0.1	0.038 88

5.4.3 Amplitude linearity (effective display range of indication value) The amplitude linearity, when tested by 7.2.6, shall be as follows:

- a) **Linear operating range** On the reference measurement range the linear operating range shall be as at least 60 dB at the reference frequency in table 2.
- b) **Tolerance of linearity error** The linearity error at the reference frequency shall be within $\pm 6\%$.
- c) **Indication for out of linearity range** When the linearity error exceeds 15%, the indication for out-of-measurement range shall be specified by under-range or over-load. The out of linearity range indication shall function for full the extent of all the nominal frequency range.

5.4.4 Overload indication The overload indication, when tested by 7.2.7, shall be as follows:

- a) Overload shall be indicated before the linearity tolerance limits are exceeded when excessive signal values are input in steady signal or signal burst at any measurement range.
- b) For the error tolerance of overload indication, the difference between the positive and negative one-half-cycle sinusoid signal values that just cause an overload indication shall be within $\pm 15\%$.

- c) The overload indication, when an excessive input occurs during a measurement for linear time-average equation (2), shall be latched to remain in the on condition until the measurement results are reset.
- d) The overload indication, when an excessive input occurs during a measurement for exponential time-average equation (3), shall remain on for a further 8 s.

5.4.5 Under-range indication The under-range indication, when tested by 7.2.8, shall be as follows:

- a) Under-range indication shall operate before the tolerance limits on indication linearity are exceeded.
- b) Under-range indication applies to the measurements for linear time-averaging equation (2) and exponential time-averaging equation (3).
- c) The under-range indication shall remain on for a minimum of 8 s from the occasion of the under-range indication.

5.5 Indicational properties

5.5.1 Signal-burst response For signal-burst response of running r.m.s acceleration value by equation (2). To use saw-tooth signals at the reference frequency. The error tolerance, when tested by 7.2.9, shall be as given in table 3. The signal-burst response applies only to band-limiting frequency weighting.

Table 3 Reference response of signal-burst and error tolerance

Number of saw-tooth cycles per burst	Signal-burst frequency and repeat time s		Mean duration and reference response value		Error tolerance (%)
	Other than W_f 15.915 Hz	W_f 0.397 9 Hz	Other than W_f 60 s	W_f 2 400 s	
1	10	400	0.043 3	0.034 1	10
2			0.061 2	0.048 7	10
4			0.086 5	0.069	10
8			0.122	0.098 2	10
16			0.173	0.139	10
Continuous	—	—	0.546	0.439	10

5.5.2 Exponential time averaging response (dynamic response) The error tolerance on trailing response of time weighting using exponential averaging equation (3), when tested by 7.2.10, shall be as given in table 4. The trailing response performance applies only to band-limiting frequency weighting.

NOTE : For obtaining approximation of the running r.m.s acceleration value from the equation (3), to take exponential averaged integral time as the time constant. The measuring instrument shall have at least 1 s of time constant and, where it is other than 1 s, those described in table 4 are desirable.

Table 4 Tolerance on trailing response of dynamic characteristic

Time constant s	Time to 10 % of original signal value s	Equivalent delay rate dB/s
1	4.61 ± 0.25	3.8 to 4.9
0.125	0.58 ± 0.03	31 to 40
8	36.8 ± 2.0	0.48 to 0.62

5.6 Other performances

5.6.1 Electrical output If the instrument provides an AC output, it shall not affect any measurement in progress, while tested by 7.2.11, by more than ± 2 %.

5.6.2 Stabilisation time Within the operation temperature range of 4.1 and humidity range of 4.2, the time interval required to allow a measurement starting from the switching on (warm-up time) shall be no more than 2 min. For this interval the display shall indicate being in a state of preparation for use.

5.6.3 Timing facilities Where an instrument provides function to indicate the duration of the time elapsed since the start of measurement, the elapsed time shall be indicated on the display device by a measurement value. The tolerance limit for the indicate elapsed time, when tested by 7.2.12 under the conditions of 7.1.2 and 7.1.3, shall be $0.1 \% \pm 1$ digit. Where it provides function indicating the time. The error tolerance shall be within ± 10 s per 24 h under the test conditions of 7.1.2 and 7.1.3.

5.6.4 Power supply For the power voltage supplied to the instrument, when tested by 7.2.13, the change in the indicated signal value shall be within ± 2 %. For battery-powered instrument, the instrument documentation shall state the acceptable battery type and the continuous instrument operating time under reference environmental conditions.

6 Construction

6.1 General Measuring instruments are comprised of vibration transducer, signal pressure, display device, etc. (see annex 5).

These may be a signal instrument, except for a transducer, or, they may be a collection of instruments meeting each requirement of clause 5. The signal processor shall include functions of amplification of transducer output signals frequency weighting, time averaging or time weighting including square calculation level conversion for indicating the results and judgement for out of measurement range indication and so on.

6.2 Vibration transducer The vibration transducer shall be an acceleration pickup.

6.3 Measurement range selector Where an instrument provides measurement range selectors, the overlap of linear operating ranges in adjacent selectors shall be at least 100 times (40 dB).

6.4 Frequency weighting An instrument shall have one or more of the frequency weighting(s) defined in 5.1.

6.4.1 Band-limiting frequency weighting The band-limiting element, which is a frequency weighting element for band-limiting to define the frequency range of table 1, consists of a combination $H_h(s) \times H_l(s)$ of high pass $H_h(s)$ and low pass $H_l(s)$ second order filters. The high pass filter characteristic and cut-off frequency f_1 , and low pass filter characteristic and cut-off frequency f_2 to determine the frequency weighting of 5.1 are defined by the following equation and as given in table 5.

a) High pass filter

$$H_h(s) = \frac{s^2}{s^2 + \sqrt{2} \omega_1 s + \omega_1^2}$$

$$\text{where, } \omega_1 = 2\pi f_1, \quad s = j\omega = j2\pi f$$

b) Low pass filter

$$H_l(s) = \frac{\omega_2^2}{s^2 + \sqrt{2} \omega_2 s + \omega_2^2}$$

$$\text{where, } \omega_2 = 2\pi f_2, \quad s = j\omega = j2\pi f$$

6.4.2 Whole body frequency weighting The whole body vibration frequency weighting depends on a combination, $H_t(s) \times H_s(s)$, of acceleration-velocity transition (A-V transition) $H_t(s)$ and upward step $H_s(s)$. The A-V transition $H_t(s)$ and upward step $H_s(s)$ determining the frequency weighting of 5.1 are according to the function given in table 5.

a) **Acceleration-velocity transition (A-V transition)** This element is to obtain frequency response proportional to acceleration at lower frequencies and to velocity at higher frequencies, and is defined as follows:

$$H_t(s) = \frac{\omega_4^2 + \frac{\omega_4^2}{Q_4} s}{s^2 + \frac{\omega_4}{Q_4} s + \omega_4^2}$$

$$\text{where, } \omega_3 = 2\pi f_3, \quad \omega_4 = 2\pi f_4, \quad s = j\omega = j2\pi f$$

b) **Upward step** The upward step has a steepness of 6 dB per octave, corresponds to frequency response depending on acceleration jerk.

$$H_s(s) = \frac{s^2 + \frac{\omega_6}{Q_5 + \omega_4} s + \frac{\omega_6^2}{\omega_5^2}}{s^2 + \frac{\omega_6}{Q_6} s + \omega_6^2} \omega_5^2$$

$$\text{where, } \omega_5 = 2\pi f_5, \quad \omega_6 = 2\pi f_6, \quad s = j\omega = j2\pi f$$

Table 5 Functions to determine frequency weightings

Frequency weighting	Band-limiting frequency weighting		Acceleration-velocity transition (A-V transition)			Upward step				Function
	$f_1(\text{Hz})$	$f_2(\text{Hz})$	$f_3(\text{Hz})$	$f_4(\text{Hz})$	Q_4	$f_5(\text{Hz})$	Q_5	$f_6(\text{Hz})$	Q_6	
W_b	0.4	100	16	16	0.55	2.5	0.9	4	0.95	1.024
W_c	0.4	100	8	8	0.63	∞	1	∞	1	1
W_d	0.4	100	2	2	0.63	∞	1	∞	1	1
W_e	0.4	100	1	1	0.63	∞	1	∞	1	1
W_f	0.08	0.63	∞	0.25	0.86	0.062 5	0.80	0.1	0.80	1
W_j	0.4	100	∞	∞	1	3.75	0.91	5.32	0.91	1
W_k	0.4	100	12.5	12.5	0.6	2.37	0.91	3.35	0.91	1
W_m	0.79	100	5.648	5.648	0.5	∞	1	∞	1	1

6.4.3 Overall transfer function of frequency weighting The frequency weighting of instrument consists of band-limiting of 6.4.1 and whole body frequency weighting of 6.4.2, and the overall transfer function is defined by the following equation.

$$H(s) = H_h(s) \times H_1(s) \times H_t(s) \times H_s(s)$$

where, $s = j2\pi f$

6.5 Computing of time average weighted acceleration value The instrument shall have the function to compute time average weighted r.m.s acceleration values.

6.6 Display device Display devices shall display a range of at least 100 times, and shall be as follows:

- For an instrument having only analogue or simulated analogue indication, the display shall be a logarithmic display of value in m/s^2 . The scale range of a decade shall be at least 10 mm wide.
- For an instrument with digital display device, the display shall indicate for at least 5 digits, and be updated at a time interval of 1 s or more. For digital displays, where the device displays the unit, display interval, time, etc. optionally or simultaneously, the instrument documentation shall state which mode conform to this Standard.

6.7 Overload indication Measuring instruments shall have an overload indicator warning against any excessive input.

6.8 Under-range indication Measuring instruments shall have an indicator warning at each measurement range, against that being less than lower boundary of the measurement range exceeding the tolerance limit of linearity.

6.9 Reset facility A measuring instrument, where it has the function of time averaging, shall contain a reset facility to reinitiate the measurement and that to clear the data-storage device.

7 Testing

7.1 Test conditions

7.1.1 Reference conditions The reference environmental conditions shall be as follows:

Air temperature : 23 °C

Relative humidity : 50 %

7.1.2 Testing temperature range To be (23 ± 5) °C

7.1.3 Testing humidity range To be 10 % to 75 % relative humidity but non-condensing.

7.1.4 Reference vibration Reference acceleration for the test is to be 1 m/s². Excepting that to be 0.1 m/s² for the frequency weighting W_f .

For the weighted acceleration at the reference frequency for each frequency weighting, table 2 applies.

7.1.5 Reference frequency Reference frequency for the test is to be 15.915 Hz. Excepting that to be 0.397 9 Hz for the frequency weighting W_f .

7.1.6 Reference rotational rate Reference rotational rate is to be 100 rad/s. Excepting that to be 2.5 rad/s for the frequency weighting W_f .

7.1.7 Conditions of testing signals The conditions of testing signals shall be as follows:

- a) Signal waveform of the mechanical test shall be sinusoidal wave.
- b) The tolerance on the frequency value of mechanical test shall be not exceeding 2 % of the indicated frequency value.
- c) Signal waveform of electrical test inputs shall be sinusoidal wave unless otherwise indicated.
- d) The tolerance on the frequency of input signals shall be not exceeding 0.2 % of the indicated test frequency.

NOTE : The distortion rate of test signals shall be within a range not affecting the test results.

7.2 Test methods

7.2.1 Frequency weighting The frequency weighting shall be as follows :

- a) Frequency weighting is defined by overall response adding frequency response of the transducer and that of the instrument to the frequency of electrical test given in table 6.