

JIS

JAPANESE INDUSTRIAL STANDARD

**Glossary of Terms used
in Mechanical Vibration
and Shock**

JIS B 0153—1985

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Glossary of Terms used in Mechanical
Vibration and Shock

B 0153-1985

1. Scope

This Japanese Industrial Standard specifies principal terms and meanings used concerning mechanical vibration and shock (containing balancing) in the mining and manufacturing industries.

2. Classification

The terms shall be classified into the following.

- (1) General
- (2) Mechanical vibration
- (3) Shock
- (4) Transducers
- (5) Balancing
- (6) Mechanical vibration and shock affecting man

3. Definitions

The terms and meanings shall be as follows:

Further, equivalent English is given for reference.

- Remarks
1. When not less than two terms are arranged, they shall be used preferentially according to their order.
 2. The fact that (1), (2) and (3) exist in a meaning indicates that three kinds of meanings of (1), (2) and (3) exist.
 3. When a part of term is attached with parentheses "()", these are two cases of the term containing the letters within the parentheses and the term omitting the letters in the parentheses or the case where the former term is replaced with the latter term.

(1) General

No.	Term	Meanings	Equivalent English (Reference)
1001	SHINDŌ	The variation of the magnitude of a quantity with respect to some coordinate system when the magnitude is alternately greater or smaller than its average value or reference. It is usually the variation with time.	oscillation, vibration
1002	REISHIN	An external force or other input applied to a system. It is called KASHIN (Japanese), too.	excitation, stimulus
1003	ŌTŌ	The state of the variation of an output signal caused by the variation of an input signal. [refer to JIS Z 8103].	response
1004	SHŪHASŪŌTŌ	The quantitative expression of an output signal expressed as the function of the frequency of an input signal (refer to 1003 ŌTŌ). It is usually shown in a graphic form.	frequency response
1005	DENTATSURITSU	The non-dimensional ratio of the response amplitude of a system in steady state forced vibration to the excitation amplitude. Remark: The term "transmissibility" may be used for the non-dimensional ratio of forces, displacements, velocities, or accelerations.	transmissibility
1006	YUKISUGIRYŌ	The difference between the maximum transient response and a steady value <i>B</i> when the maximum transient response exceeds <i>B</i> in the process in which the output of a system is changed from a steady value <i>A</i> to the steady value <i>B</i> which is greater than <i>A</i> by varying the input.	overshoot

No.	Term	Meanings	Equivalent English (Reference)
1007	FUNOYUKISUGIRYŌ	The difference between the minimum transient response and a steady value B when the minimum transient response is less than B in the process in which the output of a system is changed from a steady value A to the steady value B which is less than A by varying the input.	undershoot
1008	SENKEIKEI	A system in which the response is proportional to the magnitude of the excitation. Remark: This definition implies that the dynamic properties of each element in the system can be represented by a set of linear differential equation (with constant coefficients), and that the principle of superposition can be applied to the system.	linear system
1009	KIKAIKEI	A system constituted by combination of each element of mass, stiffness and damping.	mechanical system
1010	KANSEIRYOKU	The force exerted by the motion of the mass of mechanical system. The force having the magnitude of the product of mass and its motion acceleration.	inertia force
1011	FUKUGENRYOKU	The force caused by the deformation of the spring of mechanical system. The force having the magnitude of the product of the spring constant and the deflection of the spring in the linear as system.	restoring force
1012	KISO	A structure that supports a mechanical system. Remark: It may be fixed to the space, or otherwise it may provide excitation for the mechanical system supported by carrying out the motion.	foundation

No.	Term	Meanings	Equivalent English (Reference)
1013	BANE SHITSURYŌKEI	A vibration system constituted by spring and mass.	spring-mass system
1014	FURIKO	A vibration system constituted by utilizing gravity as restoring force when a fulcrum is provided at a point excepting the center of mass.	pendulum
1015	SAIZUMOKEI	A system consisting of a foundation frame and a mass element attached thereto through one or more spring elements. Damping is normally included. Remark 1. Seismic systems are usually idealized as single-degree-of-freedom systems with viscous damping. Remark 2. When the seismic system is used as the displacement pickup, its natural frequency is selected to be lower than the frequency to be measured and when used as the acceleration pickup, it is selected to be higher.	seismic system
1016	TŌKAKEI	A system equivalently substituted for another system for the convenience of analysis. Remark: The following various types of equivalences or equivalent systems in vibration and shock technology: 1) equivalent stiffness; 2) equivalent damping; 3) torsional system equivalent to a translational system; 4) electrical or acoustic system equivalent to a mechanical system; - etc.	equivalent system

No.	Term	Meanings	Equivalent English (Reference)
1017	JIYŪDO	The number of independent coordinates necessary to define completely the configuration of a mechanical system at any instant of time. This number is equal to the number of independent displacements possible to the system.	degree of freedom
1018	ICHIJIYŪDOKEI	A system requiring only one coordinate to define completely its configuration of any instant.	single-degree-of-freedom system
1019	TAJIYŪDOKEI	A system for which two or more coordinates are required to define completely the configuration of the system at any instant.	multi-degree-of-freedom system
1020	BUNPUKEI	A system in which elements of mass, spring, etc. are continuously distributed. Remark: The mode shape ⁽¹⁾ of a continuous system is specified by the continuous function of spatial variable. Note ⁽¹⁾ Refer to 2073 Mode Shape.	continuous system, distributed system
1021	SHŪCHŪKEI	A system in which elements of mass, spring, etc. discretely exist.	lumped parameter system, discrete system
1022	DANSEI CHŪSHIN	The intersecting point of three lines of elastic principal axes at right angles with each other.	elastic centre
1023	KOWASA, BANETEISŪ	The ratio of change of force (or torque) to the corresponding change in translational (or rotational) displacement of an elastic elements.	stiffness, spring constant

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No.	Term	Meanings	Equivalent English (Reference)
1024	DANSEI SHUJIKU	An axis with which when force is added to the spring of a vibration system in certain one direction, the direction of the force is equal to the direction of the displacement of an action point and the surface of a spring containing the action point is not rotated.	principal elastic axes
1025	KONPURAANSU	The reciprocal of stiffness.	compliance
1026	DENTATSU KANSŪ	A mathematical relation between the output and the input of the system. Remark: It is usually given as a function of frequency, and is usually a complex function.	transfer function
1027	FUKUSO REISHIN	An excitation having real and imaginary parts ⁽²⁾ . Remark: The concepts of complex excitations and responses were evolved historically in order to simplify calculations. If the system is linear, the actual excitation and response are the real parts of the complex excitation and response. If the system is linear system, the procedure of complex operation is valid because the principle of super position holds in such a situation. Note ⁽²⁾ Refer to 1002 Excitation.	complex excitation

No.	Term	Meanings	Equivalent English (Reference)
1028	FUKUSO ŌTŌ	The response of a linear system to a complex excitation ⁽³⁾ . Note ⁽³⁾ Refer to 1027 Complex Excitation.	complex response
1029	FUKUSO SHINPUKU	An amplitude having real and imaginary parts.	complex amplitude
1030	INPĪDANSU	The ratio of an excitation to its output. The excitation and the output are complex quantities and both of their arguments increase linearly with time at the same rate. Remark 1. The terms and definitions relating to impedance apply under the steady state of the quantity changing in simple frequency. Remark 2. This term usually applies to a linear system only. However, the concept of an impedance is occasionally extended to non-linear systems where the term incremental impedance is used to describe the ratio of the excitation and the output in the non-linear system.	impedance
1031	KIKAI INPĪDANSU	At a point in a mechanical system, the complex ratio of force to velocity where the force and velocity may be taken at the same or different points in the same system during simple harmonic motion. Remark: For the torsional vibration system, the words "force" and "velocity" should be respectively replaced by "torque" and "angular velocity".	mechanical impedance

No.	Term	Meanings	Equivalent English (Reference)
1032	JIKO INPĪDANSU, KUDŌTEN INPĪDANSU	The complex ratio of the force to velocity taken at the same point in a mechanical system during simple harmonic motions.	direct impedance, driving-point impedance
1033	DENTATSU INPĪDANSU, SŌGO INPĪDANSU	The complex ratio of the force taken at one point in a mechanical system to the velocity taken at another point in the same system during simple harmonic motions.	transfer impedance
1034	JIYŪ INPĪDANSU	The impedance at the input when the impedance of its mechanical load or attached structure is made zero. Remark: For example, the free electrical impedance of a transducer, or the free driving point mechanical impedance, etc. are called.	free impedance
1035	FUKAJI INPĪDANSU	The impedance at the input when the output is connected to its normal load. Remark: For example, the loaded electrical impedance of a transducer, or the loaded driving-point mechanical impedance, etc. are called.	loaded impedance
1036	KOTEI INPĪDANSU	The impedance at the input when the output is connected to a load of infinite mechanical impedance. Remark: For example, the blocked electrical impedance of a transducer, or the blocked driving-point mechanical impedance, etc. are called.	blocked impedance

No.	Term	Meanings	Equivalent English (Reference)
1037	MOBIRITI	The reciprocal of impedance. The complex ratio of velocity at a point in a mechanical system to force taken at the same or another point in the system during simple harmonic motion.	mobility, (mechanical) mobility
1038	JIKO MOBIRITI, KUDŌTEN- MOBIRITI	The complex ratio of velocity to force taken at the same point in a mechanical system during single harmonic motion.	direct (mechanical) driving-point (mechanical) mobility
1039	DENTATSU MOBIRITI, SŌGO MOBIRITI	The complex ratio of the velocity taken at one point of a mechanical system to the force taken at another point in the same system during simple harmonic motion.	transfer (mechanical) mobility
1040	DŌKOWASA, DŌBANETEISŪ	(1) The ratio of change of force to change of displacement under dynamic conditions. (2) The complex ratio of force to displacement during simple harmonic motion.	dynamic stiffness, dynamic spring constant
1041	SUPEKUTORU	A description of a quantity as a function of frequency or wavelength.	spectrum
1042	JAIRO MŌMENTO	When a rotary body is forcedly rotated around an axis at right angles with the spin axis (refer to 5001) of the rotary body, a moment is produced around an axis crossed at right angles with both of those axes. The moment is called gyroscopic moment.	gyroscopic moment
1043	JĀKU	The time derivative changing rate of vibration acceleration.	jerk

(2) Mechanical Vibration

No.	Term	Meanings	Equivalent English (Reference)
2001	(KIKAI) SHINDŌ	The vibration with time ⁽⁴⁾ of the magnitude of a quantity which is descriptive of the motion or displacement of a mechanical system, when the magnitude is attenuately greater and smaller than some average value or reference. Note ⁽⁴⁾ Refer to 1001 Oscillation, Vibration.	(mechanical) vibration
2002	SHŪKI SHINDŌ	A vibration expressed by a function like that repeating the same values every time an independent variable is increased by a certain fixed value ⁽⁵⁾. Note ⁽⁵⁾ Refer to 2001 (Mechanical) Vibration. Remark: A periodic quantity y, which is a function of time t, can be expressed as $y = f(t) = f(t + nT)$ where n: a whole number T: a constant t: an independent variable	periodic vibration
2003	FUKISOKU SHINDŌ	A vibration whose magnitude cannot be precisely predicted for any given instant of time. Remark: The probability that the magnitude of a random vibration is within a given range can be determined by a provability density function.	random vibration

No.	Term	Meanings	Equivalent English (Reference)
2004	CHŌWA REISHIN	An external force or an input expressed by a harmonic function of time. It is called "CHŌWA KASHIN" (Japanese), too.	harmonic excitation
2005	INPARUSU REISHIN	An instantaneous outer force or input. It is called "DAGEKI KASHIN" (Japanese), too.	impulse excitation
2006	FUKISOKU REISHIN	An external force or an input whose magnitude cannot be precisely predicted for any given instant of time. It is called "FUKISOKU KASHIN" (Japanese), too.	random excitation
2007	ZATSUON, NOIZU	Signals, generally of a random nature, not exhibiting clearly defined frequency components. Remark: Concerning sound, a disagreeable or undesired sound is called noise ⁽⁶⁾ . Note ⁽⁶⁾ Refer to the item of Noise of JIS Z 8106 [Glossary of Acoustical Terms (General)].	noise
2008	FUKISOKU ZATSUON	A noise whose magnitude cannot be precisely predicted for any given instant of time.	random noise
2009	GAUSU ZATSUON	A random noise whose instantaneous magnitudes have a Gaussian distribution.	Gaussian random noise
2010	HAKUSHOKU ZATSUON	White noise has equal energy for any frequency band of constant width (or any frequency band per unit bandwidth) over the spectrum of interest. Remark: White random vibration means the noise having a constant mean-square-acceleration spectral density over the frequency spectrum of interest.	white noise

No.	Term	Meanings	Equivalent English (Reference)
2011	PINKU NOIZU	A noise which has a constant energy per its bandwidth when the ratio of a bandwidth to its central frequency is constant in an optional part over the whole frequency spectrum of interest. Remark: The energy spectrum of pink noise as determined by an octave bandwidth (or any fractional part of an octave bandwidth) filter, will have a constant value (regardless of frequency).	pink noise
2012	KYŌTAI KI FUKISOKU SHINDŌ	Random vibration having frequency components within a narrow band only ⁽⁷⁾. Note ⁽⁷⁾ Refer to 2003 Random Vibration. Remark 1. The definition of what is meant by "narrow" is a relative matter depending upon the problem involved. It is usually equal to or less than 1/3 octave. Remark 2. The wave form of a narrow-band random vibration has an appearance of a sine wave whose amplitude varies in an unpredictable manner.	narrow-band random vibration
2013	KŌTAI KI FUKISOKU SHINDŌ	Random vibration having its frequency components distributed over a broad frequency band ⁽⁷⁾. Note ⁽⁷⁾ Refer to 2003 Random Vibration. Remark: The defining of what is meant by "broad" is a relative matter depending upon the problem involved. It is usually one octave or greater.	broad-band random vibration
2014	TEIJŌ SHINDŌ	A continuing periodic vibration.	steady-state vibration

No.	Term	Meanings	Equivalent English (Reference)
2015	KATO SHINDŌ	The vibration of a system other than steady-state.	transient vibration
2016	MŌDO PARAMĒTA	The generic term of fixed vibration, fixed mode, modal mass, modal damping and modal stiffness. A parameter used for expression of characteristics of each fixed mode when the vibration of multi-degree-of-freedom system is described as to its principal coordinate.	modal parameter
2017	MŌDO GYŌRETSU, MŌDO MATORIKKUSU	Square matrix of n rows and n columns, the column of which has the shape of n fixed modes in a n -degree-of freedom system.	modal matrix
2018	SHUZHAYŌ	A coordinate in which a mutually independent general coordinate is linearly transformed by a modal matrix.	principal coordinate
2019	SHUSHITSURYŌ, MŌDOSHITSURYŌ	A mass corresponding to a fixed mode when vibration in a multi-degree-of-freedom system is described by dividing it into each fixed mode. Its value changes according to the selection of modal matrix.	principal mass, modal mass
2020	SHU KOWASA, MŌDO KOWASA	A stiffness corresponding to a fixed mode when vibration in a multi-degree of freedom system is described by dividing it into each fixed mode. Its value changes according to the selection of modal matrix.	principal stiffness, modal stiffness
2021	SHITSURYŌ GYŌRETSU SHITSURYŌ MATORIKKUSU	A coefficient matrix as to acceleration vector when the equation of motion expressing the equilibrium of force in a n -degree-of-freedom system is described by using mutually independent n general coordinates.	mass matrix

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No.	Term	Meanings	Equivalent English (Reference)
2022	KOWASA GYŌRETSU, KOWASA MATORIKKUSU	A coefficient matrix as to displacement vector when the equation of motion expressing the equilibrium of force in a n -degree of freedom system is described by using mutually independent n general coordinates.	stiffness matrix
2023	GENSUI GYŌRETSU, GENSUI MATORIKKUSU	A coefficient matrix as to velocity vector when the equation of motion expressing the equilibrium of force in a n -degree-of freedom system is described by using mutually independent n general co-ordinates.	damping matrix
2024	KYŌSEI SHINDŌ	The steady state vibration caused by excitation. Remark 1. The forced vibration has the same frequencies as that of excitation. Remark 2. Transient vibration caused by excitation is not called forced vibration.	forced vibration
2025	JIYŪ SHINDŌ	Vibration that occurs after the removal of excitation. Remark: In free vibration the system vibrates at natural frequencies of the system.	free vibration
2026	GENSUI JIYŪ SHINDŌ	Free vibration of vibration system having damping.	damped free vibration
2027	JIREI SHINDŌ	Vibration resulting from conversion of non-oscillatory energy to oscillatory excitation in a mechanical system.	self-induced vibration, self-excited vibration

No.	Term	Meanings	Equivalent English (Reference)
2028	SHIKAN SHINDŌ	A vibration which is generated when non linear damping force is larger than inertia force by comparing it therewith and presents a wave shape close to square wave in a vibration system with the property of nonlinear damping in which, when displacement and velocity are small, the amplitude is increased by operation of minus damping and when they become large, the increase of amplitude is limited by operation of damping.	relaxation vibration
2029	SHŪI SHINDŌ, ANSHINDŌ	All vibrations concerning a given environment. Remark 1. It is usually expressed by composition of vibrations from a plenty of vibration sources existing far or near. Remark 2. The environment herein means all external conditions received by the system.	ambient vibration
2030	JUNSHŪKI SHINDŌ	A vibration which deviates only slightly from a periodic vibration.	quasi-periodic vibration
2031	MUSHŪKI UNDŌ	A vibration that is not periodic.	aperiodic motion
2032	SAIKURU	The complete range of states or values through which a periodic phenomenon or function passes before repeating itself identically.	cycle
2033	KIHON SHŪKI	(1) The smallest increment of the independent variable of a periodic quantity for which the function repeats itself. (2) The reciprocal of the meaning (2) in the item of fundamental frequency.	fundamental period

No.	Term	Meanings	Equivalent English (Reference)
2034	SHINDŌSŪ, SHŪHASŪ	The number of cycles per unit time.	(cyclic) frequency
2035	OKUTĀBU	The interval between two frequencies which have a frequency ratio of two.	octave
2036	SHŪKI	The reciprocal of the frequency.	period
2037	KIHON SHINDŌSŪ	(1) The reciprocal of the fundamental period. (2) The lowest natural frequency of a vibration system. The normal mode of vibration associated with this frequency is called the fundamental natural mode of vibration. (3) The frequency of the fundamental when the periodic quantity is harmonically analyzed.	fundamental frequency
2038	KIHONHA	A sinusoidal quantity having the same frequency as fundamental frequency ⁽⁸⁾. Note ⁽⁸⁾ Refer to 2037 Fundamental Frequency.	fundamental
2039	CHŌHA	A sinusoidal quantity whose frequency is an integral multiple of the fundamental frequency. Remark: A sinusoidal quantity having the frequency of integral multiple of 2 times the fundamental frequency is called higher harmonic, too.	harmonic
2040	BUNSŪ CHŌHA	A sinusoidal quantity whose period is an integral multiple of 2 minimum of the fundamental period of excitation.	subharmonic

No.	Term	Meanings	Equivalent English (Reference)
2041	UNARI	Periodic variations in the amplitude of an oscillation resulting from the combination of two oscillations of slightly different frequencies.	beats
2042	UNARI SHINDŌSŪ	The absolute value of the difference in frequency of two oscillations of slightly different frequencies.	beat frequency
2043	KAKUSHINDŌSŪ, ENSHINDŌSŪ	The quantity of 2π times a frequency. Remark: The unit of angular frequency is the radian per second.	angular frequency, circular frequency
2044	SEIGENRYŌ, CHŌWARYŌ	A periodic quantity expressed as a sinusoidal function of the independent variable. Thus $y = A \sin(\omega t + \varphi)$ where y : sinusoidal quantity, t : independent variable, A : amplitude, ω : angular frequency, φ : phase angle of oscillation.	sinusoidal quantity, simple harmonic quantity
2045	TANSHINDŌ	A motion expressed as a sinusoidal function of time.	simple harmonic motion
2046	JUNSEIGENRYŌ	A quasi-sinusoid has the appearance of a sinusoid but varies relatively slowly in frequency and/or amplitude.	quasi-sinusoid
2047	ISŌKAKU, ISŌ	The fractional part of a period through which a sinusoidal quantity has advanced as measured from a value of the independent variable as a reference. Remark: φ in 2044 Sinusoidal Quantity is usually called phase angle.	phase angle, phase

No.	Term	Meanings	Equivalent English (Reference)
2048	ISŌSA	The difference between respective phase angles of two periodic quantities of the same frequency. In the case of sinusoidal quantities, the difference between respective phase angles measured from the same reference.	phase reference
2049	SHINPUKU	The maximum value of a sinusoidal quantity. Remark: The use of "amplitude" is for those excepting the maximum value of a sinusoidal value, for example, its use for expression of the double amplitude is deprecated.	amplitude
2050	PĪKUCHI	The maximum value of a quantity during a given interval. Remark: A peak value of an oscillating quantity is usually taken as the maximum deviation value of that quantity from the mean value in a given interval. The maximum positive deviation is called a positive peak value and the maximum negative deviation is called a negative peak value.	peak value, peak magnitude
2051	ĀRUEMUESUCHI	The square root of the average of squared values. Remark: It is called JIKKŌCHI (Japanese), too.	root-mean-square value, rms value
2052	PĪPĪCHI	The maximum value among algebraic differences between the extreme values of oscillating quantity in a given interval.	peak-to-peak value
2053	ZENKŌTEI	The peak to peak value of displacement.	total excursion, stroke
2054	HAKŌRITSU	The ratio of the peak value to the rms value. Remark: The value of the crest factor of a sine wave is $\sqrt{2}$.	crest factor, peak-to-rms ratio

No.	Term	Meanings	Equivalent English (Reference)
2055	HAKEIRITSU	The ratio of the root-mean-square value to the mean value for one-half cycle between two successive zero crossings.	form factor
2056	SHUNJICHI	The value of a variable quantity at a given instant.	instantaneous value, instantaneous magnitude
2057	SHINDŌ SHIBIARITI	A quantity comprehensively expressing the severity of vibration. It is designated as the maximum value, average value and rms value of vibrating quantity, or a value of other parameter as to vibration. Remark: The vibration severity of a machine is defined by the maximum rms value of the vibration velocities measured at significant points of bearings or mountings.	vibration severity
2058	DAEN SHINDŌ	A vibration in which the locus of a vibrating point is elliptical in form.	elliptical vibration
2059	CHOKUSEN SHINDŌ	A vibration in which the locus of a vibrating point is a straight line.	rectilinear vibration
2060	ENSHINDO	A vibration in which the locus of a vibrating point is circular in form.	circular vibration
2061	RISAJŪ NO ZUKEI	A stationary figure drawn when two simple harmonic motions the ratio of frequencies of which is given by a simple integral ratio are respectively carried out in two directions crossing at right angles to each other. Remark: Lissajous' figure is changed according to the difference of the phase angle of simple harmonic motion.	Lissajous' figure

No.	Term	Meanings	Equivalent English (Reference)
2062	RŌRINGU	Rotational vibration about an axis that faces the back to front direction of aircraft, vehicles, machine of ship, car body, hull, etc.	roll
2063	YŌINGU	Rotational vibration about an axis that faces the vertical direction of aircraft, vehicles, machine of ship, car body, hull, etc.	yaw
2064	PITCHINGU	Rotational vibration about an axis that faces the transverse direction of aircraft, vehicles, machine of ship, car body, hull, etc.	pitch
2065	FUSHI, SETSU	A point, line, or surface in a stationary wave where some characteristic of the wave field has essentially zero amplitude. Remark: If the nature of the node would be desired to be clarified, an appropriate modifier should be used; for example, displacement node, velocity node, pressure node, etc.	node
2066	SESSEN	A line in a stationary wave where some characteristic of the wave field has essentially zero amplitude.	nodal line
2067	SETTEN	A point in a stationary wave where some characteristic of the wave field has essentially zero amplitude.	nodal point