INTERNATIONAL STANDARD

ISO 6070

Second edition
2019-09

Auxiliary tables for vibration generators — Methods of describing equipment characteristics

Tables auxiliaires pour générateurs de vibrations — Méthodes de description des caractéristiques

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Reference number
ISO 6070:2019(E)

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Published in Switzerland

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 108, *Mechanical vibration, shock and condition monitoring*, Subcommittee SC 6, *Vibration and shock generating systems*.

This second edition cancels and replaces the first edition (ISO 6070:1981), which has been technically revised. It also incorporates the Corrigendum ISO 6070:1981/Cor 1:2006. The main changes compared to the previous edition are as follows:

— Consideration of one more type of auxiliary table, the head expander.

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Auxiliary tables for vibration generators — Methods of describing equipment characteristics

1 Scope

This document establishes requirements to ensure appropriate exchange of information between manufacturers and users of auxiliary tables with a view to working out related specifications and possibly to comparing, in an objective way, the characteristics supplied by the manufacturers of auxiliary tables and associated guidance systems.

This document is applicable to auxiliary tables which include slip tables and head expanders. It does not cover auxiliary tables with several degrees of freedom.

This document provides three levels of description of the test equipment, as follows:

a) minimum level;

b) medium level;

c) high level.

This document gives a list of characteristics to be specified for each level of description.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2041, *Mechanical vibration, shock and condition monitoring — Vocabulary*

ISO 15261, *Vibration and shock generating systems — Vocabulary*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 2041 and ISO 15261 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
slip table
auxiliary table connected to one or several vibration generators working along axes which are parallel to the longitudinal axis of the table

Note 1 to entry: A slip table is normally used to conduct horizontal vibration test.

Note 2 to entry: See 6.4.1 for the coordinates of a slip table.

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3.2
head expander
auxiliary table connected to one or several vibration generators working along axes which are in line with the normal axis of the table

Note 1 to entry: A head expander is normally used to conduct vertical vibration test.

Note 2 to entry: See 6.4.1 for the coordinates of a head expander.

4 Symbols

C_α	Limiting pitching torque
C_β	Limiting rolling torque
C_γ	Limiting yawing torque
d	Total harmonic distortion of acceleration
F_a	Force measured in direction z to overcome static friction (stiction)
F_g	Force measured in direction z to overcome dynamic friction
F_s	Static load limit
F_p	Static load limit per unit area
F_x, F_y, F_z	Limiting forces which can be withstood by the moving auxiliary table along the three axes
f	Frequency
f_{max}	Maximum operational frequency
f_{min}	Minimum operational frequency
g_n	Standard acceleration due to gravity (according to ISO 2041, g_n equals 9,806 65 m/s^2)
I_x, I_y, I_z	Moments of inertia of the moving table with respect to axes parallel to the reference axes through the centre of gravity
K_x, K_y, K_z	Translational stiffness of guidance system along the three axes
K_α, K_β, K_γ	Rotational stiffness of guidance about the three axes
m	Total mass of moving table including moving components of guidance system
m_t	Test load (subscript “t” may be 0, 1, 4, 10, 20, or 40; see Clause 8)
v_z	Rated RMS velocity along z axis
X_C, Y_C, Z_C	Coordinates of centre of test table surface (see 6.4.1, Figure 3)
X_G, Y_G, Z_G	Coordinates of moving table centre of gravity
α	Pitch angle (rotation about y axis)
β	Roll angle (rotation about z axis for slip tables and about x axis for head expanders)
γ	Yaw angle (rotation about x axis for slip tables and about z axis for head expanders)

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5 Vibration values

When the manufacturer, or user, specifies values for the parameters required in this document, it shall be clearly defined, where applicable, whether vibration is expressed in terms of RMS, peak or peak-to-peak values.

6 Auxiliary table configurations

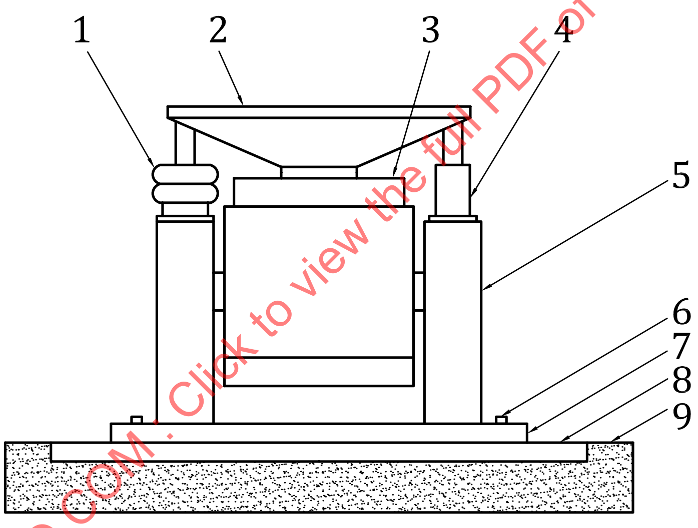
6.1 General

An auxiliary table is a mechanical system intended for transmitting vibration generated by one or more vibration generators to equipment under test.

The table is fitted with its own guidance system (if necessary), which shall be compatible with the guidance system of the vibration generator(s).

This document deals with auxiliary tables of two common types:

— head expanders, used to transfer vertical vibration (see Figure 1);



Key

1 load support system
2 head expander
3 vibration generator
4 guidance system
5 trunnion support
6 screws connecting the vibration generator to the foundation
7 vibration generator bottom plate
8 foundation plate
9 foundation

Figure 1 — Example of coupling of a head expander to single vibration generator (typical configuration)

— slip tables, used to transfer horizontal vibration (see Figure 2).

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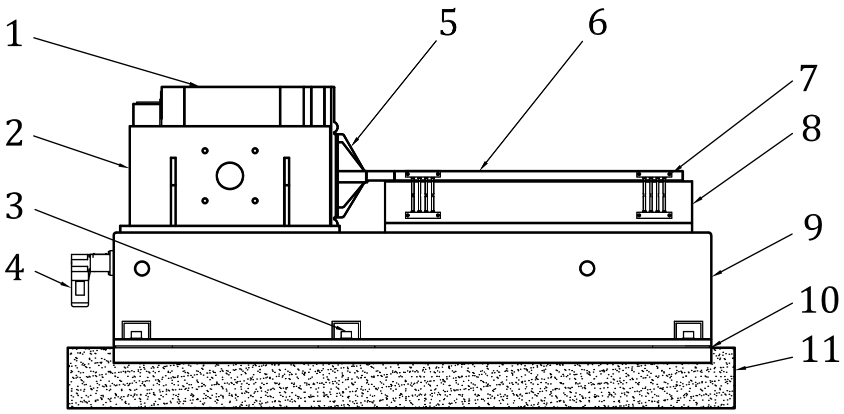

Key

1 vibration generator
2 trunnion support
3 screws connecting the vibration generator to the foundation
4 rotation device
5 driver bar
6 slip plate
7 centring device
8 guidance and support system
9 Pedestal
10 foundation plate
11 Foundation

Figure 2 — Example of coupling of an auxiliary table to single vibration generator (typical configuration)

The head expander is mainly composed of:

— the moving table;

— the guidance system (optional);

— the support system (optional).

Optionally, the head expander can be equipped with a lifting device which lifts the head expander assembly, normally with air or hydraulic cylinder, and allows rotation of the vibration generator to the horizontal direction without removing the expander assembly.

The head expander can be either of square or round shape.

The slip table is mainly composed of:

— the moving table;

— the driver bar;

— the guidance and support system.

6.2 Typical designs of the head expander

6.2.1 General

Typical designs of the head expander are given in 6.2.2 to 6.2.4.

To achieve a higher load and overturning moment capacity, guidance and support systems are normally used.

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6.2.2 Expander with linear bearing guidance and air spring support

Air springs are used to provide sufficient supporting force for the fixture and test article. They are normally arranged symmetrically relative to the xOz plane and yOz plane or circularly uniformly along the z axis as illustrated in 6.4.1. As for the test articles with a special shape and mass distribution, the air springs should be arranged accordingly in an asymmetrical and noncircular pattern to make each air spring withstand approximately equal weight and work under its maximum limit.

Linear bearings are used in vertical guidance. They are normally arranged symmetrically relative to the xOz plane and yOz plane or circularly uniformly along the z axis as illustrated in 6.4.1. The number of linear bearings used in a configuration is dependent on the overturning moment requirements of the test article and test conditions.

The maximum travel of the air springs and linear bearings shall be greater than that of the vibration generator and a safety margin (the ratio of maximum travel of air springs and linear bearings versus vibration generators) shall be maintained. The recommended safety margin is 1,3 to 1,5 for a solid vibration generator system whose trunnion is connected rigidly to the vibration generator. For a trunnion isolated system in which springs are placed between the trunnion and the vibration generator to reduce vibration transmission to the ground, the recommended safety margin should be higher, normally 1,5 to 2,0, because the relative motion between the head expander and the trunnion can exceed the value of travel on the generator table.

NOTE The air springs and bearings used in a head expander system can be located on the generator body, trunnion, or a rigid base directly screwed to the foundation, depending on the relative dimensions of the head expander and the generator.

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6.2.3 Expander with hydrostatic bearing guidance and air spring supports

Air springs are used for load supports. Normally, a hydrostatic bearing guidance system provides higher translational stiffness than a linear bearing guidance system. The arrangements of hydrostatic bearings follow the same principles as linear bearings referred to in 6.2.2.

6.2.4 Bare head expander

The head expander is used only to enlarge the load mounting surface area. No extra load and overturning moment capacity are needed as the vibration generator provides enough support and guidance for some test conditions.

6.3 Typical designs of the slip table

6.3.1 General

Typical designs of the slip table are given in 6.3.2 to 6.3.9. A combination of two or more designs can occur.

6.3.2 Hydrostatic bearing table

The connection between the table and the fixed parts of the guidance system is achieved by fluid pressure. This ensures self-centring of the system. Connecting stiffness is negligible in the longitudinal direction. Stiffness corresponding to the other degrees of freedom can be specified.

The driver bar is used to transmit the vibration from the vibration generator table to the slip table evenly. An optimized design of driver bar is necessary to reduce its mass and increase the transmissibility.

The slip plate is the vibration output surface, normally made of magnesium or aluminium alloy to reduce the loss of vibration force.

Various types of hydrostatic bearings can be employed for the guidance and support system of a slip table. Some hydrostatic bearings cannot provide enough stiffness of the reaction mass, and therefore a

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block of granite is used to increase the vertical support stiffness. Typically, the more bearings used in a system will provide larger load and overturning moment capacity.

From the perspective of cross section shapes, “T” shaped or circle shaped hydrostatic bearings are being used as the primary support. However, alternative solutions such as “V” shaped bearings or plane bearings can be employed. The main parameters of hydrostatic bearings include hydraulic pressure, static load, travel, weight, flow, vertical stiffness, pitch moment, roll moment, yaw moment, etc. The test conditions, the bearing characteristics as well as the overall budget should be taken into comprehensive consideration in the selection of bearings.

The hydraulic pump and oil cooling system needs to be able to provide sufficient flow and pressure to meet the maximum capacity of the hydrostatic bearings.

NOTE The oil pressure of the hydrostatic bearing determines the load and overturning moment capacity of the table. Higher oil pressure brings higher load and overturning moment capacity.

6.3.3 Flat spring table

The connection between the moving table and the fixed part of the guidance system is achieved by metallic flat springs, the stiffness of which is low in the longitudinal direction and high in the other five degrees of freedom.

6.3.4 Oil or air cushion table

The moving table lies on a face plate, the two opposite faces being separated by an oil or grease film or by an air cushion to reduce the friction coefficient (it is not possible to define the degree of stiffness of the connection between the moving table and the fixed part of the guidance system for this type of table).

6.3.5 Mechanical slide table

The connection between the fixed part of the guidance system and the moving table is ensured by a system of slides and connecting links. The stiffness is very low in the longitudinal direction. The stiffness for the other degrees of freedom is very high except for any clearances which can exist.

6.3.6 Ball, roller or needle bearing table

The principle is the same as for mechanical slide tables but friction reduction is obtained by ball, roller or needle bearing.

6.3.7 Hydraulic slide table

The principle is the same as for mechanical slide tables. However, the table is lubricated by a pressurized hydraulic system. Stiffness can be defined for very small transverse linear or rotational displacements.

6.3.8 Magnetic bearing table

The connection between the table and the fixed part of the guidance system is achieved by a magnetic field, the gradient of which determines the stiffness. There is no physical contact between the moving surfaces. Stiffness and friction are negligible in the longitudinal direction. Stiffness corresponding to the other degrees of freedom can be defined.

6.3.9 Dry bearing table with hydrostatic compensation

The connection between the table and the fixed part of the guidance system is achieved by contact of two materials with low-friction properties.

Self-alignment and clearance compensation are ensured by fluid pressure on the outside of the contact surface.

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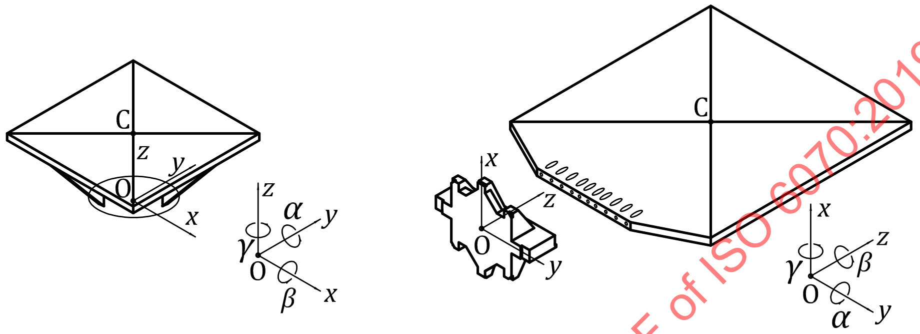
The stiffness is very low in the longitudinal direction. Stiffness corresponding to the other degrees of freedom can be specified.

6.4 Axis systems

6.4.1 Moving table reference axis system

The characteristic dimensions of the moving table are defined with respect to the axes constituting its reference axis system (see Figure 3).



a) Head expander **b) Slip table**

Figure 3 — Moving table reference axis system

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For a slip table, the reference axis system is defined as follows.

— O*z* is the longitudinal axis (parallel to the direction of the motion induced by the vibration generator and directed from the loading surface of the moving table to the free end).

— O*x* is the normal axis (perpendicular to the moving table plane and directed towards the equipment under test).

— O*y* is the lateral axis (constitutes a direct rectangular trihedral angle with the above-mentioned axes).

The origin O of the reference axis system is the intersection of the moving table loading surface with the horizontal axis of the vibration generator.

For a head expander, the reference axis system is defined as follows.

— O*z* is the normal axis (parallel to the direction of the motion induced by the vibration generator and directed towards the equipment under test).

— O*x* is one lateral axis (perpendicular to the moving table plane and directed towards the front view of the vibration generator).

— O*y* is the other lateral axis (perpendicular to the moving table plane and directed towards the side view of the vibration generator, constituting a direct rectangular trihedral angle with the above-mentioned axes).

The origin O of the reference axis system is the intersection of the moving table loading surface with the vertical axis of the vibration generator.

In the case where the table is coupled to several vibration generators, one is selected to define the reference axis system for the moving table.

Motions are defined with respect to a fixed axis system O*x*, O*y*, O*z*, the axes of which are parallel to the axes of the moving table reference axis system.

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6.4.2 Other moving table reference axis systems

Other axis systems whose axes are parallel to the table reference axis system and where the origin is according to requirement (for example, centre of gravity, centre of mounting plane, etc.) can be defined for special purposes.

7 Auxiliary table characteristics

7.1 General

This clause describes the equipment functionality and characteristics for various auxiliary tables specifying three levels of description according to this document (see Clause 9).

7.2 Characteristics

7.2.1 Effective travel

This is the limit within which the moving table normally operates and beyond which performances are no longer guaranteed by the manufacturer.

7.2.2 Rated frequency range

This is the range defined by the limits f_{min} and f_{max}, between which the moving table normally operates and below and above which performances are no longer guaranteed by the manufacturer.

7.2.3 Rated RMS velocity v_z

The rated RMS value of the velocity along the z-axis is the maximum value of the velocity for which the table can operate continuously over the rated frequency range with the selected test load (pure mass).

7.2.4 Static load (limit) F_s

This is the maximum static load which can be withstood by the table without damage.

This characteristic is applicable to most uniformly distributed loads. As for the elastic deformation of the auxiliary table due to the concentrated forces of the non-uniformly distributed loads, the load capacity of the table can be insufficient to withstand the mass within the load limits. For this case, the load support system (normally bearing allocation) should be redesigned to satisfy the static load requirements of the concentrated loads, subject to the agreement between the manufacturer and the user.

7.2.5 Static load (limit) per unit area F_p

This is the maximum static load per unit area which can be withstood by the table without damage.

7.2.6 Limiting axial forces

These are the limiting axial forces, static as well as dynamic, which can be exerted on the auxiliary table along the three axes without damage.

7.2.7 Limiting pitching torque C_α

This is the limiting torque in pitch due to static and dynamic forces which can be exerted on the table without damage.

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7.2.8 Limiting rolling torque C_β

This is the limiting torque in roll due to static and dynamic forces which can be exerted on the table without damage.

7.2.9 Limiting yawing torque C_γ

This is the limiting torque in yaw due to static and dynamic forces which can be exerted on the table without damage.

In the case of moving tables simultaneously driven from several points, the conditions of use shall be agreed between the manufacturer and the user.

7.2.10 Transmissibility

This is the non-dimensional ratio of the response amplitude of a system in steady state forced vibration to the excitation amplitude. The ratio can be one of forces, displacements, velocities or accelerations.

7.2.11 Total harmonic distortion of acceleration

Related to the output signal, it is expressed by the following formula:

$$d = \frac{\sqrt{x_2^2 + x_3^2 + \ldots + x_n^2}}{x_1}$$

where

x_1	is the RMS magnitude of the fundamental component;
$x_2, x_3, \ldots, x_n$	are the RMS magnitudes of the undesired harmonic components.

7.2.12 Environmental limits

The manufacturer shall provide the limits of all environmental conditions, such as ambient temperature, humidity, dust level, etc. below which continuous operation can be achieved. It is suggested that the manufacturer undertake endurance tests to confirm the temperature limit at the rated velocity with the test loads m_t by measuring temperature in the vicinity of the guidance system to check that the heating effect obtained is not excessive. The endurance test should be of sufficient duration to provide evidence that the product is fit for purpose.

NOTE 1 The auxiliary table is more vulnerable to environmental conditions especially when used along with a climatic chamber.

NOTE 2 Thermal barriers are normally used to isolate the heat flow from the climatic chamber to the table.

NOTE 3 Additional cooling equipment, such as water circulation cooling system, can be used to keep the temperature of the table balanced at an acceptable value.

7.2.13 Load mounting insert pattern

The load mounting inserts are threaded attaching points for the fixture or test article located on the auxiliary table. The inserts are aligned normally orthogonally on the table surface by a constant distance. However, inserts can be removed if they interfere with the bearing mounting threads.

NOTE 1 The constant distance is normally 50 mm (or 2 inches), 100 mm (or 4 inches), 150 mm (or 6 inches), or 200 mm (or 8 inches), according to the table dimensions and customer requirements.

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If the test load has a special shape, for example round, the load mounting inserts should be arranged accordingly in the form of circles.

NOTE 2 For the vibration generators that have both a slip table and a head expander, the insert patterns of the two tables are suggested to be the same, so that the fixture or test article can be tested on both tables.

8 Test loads

Auxiliary tables are tested using test loads m_t preferably chosen from those recommended in this document or any other load agreed between the manufacturer and the user.

For the natural modes of the system, including the test load and its coupling to the test table, to be outside the rated frequency range, the following guidelines should be observed:

a) fasteners should be chosen that ensure the test load is suitably secured to the auxiliary table;

b) the mounting surfaces of the test load and auxiliary table should be fabricated ensuring an appropriate surface finish and flatness to ensure adequate bond;

c) a test load of small relative height should be used. The recommended ratio of the height to the diameter or diagonal of the test load is less than or equal to 0,4.

If so agreed between the manufacturer and the user, offset test loads can be used, in which case the loads and their fixing shall be defined.

The following test loads are applied:

— m_0: the load of the table alone without added mass;

— m_1: a load permitting an acceleration of 10 m/s^2 (approximately 1 g_n) peak under sinusoidal conditions;

— m_4: a load permitting an acceleration of 40 m/s^2 (approximately 4 g_n) peak under sinusoidal conditions;

— m_{10}: a load permitting an acceleration of 100 m/s^2 (approximately 10 g_n) peak under sinusoidal conditions;

— m_{20}: a load permitting an acceleration of 200 m/s^2 (approximately 20 g_n) peak under sinusoidal conditions;

— m_{40}: a load permitting an acceleration of 400 m/s^2 (approximately 40 g_n) peak under sinusoidal conditions.

Test load m_{20} shall be used only when test load m_{40} cannot be used because an acceleration of 400 m/s^2 exceeds the capability of the vibration generator. At the option of the manufacturer, data with this load, m_{20}, may be provided wherever this document calls for data with test load m_{40}. However, such a substitution shall be called to the attention of the user by placing the subscript “20” on the symbols for all such data and adding the following note to the data page: “Test load m_{20} replaces test load m_{40}”.

9 Characteristics to be supplied by the manufacturer

Tables 1 to 10 provide data characteristics that shall be supplied by the manufacturer. Characteristics shared by all auxiliary table types are presented in Table 1. Characteristics specific for tables of a certain type are presented in Tables 2 to 10 depending on the type.

The three levels of description adopted in this document are not related to the quality or size of the auxiliary tables. A higher level of description can, for example, be required for an auxiliary table of small size and medium quality whereas, under certain circumstances, a medium level of description can be sufficient for a large-size, high quality auxiliary table. The level of description required normally depends on the use to which the equipment is to be put by the customer.

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The characteristics shown by the sign "+" in Tables 1 to 10 shall be supplied where demanded by the particular level of description.

Those characteristics which are not required in Tables 1 to 10 for the particular level of description (i.e. those which are shown by the sign "–") can however be supplied by agreement between the manufacturer and the user.

Such characteristics have to be specified at the time of the enquiry and ordering, because their cost, which can be high, has to be taken into consideration.

Clause 10 describes guidelines for the measurement of certain dynamic characteristics which can be required by Tables 1 to 10.

Table 1 — Characteristics shared by all table types

Characteristics	Reference to corresponding clause	Level of description		
		minimum	medium	high
Physical and mechanical characteristics				
Total mass *m* of moving table including moving components of guidance system		+	+	+
Dimensions of test table surface		+	+	+
Coordinates of moving table centre of gravity G		–	+	+
Coordinates of centre (C) of test table surface (see Figure 3)	6.4.1	–	+	+
Dimensions of the insert pattern and tightening torques on test table		+	+	+
Flatness tolerance of the table		–	+	+
Surface flatness of coupling (*S*)		–	–	+
Dimensioned drawing of auxiliary table		+	+	+
Static load limit (F_S)	7.2.4	+	+	+
Static load limit per unit area (F_p)	7.2.5	–	+	+
Moment of inertia of moving table including moving components of guidance system with respect to an axis parallel to *x*-axis, through the centre of gravity of the table (I_x)		–	–	–
Moment of inertia of moving table including moving components of guidance system with respect to an axis parallel to *y*-axis, through the centre of gravity of the table (I_y)		–	–	–
Moment of inertia of moving table including moving components of guidance system with respect to an axis parallel to *z*-axis, through the centre of gravity of the table (I_z)		–	–	–
Operational characteristics				
Rated frequency range	7.2.2	+	+	+
Effective travel	7.2.1	+	+	+
Mechanical stop clearance		–	+	+
Maximum no-load acceleration at point C (along *z*-axis)		+	+	+
Limiting axial force (F_z)	7.2.6	+	+	+
Test table acceleration field uniformity along *x*-axis	10.3	–	–	–
Test table acceleration field uniformity along *y*-axis	10.3	–	–	–
Test table acceleration field uniformity along *z*-axis	10.3	–	+	+
First no-load resonance frequency		+	+	+
Parasitic rotation	10.5	–	–	–

[a] For the various test loads m_t.

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Table 1 *(continued)*

Characteristics	Reference to corresponding clause	Level of description		
		minimum	medium	high
(No-load) angular acceleration about *x*-axis at point C		–	–	–
(No-load) angular acceleration about *y*-axis at point C		–	–	–
(No-load) angular acceleration about *z*-axis at point C		–	–	–
(Loaded) angular acceleration[a] about *x*-axis at point C		–	–	–
(Loaded) angular acceleration[a] about *y*-axis at point C		–	–	–
(Loaded) angular acceleration[a] about *z*-axis at point C		–	–	–
Total harmonic distortion	10.4	+	+	+
Acceleration transmissibility between point C and point O	10.1	–	–	+
Maximum temperature of moving table		–	–	+
Characteristics of installation and mounting				
Total mass of auxiliary table		+	+	+
Condition of generator suspension (free or locked)		+	+	+
Operating position (horizontal or vertical)		+	+	+
Environmental conditions to which the auxiliary table can be subjected (temperature, humidity, etc.)		–	+	+
Safety devices		+	+	+
Requirements for installation and operation (for example, water, electrical power, overhead crane)		+	+	+
Mechanical characteristics of coupling(s)		–	+	+
Coupling compatibility and alignment tolerances between vibration generator and auxiliary tables		–	+	+
Mounting tolerances (specify in particular the distance between point O and the lowest plane of the parts of auxiliary tables being supplied, as well as the associated tolerances)		+	+	+
Heaviest load to be handled		+	+	+
Pollution generated by auxiliary table (for example, oil)		–	–	–
Details of installation (see Figures 1 and 2), including				
— screws connecting the vibration generator to the foundation	Clause 6	+	+	+
— foundation surface drawing	Clause 6	+	+	+
Environmental limits	7.2.12	–	+	+

[a] For the various test loads m_t.

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Table 2 — Characteristics specific for head expanders

Characteristics	Reference to corresponding clause	Level of description		
		minimum	medium	high
Rated velocity (v_z)	7.2.3	+	+	+
Limiting lateral force (F_x)	7.2.6	–	–	+
Limiting pitching torque (C_α)	7.2.7	–	+	+
Translational stiffness of guidance system along *x*-axis (K_x)		–	+	+
Translational stiffness of guidance system along *y*-axis (K_y)		–	–	+
Rotational stiffness of guidance system about *x*-axis (K_γ)		–	–	–
Rotational stiffness of guidance system about *y*-axis (K_α)		–	–	–
Rotational stiffness of guidance system-about *z*-axis (K_β)		–	–	–

Table 3 — Characteristics specific for hydrostatic bearing tables

Characteristics	Reference to corresponding clause	Level of description		
		minimum	medium	high
Rated velocity (v_z)	7.2.3	+	+	+
Limiting lateral force (F_y)	7.2.6	–	–	+
Limiting pitching torque (C_α)	7.2.7	+	+	+
Force to overcome static friction[a] (F_α)		–	+	+
Translational stiffness of guidance system along *x*-axis (K_x)		–	+	+
Translational stiffness of guidance system along *y*-axis (K_y)		–	–	+
Rotational stiffness of guidance system about *x*-axis (K_γ)		–	–	–
Rotational stiffness of guidance system about *y*-axis (K_α)		–	–	–
Rotational stiffness of guidance system-about *z*-axis (K_β)		–	–	–

[a] Can depend on the test load m_t and the position of the moving table along *z* axis.

Table 4 — Characteristics specific for flat spring tables

Characteristics	Reference to corresponding clause	Level of description		
		minimum	medium	high
Rated velocity (v_z)	7.2.3	+	+	+
Limiting lateral force (F_y)	7.2.6	–	–	+
Limiting pitching torque (C_α)	7.2.7	+	+	+
Translational stiffness of guidance system along *x*-axis (K_x)		–	+	+
Translational stiffness of guidance system along *y*-axis (K_y)		–	–	+
Translational stiffness of guidance system along *z*-axis (K_z)		–	+	+
Rotational stiffness of guidance system about *x*-axis (K_γ)		–	+	+
Rotational stiffness of guidance system about *y*-axis (K_α)		–	–	–
Rotational stiffness of guidance system-about *z*-axis (K_β)		–	+	+

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Table 5 — Characteristics specific for oil film or air cushion tables

Characteristics	Reference to corresponding clause	Level of description		
		minimum	medium	high
Rated velocity (v_z)	7.2.3	+	+	+
Limiting pitching torque (C_α)	7.2.7	+	+	+
Force to overcome static friction[a] (F_α)		–	+	+

[a] Can depend on the test load m_t and the position of the moving table along z axis.

Table 6 — Characteristics specific for mechanical slide tables

Characteristics	Reference to corresponding clause	Level of description		
		minimum	medium	high
Rated velocity (v_z)	7.2.3	+	+	+
Limiting lateral force (F_y)	7.2.6	–	–	+
Limiting pitching torque (C_α)	7.2.7	+	+	+
Force to overcome static friction[a] (F_α)		–	+	+

[a] Can depend on the test load m_t and the position of the moving table along z axis.

Table 7 — Characteristics specific for ball, roller or needle bearing tables

Characteristics	Reference to corresponding clause	Level of description		
		minimum	medium	high
Rated velocity (v_z)	7.2.3	+	+	+
Limiting lateral force (F_y)	7.2.6	–	–	+
Limiting pitching torque (C_α)	7.2.7	+	+	+
Force to overcome static friction[a] (F_α)		–	+	+
Translational stiffness of guidance system along x-axis (K_x)		–	+	+
Translational stiffness of guidance system along y-axis (K_y)		–	+	+
Rotational stiffness of guidance system about x-axis (K_γ)		–	–	–
Rotational stiffness of guidance system about y-axis (K_α)		–	–	–
Rotational stiffness of guidance system about z-axis (K_β)		–	–	–

[a] Can depend on the test load m_t and the position of the moving table along z axis.

Table 8 — Characteristics specific for hydraulic slide tables

Characteristics	Reference to corresponding clause	Level of description		
		minimum	medium	high
Rated velocity (v_z)	7.2.3	+	+	+
Limiting lateral force (F_y)	7.2.6	–	–	+
Limiting pitching torque (C_α)	7.2.7	+	+	+
Force to overcome static friction[a] (F_α)		–	+	+

[a] Can depend on the test load m_t and the position of the moving table along z axis.

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