International Standard 6070

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Auxiliary tables for vibration generators — Methods of describing equipment characteristics

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

First edition — 1981-07-01

UDC 534.232 **Ref. No. ISO 6070-1981 (E)**

Descriptors : vibrators (machinery), tables (data), categories, symbols, characteristics, tests, vibration tests.

Price based on 10 pages

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 6070 was developed by Technical Committee ISO/TC 108, *Mechanical vibration and shock*, and was circulated to the member bodies in February 1980.

It has been approved by the member bodies of the following countries:

Australia	Germany, F.R.	South Africa, Rep. of
Austria	Ireland	Spain
Belgium	Italy	Sweden
Brazil	Japan	Switzerland
Czechoslovakia	Mexico	United Kingdom
Egypt, Arab Rep. of	Netherlands	USA
Finland	New Zealand	USSR
France	Poland	

No member body expressed disapproval of the document.

Contents

Auxiliary tables for vibration generators — Methods of describing equipment characteristics

1 Scope

This International Standard defines the content of the information flow to be established 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 advertised by the various manufacturers of auxiliary tables and associated guidance systems.

2 Field of application

This International Standard applies to auxiliary tables associated with one or several vibration generators working along axes which are parallel to the longitudinal axis of the table.[1)]

The tables dealt with in this International Standard are of the following types :

— flat spring tables;

— oil film or air cushion tables;

— mechanical slide tables;

— ball, roller or needle bearing tables;

— hydraulic slide tables;

— hydrostatic bearing tables;

— magnetic bearing tables;

— dry bearing tables with hydrostatic compensation;

or

— a combination of two or more of the above types.

This International Standard provides three levels of description to be used in describing test equipment, as follows :

a) minimum level of description;

b) medium level of description;

c) high level of description.

This International Standard gives for each level of description a list of the characteristics to be described by the manufacturer either in his tender or in his literature.

1) Auxiliary tables with several degrees of freedom are not covered by this International Standard which applies specifically to the more common types of auxiliary tables where the surface of the table is horizontal; however, if suitable means for counteracting the force of gravity are provided, the table may have any orientation.

3 Symbols

C_α	Limiting pitching torque
C_β	Limiting rolling torque
C_ψ	Limiting yawing torque
d	Total harmonic distortion of acceleration
F_a	Force measured in direction z to overcome static (stiction) friction (possibly for various test loads and various positions of the moving table along longitudinal z axis)
F_g	Force measured in direction z to overcome dynamic friction
F_s	Static load limit
$F_x - F_y - F_z$	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
$I_x - I_y - I_z$	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
$K_\alpha - K_\beta - K_\psi$	Rotational stiffness of guidance about the three axes
m	Total mass of moving table including moving components of guidance system
m_t	Test load (index t = 0, 1, 2, 3, 4 and 5, see clause 6)
V_z	Rated rms velocity along z axis
$X_C - Y_C - Z_C$	Coordinates of centre of test table surface (see 5.2, figure 2)
$X_G - Y_G - Z_G$	Coordinates of moving table centre of gravity
α	Pitch angle (rotation about y axis)
β	Roll angle (rotation about z axis)
ψ	Yaw angle (rotation about x axis)

4 Units

When the manufacturer, or user, specifies values for the parameters required in this International Standard, the units to be used shall be clearly defined and it shall be stated, where applicable, whether quantities are expressed as rms, peak or peak-to-peak values.

5 Definitions

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 which shall be compatible with the guidance system of the vibration generator(s).

The auxiliary table is composed of :

— the moving table including the test table and the coupling (or couplings) to the vibration generator (or generators);

— the guidance system;

— levelling blocks.

5.1 Types of auxiliary tables

5.1.1 flat spring tables : 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.

5.1.2 oil or air cushion tables : 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).

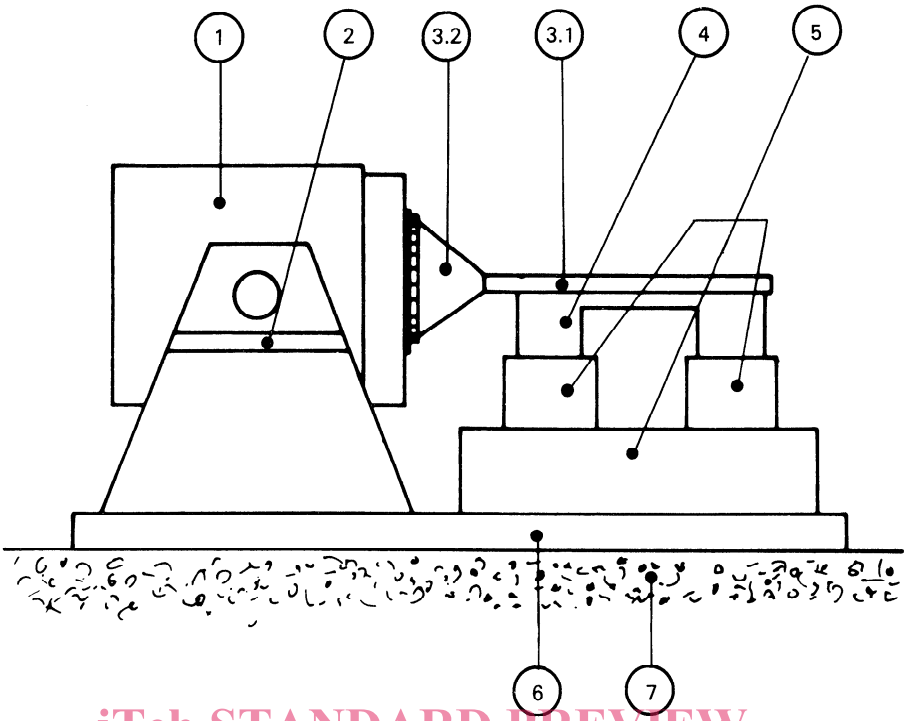
5.1.3 mechanical slide tables : The connection between the fixed part of the guidance system and the moving table is ensured by a system of slides and connecting links. The stiffness is very low in the longitudinal direction. The stiffness for the other degrees of freedom is very high except for any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

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

5.1.5 hydraulic slide tables : The principle is the same as for mechanical slide tables but lubrication is achieved under pressure. Stiffness can be defined for very small transverse linear or rotational displacements.

5.1.6 hydrostatic bearing tables : The connection between the table and the fixed parts of the guidance system is achieved by fluid pressure. This ensures self-centering of the system.

Connecting stiffness is negligible in the longitudinal direction. Stiffness corresponding to the other degrees of freedom can be defined.



1 Vibration generator

2 Vibration generator suspension (free or locked)

3 Moving table
3.1 Test table
3.2 Coupling

4 Guidance system of moving table

5 Levelling blocks

6 Base plate

7 Foundation

Figure 1 — Example of coupling of an auxiliary table to single vibration generator — Typical arrangement

5.1.7 magnetic bearing tables : 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.

5.1.8 dry bearing tables 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.

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

5.2 Axis systems

5.2.1 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 2).

OZ 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).

OX is the normal axis (perpendicular to the moving table plane and directed towards the equipment under test).

OY 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.

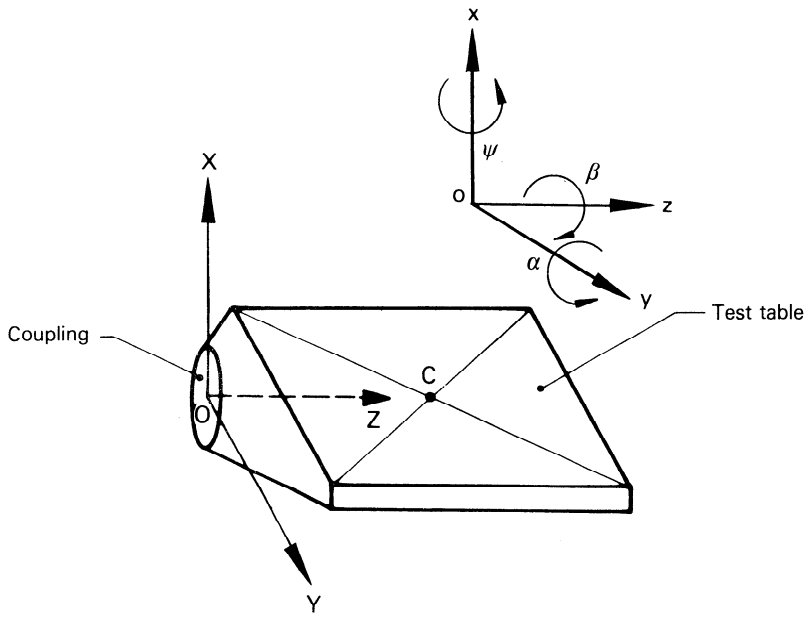


Figure 2 — Moving table reference axis system

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 ox, oy, oz, the axes of which are parallel to the axes of the moving table reference axis system.

5.2.2 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.

5.3 Characteristics

5.3.1 effective travel : The limits between which the moving table normally operates and beyond which performances are no longer guaranteed by the manufacturer.

5.3.2 rated frequency range : 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.

5.3.3 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).

5.3.4 static load (limit) F_s : The maximum static load which can be withstood by the table without damage.

5.3.5 limiting axial forces F_x, F_y, F_z : The limiting axial forces, static as well as dynamic, which can be exerted on the auxiliary table along the three axes without damage.

5.3.6 limiting pitching torque C_α : The limiting torque in pitch due to static and dynamic forces which can be exerted on the table without damage.

5.3.7 limiting rolling torque C_β : The limiting torque in roll due to static and dynamic forces which can be exerted on the table without damage.

5.3.8 limiting yawing torque C_ψ : The limiting torque in yaw due to static and dynamic forces which can be exerted on the table without damage.

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

5.3.9 transmissibility : The non-dimensional ratio of the response amplitude of a system in steady state forced vibration to the excitation amplitude. The ratio may be one of forces, displacements, velocities or accelerations.

5.3.10 total harmonic distortion of acceleration : Related to the output signal, it is expressed by the following equation :

$$d = \frac{\sqrt{A_2^2 + A_3^2 + \ldots A_n^2}}{\sqrt{A_1^2 + A_2^2 + \ldots A_n^2}} \times 100 \text{ (as a percentage)}$$

in which A_1 represents the value of the fundamental term of the signal and $A_2 \ldots A_n$ the harmonic components of the nth order of the signal.

5.3.11 environmental limits : The upper 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 confirm the ambient temperature limit during an endurance test (of 8 h for example) 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.

6 Test loads m_t

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

NOTES

1 In order that the natural modes of the system, including the test load and its coupling to the test table, are outside the rated frequency range, the following guidelines should be observed.

a) fixing screws shall be used in all available mounting locations to ensure sufficient stiffness of connection and avoid loosening or slipping;

b) attention should be paid to the compatibility between contact surfaces of the test load and test table (for example, as concerns flatness);

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

2 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.

6.1 Test load m_0

The load of the table alone without added mass.

6.2 Test load m_1

A load permitting an acceleration of approximately 40 g_n peak under sinusoidal conditions.

6.3 Test load m_2

A load permitting an acceleration of approximately 10 g_n peak under sinusoidal conditions.

6.4 Test load m_3

A load permitting an acceleration of approximately 4 g_n peak under sinusoidal conditions.

6.5 Test load m_4

A load permitting an acceleration of approximately 1 g_n peak under sinusoidal conditions.

6.6 Test load m_5

A load permitting an acceleration of approximately 20 g_n peak under sinusoidal conditions.

NOTE — This test load m_5 shall be used only when test load m_1 cannot be used because an acceleration of 40 g_n exceeds the capability of the vibration generator. At the option of the manufacturer, data with this load m_5 may be provided wherever this International Standard calls for data with the test load m_1, however such substitution shall be called to the attention of the user by placing the subscript 5 on the symbols for all such data and adding to the page of data the note : Test load m_5 replaces test load m_1.

7 Characteristics to be supplied by the manufacturer

Attention is drawn to the fact that the three levels of description adopted in this International Standard are not related to the quality or size of the auxiliary tables.

A higher level of description may, 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 will normally depend on the use to which the equipment is to be put by the customer.

The characteristics shown by the sign "+" in tables 1 to 9 shall be supplied where demanded by the particular level of description.

Those characteristics which are not required in the tables 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.

NOTE — Attention is drawn to the fact that 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 8 describes guidelines for measurement for certain dynamic characteristics which may or may not be required by the tables 1 to 9.