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JAPANESE INDUSTRIAL STANDARD

Testing Methods for Watches and Clocks

JIS B 7001—1983



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Testing Methods for Watches and Clocks

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1. Scope

This Japanese Industrial Standard specifies the testing methods for watches and clocks, hereinafter referred to as the "timepieces".

- Remarks
1. This standard does not apply to timepieces for special applications such as those for aircraft, ships, land vehicles, and for particular installations.
 2. This standard does not apply to timepieces built in other products.

2. Definition

The main terms used in this standard mean as follows:

Remark: The letters in parentheses () after the terms indicate the pronunciation in Japanese.

- (1) watch Timepiece intended mainly for use by wearing or carrying on or about the human body.
- (2) clock As a rule, timepiece used in a fixed position.
- (3) quartz type Type of timepiece with a built-in quartz oscillator as the time base.
- (4) balance wheel type Type of timepiece with a built-in balance wheel with hair spring as the time base.

Reference: Pendulum Type Type of timepiece with a built-in pendulum as the time base.

- (5) spring type Type of timepiece with a main-spring as the power source.
- (6) battery type Type of timepiece with an electric battery as the power source.
- (7) electronic display type Type of timepiece with a display device consisting of an electronic part such as a liquid crystal panel or a light emitting diode panel.
- (8) mechanical display type Type of timepiece with a display device consisting of a mechanical part such as a combination of a dial and hands, indicator plate, drum, etc.

Applicable Standard and Corresponding International Standards: See page 31.

- (9) Manipulating parts Parts used for manipulating the timepiece, such as a crown, buttons, and switches.
 - (10) display device The part which indicates time or the like.
 - (11) additional devices Devices which operate functions other than time display.
 - (12) starting To give power to the timepiece⁽¹⁾ and making it start running.
- Note ⁽¹⁾ This means fully winding up the main-spring or weight, assembling batteries into the timepiece, or connecting the timepiece with an outside power source.
- (13) running-in A preparatory running of the timepiece before the test to adapt it to the test conditions.
 - (14) rated voltage The standard voltage to operate the timepiece.
 - (15) prescribed manipulation The procedure of manipulation described in the handling instruction book or the like.
 - (16) nominal number of days for winding interval mentioned on the timepiece body, in the handling instruction book, or the like.
 - (17) position The direction of the timepiece placed (refer to Appendix 1).
 - (18) normal position The position of the timepiece in which it is normally used.
 - (19) state The difference between the time of day indicated by the timepiece and the reference clock time⁽²⁾.
 - (20) stopping The stopping of running of the timepiece within the prescribed testing period.
 - (21) indication lag The phenomenon occurring in the case of mechanical display type timepieces in which the indication of the display device shows a remarkable lag due to the loosening of connection between the cannon pinion and center wheel or to other reasons.
 - (22) indication disorder The phenomenon in which the state shows an abnormal change during the prescribed testing period.
 - (23) precision The time precision of the timepiece.
 - (24) rate (HODO) The difference per unit time between two states measured at a given time interval⁽²⁾, that is the gain or loss per unit time of the timepiece, usually converted to the value per day.

- (25) daily rate (NISSA) The difference per day between two states separated by a time interval of 24 h⁽²⁾, that is, the gain or loss of the time piece relative to the reference time measured after a time elapse of 24 h.

Note ⁽²⁾ The rate or daily rate shall be expressed as plus (+) if the timepiece gains relative to the reference time, and as minus (-) if it loses.

- (26) basic rate⁽³⁾ The rate measured with the timepiece left standing still at room temperature.
- (27) basic daily rate⁽³⁾ The daily rate measured with the timepiece left standing still at room temperature.
- (28) mean basic daily rate⁽³⁾ The arithmetic mean value of basic daily rates.

Note ⁽³⁾ Where judgment is made that there is no fear of misunderstanding occurring, these rates may respectively be indicated simply as rate, daily rate, and mean daily rate.

- (29) time-dependent change The quantity of time-dependent change in rate or daily rate, expressed by the difference between the rates or daily rates measured on a given day and that measured after a given period under the same conditions. In a wide sense, this includes the recovery rate.
- (30) recovery rate A value indicating the ability of recovering the initial rate or daily rate when the timepiece is operated under changed conditions in temperature, position, and the like for a given period, expressed by the difference between the initial rate or daily rate and that measured when the timepiece is operated under different conditions for a given period and then again operated under the initial conditions.
- (31) residual effect A value indicating the ability of recovering the initial rate or daily rate when an environmental resistance test is performed, expressed by the difference between the initial rate or daily rate and that measured when the timepiece is exposed to given environmental conditions and then the initial conditions are restored.
- (32) drift The rate of time-dependent change in rate or daily rate, expressed by the difference per unit time between the rate or daily rate measured on a given day and that measured after a given period under the same conditions.
- (33) variation of daily rate (NIKKAKUSA) The quantity of variation per day in rate or daily rate, expressed by the difference between the rate or daily rate measured on a given day and that measured on the next day under the same conditions.
- (34) mean deviation of daily rate The value of mean deviation of daily rate measured consecutively for a given period.

- (35) maximum deviation of daily rate The value of maximum deviation of daily rate measured consecutively for a given period.
- (36) temperature coefficient The rate of change in rate or daily rate relative to the change in temperature, expressed by the value per 1°C.
- (37) temperature error The quantity of change in rate or daily rate, expressed by the difference between the rate or daily rate measured at a high temperature or low temperature and that measured at ordinary temperature.
- (38) secondary temperature error The difference between the rate or daily rate at ordinary temperature calculated from the temperature coefficient and that actually measured at ordinary temperature, which indicates the linearity of the temperature characteristics.
- (39) atmospheric pressure coefficient The rate of change in rate or daily rate relative to the change in atmospheric pressure, expressed by the value per 1 mbar.
- (40) atmospheric pressure error The quantity of change in rate or daily rate relative to the change in atmospheric pressure, expressed by the difference between the rate or daily rate measured at a low atmospheric pressure and that measured at ordinary pressure.
- (41) position error The quantity of change in rate or daily rate relative to the change in position, expressed by the difference between the rate or daily rate measured in a given position and that measured in a different position.
- (42) position mean deviation The mean deviation value of the rates or daily rates measured in various postures.
- (43) position maximum deviation The greatest deviation in rates or daily rates measured in various position.
- (44) vertical-horizontal difference The difference between the rate or daily rate measured in the vertical position and that measured in the horizontal position.
- (45) voltage coefficient The rate of change in rate or daily rate relative to the change in source voltage, expressed by the value per 0.1 V or 1 V.
- (46) voltage error The quantity of change in rate or daily rate relative to the change in source voltage, expressed by the difference between the rate or daily rate measured at a high source voltage and that measured at a low source voltage.
- (47) spring torque error The quantity of change in rate relative to the change in main spring torque, expressed by the difference between the rate measured when the main spring is fully wound up and that measured when the spring has got unwound by a quantity equivalent to the nominal number of days for winding.

- (48) running time The time duration from starting to the time when the timepiece ceases to run.
- (49) effective running time The time duration for which the timepiece maintains the prescribed performance from starting.
- (50) temperature endurance General term for heat endurance and cold endurance.
- (51) heat endurance The characteristic of the timepiece to endure a high temperature.
- (52) cold endurance The characteristic of the timepiece to endure a low temperature.
- (53) humidity endurance The characteristic of the timepiece to endure a high humidity.
- (54) light magnetic field resistance The characteristic of the timepiece to resist a magnetic field of the degree applied in daily use.
- (55) light shock resistance The characteristic of the timepiece to resist an shock of the degree applied in daily use.
- (56) light vibration resistance The characteristic of the timepiece to resist a vibration of the degree applied in daily use.
- (57) water-resistance The characteristic to prevent the immersion of water, sweat, or the like into the case from outside.
- (58) antimagnetic The characteristic of the timepiece to resist a strong magnetic field which is rarely applied in daily use.
- (59) shock resistance The characteristic to resist a shock equivalent to that applied when the timepiece is dropped by mistake.

Reference: Swing Angle The angle through which the balance wheel with hair spring or pendulum swings to one side from the centre of vibration.

Out-beat (KATAFURI) In the case of a balance wheel with hair spring or pendulum, the phenomenon in which the transfer of oscillation energy is not performed symmetrically for the left and right about the centre of vibration.

3. Kind of Tests

The kind of tests covered by this standard shall be as follows, and timepieces shall be tested by selecting the kind of tests according to the purpose and demand of the test and the characteristics of the timepiece.

- (1) Function Test
- (2) Performance Tests

(2.1) Stationary and room-temperature accuracy test

- (2.2) Accuracy stability test
- (2.3) Temperature-dependent accuracy test
- (2.4) Atmospheric pressure-dependent accuracy test
- (2.5) Position-dependent accuracy test
- (2.6) Source voltage-dependent accuracy test
- (2.7) Spring torque-dependent accuracy test

(3) Environmental Endurance Tests

- (3.1) Temperature endurance test
 - (a) Heat endurance test
 - (b) Cold endurance test
- (3.2) Humidity endurance test
- (3.3) Light magnetic field endurance test
- (3.4) Light shock resistance test
- (3.5) Light vibration resistance test
- (3.6) Water-resistance test
- (3.7) Antimagnetic test
- (3.8) Shock resistance test

(4) Other Characteristics Test

- (4.1) Running time test

4. Common Requirements of Test and General Test Conditions

Tests shall, as a rule, be performed as follows except as specified for the individual tests.

- (1) Tests shall, as a rule, be performed on the completed products.

Remark: External accessories such as the wristwatch band, chain, and decorative accessories may be detached in the test.

- (2) Test shall be performed at room temperature (18 to 28°C) and a relative humidity of 30 to 70 % and the temperature variation during the test shall be within $\pm 2^\circ\text{C}$.

Remark: According to the purpose and demand of the test, the test temperature and tolerances thereon may be given as $23 \pm 0.2^\circ\text{C}$, $23 \pm 0.5^\circ\text{C}$, or $23 \pm 1^\circ\text{C}$, and the test humidity and tolerances thereon may be given as $50 \pm 2\%$, $50 \pm 5\%$, $65 \pm 2\%$, or $65 \pm 5\%$.

- (3) Tests shall be performed by starting the timepiece and letting it run in the "dial up" position in the case of a watch, and in the normal position in the case of a clock. However, tests shall, as a rule, be performed without operating additional devices except where such devices are particularly made the object of the test.

Remarks 1. Spring type timepieces shall be tested after fully winding up the main-spring again directly before exposing them to the respective test conditions.

2. Battery type timepieces shall be tested at a source voltage in the rang from the rated voltage to 110 % threrof.

- (4) Tests shall be performed, as required, after performing a running-in until a stationary state is reached. Particularly in the following cases, a running-in operation shall be performed.

(a) Where a test relating to accuracy is perfoemd.

(b) When performing tests consecutively, where the preceding test influences the results of the subsequent test.

- (5) The test apparatus and measuring instruments shall be as shown in Appendix 2.

In addition, the test apparatus and the instruments shall have an accuracy meeting the requirements of the respective tests.

- (6) The rate and daily rate shall be measured as follows:

(6.1) The rate shall be measured as follows:

(a) The rate shall be measured by using a rate measuring instrument.

(b) For the main spring type, measurement shall be made within 30 min from the prescribed measuring point of time.

(c) For the quartz type, measurement shall be made after adapting the timepiece to ambient temperature at least for 1 h.

(d) To obtain accurate measured values, measurement shall be made taking into consideration the selection of the measuring tiem, number of measurements, and measuring clock time signal, and other factors.

(6.2) The daily rate shall be measured by reading the state by suitable means such as visual observation, photography, or time signal detection.

(6.3) The reading unit for the rate or daily rate shall be selected according to the purpose and demand of the test and the accuracy of the timepiece. Fractions of the measured values shall be rounded off.

(6.4) The means of measuring accuracy - by the rate or daily rate - shall be selected according to the purpose and demand of the test.

- (7) When changing the test temperature, the rate of rise or fall in temperature shall, as a rule, be 20 min per 10°C.

5. Tests

5.1 Function Test The function test shall be performed as follows:

- (1) Purpose This test shall be performed for the purpose of examining the manner of running of the timepiece, manner of actuation, functions such as the operability of the manipulating parts.

- (2) Testing Method The following procedures shall be performed:

- (2.1) After letting the timepiece run for the prescribed time⁽⁴⁾ from stating, examine its manner of running.

Note ⁽⁴⁾ This time shall be 1 h for the quartz type and 24 h, as a rule, for the other types.

- (2.2) Manipulate the manipulating parts according to the prescribed procedure and examine for the occurrence of abnormalities.

- (2.3) Visually examine for abnormalities in the display device.

- (2.4) For timepieces having additional devices, operate them according to the prescribed procedure and examine the existence of abnormalities.

- (3) Items of Examination The items of examination shall be as follows:

- (3.1) Running condition such as stopping, indication lag, and indication disorder.

- (3.2) Manipulating functions such as pulling out and pushing in of winding stem, winding of main spring, turning of hands, manipulation of buttons and switches, and manipulation of regulator, and adjusting screw.

- (3.3) Functioning conditions of the display device, such as fluctuation in the movement of the second hand, switching of number card or drum, and the manner of display and indication switching of electronic display device.

- (3.4) The items of examination for the calendar device, alarm device, time announcing device, and time measuring device among additional devices shall be as follows:

- (a) Calendar Device Functions of the calendar device such as the clock time of calendar actuation, switching of calendar, and operation of quick turn device.

- (b) Alarm Device Functions of alarm device such as the manner of actuation corresponding to alarm setting time, operations of alarm setting and resetting and sound stopping, feasible range of alarm setting, and manner of alarm sounding.