
INTERNATIONAL STANDARD



3159

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

Timekeeping instruments — Wrist-chronometers with spring balance oscillator

Instruments horaires — Chronomètres-bracelet à oscillateur balancier-spiral

First edition — 1976-02-01

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UDC 681.114.8

Ref. No. ISO 3159-1976 (E)

Descriptors : time-measuring instruments, wrist-chronometers.

Price based on 3 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 3159 was drawn up by Technical Committee ISO/TC 114, *Horology*, and circulated to the Member Bodies in April 1975.

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It has been approved by the Member Bodies of the following countries :

Czechoslovakia	Mexico	standards.iteh.ai/catalog/standards/sist/3b0a81f1-057a-4522-88d4-4d07964a9c88/iso-3159-1976	Switzerland
France	Portugal		Turkey
Germany	Romania		United Kingdom
Ireland	South Africa, Rep. of		U.S.S.R.
Japan	Spain		

No Member Body expressed disapproval of the document.

Timekeeping instruments – Wrist-chronometers with spring balance oscillator

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1 SCOPE AND FIELD OF APPLICATION

This International Standard lays down the definition of the term "chronometer", describing the categories, the test programme and the acceptable minimum requirements for wrist-chronometers.

NOTE – Wristwatches using a tuning fork oscillator are subjected to these tests pending the availability of separate standards.

2 REFERENCE

ISO 3158, *Timekeeping instruments – Symbolization of control positions*.

3 DEFINITION

3.1 A wristwatch described as a "chronometer" must satisfy the minimum requirements laid down in clause 7.

3.2 The term "chronometer" is applied to precision wristwatches regulated for different positions and for various conditions of use. Conformity to the definition of

chronometer will be certified by a neutral official authority, which checks the watch, or if necessary the movement, and issues an official certificate.

4 CATEGORIES OF WRISTWATCHES

Wristwatches are divided into two categories dependent on casing diameter or casing-up surface.

Category	Casing diameter mm	Casing-up surface mm ²
1	> 20	> 314
2	≤ 20	≤ 314

5 DEFINITION OF CRITERIA

The condition of the watch designated by the letter E_i is obtained by subtracting the standard reference time from the time indicated by the watch. The time is observed to within limits of $\pm 0,5$ s.

The condition is rounded to the nearest full second.

The daily rate M_i is obtained by subtracting the condition observed 24 h earlier from the condition on the day of observation; it is expressed by the following formula :

$$M_i = \frac{1}{t_d}(E_i - E_{i-1})$$

where

$$t_d = 1 \text{ (one day);}$$

$$i = 1, 2, \dots, 15.$$

By convention, this daily rate M_i is expressed in seconds per day (s/d). It is positive if the watch gains and negative if the watch loses.

5.1 \bar{M} : Mean daily rate

\bar{M} is the arithmetic mean of daily rates during the first 10 days of the tests.

$$\bar{M} = \frac{1}{10}(M_1 + M_2 + \dots + M_{10})$$

5.2 \bar{V} : Mean variation in rates

\bar{V} is the arithmetic mean of the five absolute values of variations in rates obtained for the five positions of the watch during the first 10 days of the tests.

$$\bar{V} = \frac{1}{5}(|M_2 - M_1| + |M_4 - M_3| + \dots + |M_{10} - M_9|)$$

NOTE – The variation in rate is the difference between two consecutive daily rates in identical environmental conditions.

5.3 V_{max} : Greatest variation in rates

V_{max} is the absolute value of the greatest of the five variations in rates with regard to the five positions of the watch during the first 10 days of the tests.

$$V_{max} = |M_{i+1} - M_i|_{max}$$

where $i = 1, 3, 5, 7, 9$.

5.4 D : Difference between the rates in horizontal and vertical positions of the watch

D is obtained by subtracting the average of the rates observed in position CH (9th and 10th days) from the average of the rates observed in position 6H (1st and 2nd days).

$$D = \frac{1}{2}(M_1 + M_2) - \frac{1}{2}(M_9 + M_{10})$$

5.5 P : Greatest deviation in rates

P is the absolute value of the greatest of the ten differences between one of the first ten rates and the mean daily test rate.

$$P = |M_i - \bar{M}|_{max}$$

where $i = 1, 2, \dots, 10$.

5.6 C : Variation in rate as a function of temperature

C is obtained by subtracting the rate at 8 °C from the rate at 38 °C, the whole being divided by the temperature difference, expressed in degrees Celsius.

$$C = \frac{M_{13} - M_{11}}{30}$$

5.7 R : Resumption of the rate

R is obtained by subtracting the average of the first two rates from the last rate.

$$R = M_{15} - \frac{M_1 + M_2}{2}$$

6 TEST PROGRAMME¹⁾

Day	Position ²⁾	Nominal temperature ³⁾ in degrees Celsius	E_j	M_j
0	6H	23	E_0	
1	6H	23	E_1	M_1
2	6H	23	E_2	M_2
3	3H	23	E_3	M_3
4	3H	23	E_4	M_4
5	9H	23	E_5	M_5
6	9H	23	E_6	M_6
7	FH	23	E_7	M_7
8	FH	23	E_8	M_8
9	CH	23	E_9	M_9
10 ⁴⁾	CH	23	E_{10}	M_{10}
11	CH	8	E_{11}	M_{11}
12	CH	23	E_{12}	M_{12}
13	CH	38	E_{13}	M_{13}
14	6H	23	E_{14}	M_{14}
15	6H	23	E_{15}	M_{15}

1) Normally, there shall be no interruption during the tests.

2) See ISO 3158.

3) The tolerance on the temperature is ± 1 °C.

4) Auxiliary mechanisms the functions of which can be interrupted shall be made to function only on the 10th day.

7 MINIMUM REQUIREMENTS

Criteria	Units	Minimum requirements	
		Categories	
		1	2
\bar{M} : Mean daily rate	s/d	- 4 + 6	- 5 + 8
\bar{V} : Mean variation in rates	s/d	2	3,4
$V_{\max.}$: Greatest variation in rates	s/d	5	7
D : Difference between the rates in horizontal and vertical positions of the watch	s/d	- 6 + 8	- 8 + 10
P : Greatest difference in rates	s/d	10	15
C : Variation in rate as a function of temperature	s/(d·°C)	± 0,6	± 0,7
R : Resumption of the rate	s/d	± 5	± 6

NOTE – The minimum requirements are considered to be absolute limits and no calculation result shall be rounded off.

8 FINAL CONDITIONS

8.1 The official authority of each member country of ISO authorized to issue the titles of "chronometer" shall be under the supervision of the CICC (Commission Internationale des Contrôles Chronométriques).

8.2 All important changes proposed by CICC shall be submitted to ISO for agreement. To that end, a close liaison between CICC and the Secretariat of ISO/TC 114 will be maintained.

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