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## Horology — Magnetic resistant watches

*Horlogerie — Montres résistantes au magnétisme*

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# Contents

Page

<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Requirements</b> .....	<b>1</b>
4.1 General.....	1
4.2 Requirements for mechanical watches.....	1
4.2.1 Running conditions of mechanical watches during magnetic fields application.....	1
4.2.2 Residual effect for mechanical watches after magnetic fields application.....	2
4.2.3 Other effects.....	2
4.3 Requirements for electronic watches.....	2
4.3.1 Running conditions of electronic watches during magnetic fields application.....	2
4.3.2 Other effects.....	2
<b>5 Test methods</b> .....	<b>2</b>
5.1 Test conditions.....	2
5.2 Test apparatus.....	3
5.3 Test procedure.....	3
5.3.1 General.....	3
5.3.2 Test procedure for mechanical watches.....	3
5.3.3 Test procedure for electronic watches.....	4
<b>6 Marking</b> .....	<b>4</b>
<b>Annex A (normative) Enhanced magnetic resistant watches</b> .....	<b>6</b>
<b>Annex B (informative) Flow chart for the test procedure</b> .....	<b>8</b>
<b>Annex C (informative) Relationship with the distance from products generating magnetic fields</b> .....	<b>12</b>
<b>Bibliography</b> .....	<b>14</b>

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 114, *Horology*, Subcommittee SC 12, *Antimagnetism*.

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This fourth edition cancels and replaces the third edition (ISO 764:2002), which has been technically revised. The main changes compared to the previous edition are as follows:

- additions of enhanced magnetic resistant watches and relationship with the distance from products generating magnetic fields in [Annex C](#).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

Before all, we are exposed to various magnetic fields in daily life and, the watches we wear are also exposed to magnetic fields.

Unfortunately, the exposure of watches to strong magnetic fields may influence their accuracy.

In the case of mechanical watches, the motion of the spring balance oscillator responsible for the accuracy of the watch may be adversely affected, resulting in an influence on their accuracy. In the case of electronic watches, the rotation of the motor(s) that moves the hand(s) is affected.

Also, as magnetic fields are invisible, they are not easily understood by consumers. Furthermore, the strengths of magnetic fields are closely related to the distances between the watch and the sources of magnetic fields generated by products. For the effect on the accuracy of watches, since the strengths of magnetic fields differ with the distances from the sources of magnetic fields, it is advisable to make consumers understand magnetic fields encountered in daily life and their strengths, and the distance relationship between watches and the sources of magnetic fields.

Based on the above, products generating magnetic fields encountered in daily life, and the relationship between the strengths of magnetic fields generated by these products and the distances from the sources of magnetic fields are summarized in [Annex C](#).

Also, the following two types are defined: magnetic resistant watches that can withstand the strengths of magnetic fields encountered in normal daily life and enhanced magnetic resistant watches that can withstand strong magnetic fields.

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# Horology — Magnetic resistant watches

## 1 Scope

This document specifies the minimum requirements and test methods for magnetic resistant watches.

This document applies to magnetic resistant watches designed to withstand daily magnetic fields.

Moreover, it indicates the marking which the manufacturer is authorized to apply to them.

## 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 3158, *Timekeeping instruments — Symbolization of control positions*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions 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

#### **magnetic resistant watch**

watch designed to withstand a homogeneous and continuous direct current magnetic field of 4 800 A/m encountered on a daily basis

### 3.2

#### **enhanced magnetic resistant watch**

watch designed to withstand a homogeneous and continuous strong direct current magnetic field equal or higher than 16 000 A/m encountered in close proximity

### 3.3

#### **residual effect**

difference of rates before and after the magnetic resistance test

## 4 Requirements

### 4.1 General

Magnetic resistant watches shall meet the requirements of 4.2 or 4.3 when applying magnetic fields of 4 800 A/m. Enhanced magnetic resistant watches shall meet the requirements of Annex A.

### 4.2 Requirements for mechanical watches

#### 4.2.1 Running conditions of mechanical watches during magnetic fields application

When observed during the magnetic fields application, watches shall not stop.

**4.2.2 Residual effect for mechanical watches after magnetic fields application**

The residual effects  $d_{CH-X}$  on the watch rate are calculated as by the following formulae as differences between rates after magnetic fields application  $M_{CH-X}$  and initial rate  $M_{CH-0}$ .

- Residual effect with magnetic fields application in 3H-9H direction:  $d_{CH-1} = M_{CH-1} - M_{CH-0}$
- Residual effect with magnetic fields application in 12H-6H direction:  $d_{CH-2} = M_{CH-2} - M_{CH-0}$
- Residual effect with magnetic fields application in CH-FH direction:  $d_{CH-3} = M_{CH-3} - M_{CH-0}$

The residual effect ( $d_{CH-X}$ ) shall not exceed the values in [Table 1](#).

**Table 1 — Residual effect for mechanical watches with spring balance oscillator**

Casing diameter mm	Casing-up surface mm <sup>2</sup>	Residual effect ( $d_{CH-X}$ ) s/d
$>\phi 20$	$>314$	$\pm 30$
$\leq\phi 20$	$\leq 314$	$\pm 45$

**4.2.3 Other effects**

The examination of the watch shall not reveal any permanent deterioration affecting its functions or its appearance (e.g. sticking hands, chronograph, calendar, etc.).

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**4.3 Requirements for electronic watches**

**4.3.1 Running conditions of electronic watches during magnetic fields application**

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When observed during the magnetic fields application, watches shall not stop.

See 174e2b96/iso-764-2020

For electronic watches equipped with multiple motors, no motor shall stop during magnetic resistance test.

**4.3.2 Other effects**

The examination of the watch shall not reveal any permanent deterioration affecting its functions or its appearance (e.g. sticking hands, chronograph, calendar, etc.).

**5 Test methods**

**5.1 Test conditions**

Magnetic resistant watches shall be tested on finished products and preparations for the test shall be as follows:

- a) The test shall be carried out without bracelets, if removable.
- b) The test room temperature shall be in a range of  $23\text{ °C} \pm 5\text{ °C}$ .
- c) During the measurement of all rates as specified in [5.3](#), the watch temperature shall not vary by more than  $\pm 2\text{ °C}$ .

NOTE The watch temperature can be measured, for example, by infrared emission.



## 5.2 Test apparatus

The test apparatus used shall produce homogeneous and continuous direct current magnetic fields of the test value according to the directions specified in 5.3. Admissible variations in magnetic fields strength during the magnetic resistance test shall be 0 % to +5 %.

## 5.3 Test procedure

### 5.3.1 General

Flowcharts summarizing these procedures (5.3.2 and 5.3.3) are described in Annex B.

### 5.3.2 Test procedure for mechanical watches

#### 5.3.2.1 Preparation before magnetic resistance test

For mechanical watches, the following procedures are performed before magnetic resistance test.

##### 5.3.2.1.1 Demagnetization

A demagnetization of the watch is required in order to take into account a possible effect on the rate by repeated magnetizations and demagnetizations.

The watch shall be demagnetized in each of the three 3H-9H, 6H-12H and CH-FH directions.

##### 5.3.2.1.2 Winding

At least 1 h before the initial rate measurement, the watch shall be completely wound up.

##### 5.3.2.1.3 Measurement of the initial rate $M_{CH-0}$

A measurement of the initial rate shall be carried out prior to applying any magnetic field.

Switchable mechanisms shall be stopped and the hands, the date and other mechanisms shall be set up such to avoid any disturbance during the rate measurement.

The rate shall be measured during at least 180 s in CH position, according to ISO 3158, by using a rate measurement apparatus.

This duration shall be increased if necessary, based on the stability and periodicity of the rate.

The initial rate ( $M_{CH-0}$ ) is the average of instantaneous rates measured for 180 s or longer.

#### 5.3.2.2 Magnetic resistance test

Magnetic resistance tests shall be carried out as follows:

- a) Switchable mechanisms shall be stopped and the hands, the date and other mechanisms shall be set up such to avoid any disturbance during the rate measurement and magnetic fields application.
- b) Place the watch on the test apparatus so that the magnetic field is applied in the 3H-9H direction parallel to the watch face.
- c) Increase progressively, at least 5 s, the strength of the magnetic field to the test value (in this case 4 800 A/m).

- d) Observe the watch for 60 s to confirm that the watch does not stop during magnetic field application.  
Especially for watches not equipped with a second hand and with the spring balance oscillator not visible in the testing position, increase the magnetic field application time to bring clarity to their stoppage.
- e) Decrease progressively, at least 5 s, the strength of the magnetic field back to zero.
- f) Remove the watch from the test apparatus.
- g) The rate ( $M_{CH-1}$ ) shall be measured for at least 180 s in the CH position, according to ISO 3158, by using a rate measurement apparatus.  
This duration shall be increased if necessary, based on the stability and periodicity of the rate.  
The rate ( $M_{CH-1}$ ) is the average of instantaneous rates measured for 180 s or longer.
- h) Demagnetize the watch in each of the three 3H-9H, 6H-12H and CH-FH directions.
- i) Carry out steps from a) to h) also in the 6H-12H and CH-FH directions of magnetic fields application in order to define respectively the  $M_{CH-2}$  and  $M_{CH-3}$  rates.

### 5.3.3 Test procedure for electronic watches

#### 5.3.3.1 Magnetic resistance test

Magnetic resistance tests shall be carried out as follows:

- a) Place the watch on the test apparatus for each stepper motor installed in the direction most affected by the magnetic fields.  
**NOTE** When the most affected direction is unknown, the tester (laboratory) is responsible to determine it (e.g. turning the watch in the horizontal plane while applying the field; testing the watch 6 times every 30° in the horizontal plane and once perpendicularly).
- b) Increase progressively, at least 5 s, the strength of the magnetic field to the test value (in this case 4 800 A/m)
- c) Observe the watch for 60 s to confirm that the watch does not stop during magnetic field application.  
In the case of a stepper motor having an interval of impulses of 20 s or more, observe the running condition during five stepper motor runs.  
Especially for watches not equipped with a second hand, increase the magnetic field application time to bring clarity to their stoppage.
- d) Decrease progressively, at least 5 s, the strength of the magnetic field back to zero.
- e) Remove the watch from the test apparatus.

## 6 Marking

Magnetic resistant watches meeting the requirements of [Clause 4](#) may be marked as shown below in an easily visible position on the main body or a tag in the language of each country.

In English: magnetic resistant

In French: résistante au magnétisme

In Russian: магнитозащитные

In German: magnetfeldresistent

In Japanese: 耐磁

In Chinese: 防磁

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