



**SLOVENSKI STANDARD**  
**oSIST prEN IEC 60068-2-14:2022**  
**01-september-2022**

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**Okoljsko preskušanje - 2-14. del: Preskusi - Preskus N: Temperaturne spremembe**

Environmental testing - Part 2-14: Tests - Test N: Change of temperature

Umgebungseinflüsse - Teil 2-14: Prüfverfahren - Prüfung N: Temperaturwechsel

Essais d'environnement - Partie 2-14: Essais - Essai N: Variation de température

**Ta slovenski standard je istoveten z: prEN IEC 60068-2-14:2022**

<https://standards.iteh.ai/catalog/standards/sist/d6717347-0386-41c4-8d1b-515743ac4ab7/osist-pr-en-iec-60068-2-14-2022>

**ICS:**

19.040	Preskušanje v zvezi z okoljem	Environmental testing
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# 104/933/CDV

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OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD: <input type="checkbox"/> Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.
FUNCTIONS CONCERNED: <input type="checkbox"/> EMC <input checked="" type="checkbox"/> ENVIRONMENT <input type="checkbox"/> QUALITY ASSURANCE <input type="checkbox"/> SAFETY	
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TITLE:

**Environmental testing - Part 2-14: Tests - Test N: Change of temperature**

PROPOSED STABILITY DATE: 2027

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## ENVIRONMENTAL TESTING –

## Part 2-14: Tests – Test N: Change of temperature

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International Standard IEC 60068-2-14 has been prepared by IEC technical committee 104: Environmental conditions, classification and methods of test.

This seventh edition cancels and replaces the sixth edition, published in 2009 and constitutes a technical revision.

The major changes with regard to the previous edition concern:

- updating of the figures, changes to some of the wording and editorial corrections made for clarification.
- Updating specimen temperature(s) and severities as well as tolerances for change of temperature tests.
- Standardized requirements for test reports for tests Na, Nb and Nc

130 The text of this standard is based on the following documents:

FDIS	Report on voting
XXX/XXX/FDIS	XXX/XXX/RVD

131

132 Full information on the voting for the approval of this standard can be found in the report on  
133 voting indicated in the above table.

134 This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

135 A list of all the parts in the IEC 60068 series, under the general title *Environmental testing*, can  
136 be found on the IEC website.

137 The committee has decided that the contents of this publication will remain unchanged until the  
138 maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data  
139 related to the specific publication. At this date, the publication will be

- 140 • reconfirmed,
- 141 • withdrawn,
- 142 • replaced by a revised edition, or
- 143 • amended.

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## INTRODUCTION

146 A change of temperature test is intended to determine the effect on the specimen of a change  
147 of temperature or a succession of changes of temperature.

148 It is not intended to show effects that are caused by low or high temperature exposure. For  
149 these effects, the cold test or the dry heat test, as specified in IEC 60068-2-1 and IEC 60068-  
150 2-2, should be used.

151 The effect of change of temperature tests is determined by

- 152 – values of high and low conditioning temperature between which the change is to be affected,
- 153 – the conditioning times for which the test specimen is kept at these temperatures,
- 154 – the rate of change between these temperatures,
- 155 – the number of cycles of conditioning,
- 156 – the amount of heat transfer into or from the specimen,
- 157 – the thermal conductivity and the materials of the specimen,
- 158 – the rate of change of the specimen's temperature on its surface (respectively in relevant  
159 positions) or in its core.

160 Guidance on the choice of suitable test parameters for inclusion in the detail specification is  
161 given throughout this standard.

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## ENVIRONMENTAL TESTING –

### Part 2-14: Tests – Test N: Change of temperature

#### 169 **1 Scope**

170 This part of IEC 60068 provides tests with specified ambient temperature changes to analyse  
171 their impacts on specimen.

#### 172 **2 Normative references**

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

177 IEC 60068 (all parts), Environmental testing

178 IEC 60068-2-1, Environmental testing – Part 2-1: Tests – Test A: Cold

179 IEC 60068-2-2, Environmental testing – Part 2-2: Tests – Test B: Dry heat

180 IEC 60068-2-6, Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)

181 IEC 60068-2-17, Environmental testing – Part 2-17: Tests – Test Q: Sealing

182 IEC 60068-2-67, Environmental testing – Part 2-67: Tests – Test Cy: Damp heat, steady state,  
183 accelerated test primarily intended for components

#### 184 **3 Terms and definitions**

185 For the purposes of this document, the terms and definitions given in IEC 60068-2-1 and IEC  
186 60068-2-2 apply.

187 No terms and definitions are listed in this document.

188 ISO and IEC maintain terminological databases for use un standardization at the following ad-  
189 dresses:

- 190 • IEC Electropedia: available at <http://www.electropedia.org/>
- 191 • ISO online browsing platform: available at <http://www.iso.org/obp>

192

193 **4 List of symbols**

$D$	temperature difference between high conditioning temperature $T_B$ and low conditioning temperature $T_A$
$T_A$	low conditioning temperature
$T_{Ad}$	decreased low conditioning temperature
$T_B$	high conditioning temperature
$T_{Bi}$	increased high conditioning temperature
$T_{STD}$	standard atmospheric conditions (15 °C to 35 °C)
$\Delta T_S$	temperature difference between the specimen and the test medium (e.g. air)
$dT_R$	temperature change rate (Test Nb)
$t_s$	stabilization time of specimen temperature
$t_{s*}$	stabilization time of specimen temperature during the first cycle, starting from laboratory air temperature
$t_1$	exposure time of the specimen to each conditioning temperature
$t_2$	transfer time of the specimen from one test chamber to another (two-chamber test method)
$\pm\sigma_T$	applicable temperature tolerance of the medium temperature during temperature transition (Test Nb)
$\pm\sigma_{Tconst}$	applicable temperature tolerance of the medium temperature during the constant conditioning

194 **5 General**195 **5.1 Field conditions of changing temperature**

196 It is common in electronic equipment and components that changes of temperature occur. Parts  
 197 inside equipment undergo slower changes of temperature than those on an external surface  
 198 when the equipment is not switched on.

199 Rapid changes of temperature may be expected

- 200 – when equipment is transported from warm indoor into cold outdoor environments or vice  
 201 versa,
- 202 – when equipment is suddenly cooled by rainfall or immersion in cold water,
- 203 – when equipment is attached or in close proximity to components leading to high thermal  
 204 stress (e.g. combustion engines, central processing units),
- 205 – when equipment is artificially cooled or heated,
- 206 – in externally mounted airborne equipment,
- 207 – under certain conditions of transportation and storage.

208 Components will undergo stresses due to changing temperature when high temperature gradi-  
 209 ents build up in an equipment after being switched on, e.g. in the proximity of high power resis-  
 210 tors, radiation can cause rise of the surface temperature on close components while other por-  
 211 tions remain cold.

212 Artificially cooled components may be subjected to rapid temperature changes when the cooling  
 213 system is switched on. Rapid changes of temperature in components may also be induced  
 214 during manufacturing processes or the transportation of equipment. Both the number and

215 amplitude of temperature changes, the time interval between them and the thermal responsive-  
216 ness of the equipment (or specimen) are important.

## 217 5.2 Design of tests with temperature change

218 Change of temperature Tests Na, Nb and Nc comprise alternate periods at a high and a low  
219 temperature with well-defined transfers from one temperature to the other. The conditioning run  
220 from laboratory ambient to the first conditioning temperature, then to the second conditioning  
221 temperature, then back to laboratory ambient is considered one test cycle.

## 222 5.3 Test parameters

223 Test parameters comprise the following:

- 224 – laboratory ambient conditions (mainly temperature and humidity);
- 225 – high conditioning temperature  $T_B$ ;
- 226 – increased high conditioning temperature  $T_{Bi}$ , if applicable;
- 227 – low conditioning temperature  $T_A$ ;
- 228 – decreased low conditioning temperature  $T_{Ad}$ , if applicable;
- 229 – exposure time of the specimen to each conditioning temperature  $t_1$ ;
- 230 – transfer time  $t_2$  or temperature change rate  $dT_R$ ;
- 231 – number of test cycles.

232 NOTE The high and low conditioning temperatures are understood to be ambient temperatures which will be  
233 reached by most specimens with a certain time-lag.

234 As these tests are intended to validate the effects of temperature changes on the specimen,  
235 the specimen's characteristics should always be taken into consideration (if not specified oth-  
236 erwise):

- 237 – thermal responsiveness of the specimen in affected areas or the core;
  - 238 ○ thermal conductivity;
  - 239 ○ specific heat capacity;
- 240 – density;
- 241 – geometry;
- 242 – mass.

243 The experimental determination of these characteristics is recommended, if unknown and not  
244 specified otherwise.

245 The test is accelerated because the number of severe changes of temperature in a given period  
246 is greater than that which will occur under field conditions.

247 The high and low temperatures are understood to be ambient temperatures which will be  
248 reached by most specimens with a certain time-lag.

249 *Only in exceptional cases* may these temperatures be specified outside the normal storage or  
250 operating temperature range of the object under test.

251 NOTE If the specimen's characteristics (mass, density, geometry) prevent the specified rate of change, the tem-  
252 peratures may be specified outside the normal storage or operating temperatures in order to increase the severity of  
253 the intended test, if not specified otherwise.

## 254 5.4 Purpose and choice of the tests

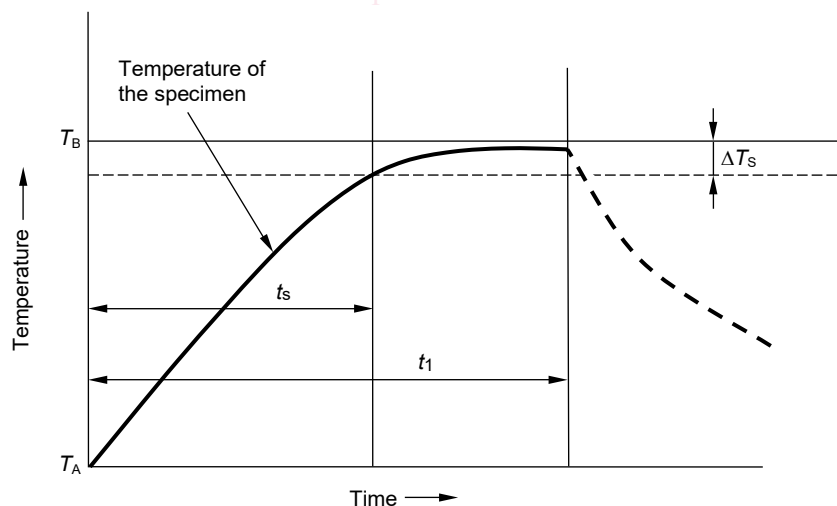
255 Change of temperature testing is recommended in the following cases:

- 256 – evaluation of electrical performance after a specified number of rapid changes of tempera-  
257 ture, Test Na or Test Nc;
- 258 – evaluation of the suitability of mechanical components, and of materials and combinations  
259 of materials to withstand rapid changes of temperature, Test Na or Test Nc;
- 260 – evaluation of the suitability of construction of components to withstand artificial stressing,  
261 Test Na or Test Nc;
- 262 – evaluation of electrical performance during a change of temperature, Test Nb;
- 263 – evaluation of mechanical performance during a change of temperature, Test Nb.
- 264 The change of temperature tests specified in the IEC 60068 series is not intended to evaluate  
265 the difference in material constants or electrical performance when operating under the condi-  
266 tioning temperatures  $T_A$  and  $T_B$ .

### 267 5.5 Choice of the exposure time to each conditioning temperature

268 The duration of the exposure should be based on the requirements stated in 8.2.3, 9.2.3 or  
269 10.2.2, or as stated in the relevant specification, keeping in mind the following points:

- 270 a) The exposure begins as soon as the specimen is in the new environment.
- 271 b) Stabilization occurs when the temperature difference between the specimen and the  
272 test medium ( $\Delta T_s$ ) is within 3 K to 5 K, or as stated in the test specification. The  
273 stabilization time of specimen temperature  $t_s$  is from the start of exposure until the  
274 moment when the temperature is within the specified difference. A representative point  
275 (or points) on the specimen may be used for this measurement.
- 276 c) The exposure time of the specimen to each conditioning temperature  $t_1$  shall be longer  
277 than the stabilization time of the specimen temperature  $t_s$ . Figure 1 provides a graphical  
278 representation of the process. This may not be appropriate for heat generating  
279 specimens.



280

281 **Figure 1 – Determination of the exposure time of the specimen to each conditioning**  
282 **temperature ( $t_1$ )**

### 283 5.6 Choice of the duration of the transfer time $t_2$

284 If, e.g. due to the large size of the specimens, the transfer time  $t_2$  cannot be kept within in 3  
285 min, the transfer time may be increased with a negligible influence on the test results as follows: