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Part 20-1: Handling, packing, labelling and shipping of surface-mount devices sensitive to the combined effect of moisture and soldering heat

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Introduction

This draft standard is based on international discussions in which the UK has taken an active part. Your comments on this draft are welcome and will assist in the preparation of the consequent standard. There is a high probability that this text could be adopted by CENELEC as a reference document for harmonization or as a European Standard. Recipients of this draft are requested to comment on the text bearing in mind this possibility.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	(7)
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/ Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

**47/2488/CDV**

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER:

IEC 60749-20-1 ED2

DATE OF CIRCULATION:

2018-07-06

CLOSING DATE FOR VOTING:

2018-09-28

SUPERSEDES DOCUMENTS:

47/2483/RR

IEC TC 47 : SEMICONDUCTOR DEVICES

SECRETARIAT:

Korea, Republic of

SECRETARY:

Mr Cheolung Cha

OF INTEREST TO THE FOLLOWING COMMITTEES:

PROPOSED HORIZONTAL STANDARD:



Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.

FUNCTIONS CONCERNED:

☐ EMC☒ ENVIRONMENT☐ QUALITY ASSURANCE☐ SAFETY☒ SUBMITTED FOR CENELEC PARALLEL VOTING☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING**Attention IEC-CENELEC parallel voting**

The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting.

The CENELEC members are invited to vote through the CENELEC online voting system.

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Semiconductor devices - Mechanical and climatic test methods - Part 20-1: Handling, packing, labelling and shipping of surface-mount devices sensitive to the combined effect of moisture and soldering heat

PROPOSED STABILITY DATE: 2023

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SEMICONDUCTOR DEVICES –
MECHANICAL AND CLIMATIC TEST METHODS –****Part 20-1: Handling, packing, labelling and shipping of surface-mount
devices sensitive to the combined effect of moisture and soldering heat**

FOREWORD

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This second edition cancels and replaces the first edition published in 2009. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a. Updates to subclauses to better align the test method with IPC/JEDEC J-STD-033C, including new sections on aqueous cleaning and dry pack precautions;
- b. Addition of a 2 annexes on colorimetric testing of HIC and derivation of bake tables

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

FDIS	Report on voting
47/XXXX/FDIS	47/XXXX/RVD

154
155 Full information on the voting for the approval of this standard can be found in the report on
156 voting indicated in the above table.

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

158 A list of all the parts in the IEC 60749 series, under the general title *Semiconductor devices –*
159 *Mechanical and climatic test methods*, can be found on the IEC website.

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

- 163 • reconfirmed,
164 • withdrawn,
165 • replaced by a revised edition, or
166 • amended.

167

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INTRODUCTION

171 The advent of surface-mount devices (SMDs) introduced a new class of quality and reliability
172 concerns regarding package damage “cracks and delamination” from the solder reflow
173 process. This document describes the standardized levels of floor life exposure for
174 moisture/reflow-sensitive SMDs along with the handling, packing and shipping requirements
175 necessary to avoid moisture/reflow-related failures. IEC 60749-20 defines the classification
176 procedure and Annex A of this document defines the labelling requirements.

177 Moisture from atmospheric humidity enters permeable packaging materials by diffusion.
178 Assembly processes used to solder SMDs to printed circuit boards (PCBs) expose the entire
179 package body to temperatures higher than 200 °C. During solder reflow, the combination of
180 rapid moisture expansion, materials mismatch, and material interface degradation can result
181 in package cracking and/or delamination of critical interfaces within the package.

182 Typical solder reflow processes of concern for all devices are infrared (IR), convection/IR,
183 convection, vapor phase reflow (VPR), hot air rework tools, and wave solder, including full
184 immersion.

185 Non-semiconductor devices may exhibit additional process sensitivities beyond moisture
186 sensitivity such as thermal sensitivity, flux sensitivity, or cleaning process sensitivity.

187

SEMICONDUCTOR DEVICES – MECHANICAL AND CLIMATIC TEST METHODS –

Part 20-1: Handling, packing, labelling and shipping of surface-mount devices sensitive to the combined effect of moisture and soldering heat

1 Scope

This part of IEC 60749 applies to all devices subjected to bulk solder reflow processes during PCB assembly, including plastic encapsulated packages, process sensitive devices, and other moisture sensitive devices made with moisture-permeable materials (epoxies, silicones, etc.) that are exposed to the ambient air.

The purpose of this document is to provide SMD manufacturers and users with standardized methods for handling, packing, shipping, and use of moisture/reflow sensitive SMDs which have been classified to the levels defined in IEC 60749-20. These methods are provided to avoid damage from moisture absorption and exposure to solder reflow temperatures that can result in yield and reliability degradation. By using these procedures, safe and damage-free reflow can be achieved, with the dry packing process, providing a minimum shelf life capability in sealed dry-bags from the seal date.

Two test conditions, method A and method B, are specified in the soldering heat test of IEC 60749-20. For method A, moisture soak conditions are specified on the assumption that moisture content inside the moisture barrier bag is less than 30 % RH. For method B, moisture soaking conditions are specified on the assumption that manufacturer's exposure time (MET) does not exceed 24 h and the moisture content inside the moisture barrier bag is less than 10 % RH. In an actual handling environment, SMDs tested by method A are permitted to absorb moisture up to 30 % RH, and SMDs tested by method B are permitted to absorb moisture up to 10 % RH. This standard specifies the handling conditions for SMDs subjected to the above test conditions.

NOTE Hermetic SMD packages are not moisture sensitive and do not require moisture precautionary handling.

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.

IEC 60749-20, *Semiconductor devices – Mechanical and climatic test methods – Part 20: Resistance of plastic-encapsulated SMDs to the combined effect of moisture and soldering heat*

IEC 60749-30, *Semiconductor devices – Mechanical and climatic test methods – Part 30: Preconditioning of non-hermetic surface mount devices prior to reliability testing*

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:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

- 232 **3.1**
233 **active desiccant**
234 desiccant that is either fresh (new) or has been baked according to the manufacturer's
235 recommendations to renew it to original specifications
- 236 **3.2**
237 **bar code label**
238 a label that gives information in a code consisting of parallel bars and spaces, each of various
239 specific widths
- 240 NOTE For the purposes of this standard, the bar code label is on the lowest level shipping container and includes
241 information that describes the product, e.g., part number, quantity, lot information, supplier identification, and
242 moisture-sensitivity level etc.
- 243 **3.3**
244 **mass reflow**
245 reflow of a number of components with simultaneous attachment by an infrared (IR),
246 convection/IR, convection, or vapour phase reflow (VPR) process
- 247 **3.4**
248 **carrier**
249 container that directly holds components such as a tray, tube, or tape and reel
- 250 **3.5**
251 **desiccant**
252 absorbent material used to maintain a low relative humidity
- 253 **3.6**
254 **floor life**
255 allowable time period for a moisture-sensitive device, after removal from a moisture barrier
256 bag, dry storage or dry bake and before the solder reflow process
- 257 **3.7**
258 **humidity indicator card**
259 **HIC**
260 card on which a moisture-sensitive chemical is applied in such a way that it will make a
261 significant, perceptible change in colour (hue), typically from blue (dry) to pink (wet) when the
262 indicated relative humidity is exceeded
- 263 NOTE The HIC is packed inside the moisture-barrier bag, along with a desiccant, to aid in determining the level of
264 moisture to which the moisture-sensitive devices have been subjected.
- 265 **3.8**
266 **manufacturer's exposure time**
267 **MET**
268 maximum time after bake that the component manufacturer requires to process components
269 prior to bag seal; it also includes the maximum time allowed at the distributor for having the
270 bag open to split out smaller shipments
- 271 **3.9**
272 **moisture barrier bag**
273 **MBB**
274 bag designed to restrict the transmission of water vapour and used to pack moisture-sensitive
275 devices
- 276 **3.10**
277 **rework**
278 the removal of a component for scrap, reuse, or failure analysis; the replacement of an
279 attached component; or the heating and repositioning of a previously attached component

280 **3.11**
281 **shelf-life**
282 maximum storage period for a dry-packed moisture-sensitive device in an unopened moisture
283 barrier bag (MBB) to avoid exceeding the specified interior bag ambient humidity

284 **3.12**
285 **surface-mount device**
286 **SMD**
287 plastic-encapsulated surface-mount devices made with moisture-permeable materials

288 NOTE For the purposes of this standard, the term SMD is limited as indicated in the definition.

289 **3.13**
290 **solder reflow**
291 a solder attachment process in which previously applied solder or solder paste is melted to
292 attach a component to the printed circuit board

293 **3.14**
294 **water vapour transmission rate**
295 **WVTR**
296 measure of the permeability of plastic film or metallized plastic film material to moisture

297 **4 General applicability and reliability considerations**

298 **4.1 Assembly processes**

299 **4.1.1 Mass reflow**

300 This standard applies to mass solder reflow assembly by convection, convection/IR, infrared
301 (IR), and vapour phase (VPR), processes. It does not apply to mass solder reflow processes
302 that immerse the component bodies in molten solder (e.g., wave soldering bottom mounted
303 components). Such processes are not allowed for many SMDs and are not covered by the
304 component qualifications standards used as a basis for this document.

305 **4.1.2 Localized heating**

306 This standard also applies to moisture sensitive SMDs that are removed or attached singly by
307 local ambient heating, i.e., “hot air rework.” See Annex B.

308 **4.1.3 Socketed components**

309 This standard does not apply to SMDs that are socketed and not exposed to solder reflow
310 temperatures. Such SMDs are not at risk and do not require moisture precautionary handling.

311 **4.1.4 Point-to-point soldering**

312 This standard does not apply to SMDs in which only the leads are heated to reflow the solder,
313 e.g., hand-soldering, hot bar attach of gull wing leads, and through hole by wave soldering.
314 The heat absorbed by the SMD body from such operations is typically much lower than for
315 mass surface mount reflow or hot air rework, and moisture precautionary measures are
316 typically not needed.

317 **4.1.5 Aqueous cleaning**

318 For non-cavity SMDs, typical short term aqueous cleaning processes will not impact the floor
319 life (internal moisture content). Special consideration should be given to non-hermetic cavity
320 packages.