IEC/PAS 62190

Edition 1.0
2000-11

Moisture/reflow sensitivity classification for nonhermetic solid state surface mount devices

PUBLICLY AVAILABLE SPECIFICATION

INTERNATIONAL ELECTROTECHNICAL COMMISSION

Reference number
IEC/PAS 62190

IPC/JEDEC J-STD-020A

APRIL 1999

JOINT INDUSTRY STANDARD

Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices

NOTICE

JEDEC standards and publications contain material that has been prepared, reviewed, and approved through the JEDEC Board of Directors level and subsequently reviewed and approved by the EIA General Counsel.

JEDEC standards and publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for use by those other than JEDEC members, whether the standard is to be used either domestically or internationally.

JEDEC standards and publications are adopted without regard to whether or not their adoption may involve patents or articles, materials, or processes. By such action JEDEC does not assume any liability to any patent owner, nor does it assume any obligation whatever to parties adopting the JEDEC standards or publications.

The information included in JEDEC standards and publications represents a sound approach to product specification and application, principally from the solid state device manufacturer viewpoint. Within the JEDEC organization there are procedures whereby a JEDEC standard or publication may be further processed and ultimately become an ANSI/EIA standard.

No claims to be in conformance with this standard may be made unless all requirements stated in the standard are met.

Inquiries, comments, and suggestions relative to the content of this EIA/JEDEC standard or publication should be addressed to JEDEC Solid State Technology Association, 2500 Wilson Boulevard, Arlington, VA 22201-3834, (703)907-7560/7559 or www.jedec.org

Published by

2500 Wilson Boulevard
Arlington, VA 22201-3834

INTERNATIONAL ELECTROTECHNICAL COMMISSION

MOISTURE/REFLOW SENSITIVITY CLASSIFICATION FOR NONHERMETIC SOLID STATE SURFACE MOUNT DEVICES

FOREWORD

A PAS is a technical specification not fulfilling the requirements for a standard, but made available to the public and established in an organization operating under given procedures.

IEC-PAS 62190 was submitted by JEDEC and has been processed by IEC technical committee 47: Semiconductor devices.

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document:
Draft PAS	**Report on voting**
47/1475/PAS	47/1511/RVD

Following publication of this PAS, the technical committee or subcommittee concerned will investigate the possibility of transforming the PAS into an International Standard.

An IEC-PAS licence of copyright and assignment of copyright has been signed by the IEC and JEDEC and is recorded at the Central Office.

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attention is drawn to the possibility that some of the elements of this PAS may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

MOISTURE/REFLOW SENSITIVITY CLASSIFICATION FOR NONHERMETIC SOLID STATE SURFACE MOUNT DEVICES

Contents

MOISTURE/REFLOW SENSITIVITY CLASSIFICATION FOR NONHERMETIC SOLID STATE SURFACE MOUNT DEVICES

Contents (concluded)

MOISTURE/REFLOW SENSITIVITY CLASSIFICATION FOR NONHERMETIC SOLID STATE SURFACE MOUNT DEVICES

(From JEDEC Board Ballot JCB-98-104, formulated under the cognizance of the IPC Plastic Chip Carrier Cracking Task Group, B-10a, and the JEDEC JC-14.1 Subcommittee on Reliability Test Methods for Packaged Devices.)

1 Purpose

The purpose of this standard is to identify the classification level of nonhermetic solid state Surface Mount Devices (SMDs) that are sensitive to moisture-induced stress so that they can be properly packaged, stored, and handled to avoid subsequent thermal/mechanical damage during the assembly solder reflow attachment and/or repair operation.

This standard may be used to determine what classification level should be used for initial reliability qualification.

If an initial qualification exists and no major changes have been made, this method may be used for reclassification to an improved level (longer floor life up to level 2). The reclassification level cannot be improved by more than one level without additional reliability testing.

No components classified as moisture sensitive by any previous version of JESD22-A112, IPC-SM-786 or J-STD-020 may be reclassified as non-moisture sensitive (level 1) without additional reliability stress testing, e.g., JESD22-A113 and JESD47 or the semiconductor manufacturer's in-house procedures.

Passing the reject criteria in this test method is not sufficient by itself to provide assurance of long term reliability.

2 Scope

The classification procedure applies to all nonhermetic solid state Surface Mount Devices (SMDs) in packages which, because of absorbed moisture, could be sensitive to damage during solder reflow. The term SMD as used in this document means plastic encapsulated packages and other packages made with moisture-permeable materials. The categories are intended to be used by SMD producers to inform users (board assembly operations) of the level of moisture sensitivity of product devices, and by board assembly operations to ensure that proper handling precautions are applied to moisture/reflow sensitive devices.

NOTE The procedures in this document may be used on packaged devices not included in the scope. The failure criteria for such packages must be agreed upon by the device supplier and the end user.

3 Background

The vapor pressure of moisture inside a plastic package increases rapidly when the package is exposed to the high temperature of solder reflow. Under certain conditions, this pressure can cause internal delamination of the plastic from the die and/or leadframe, internal cracks that do not extend to the outside of the package, bond damage, wire necking, bond lifting, die lifting, thin film cracking, or cratering beneath the bonds. In the most severe case, the stress can result in external package cracks. This is commonly referred to as the "popcorn" phenomenon because the internal stress causes the package to bulge and then crack with an audible "pop". SMDs are more susceptible to this problem than through-hole parts because they are exposed to higher temperatures during reflow soldering. The reason for this is that the soldering operation must occur on the same side of the board as the SMD device. For through-hole devices, the soldering operation occurs under the board that shields the devices from the hot solder. Also, SMDs have a smaller minimum plastic thickness from the chip or mount pad interface to the outside package surface that has been identified as a critical factor in determining moisture sensitivity.

4 Applicable documents

EIA 625	Requirements for Handling Electrostatic Discharge Sensitive (ESD) Devices
IPC-TM-650	Test Methods Manual
IPC-SM-786	Procedures for Characterizing and Handling of Moisture/Reflow Sensitive ICs
JEP113	Symbol and Labels for Moisture Sensitive Devices
JESD 47	Stress Test Driven Qualification Specification
JESD22-A112	Moisture Induced Stress Sensitivity for Plastic Surface Mount Devices
JESD22-A113	Preconditioning Procedures of Plastic Surface Mount Devices Prior to Reliability Testing
J-STD-035	Acoustic Microscopy for Nonhermetic Encapsulated Electronic Components

5 Apparatus

5.1 Temperature humidity chambers

Moisture chamber(s), capable of operating at 85 °C/85% RH, 85 °C/60% RH, 60 °C/60% RH, and 30 °C/60% RH. Within the chamber working area, temperature tolerance must be ± 2 °C and the RH tolerance must be ± 3% RH.

5 Apparatus (cont'd)

5.2 Solder reflow equipment

(a) (Preferred) - 100% Convection reflow system capable of maintaining the reflow profiles required by this standard.

(b) VPR chamber capable of operating from 215-219 °C and/or 235 +5/-0 °C with appropriate fluids. The chamber must be capable of heating the packages without collapsing the vapor blanket and recondensing the vapor to minimize loss of the vapor phase soldering liquid. The vapor phase soldering fluid must vaporize at the appropriate temperature specified above.

(c) Infrared (IR)/Convection solder reflow equipment capable of maintaining the reflow profiles required by this standard. It is recommended that this equipment use the IR to heat the air and not directly impinge upon the components under test.

NOTE The moisture sensitivity classification test results are dependent upon the package body temperature (rather than board or lead temperature). Convection and VPR are known to be more controllable and repeatable than IR. When there are correlation problems between VPR, IR/Convection, and Convection, the convection results shall be considered as the standard.

5.3 Ovens

Bake oven capable of operating at 125 +5/-0 °C .

5.4 Microscopes

(a) Optical Microscope (40X for external and 100X for cross-section exam).

(b) Scanning Acoustic Microscope.

Note 1 The Scanning Acoustic Microscope is used to detect cracking and delamination. However, the presence of delamination does not necessarily indicate a pending reliability problem. The reliability impact of delamination must be established for a particular die/package system.

Note 2 Refer to J-STD-035 for operation of the Scanning Acoustic Microscope.

5.5 Cross sectioning

Micro-sectioning Equipment as recommended per IPC-TM-650 Methods 2.1.1, 2.1.1.2 or other applicable document.

5.6 Electrical test

Electrical test equipment capable of performing dc and functional tests.

5 Apparatus (cont'd)

5.7 Weighing apparatus (Optional)

Weighing apparatus capable of weighing the package to a resolution of 1 microgram. This apparatus must be maintained in a draft-free environment, such as a cabinet. It is used to obtain absorption and desorption data on the devices under test (see Section 10).

6 Classification/Reclassifaction

Refer to 6.1 for guidance on reclassification of previously qualified/classified SMDs.

Engineering studies have shown that small volume components reach body temperatures greater than 225 °C when reflow soldered to boards profiled for larger components. Therefore technical and/or business issues might require small thin packages (reference Table 1) to be classified at 235 °C. However, where it is known that certain small thin packages are used on boards without larger packages, these small packages, may be classified at 220 °C. Table 1 defines the transition thickness/volume where data have shown these SMDs can reach 235 °C when reflowed on boards with larger components.

Note 1 Previously classified SMDs will not reflect this higher temperature until reclassified by the manufacturer. As a result users should refer to the "Moisture Sensitivity" Label on the bag to determine at which reflow temperature the components were classified.

Note 2 Level 1 devices should be considered to have a maximum reflow temperature of 220 °C unless labeled as capable of reflow at 235 °C.

6.1 Reclassification

In order to minimize testing, the results from a given SMD package may be accepted to cover all other devices in the same SMD package, mold compound, fab technology, and same or smaller die pad dimensions.

The following attributes could affect the moisture sensitivity of a device and may require reclassification:

- Die attach material/process
- Number of pins
- Mold compound material/process
- Die pad area and shape
- Body size
- Passivation/die coating
- Leadframe and/or heat spreader design/material/finish
- Die size/thickness
- Fab process
- Interconnect
- Lead lock tape

6 Classification/Reclassifaction (cont'd)

6.1 Reclassification (cont'd)

Table 1 — Package Reflow Conditions

Pkg. Thickness ≥ 2.5 mm and all BGAs	Pkg. Thickness < 2.5 mm and Pkg. Volume ≥ 350 mm^3	Package Thickness < 2.5 mm and Pkg. Volume < 350 mm^3
Convection 220 +5/-0 °C		Convection 235 +5/-0 °C
VPR 215-219 °C		VPR 235 +5/-0 °C
IR/Convection 220 +5/-0 °C		IR/Convection 235 +5/-0 °C

Note 1 Package volume is defined as the body height x width x length but excludes external leads and non-integral heatsinks.

Note 2 The maximum component temperature reached during reflow depends on package thickness and volume. Smaller, thinner components typically reach higher temperatures during board assembly, particularly in IR based reflow processes. Use of 100 % convection reflow processes reduces the thermal gradients between packages. However, thermal gradients due to differences in thermal mass of components still exist.

Note 3 The 235 °C reflow temperature applies primarily to peripherally leaded package types that are mounted on boards with mixed sized components. BGAs shall be classified at 220 °C, unless otherwise specified by the supplier.

7 Procedure

The recommended procedure is to start testing at the lowest moisture sensitivity level the evaluation package is reasonably expected to pass (based on knowledge of other similar evaluation packages).

7.1 Sample requirements

7.1.1 Reclassification (qualified package without additional reliability testing)

For a qualified package being reclassified without additional reliability testing select a minimum sample of 22 units for each moisture sensitivity level to be tested. A minimum of two nonconsecutive assembly lots must be included in the sample with each lot having approximately the same representation. Sample units shall have completed all manufacturing processing required prior to shipment. Sample groups may be run concurrently on one or more moisture sensitivity levels.

7.1.2 Classification/Reclassification (additional qualification/reliability testing is planned)

Select a minimum sample of 11 units for each moisture sensitivity level to be tested. A minimum of two nonconsecutive assembly lots must be included in the sample with each lot having approximately the same representation. Sample units shall have completed all manufacturing processes required prior to shipment. Sample groups may be run concurrently on one or more moisture sensitivity levels. Testing must be continued until a passing level is found.

7 Procedure (cont'd)

7.2 Electrical test

Test appropriate electrical parameters, e.g., data sheet values, in house specifications, etc. Replace any devices that fail to meet tested parameters.

7.3 Initial inspection

Perform an external visual and acoustic microscope examination to establish a baseline for the cracking/delamination criteria in 8.2.1.

Note This standard does not consider or establish any time zero requirements for delamination.

7.4 Bake

Bake the sample for 24 hours minimum at 125 +5/-0 °C. This step is intended to remove moisture from the package so that it will be "dry."

Note This time/temperature may be modified if desorption data on the particular device under test shows that a different condition is required to obtain a "dry" package when starting in the wet condition for 85 °C /85% RH. See 10.3.

7.5 Moisture soak

Place devices in a clean, dry, shallow container so that the package bodies do not touch or overlap each other. Submit each sample to the appropriate soak requirements shown in Table 2. (At all times parts should be handled using proper ESD procedures in accordance with EIA 625).

7 Procedure (cont'd)

7.5 Moisture soak (cont'd)

Table 2 — Moisture Sensitivity levels

LEVEL	FLOOR LIFE		SOAK REQUIREMENTS			
			Standard		Accelerated Equivalent [1]	
	TIME	CONDITIONS	TIME (hours)	CONDITIONS	TIME (hours)	CONDITIONS
1	Unlimited	≤30 °C/85% RH	168	85 °C/85% RH		
2	1 year	≤30 °C/60% RH	168	85 °C/60% RH		
2a	4 weeks	≤30 °C/60% RH	696[2]	30 °C/60% RH	120	60 °C/60% RH
3	168 hours	≤30 °C/60% RH	192[2]	30 °C/60% RH	40	60 °C/60% RH
4	72 hours	≤30 °C/60% RH	96[2]	30 °C/60% RH	20	60 °C/60% RH
5	48 hours	≤30 °C/60% RH	72[2]	30 °C/60% RH	15	60 °C/60% RH
5a	24 hours	≤30 °C/60% RH	48[2]	30 °C/60% RH	10	60 °C/60% RH
6	Time on Label (TOL)	≤30 °C/60% RH	TOL	30 °C/60% RH		

Note 1 To use the "Accelerated Equivalent" soak requirements; correlation of damage response, including electrical, after soak and reflow must be established with the "Standard" soak requirements. Accelerated soak times may vary due to material properties, i.e., Mold compound, encapsulant, etc.

Note 2 Standard soak time, which includes a default value for semiconductor Manufacturer's Exposure Time (MET) between bake and bag plus the maximum time allowed out of the bag at the distributor's facility, of 24 hours.

If the actual MET is less than 24 hours the soak time may be reduced. For soak conditions of 30 °C/60% RH the soak time is reduced by 1 h. for each hour the MET is less than 24 hours. For soak conditions of 60 °C/60% RH, the soak time is reduced by 1 h. for each 5 hours the MET is less than 24 hours.

If the actual MET is greater than 24 hours the soak time must be increased. If soak conditions are 30 °C/60% RH, the soak time is increased 1 h. for each hour that the actual MET exceeds 24 hours. If soak conditions are 60 °C/60% RH, the soak time is increased 1 h. for each 5 hours that the actual MET exceeds 24 hours.

7.6 Reflow

Not sooner than fifteen (15) minutes and not longer than four (4) hours after removal from the temperature/humidity chamber, subject the sample to three (3) cycles of the appropriate reflow conditions as defined in Table 3.

7 Procedure (cont'd)

7.6 Reflow (cont'd)

Table 3 — Classification Reflow Profiles

	Convection or IR/Convection	**VPR**
Average ramp-up rate (183 °C to Peak)	3 °C/second max.	10 °C/second max.
Preheat temperature 125(±25) °C	120 seconds max.	
Temperature maintained above 183 °C	60-150 seconds	
Time within 5 °C of actual peak temperature	10-20 seconds	60 seconds
Peak temperature range	220 +5/-0 °C or 235 +5/-0 °C	215-219 °C or 235 +5/-0 °C
Ramp-down rate	6 °C /second max.	10 °C/second max.
Time 25 °C to peak temperature	6 minutes max.	

Note All temperatures refer to top side of the package, measured on the package body surface. The devices shall be allowed to cool down for five (5) minutes minimum between Convection, IR/Convection, or VPR cycles.

7.7 External visual

Examine the devices using an optical microscope (40X) to look for external cracks.

7.8 Electrical test

Perform appropriate electrical testing on all devices, e.g., data sheet values, in-house specifications, etc.

7.9 Acoustic microscopy

Perform scanning acoustic microscope analysis on all devices.

8 Criteria

8.1 Failure criteria

If one or more devices in the test sample fail, the package shall be considered to have failed the tested level.

A device is considered a failure if it exhibits any of the following:

(a) External crack visible using 40X optical microscope

(b) Electrical dc and/or functional failure

(c) Internal crack that intersects a bond wire, ball bond, or wedge bond

(d) Internal crack extending from any lead finger to any other internal feature (lead finger, chip, die attach paddle)

(e) Internal crack extending more than two-thirds (2/3) the distance from any internal feature to the outside of the package

(f) Changes in package body flatness caused by warpage, swelling or bulging visible to the naked eye. If parts still meet coplanarity and standoff dimensions they shall be considered passing.

Note 1 If internal cracks are indicated by acoustic microscopy, they must either be considered a failure or verified good using polished cross sections through the identified site.

Note 2 Failing components must be evaluated to the next level of moisture sensitivity using a new set of samples.

Note 3 If the components pass the requirements of 8.1, and there is no evidence of delamination or cracks observed by acoustic microscopy or other means, the component is considered to pass that level of moisture sensitivity.

8.2 Criteria requiring further evaluation

To evaluate the impact of delamination on device reliability, the semiconductor manufacturer may either meet the delamination change requirements shown in 8.2.1 or perform reliability assessment using JESD22-A113 and JESD47 or the semiconductor manufacturer's in-house procedures. The reliability assessment may consist of stress testing, historical generic data analysis, etc. Annex A shows the logic flow diagram for the implementation of these criteria.

If the components pass electrical tests and there is delamination on the back side of the die paddle, heat spreader, die back side (lead on chip only) but there is no evidence of cracking, or other delamination, and still meet specified dimensional criteria, the components are considered to pass that level of moisture sensitivity.

8 Criteria (cont'd)

8.2 Criteria requiring further evaluation (cont'd)

8.2.1 Delamination

The following delamination changes are measured from premoisture soak to post reflow. A measurable delamination change is defined as a 10% absolute change between pre- and post- reflow. The absolute percent (%) delamination change is calculated in relation to the total area being evaluated. For this criterion, the equipment must be capable of measuring a minimum absolute delamination change of 10 %.

Peripherally Leaded IC Components

(a) No measurable delamination change on the top surface of the die

(b) No measurable delamination change on any wire bonding surface of the die paddle (downbond area) or the leadframe of LOC (Lead On Chip) devices.

(c) No measurable delamination change along any polymeric film bridging any metallic features that are designed to be isolated (verifiable by through transmission acoustic microscopy).

(d) No measurable delamination/cracking change through the die attach region in thermally enhanced packages or devices that require backside electrical contact.

(e) No surface-breaking feature delaminated over its entire length. A surface-breaking feature includes: lead fingers, tie bars, heat spreader alignment features, heat slugs, etc.

Ball Grid Array Packages

(a) No measurable delamination change on the top surface of the die

(b) No measurable delamination change on any wire bonding surface of the laminate

(c) No measurable delamination change along the polymer potting or molding compound/laminate interface for cavity and overmolded packages

(d) No measurable delamination change along the solder mask/laminate resin interface

(e) No measurable delamination change within the laminate

(f) No measurable delamination/cracking change through the die attach region

(g) No measurable delamination/cracking change between underfill resin and chip or underfill resin and substrate/solder mask.

(h) No surface-breaking feature delaminated over its entire length. A surface-breaking feature includes lead fingers, laminate, laminate metallization, PTH, heat slugs, etc.

8 Criteria (cont'd)

8.2 Criteria requiring further evaluation (cont'd)

8.2.1 Delamination (cont'd)

Note On BGAs, the C-mode acoustic image is not easy to interpret. Through transmission acoustic imaging is recommended because it is easier to interpret and more reliable. If it is necessary to verify results or determine at what level in the package the cracking/delamination is occurring, cross-sectional analysis should be used.

8.3 Failure verification

All failures should be analyzed to confirm that the failure mechanism is associated with moisture sensitivity. If there are no reflow moisture-sensitive-induced failures in the level selected, the component meets the tested level of moisture sensitivity.

If the acoustic microscope scans show failure to any of the criteria listed in 8.2.1, the components shall be tested to the next level of moisture sensitivity or subjected to a reliability assessment using JESD22-A113 and JESD47 or the semiconductor manufacturer's in-house procedures.

9 Moisture/reflow sensitivity classification

(a) If a device passes level 1, it is classified as not moisture sensitive and does not require dry pack.

(b) If a device fails level 1 but passes a higher numerical level, it is classified as moisture sensitive and must be dry packed. Labeling should be in accordance with JEP113.

(c) If a device will only pass level 6, it is classified as extremely moisture sensitive and dry pack will not provide adequate protection. If this product is shipped, the customer must be advised of its classification. The supplier must also include a warning label with the device indicating that it either be socket mounted, or baked dry within time on label before reflow soldering. The minimum bake time and temperature should be determined from desorption studies of the device under test. See 10.3.

10 Optional weight gain/loss analysis

10.1 Weight gain

Weight gain analysis (absorption) can be very valuable in determining estimated floor life (the time from removal of a device from dry pack until it absorbs sufficient moisture to be at risk during reflow soldering). Weight loss analysis (desorption) is valuable in determining the bake time required to remove excess moisture from a device so that it will no longer be at risk during reflow soldering. Weight gain/loss is calculated using an average for the entire sample. It is recommended that ten (10) devices be used in the sample.

Final weight gain = (wet weight - dry weight)/dry weight.
Final weight loss = (wet weight - dry weight)/wet weight.
Interim weight gain = (present weight - dry weight)/dry weight.
Interim weight loss = (wet weight - present weight)/wet weight

"Wet" is relative and means the package is exposed to moisture under specific temperature and humidity conditions.

"Dry" is specific and means no additional moisture can be removed from the package at 125 °C .

10.2 Absorption curve

10.2.1 Read points

The X-axis (time) read points should be selected for plotting the absorption curve. For the early readings, points should be relatively short (24 hours or less) because the curve will have a steep initial slope. Later readings may be spread out further (10 days or more) as the curve becomes asymptotic. The Y-axis (weight gain) should start with "0" and increase to the saturated weight gain. Most devices will reach saturation between 0.3% and 0.4% when stored at 85 °C/85% RH. Use the formula in 10.1. Devices shall be kept at room ambient between removal from the oven or chamber and weighing and subsequent reinsertion into the oven or chamber.

10.2.2 Dry weight

The dry weight of the sample should be determined first. Bake the sample for 48 hours minimum at 125 +5/-0 °C to ensure that the devices are dry. Within one (1) hour after removal from the oven, weigh the devices using the optional equipment in 5.7 and determine an average dry weight per 10.1. For small SMDs (less than 1.5 mm total height), devices should be weighed within thirty (30) minutes after removal from oven.

10.2.3 Moisture soak

Within one (1) hour after weighing, place the devices in a clean, dry, shallow container so that the package bodies do not touch each other. Place the devices in the desired temperature/humidity condition for the desired length of time.