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Environmental testing Part 2 : Tests—Guidance for damp heat tests

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of International Trade and Industry through deliberations at Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law:

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Environmental testing Part 2 : Tests — Guidance for damp heat tests

Foreword as Japanese Industrial Standard

This Japanese Industrial Standard has been prepared based on the third edition issued in 1990 of **ISO 68-2-28**, *Environmental testing Part 2 : Tests — Guidance for damp heat tests* without changing the technical contents.

Furthermore, the matters that are indicated by underline (dotted line) do not appear in the original International Standard.

1 Scope and object This guide includes the necessary information for those experts who, when preparing a relevant specification (e.g. standards for components or equipment), have to select the appropriate tests and test severities for a particular product and possibly a given kind of application.

The object of damp heat tests is to determine the ability of electrotechnical products to withstand the stresses occurring in a climate of high relative humidity, with or without condensation, with special regard to variations of electrical and mechanical characteristics.

Damp heat tests may also be applied to check the resistance of a specimen to some forms of corrosion attack (see **8.3**)

Normative references to this Standard are as follows:

IEC 68-2-3 Test Ca : 1969 *Damp heat, steady state*

Note: **JIS C 0022**, *Basic environmental testing procedures Part 2 : Tests, Test Ca : Damp heat, steady state* is equivalent to this International Standard.

IEC 68-2-56 Test Cb : 1988 *Damp heat, steady state, primarily for equipment*

Note: **JIS C 0032**, *Environmental testing Part 2 : Tests. Test Cb: Damp heat, steady state, primarily for equipment* is equivalent to this International Standard.

IEC 68-2-30 : 1980 *Test Db and guidance: Damp heat, cyclic (12+12-hour cycle)*

Note: **JIS C 0027**, *Basic environmental testing procedures Part 2 : Tests, Test Db : Damp heat, cyclic (12+12-hour cycle)* is equivalent to this International Standard.

IEC 68-2-38 : Test Z/AD : 1974 *Composite temperature/humidity cyclic test*

Note: **JIS C 0028**, *Basic environmental testing procedures Part 2 : Tests, Test Z/AD : Composite temperature/humidity cyclic test* is equivalent to this International Standard.

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2 Environmental influence of damp heat Temperature and relative humidity of the air, in varying combinations, are climatic factors which always act upon a product during storage, transport and operation.

Meteorological measurements made over many years have shown that a relative humidity above or equal or equal to 95 % combined with a temperature above 30 °C does not occur in free air conditions over long periods, except in regions with extreme climates (e.g. Persian Gulf). For a classification of climates and climatic data, see **IEC 721-2-1**: 1982, *Classification of environmental conditions, Part 2 : Environmental conditions appearing in nature, Temperature and humidity*.

In dwelling-rooms and workshops, temperatures, above 30 °C may occur, but are in most cases combined with a lower relative humidity than in the open air. Climatic data for various environments for different applications are given in the series of **IEC 721-3** : 1984 *Part 3 : Classification of groups of environmental parameters and their severities*.

Special conditions exist in certain wet rooms in the chemical industry, metallurgical plants, mines, electroplating plants, laundries, etc., where the temperature can reach as much as 45 °C combined with a relative humidity of 100 % over long periods.

However, it is possible that certain equipment placed under particular conditions may be subjected to relative humidities of more than 95 % at higher temperatures. In particular, this may happen when the equipment is placed in unventilated enclosures such as vehicles, tents, or aircraft cockpits. In these circumstances the intense heating through solar radiation can be combined with a high relative humidity because of moisture released from hygroscopic materials, the breathing and perspiration of people, open vessels containing water, or other sources of moisture.

In rooms having several heat sources, temperatures and relative humidities may differ in different parts of the room.

Atmospheric pollution, which is found to a large extent in a number of places, can intensify the effects of a damp climate on products. Attention is drawn to this fact because of its general importance although pollutants are not contained in the atmospheres used for damp heat testing. If the effects of pollutants are to be investigated, a suitable test, for example corrosive atmospheres or mould growth, should be used.

3 Definitions For the purpose of this publication, the following definitions apply.

a) **condensation** The precipitation of water vapour on a surface when the surface temperature is lower than the dew-point temperature of the ambient air. The water is thereby transformed from the vapour to the liquid state of aggregation.

b) **adsorption** The adherence of water vapour molecules to a surface when the surface temperature is higher than the dew-point temperature.

c) **absorption** The accumulation of water molecules within a material.

d) **diffusion** The transportation of water molecules through a material produced by a partial pressure difference.

Remarks: Diffusion results in a balance of partial pressures whilst flow (such as through leaks, when the dimensions of such leaks are great enough to provide viscous or laminar flow) always finally results in the balance of the total pressures.

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e) **breathing** Exchange of air between a hollow space and its surroundings, produced by a change of temperature which results in a change of internal pressure. This phenomenon can produce an accumulation of water in the hollow space.

f) **flow** The transportation of water of molecules through a leak due to a pressure difference.

4 Procedures for the production of humidity

4.1 General There are a great number of humidity test chambers available, equipped with different systems of generation of humidity and of humidity control.

In the following sub-clauses, only the principal methods of generation of humidity are mentioned.

4.2 Water spraying De-ionized water is atomized to very fine particles.

The aerosol produced in this way moistens the air stream before it enters into the working space of the chamber the greater part of the droplets evaporating on the way. Direct water injection into the working space should be avoided.

This simple system gives rapid humidification and needs little maintenance. However, when using direct injection, small amounts of aerosol may remain in the working space; rapid changes of humidity may be difficult to control (overshoot).

4.3 Injection of water vapour Hot water vapour is blown into the working space of the chamber.

This simple system gives rapid humidification and it is easy to control the quantity of vapour (steam valve). Condensation on cooler parts of the chamber may occur. The heat input may necessitate additional cooling with possible de-humidification effects.

4.4 Volatilization

4.4.1 Bubbling-through type Air is blown through a vessel containing water, thus becoming saturated with vapour.

This system is simple. At a fixed air flow, the humidity is easily controlled by changing the water temperature. If an increase of humidification is produced by increasing the water temperature, this may cause a temperature rise in the working space and introduce a time lag due to the thermal capacity of the water. The bubbles may produce small amount of aerosol when bursting.

4.4.2 Surface volatilization The air is humidified by passing it over a large surface area of water. Different methods are used, for example, repeated air flow over standing water, water-jet flowing over a vertical surface with the air stream in counter current.

In this system, the generation of aerosols is minimized. The humidity is easily controlled by changing the water temperature.

Due to the thermal capacity of the water a time-lag in change of humidity may occur.

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