

JIS

JAPANESE INDUSTRIAL STANDARD

Basic Environmental Testing Procedures Part 2: Tests, Tests B: Dry Heat

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In the event of any doubt arising,
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Basic Environmental Testing Procedures
Part 2: Tests, Tests B: Dry Heat

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Introduction1. General

This Japanese Industrial Standard specifies dry heat tests (resistance to heat) applicable both to non heat-dissipating and heat-dissipating specimens, hereinafter referred to as "dry heat tests".

Informative Reference: This Standard is prepared based on IEC 68-2-2 Basic environmental testing procedures Part 2: Tests, Tests B: Dry heat (1974) and Supplement A (1976), but some parts are modified to meet present situation of this country.

The object of the dry heat test is limited to the determination of the ability of components, equipment or other articles to be used or stored at high temperature.

These dry heat tests do not enable the ability of specimens to withstand or operate during temperature variations to be assessed.

Informative Reference: In the above case, IEC 68-2-14 Test N: Change of temperature shall apply.

The dry heat tests are subdivided as follows:

- (1) Dry heat tests for non heat-dissipating specimens
 - (a) Test Ba: Dry heat test with sudden change of temperature
 - (b) Test Bb: Dry heat test with gradual change of temperature
- (2) Dry heat tests for heat-dissipating specimens
 - (a) Test Bc: Dry heat test with sudden change of temperature
 - (b) Test Bd: Dry heat test with gradual change of temperature

The procedures specified in this Standard are normally intended for specimens which achieve temperature stability (see 4.8 of JIS C 0010) during the performance of the test procedure.

The duration of the test commences at the time when temperature stability of the specimen has been reached. For the exceptional cases when the specimen does not reach temperature stability during the performance of the test procedure, the duration of the test commences at the time when the test chamber reaches the test temperature. The relevant specification shall define:

Applicable Standard and Corresponding International Standard: See page 32.

- (1) The rate of change of temperature in the test chamber
- (2) The time at which the specimens are introduced into the test chamber
- (3) The time at which the exposure commences
- (4) The time at which the specimens are energized.

2. Application of Tests for Non Heat-Dissipating Specimens versus Tests for Heat-Dissipating Specimens

A specimen is considered heat-dissipating only if the hottest point on its surface, measured in free air conditions (i.e. with no forced air circulation), is more than 5 deg C above the ambient temperature of the surrounding atmosphere after temperature stability has been reached (see 4.6 of JIS C 0010).

It is obvious that when the relevant specification calls for a storage test or does not specify an applied load during the test, the Dry Heat Tests Ba and Bb will apply.

3. For Non Heat-Dissipating Specimens: Application of Tests with Sudden Change of Temperature versus Tests with Gradual Change of Temperature

In Test Ba with sudden change of temperature, the specimen is introduced into the test chamber, the latter being at the temperature specified for the test. Test Ba shall be used only when it is known that the effects of a sudden change of temperature are not detrimental to the test specimen.

In Test Bb with gradual change of temperature, the specimen is introduced into the test chamber, the latter being at the laboratory temperature. The temperature in the chamber is then increased gradually so as to cause no detrimental effects on the test specimen due to the temperature change.

4. Testing of Heat-Dissipating Specimens with and without Forced Air Circulation

The preferable method of testing heat-dissipating specimens is that which does not use forced air circulation. If this is impracticable, however, Tests Bc and Bd envisage also procedures for testing heat-dissipating specimens with forced air circulation.

Three methods for testing with air circulation are given (Method I, Method II and Method III). Method I applies to the cases where the chamber is large enough to comply with the requirements for testing without forced air circulation, but where the high temperature cannot be maintained without circulating the air in the chamber.

Method II applies to the cases where the chamber is too small to comply with the requirements for testing without forced air circulation.

Method III applies to the cases where Methods I and II are not applicable.

Informative Reference: Method III is not specified in IEC 68-2-2.

5. Diagrammatic Representations

To facilitate the choice of test method, a diagrammatic representation of the various procedures including number of Sub-clauses specifying the procedure is given in Fig. 1. Several clauses are identical, especially in Tests Ba and Bb and in Tests Bc and Bd.

A block diagram showing which clauses are identical and which are different is given in Fig. 2.

Fig. 1. Diagrammatic Representation of the Various Test Procedures for Dry Heat Tests

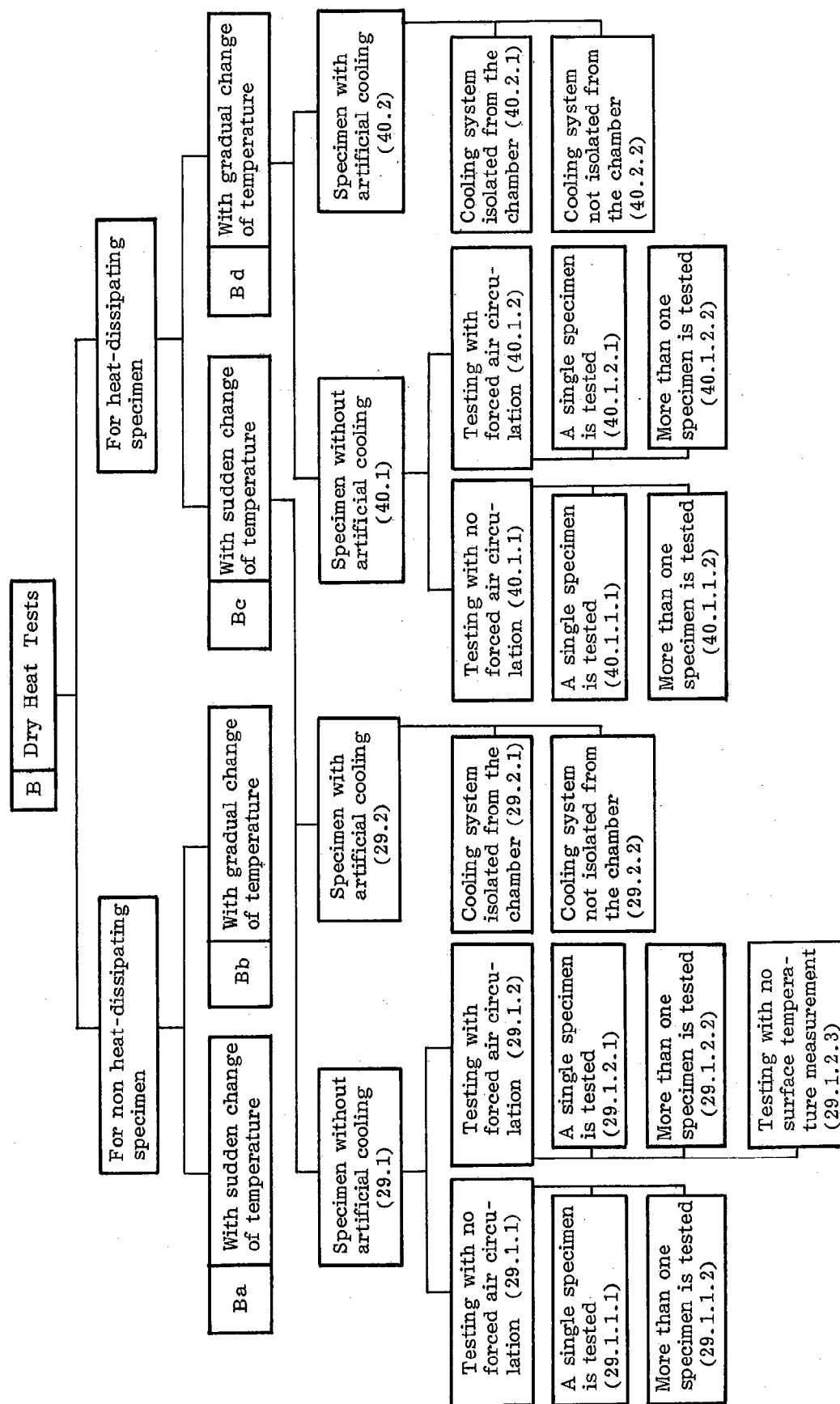
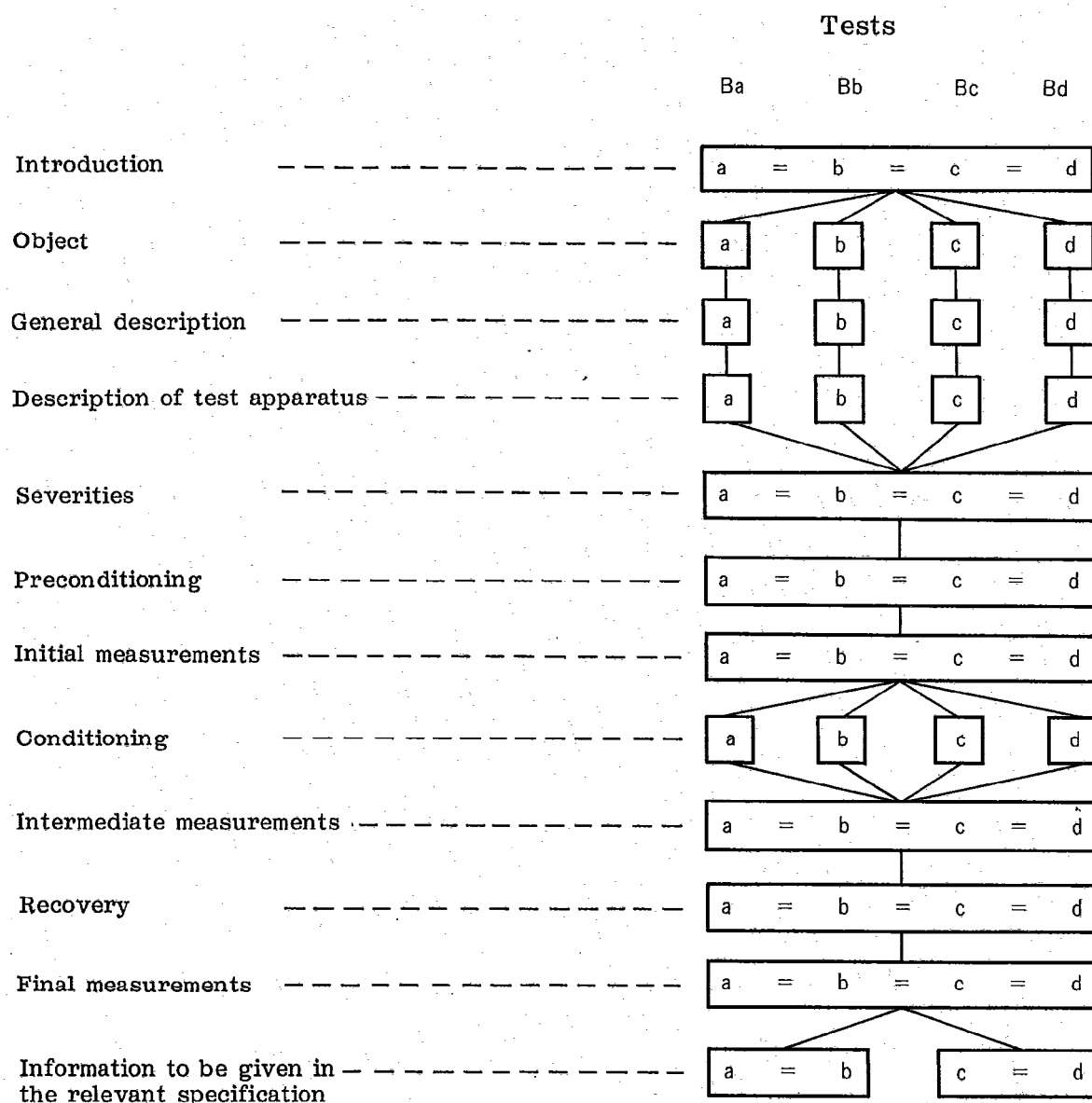


Fig. 2. Diagram Showing Identical and Different Clauses of the Dry Heat Tests Ba, Bb, Bc and Bd



(Identical and different descriptions in Tests Ba, Bb, Bc and Bd are shown for each item)

Section 1 Test Ba: Dry Heat for Non Heat-Dissipating Specimen with Sudden Change of Temperature

1. Object

To provide a standard test procedure to determine the suitability of non heat-dissipating components, equipment or other articles for use and/or storage under conditions of high temperature and for which the subjection to a sudden change of temperature has no detrimental effect.

This procedure is for specimens which are subjected to an elevated temperature for a time long enough for the specimen to achieve temperature stability.

In this procedure, the test duration is normally measured from the time when the specimen achieves temperature stability. For such exceptional cases that the specimen does not reach temperature stability, the test duration is measured from the time when the inside of chamber reaches the test temperature.

2. General Description

In this test, the specimen while being at the ambient temperature of the laboratory is introduced into the chamber, the latter being at the temperature appropriate to the degree of severity as specified in the relevant specification.

After temperature stability of the test specimen has been reached, the specimen is exposed to these conditions for the specified duration.

Specimens under test are normally in non-operating conditions.

Forced air circulation is normally used for this test.

3. Description of Test Apparatus

3.1 The chamber shall be capable of maintaining the specified temperature in the working space within the tolerances given in 4.1. Forced air circulation may be used to maintain homogeneous conditions.

3.2 In order to limit radiation problems, the temperature of the walls of the chamber shall not differ by more than 3 % of the specified ambient temperature of the test, expressed in K. This requirement applies to all parts of the chamber walls and the specimens shall be unable to "see" any heating or cooling elements which do not comply with this requirement.

3.3 The absolute humidity shall not exceed 30 g of water vapour per cubic metre of air (corresponding approximately to 75 % relative humidity at 35 °C). When testing is performed at a temperature lower than 35 °C, the relative humidity shall not exceed 75 %.

Remark: The absolute humidity is decided to be 30 g/m³ taking the climate of this country in consideration, inspite of 20 g/m³ in IEC 68-2-2.

4. Severities

The severities, as indicated by temperature and duration of exposure, shall be specified in the relevant specification. The values shall be selected from those given in 4.1 and 4.2.

4.1 Temperature

- + 200 $\pm$ 2 °C
- + 175 $\pm$ 2 °C
- + 155 $\pm$ 2 °C
- + 125 $\pm$ 2 °C
- + 100 $\pm$ 2 °C
- + 85 $\pm$ 2 °C
- + 70 $\pm$ 2 °C
- + 55 $\pm$ 2 °C
- + 40 $\pm$ 2 °C
- + 30 $\pm$ 2 °C

Remarks 1. In the absence of other considerations, temperatures above 200 °C and up to 1000 °C should be chosen from the following values and the chosen values shall be specified in the relevant specification.

250 °C 315 °C 400 °C 500 °C 630 °C 800 °C 1000 °C.

The tolerance in each case should be $\pm$ 2 % of the above temperatures in °C.

2. Where due to the size of the chamber it is not feasible to maintain these tolerances, the tolerance may be widened to $\pm$ 3 °C up to 100 °C and $\pm$ 5 °C up to 200 °C. When this is done, the tolerance used shall be specified in the test report.

4.2 Duration

2 h, 16 h, 72 h, 96 h

Where this testing procedure is used in connection with tests associated with endurance or reliability, the duration shall be specified in the relevant specification.

If the only intention of the testing procedure is to show whether the specimen will function at high temperature, the conditioning may be limited to a time such that the specimen under the test has reached temperature stability. In no case shall the duration be less than 30 min.

5. Preconditioning

The relevant specification may call for a preconditioning.

6. Initial Measurements

The specimen shall be visually inspected and electrically and mechanically checked as required by the relevant specification.

7. Conditioning

7.1 The chamber shall be at the temperature of the specified severity.

The specimen, while being at the ambient temperature of the laboratory, shall be introduced into the chamber in the unpacked, switched off, "ready for use" state, in its normal position or as otherwise specified.

When the test specimen is intended for use with specific mounting devices, these should be used for testing.

The test (ambient) temperature shall be the average of the temperatures measured as specified in 4.6 of JIS C 0010 at several points specified in the relevant specification on a horizontal plane 0 to 50 mm below the specimen at a distance from specimen equal to 1/2 of the distance between the specimen and inside wall of chamber or 1 m whichever is the shorter.

7.2 Time shall then be allowed for the chamber conditions to be re-establish and for the specimen to reach temperature stability.

7.3 For operational tests the specimen shall be switched on or electrically loaded and checked to ascertain whether it is capable of functioning in accordance with the relevant specification.

If required by the relevant specification, the specimen shall remain in operating condition in accordance with the duty cycle and at the loading condition (if applicable) as prescribed by the relevant specification.

Remark: A specimen, even under operating or loaded conditions shall be considered as non heat-dissipating as long as its surface temperature rise is not more than 5 deg C above the ambient temperature.

7.4 The specimen shall then be exposed to the high temperature conditions for a duration as specified in the relevant specification. The duration shall be measured from the time when temperature stability has been reached.

- Remarks 1. In some cases, direct measurement of internal temperature of specimen is practically impossible, therefore the stability may be confirmed by measuring other parameter if it has temperature dependency and if the rule of dependence is known.
2. In the case of small specimens, it is not necessary to check by measurement that temperature stability has been reached.

7.5 If required by the relevant specification, intermediate measurements shall be performed in accordance with 8.

7.6 At the end of this period, the specimen shall be subjected to the recovery procedure of 9. In case the specimen remains in operating or loaded conditions during the test, it shall be switched off or unloaded before being subjected to the recovery procedure.

8. Intermediate Measurements

The relevant specification may call for loading and/or measurements during or at the end of conditioning while the specimen is still in the chamber. If such measurements are required, the relevant specification shall define the measurements and the period or periods after which they shall be carried out. For these measurements, the specimen shall not be removed from the chamber.

Remark: If it is desired to know the performance of the type of specimen before the end of the prescribed duration, one additional lot will be required for each desired time of intermediate measurement. Recovery and final measurements shall be performed separately for each lot.

Example: In the case where it is desired to know the performance at 24 h, 48 h and 72 h.

Lot 1	Initial measurement	—————→	Final measurement
Lot 2	Initial measurement	→ 24 h →	Final measurement
Lot 3	Initial measurement	→ 48 h →	Final measurement
Lot 4	Initial measurement	→ 72 h →	Final measurement

9. Recovery

9.1 The specimen shall then remain under standard atmospheric conditions for recovery for a period adequate for the attainment of temperature stability, with a minimum of 1 h.

When several specimens are tested simultaneously and where the 1 h recovery period is adequate, the maximum period for recovery shall be 2 h and all measurements shall be completed at the end of this period.

9.2 If required by the relevant specification, the specimen shall be switched on or loaded and measured continuously during the recovery period.

9.3 If the standard conditions given in 9.1 are not appropriate for the specimen to be tested, the relevant specification may call for other recovery conditions.

10. Final Measurements

The specimen shall be visually inspected and electrically and mechanically checked as required by the relevant specification.