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EIA STANDARD

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Humidity Test Procedure for Electrical Connectors and Sockets

EIA-364-31B

(Revision of EIA-364-31A)

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Electronic Components, Assemblies & Materials Association

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(From Standards Proposal No. 3427-B, formulated under the cognizance of the CE-2.0 National Connector Standards Committee.)

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TEST PROCEDURE No. 31B
HUMIDITY TEST PROCEDURE
FOR
ELECTRICAL CONNECTORS AND SOCKETS

(From EIA Standards Proposal No. 3427-B, formulated under the cognizance EIA CE-2.0 Committee on National Connector Standards, and previously published in EIA Standard 364 as TP-31A.)

1 Introduction

1.1 Scope

This standard establishes test methods for the evaluation of connectors and sockets as they are influenced by the effects of high humidity and heat.

1.2 Object

This is an accelerated environmental test, accomplished by the continuous exposure of the specimen to high relative humidity at various temperatures. Measurements made under high humidity conditions may reflect the peculiar conditions under which the readings were made, and should be compared only to initial readings when careful analysis indicates that such comparison is valid and applicable.

2 Test resources

2.1 Equipment

The test chamber and accessories shall be constructed and arranged in such a manner as to avoid condensate dripping on the test specimen. A suitable open screen tray or rack shall be provided to ensure that the specimen shall be exposed to circulating air. Specimens shall not be subjected to radiant heat from chamber conditioning processes. The chamber shall be trap-vented to the atmosphere to prevent the buildup of total pressure. Relative humidity shall be determined from the dry bulb-wet bulb thermometer comparison method or an equivalent method approved by the procuring activity. When readout charts are used, they shall be capable of being read with a resolution within 0.6 °C (1 °F). When wet bulb control method is used, the wet bulb and tank shall be cleaned and a new wick installed at least every 30 days. The air velocity flowing across the wet bulb shall be not less than 274 meters per minute (900 feet per minute). The circulation of air shall be at a cubic rate per minute equivalent to five times the volume of the chamber; e.g. in a chamber volume 2 cubic meters (71 cubic feet), air flow shall be 10 cubic meters per minute (353 cubic feet per minute). However, provisions shall be made for controlling the flow of air throughout the internal test chamber area so that the velocity of air shall not exceed 46 meters per minute (150 feet per minute). Steam, or distilled, demineralized, or deionized water shall be used to obtain the specified humidity. No rust or corrosion contaminants shall be imposed on the test specimen by the test facility.

3 Test specimen

3.1 Description

Test specimen shall consist of a plug, a receptacle, a mated plug and receptacle, or socket as specified in the referencing document.

3.2 Preparation

The specimen shall be wired using the contacts, wire type, size, and sealing plugs (if applicable), specified.

4 Test procedure

4.1 Method I, ambient condensation

4.1.1 Conditioning

The specimens shall be conditioned in a dry oven at a temperature of 50 °C (122 °F) for 24 hours. At the end of this period, measurements shall be made as specified in the referencing document.

4.1.2 Mounting

The connectors shall be mounted in the test chamber in their normal mounting position by their normal mounting means, but shall be positioned so that they do not contact each other, and so that each specimen receives essentially the same degree of humidity. There shall be no drip loops in wires.

4.1.3 Initial measurements

Immediately after conditioning of the test specimen, the specified initial measurements shall be made at standard atmospheric conditions.

4.1.4 Duration of test

The specimens shall be subjected to tests for a period of time indicated by one of the test conditions in table 1.

Table 1 – Test conditions

Test condition	Length of test, hours
A	96
B	240
C	504
D	1,344
E	1,000

4.1.5 Polarization and load

When specified, a polarizing potential of 100 Vdc shall be applied between alternate contacts connected together electrically and the remaining contacts and shell connected together electrically. The polarity of the voltage applied to the shell shall be negative, unless otherwise specified in the referencing document.

4.1.6 Exposure

The chamber air temperature shall be lowered once each hour to a point not below 20 °C (68 °F). Humid warm air shall be introduced into the chamber, sufficient to cause heavy condensation to form on the specimens. The introduction of warm air shall be continued not less than 10 minutes. The temperature and humidity in the chamber need not be controlled after condensation has occurred until the next condensation period the following hour. Test condition C shall be used unless otherwise specified. This test may be performed with condensation occurring once each hour during a normal working day with the temperature chamber and humidity remaining undisturbed between the close of work one day and start of testing the next working day. There shall not be more than 17 hours between condensation periods. (This does not apply for non-working day(s)).

4.2 Method II, steady state humidity

4.2.1 Conditioning

The specimens shall be conditioned in a dry oven at a temperature of 50 °C (122 °F) for 24 hours. At the end of this period, measurements shall be made as specified in the referencing document.

4.2.2 Mounting

The connectors shall be mounted in the test chamber so that the wires descend vertically into the connector or one connector half. There shall be no drip loops in wires.

4.2.3 Initial measurements

Immediately after conditioning of the test specimen, the specified initial measurements shall be made at standard atmospheric conditions.

4.2.4 Polarization and load

When specified, a polarizing potential of 100 Vdc shall be applied between alternate contacts connected together electrically and the remaining contacts and shell connected together electrically. The polarity of the voltage applied to the shell shall be negative, unless otherwise specified.

4.2.5 Exposure

The specimens shall be placed in a chamber and subjected to a relative humidity of 90% to 95% and a temperature of $40\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ ($104\text{ }^{\circ}\text{F} \pm 4\text{ }^{\circ}\text{F}$) for the period of time indicated by one of the test conditions in table 1. Test condition A will be used unless otherwise specified in the referencing document.

4.3 Method III, cycling temperature - humidity with optional cold shock and vibration

4.3.1 Conditioning

The specimens shall be conditioned in a dry oven at a temperature of $50\text{ }^{\circ}\text{C}$ ($122\text{ }^{\circ}\text{F}$) for 24 hours. At the end of this period, measurements shall be made as specified in the referencing document.

4.3.2 Mounting

The connectors shall be mounted by their normal mounting means, in their normal mounting position, but shall be positioned so that they do not contact each other, and so that each specimen receives essentially the same degree of humidity.

4.3.3 Initial measurements

Prior to step 1 of the first cycle, the specified initial measurements shall be made at room ambient conditions, or as specified in the referencing document.

4.3.4 Polarization and load

When specified, a polarizing potential of 100 Vdc shall be applied between alternate contacts connected together electrically and the remaining contacts and shell connected together electrically. The polarity of the voltage applied to the shell shall be negative, unless otherwise specified.

4.3.5 Number of cycles

Specimens shall be subjected to 10 continuous cycles, each as shown on figure 1, unless otherwise specified in the referencing document.

4.3.6 Subcycle

During step 7, at least 1 hour but not more than 4 hours after step 7 begins, the specimens shall be either removed from the humidity chamber, or the temperature of the chamber shall be reduced, for performance of step 7a and 7b, when specified in the referencing document. After step 7a, when specified in the referencing document, the specimens shall be returned to 25 °C at 90% to 98% relative humidity and kept there until the next cycle begins. This subcycle shall be performed during any five of the first nine cycles. Subcycles are optional.

4.3.6.1 Step 7a

At least 1 hour but not more than 4 hours after the beginning of step 7, the specimens shall be either removed from the humidity chamber, or the temperature of the chamber shall be reduced. Specimens shall be conditioned at $-10\text{ °C} \pm 2\text{ °C}$ ($14\text{ °F} \pm 4\text{ °F}$) with humidity not controlled, for 3 hours as indicated in figure 1. When a separate cold chamber is not used, care should be taken to assure that the specimens are held at $-10\text{ °C} \pm 2\text{ °C}$ ($14\text{ °F} \pm 4\text{ °F}$) for the full 3 hour period.

4.3.6.2 Step 7b

Within 15 minutes after completion of step 7a, when specified in the referencing document, and with humidity not controlled, specimens shall be vibrated for 15 minutes, at room ambient temperature; see 4.3.3; using a simple harmonic motion of 0.15 millimeter (0.006 inch) maximum total excursion, the frequency being varied uniformly between the approximate limits of 10 and 55 Hz. The entire frequency range, from 10 to 55 Hz and return to 10 Hz, shall be traversed in approximately one minute.

4.4 Method IV, cycling temperature - humidity with optional cold shock

4.4.1 Conditioning

The specimens shall be conditioned in a dry oven at a temperature of 50 °C (122 °F) for 24 hours. At the end of this period, measurements shall be made as specified in the referencing document.

4.4.2 Mounting

The connectors shall be mounted by their normal mounting means, in their normal mounting position, but shall be positioned so that they do not contact each other, and so that each specimen receives essentially the same degree of humidity.

4.4.3 Initial measurements

Prior to step 1 of the first cycle, the specified initial measurements shall be made at room ambient conditions, or as specified in the referencing document.

4.4.4 Polarization and load

When specified, a polarizing potential of 100 Vdc shall be applied between alternate contacts connected together electrically and the remaining contacts and shell connected together electrically. The polarity of the voltage applied to the shell shall be negative, unless otherwise specified.

4.4.5 Number of cycles

Specimens shall be subjected to 10 continuous cycles, each as shown on figure 2, unless otherwise specified in the referencing document.

4.4.6 Subcycle

During step 7, at least 1 hour but not more than 4 hours after step 7 begins, the specimens shall be either removed from the humidity chamber, or the temperature of the chamber shall be reduced, for performance of step 7a, when specified in the referencing document. After step 7a, when specified in the referencing document, the specimens shall be returned to 25 °C (77 °F) at 90% to 98% relative humidity and kept there until the next cycle begins. This subcycle shall be performed during any five of the first nine cycles. Subcycles are optional.

4.4.6.1 Step 7a

At least 1 hour but not more than 4 hours after the beginning of step 7, the specimens shall be either removed from the humidity chamber, or the temperature of the chamber shall be reduced. Specimens shall be conditioned at $-10\text{ °C} \pm 2\text{ °C}$ ($14\text{ °F} \pm 4\text{ °F}$) with humidity not controlled, for 3 hours as indicated in figure 2. When a separate cold chamber is not used, care should be taken to assure that the specimens are held at $-10\text{ °C} \pm 2\text{ °C}$ ($14\text{ °F} \pm 4\text{ °F}$) for the full 3 hour period.

4.5 Method V, cycling sawtooth temperature - humidity with optional cold shock

4.5.1 Conditioning

The specimens shall be conditioned in a dry oven at a temperature of 50 °C (122 °F) for 24 hours. At the end of this period, measurements shall be made as specified in the referencing document.

4.5.2 Mounting

The connectors shall be mounted by their normal mounting means, in their normal mounting position, but shall be positioned so that they do not contact each other, and so that each specimen receives essentially the same degree of humidity.

4.5.3 Initial measurements

Prior to step 1 of the first cycle, the specified initial measurements shall be made at room ambient conditions, or as specified in the referencing document.

4.5.4 Polarization and load

When specified, a polarizing potential of 100 Vdc shall be applied between alternate contacts connected together electrically and the remaining contacts and shell connected together electrically. The polarity of the voltage applied to the shell shall be negative, unless otherwise specified.

4.5.5 Number of cycles

Specimens shall be subjected to 10 continuous cycles, each as shown on figure 3, unless otherwise specified in the referencing document.

4.5.6 Subcycle

During step 7, at least 1 hour but not more than 4 hours after step 7 begins, the specimens shall be either removed from the humidity chamber, or the temperature of the chamber shall be reduced, for performance of step 7a, when specified in the referencing document. After step 7a, when specified in the referencing document, the specimens shall be returned to 25 °C (77 °F) at 90% to 98% relative humidity and kept there until the next cycle begins. This subcycle shall be performed during any five of the first nine cycles. Subcycles are optional.

4.5.6.1 Step 7a

At least 1 hour but not more than 4 hours after the beginning of step 7, the specimens shall be either removed from the humidity chamber, or the temperature of the chamber shall be reduced. Specimens shall be conditioned at $-10\text{ °C} \pm 2\text{ °C}$ ($14\text{ °F} \pm 4\text{ °F}$) with humidity not controlled, for 3 hours as indicated in figure 2. When a separate cold chamber is not used, care should be taken to assure that the specimens are held at $-10\text{ °C} \pm 2\text{ °C}$ ($14\text{ °F} \pm 4\text{ °F}$) for the full 3 hour period.

4.5.7 Exposure

4.5.7.1 Place the test specimen in the test chamber in accordance with 4.5.1. Prior to starting the test, the internal chamber temperature shall be at standard test with uncontrolled humidity.

4.5.7.2 Gradually raise internal chamber temperature to 71 °C (160 °F) and the relative humidity to 95%, +5%, -0% over a period of 2 hours.

4.5.7.3 Maintain condition of 4.5.5.2, see figure 3, for not less than 6 hours.

4.5.7.4 Maintain 85%, or greater, relative humidity and reduce internal chamber temperature in 16 hours to 28 °C ± 10 °C (82 °F ± 18 °F).

4.5.7.5 Repeat 4.5.5.2, 4.5.5.3 and 4.5.5.4 for 10 cycles (not less than 240 hours). Figure 3 is an outline of the humidity cycle for this method.

4.6 Final measurements

4.6.1 At high humidity

Due to the difficulty in making measurements under high humidity conditions, the referencing document shall specify particular precautions to be followed in making measurements under such conditions when specified.

4.6.1.1 Methods I and II

Upon completion of the exposure period, and while the specimens are still in the chamber, the specified measurements shall be performed.

4.6.1.2 Method III

Upon completion of step 6 of the final cycle, the specimens shall be maintained at a temperature of 25 °C (77 °F) ± 2 °C (4 °F) at 90% to 98% relative humidity for a period of 1.5 hours to 3.5 hours, after that the specified measurements shall be made.

4.6.1.3 Method IV

Upon completion of step 6 of the final cycle, the specified measurement shall be made.

4.6.1.4 Method V

Upon completion of step 7 of the final cycle, the chamber program shall be stopped to maintain a temperature of 25 °C (77 °F) at high humidity condition. The specified measurement shall be made.

4.7 During the recovery period (all methods)

When measurements are specified to be performed during a period of recovery, usually not exceeding five hours, the specimens shall be removed from the chamber and placed in room ambient conditions, see 4.1.3, unless otherwise specified. Specimens shall not be subjected to any means of artificial drying.

4.8 After recovery period

4.8.1 Methods I and II

Upon completion of the exposure period, and following measurements at high humidity if specified, the specimens shall be conditioned at room ambient, see 4.1.3 or 4.2.3, for a period of five hours unless otherwise specified after that the required measurements shall be performed at room ambient conditions.

4.8.2 Method III

Following step 6 of the final cycle, or following measurements at high humidity, if specified, specimens shall be conditioned for 24 hours at room ambient conditions, see 4.3.3, after that the specified measurements shall be made.

5 Details to be specified

The following details shall be specified in the referencing document:

5.1 Test specimen preparation, if special preparation required

5.2 Initial measurements, and conditions if other than room ambient; see 4.1.3, 4.2.3, 4.3.3, 4.4.3 or 4.5.3.

5.3 Test conditions (length); see table 1

5.4 Polarizing voltage and load, the length of time, and points of application; see 4.1.5, 4.2.4, 4.3.4, 4.4.4, or 4.5.4

5.5 Method III, IV or V; conducting subcycles step 7a or step 7b, or both, if desired

5.6 Final measurement; see 4.6

5.6.1 At high humidity; see 4.6.1

5.6.2 During recovery period; see 4.7

5.6.3 After recovery period; see 4.8

5.7 Number of specimens to be tested

5.8 Define test specimen, mated or unmated

5.9 Wire type, size, and sealing plugs, if applicable; see 3.2

6 Documentation

Documentation shall contain the details specified in clause 5, with any exceptions, and the following:

6.1 Title of test

6.2 Specimen description including fixturing; if applicable

6.3 Test equipment used, and date of last and next calibration

6.4 Test procedure and duration

6.5 Values and observations, initial and final ambient conditions

6.6 Name of operator and date of test

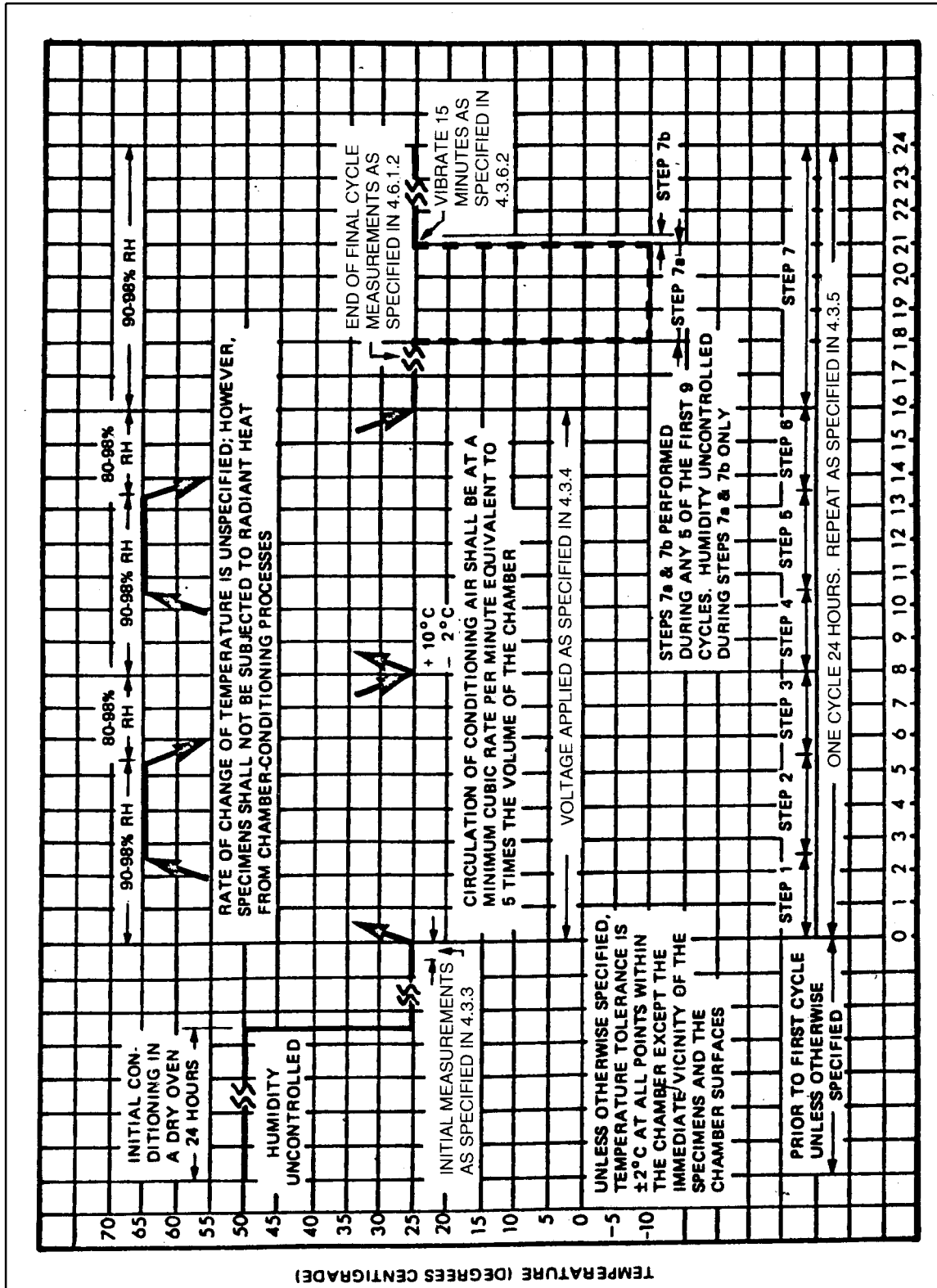


Figure 1 - Graphical representation of moisture resistance method III humidity test

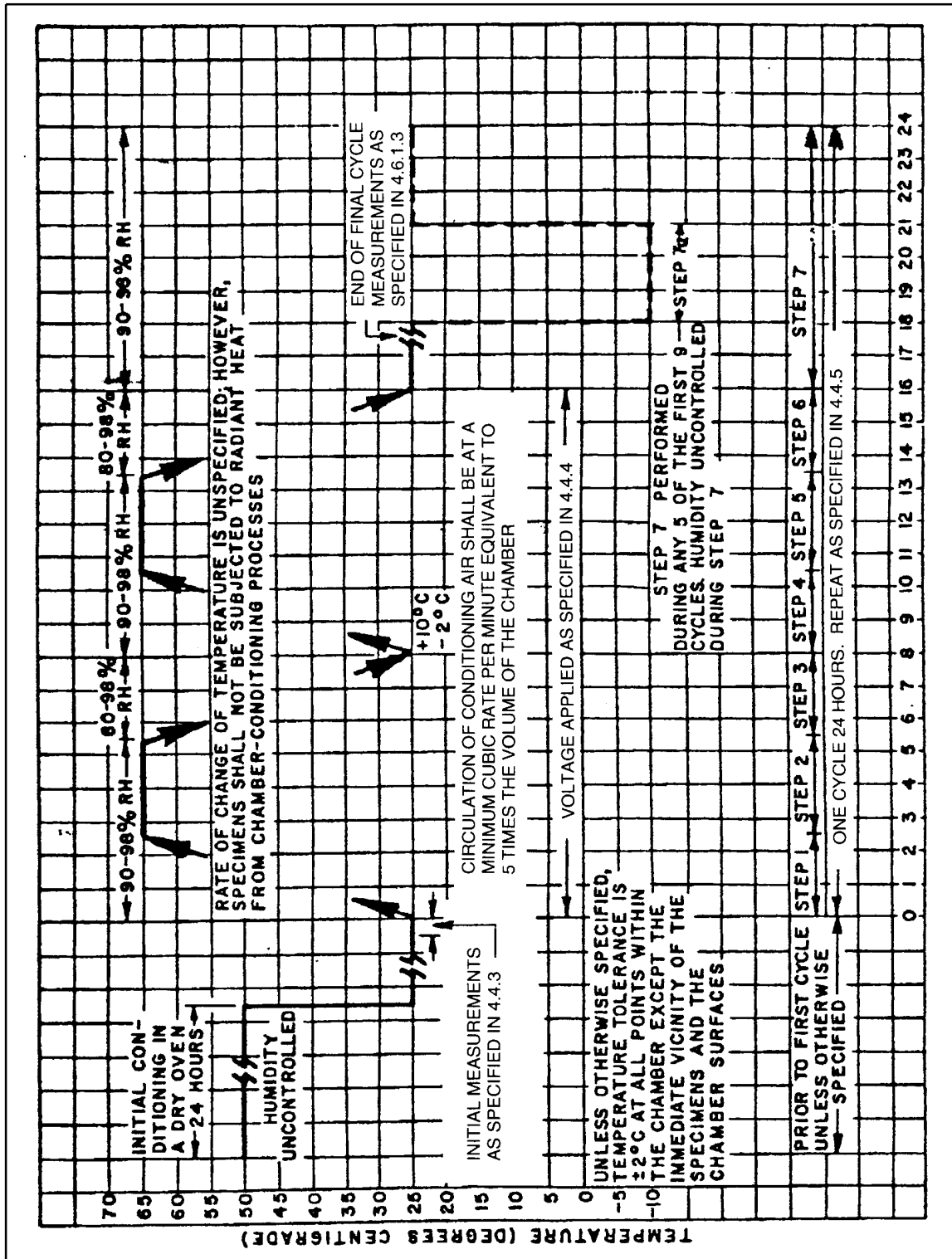


Figure 2 - Graphical representation of moisture resistance method IV humidity test

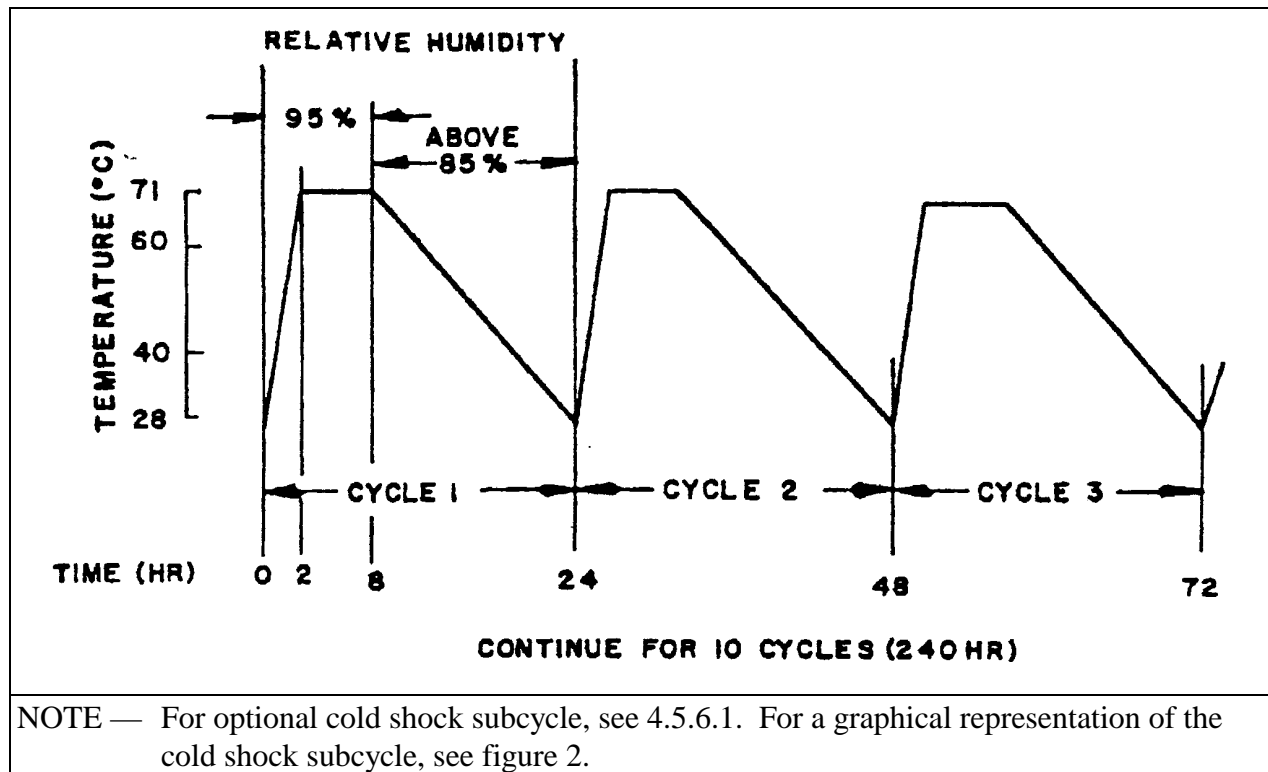


Figure 3 - Graphical representation of method V humidity cycling test

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