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Indian Standard
**SPECIFICATION FOR
EQUIPMENT FOR ENVIRONMENTAL
TESTS FOR ELECTRONIC AND
ELECTRICAL ITEMS
PART III HUMIDITY CHAMBER**

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SPECIFICATION FOR EQUIPMENT FOR ENVIRONMENTAL TESTS FOR ELECTRONIC AND ELECTRICAL ITEMS

PART III HUMIDITY CHAMBER

0. FOREWORD

0.1 This Indian Standard (Part III) was adopted by the Indian Standards Institution on 12 June 1979, after the draft finalized by the Environmental Testing Procedures Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 The object of this standard (Part III) is primarily to guide the environmental equipment manufacturers with respect to broad specifications for their equipment and to assist the users of such equipment to properly define their requirements in the indent of the equipment. The requirements of the equipment largely depend on the conditions of environmental tests to be simulated or created. It is expected that this standard will harmonize the various requirements of the equipment.

0.3 Certain requirements have been specified in a general form in view of practical difficulties in defining such requirements quantitatively. It is presumed, with the experience gained, more precise requirements will be laid down for such equipment.

0.4 An overall performance assessment of the complete equipment for a short duration has been included although it may be realized that it may not be entirely sufficient. This will at least ensure the functional performance and operatability of the equipment. Many of the constructional requirements specified can be checked through visual examination.

0.5 In view of the subjective nature of some of the requirements, sufficient care shall be taken in using this standard.

0.6 This standard is one of a series of Indian Standards on equipment for environmental tests for electronic and electrical items. Other standards published so far in the series are:

IS:9002 Equipment for environmental tests for electronic and electrical items:

9002 (Part I)-1977 Chamber for cold test

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9002 (Part II)-1977 Chamber for dry heat test

9002 (Part IV)-1979 Chamber for mould growth test

9002 (Part V)-1979 Equipment for vibration (sinusoidal) test

0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS:2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part III) lays down guiding requirements for the design of humidity chamber required for carrying out damp heat (steady state), damp heat (cyclic) and composite temperature/humidity (cyclic) tests.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions and explanation of terms given in IS:9000 (Part I)-1977† shall apply.

3. CHAMBER CHARACTERISTICS

3.1 The chamber shall be so constructed that:

- a) the temperature and relative humidity in the working space shall be maintained as follows:

<i>Test</i>	<i>Temperature</i>	<i>Relative Humidity</i>	<i>Remarks</i>
Damp heat (steady state)	$40 \pm 2^{\circ}\text{C}$	90-95 percent	—
Damp heat (cyclic)	a) $25 \pm 3^{\circ}\text{C}$	95-100 percent	} For the first 15 min and last 15 min at the upper temperature the relative humidity shall be 90-100 percent
	$40 \pm 2^{\circ}\text{C}$	90-96 percent	
	b) $25 \pm 3^{\circ}\text{C}$	95-100 percent	
	$55 \pm 2^{\circ}\text{C}$	90-96 percent	
Composite temperature / humidity (cyclic)	$25 \pm 2^{\circ}\text{C}$	80-96 percent	—
	$65 \pm 2^{\circ}\text{C}$	90-96 percent	

- b) the temperature and humidity of the chamber are monitored by sensing devices located in the working space.

*Rules for rounding off numerical values (revised).

†Basic environmental testing procedures for electronic and electrical items: Part I General.

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3.1.1 The procedure for production of humidity is given in 4 of IS:9001 (Part IV)-1979*.

3.2 Precautions shall be taken to ensure that:

- a) conditions prevailing throughout the working space are uniform and as similar as possible to those prevailing in the immediate vicinity of the monitoring devices.
- b) properties for loading of the item under test do not appreciably influence conditions within the chamber.
- c) no condensed water from the walls and roof of the test chamber can fall on the item.

3.3 In case of damp heat chambers employing steam injection, the air velocity of the point accessible to the wet bulb thermometer shall be not less than 3 m/s.

3.4 Condensed water shall be continuously drained from the chamber.

3.5 When the humidity conditions are obtained by using an injection type chamber, the water shall have a resistivity not less than 500 Ω m.

4. CONSTRUCTION, WORKMANSHIP AND FINISH

4.1 General

4.1.1 The chamber shall be fabricated preferably with welded steel of sufficient thickness to provide necessary mechanical strength. Corners and seams of the interior liners are to be so welded as to allow for expansion and contraction under all temperatures changes to prevent distortion and damage.

4.1.2 The materials used for the construction of interior walls of the chamber shall preferably be of stainless steel of the non-corrosive type.

4.1.3 The chamber shall employ air circulation for maintaining the specified conditions uniformly. The air circulating fan should not protrude into the working space.

4.2 Working Volume — The working volume of the chamber should be chosen from the following preferred values, unless otherwise specified:

0.25, 0.5, 1, 2.5 m³

4.3 Insulation — The chamber shall be suitably and sufficiently insulated for the temperature range involved.

*Guidance for environmental testing: Part IV Damp heat testing.

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4.4 Doors — The front door shall be capable of full opening to ensure full access to the working space and fitted with suitable gaskets to prevent heat losses.

4.5 Shelves — Removable, perforated shelves capable of supporting without distortion the items of specified mass shall be provided. The number of shelves and adjustable heights are to be as specified. The materials used shall be of non-corrosive type.

4.6 Viewing Window — A viewing window of the required dimension shall be provided on the door preferably of the multipane type, hermetically sealed.

4.7 Terminal Panel — As an optional facility a suitable terminal panel for making external connections with the test items inside the chamber shall be provided. The relevant details and requirements, for example, voltage and current levels are to be as specified.

4.8 Port Hole — A port hole of specified dimension may be provided as an optional item at the specified point of the chamber for accommodating wires, hoses, etc. To ensure thermal integrity, means shall be provided for sealing of the port hole when not in use.

4.9 Interior Light — Provision shall be made for illuminating the working space by incandescent lamps with water tight fittings. The lamps may be recessed so as not to project into the working space.

4.10 Workmanship — The workmanship shall be of good current engineering practice.

4.11 Finish — The external and internal finish of the chamber shall be as specified for parts not otherwise covered so as to ensure protection against corrosion and other similar effects.

4.12 Miscellaneous

4.12.1 The chamber shall be designed for optimum performance and economic continuous operation with minimum maintenance requirement. It shall occupy minimum floor area.

4.12.2 The electrical and electronic components and cables shall conform to relevant Indian Standards, wherever available.

4.12.3 Provision of castor wheels shall be made for easy movability of the equipment, if required.

5. INSTRUMENT CONSOLE

5.1 An instrument console consisting of required instruments should

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preferably be fitted to the chamber for ease of operation. This instrument console should include, inter alia, the following:

- Indicating panel consisting of mains on-off switch, mains-on indicator lamp, temperature indicator, relative humidity indicator, on-off switch for circulation;
- Necessary instruments for controlling and recording temperature and relative humidity. The temperature control stability shall be within $\pm 0.5^{\circ}\text{C}$;
- Input regulation to ensure close temperature accuracy and for modulating, that is, adjusting regulating or varying heating and humidifying capacities from 0 to 100 percent; and
- A time switch for test programming as an optional item, if required.

5.1.1 Provision for automatic test programming be made as an optional facility, if required.

6. ADDITIONAL REQUIREMENTS

6.1 The chamber may be designed with provision for the following, when required:

- Cooling (refrigeration) system may be provided in places where ambient temperature is above 25°C ;
- For wider applications such as moisture resistance, the lower limit might be -10°C . It should be possible to lower the temperature from $25 \pm 2^{\circ}\text{C}$ to $-10 \pm 2^{\circ}\text{C}$ in a period of not more than 30 min; and raise the temperature from $-10 \pm 2^{\circ}\text{C}$ to $25 \pm 2^{\circ}\text{C}$ in a period of not more than 90 min; and
- Dehumidification system using a separate condensing unit or a chemical drier, as required, may be provided.

7. POWER SUPPLY REQUIREMENTS

7.1 The test equipment shall be capable of operating from an ac supply of 50 Hz either from single phase $240 \text{ V} \pm 10$ percent or 3 phase $415 \text{ V} \pm 10$ per cent. Total power input shall be declared by the manufacturer, if required by the purchaser.

8. SAFETY

8.1 Adequate electrical safety arrangement shall be incorporated in the chamber design to avoid electric shock to personnel and damage to the chamber. The safety protection should be as follows:

- Protection against supply voltage variation;

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- b) Safety cut-outs for high temperature and for low water level;
- c) Adequate heat/electrical insulation at control panel;
- d) Safety alarm in case of chamber mal-functioning, where required;
- e) Provision for interlocking of fan in the heater circuit; and
- f) Provision of a suitable earth terminal.

9. MARKING

9.1 The equipment shall be marked with the following information:

- a) Manufacturer's name or trade-mark;
- b) Type designation;
- c) Working volume and range of operating conditions;
- d) Power supply requirements; and
- e) Any other additional marking, as required.

10. TESTS

10.1 Each chamber shall be subjected to the following tests:

- a) Visual examination and inspection (*see* 10.2), and
- b) Performance (*see* 10.3).

10.2 Visual Examination — Each chamber shall be visually examined and inspected for compliance with the relevant requirements of the standard.

10.3 Performance — The chamber shall be capable of fulfilling one or more test conditions specified in 3.1(a) for the following minimum durations:

- a) Damp heat (steady state) 56 days
- b) Damp heat (cyclic) 6 cycles
- c) Composite temperature humidity (cyclic) 10 cycles

11. INSTRUCTION MANUAL

11.1 Each chamber shall be provided with instruction manual which shall contain the following:

- a) Operating instructions,
- b) Maintenance and service instructions,
- c) Schematic diagrams and design of layout,
- d) List of component parts with performance data, and
- e) List of spare parts.

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12. INFORMATION TO BE FURNISHED BY THE INDENTOR

12.1 The following information shall be furnished by the indentor:

- a) Temperature/humidity range of the chamber if other than that specified in 3.1(a);
- b) The maximum permissible external surface temperature (*see* 4.3);
- c) Number of shelves and adjustable heights (*see* 4.5);
- d) Dimensions of viewing window (*see* 4.6);
- e) Relevant details and requirements of terminal panels (*see* 4.7);
- f) Dimension of port hole, if required (*see* 4.8);
- g) Finish (*see* 4.11);
- h) Provision of castor wheels (*see* 4.12.3);
- j) Interlock provision [*see* 8.1(e)];
- k) Time switch for test programming, if required [*see* 5.1(d)];
- m) Automatic test programming, if required (*see* 5.1.1);
- n) Total power input (*see* 7);
- p) Safety alarm, if required [*see* 8.1(d)]; and
- q) Any other characteristics or parameters with tolerances.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

<i>Quantity</i>	<i>Unit</i>	<i>Symbol</i>	<i>Definition</i>
Force	newton	N	1 N=1 kg. m/s ²
Energy	joule	J	1 J=1 N.m
Power	watt	W	1 W=1 J/s
Flux	weber	Wb	1 Wb=1 V.s
Flux density	tesla	T	1 T=1 Wb/m ²
Frequency	hertz	Hz	1 Hz=1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S=1 A/V
Electromotive force	volt	V	1 V=1W/A
Pressure, stress	pascal	Pa	1 Pa=1 N/m ²