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JCI 191 CONTROLLED HUMIDITY TEST CHAMBER

To provide opportunity to measure the charge dissipation and capacitance loading capabilities of materials under defined humidity conditions with measurement of temperature and humidity. Humidity can be controlled and measured from 65% down to below 15% RH.

INTRODUCTION

The ability of materials to dissipate static electricity quickly, as needed if static risks and problems are to be controlled, can depend strongly on ambient humidity. The reason is that the ease of charge movement depends on the amount of surface moisture that is adsorbed. Humidity can also affect the ‘capacitance loading’ experienced by charge on the surface of materials [1, 2]. Studies to compare the capabilities of materials and to judge their suitability for practical applications need to be made under defined and measured conditions of temperature and humidity. The JCI 191 Controlled Humidity Test Chamber provides simple and easy to use facilities in which charge decay and capacitance loading measurements can be made under set condition of humidity using JCI 155 charge decay test instrumentation with various types of sample support [5].

DESIGN FEATURES

JCI 191 Controlled Humidity Test Chamber has internal dimensions of 600 x 800mm and 300mm high with a glazed lid that can be lifted up for loading and removal of samples. The lid is hinged at its rear edge and can open 120° to stay in the open position. Two long sleeve rubber gloves are mounted in the front side so that anything in the chamber can be reached for handling or operation. The size of the chamber is adequate to take a good number of samples and a JCI 155 Charge Decay Test Unit on a JCI 166 Sample Support or a JCI 176 Charge Measuring Sample Support. A JCI 170 or JCI 173 Powder Sample Support may be used for studies on powders. A JCI 150 Faraday Pail with JCI 178 Charge Measurement Unit may be used for charge measurements on powders and small items.

The humidity in the chamber is measured using a pre-calibrated semiconductor sensor (Honeywell HIH-3160) which gives a linear response signal from 0 to 100%RH. A semiconductor sensor is used to measure the temperature within the chamber. Observations of humidity and temperature are displayed on separate 3½ digit LCDs on the control box mounted on the right hand side of the chamber.

Humidity is controlled using a circuit that compares the observed humidity to a user set level. If the humidity is above the set level then an electromagnetic airflow valve is opened to provide a supply of lightly pressurised dry air into the chamber until the humidity has fallen appropriately. For above ambient levels of humidity air is blown through a ‘water bubbler’

into the chamber via a separate input port. The dead band window of humidity control between too dry (amber LED) and too wet (red LED) is about 2%RH. In the middle of the range a green LED shows satisfactory operation.



JCI 191 Controlled Humidity Test Chamber

Dry air may be supplied as a pressure regulated flow from, for example, a cylinder of dry compressed air or from a special air drier unit, such as the JCI 192 Dry Air Supply Unit. The supply pressure needs to be a few p.s.i. pressure – up to 6 p.s.i. It is advantageous to have a small buffer volume (say 10l) in the supply line to give quick response to any ambient air inflow leakage into the chamber that may occur when hands are taken out of the gloves. Humidity changes in such events are minimised by arranging the gasflow into the chamber to exit via a very flexible buffer volume. This is a light plastic bag in a shielding box. Gas leaks from this bag via a small hole on the opposite side to gas entry. If hands are removed from the gloves the bag tends to collapse to back-fill the chamber with air already at chamber controlled humidity conditions.

Temperature in the chamber can be controlled to a set level that is above the surrounding ambient level. This is achieved in a similar way to the control of humidity and with heat input via a switching electrical power to a resistor heater in a shielding box in the chamber.

A small fan is provided in the chamber to circulate the air and give uniform humidity and temperature conditions throughout the chamber.

CONNECTIONS

The mains input to the control box (240V/115V 50/60Hz) is made via an IEC connector fused at 500mA (20mm long 5mm dia fuse).

Three blanked-off glands are provided in the side panel for user cables into the chamber. These may be used, for example, to provide:

- 18V input from an external switched mode power supply for mains operation and/or battery recharging with a JCI 155v5 Charge Decay Test Unit
- serial data output linkage from a JCI 155v5 or JCI 155v4 Charge Decay Test Unit to an external computer
- analogue signal outputs for remote measurement of charge measurement, for example, when using a JCI 176 in conjunction with a JCI 155v5.



Inside of JCI 191 Controlled Humidity Test Chamber

OPERATION

Temperature and humidity levels are set with the potentiometers on the right of the LCDs when the 'set' buttons are pressed. When the humidity in the chamber is above the set target value the valve to allow inflow of dry air is opened and this is closed when the target level is reached. If the humidity is below the set level then the air pump mounted on the outside of the panel (behind the control unit) is switched on and air is pumped into the chamber via the water bubbler unit. Using the JCI 192 Dry Air Supply Unit and the water bubbler the humidity within the chamber can be controlled from below 15%RH to over 65%RH.

When the temperature in the chamber is below the set target value a heater is switched on to warm the air within the chamber. Although provision is made in the circuitry in the control unit to activate cooling of the air in the chamber, if the temperature is above the set level, no suitable facilities have so far been provided. The heater is about 100W dissipation and will give a temperature elevation above ambient up to around 10°C.

For charge decay and capacitance loading measurements using a JCI 155 Charge Decay Test Unit on a JCI 176 Charge Measuring Sample Support [5] in the chamber it is usually most convenient to place the instruments about in the middle of the chamber. The operator will then easily be able to read instrument displays and select and position samples in the JCI 176. Samples may be placed on one side of the instrumentation and, for example, moved to the other side as they are tested.

The JCI 155v5 is best pre-connected to an external 18V switched mode power supply via the 2.5mm d.c. connector. Mains operation can then be switched on and off externally. An earth bonding link should be made between the 'Durable Dot'/Bayonet Pin connector on the sample support and on the body of the JCI 155 and to the earthing point on the chamber. The JCI 155v5 and the JCI 176 will be interconnected using a 8w mini DIN cable supplied with these instruments. The charge measurement port of the JCI 155v5 is that at the left-hand side of the instrument backplate. The JCI 176 will be powered directly from power supplies in the JCI 155v5 and zeroing will be appropriately controlled by the software. It is hence not necessary to have batteries present in the JCI 176 unit or to switch this unit on. Care needs to be taken to ensure these 8w connectors are pushed fully home into the sockets and it will be best to connect the smaller section 8w plug to the JCI 155v5.

When JCI 155v4 instruments are used in the chamber the 8w mini DIN to 9w D type connector serial communications lead is plugged into the 8w min DIN socket in the back plate of the JCI 155. If a JCI 176 is used the 8w min DIN plug for external charge measurements may be plugged into either of the two 8w min DIN sockets in the back plate of the JCI 176 unit. The JCI 176 will need to be fitted with batteries and switched on (or powered from an external supply) for taking measurements. Operating the zeroing button of the JCI 176 through the gloves on the chamber will not be easy. It will be better to arrange for an external zeroing push button to be connected externally to the 8w lead.

Before starting test work it is wise to check that the operator can easily enter hands into the gloves and can handle and control any item within the chamber volume.

When several samples are put into the chamber it will be wise a) to keep these separated to minimise chance of transfer of surface treatments between samples, and b) to make it easy for samples to acclimatise to local environmental conditions. It may prove helpful to have small wire racks within the chamber to store samples with segregation. At least 24 hours should be allowed for acclimatisation of samples – possibly longer for getting to low humidity levels.

When loading samples between the sample support plates of the JCI 176 (or between the JCI 155 and a JCI 166 Sample Support) it is important to check that the upper surface of the sample is flat and smooth, and that there is no chance that loose fibres or pieces of material will get into the test aperture of the JCI 155. Many samples are easily charged by rubbing. It is hence important to minimise sliding and rubbing actions in positioning samples between the plates of the JCI 176

JCI 192 Dry Air Supply Unit

The JCI 192 Dry Air Supply Unit provides a low pressure flow of very low humidity air via a push-in connector for 6mm airline plastic tube. This tube (typically 3m long) can be connected directly to the input push-in connector on the control box of the JCI 191. The supply pressure is set to operate over an output pressure range between about 0.05 and 9 p.s.i. The air normally has a dewpoint of -40°C or less.

It needs to be noted that the lowest level of humidity achievable depends upon the ambient temperature and humidity. Levels down to 20%RH should be readily achieved. For much lower levels it may be necessary to ensure the ambient temperature and humidity are at moderate levels.

SPECIFICATION FEATURES:

<i>Chamber size:</i>	600 x 800mm and 300mm high inside
<i>Measurements:</i>	humidity and temperature values are displayed on a 3½ digit LCD
<i>Humidity control:</i>	within about $\pm\frac{1}{2}$ % from below 15%RH to over 65%RH
<i>RH/T Display:</i>	Humidity to 0.1% Temperature to 0.1°C.
<i>Controls:</i>	Push buttons to enable target humidity and temperature levels to be set with potentiometer
<i>Dry air supply:</i>	Standard 6mm push-in plastic tube connector. Dry air supply 0.1 bar about 1litre min ⁻¹ (for example from JCI 192 Dry Air Supply Unit)
<i>Power supply:</i>	Mains power is connected via an IEC connector on the Control Box. Operation from 110-240V 5VA supplies. Fused at IEC socket 3A with a 'SoBlo' fuse. External supply should be fused 3A.
<i>Signal connections:</i>	3 gland seals provide for linking signals from instruments within the chamber to external control and display facilities

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