

# Anti-Static Measure Guide

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## I. Operation Standards

### 1. Purpose of Anti-Static Measures

The purpose is to eliminate characteristic degradation and fracture defect of semiconductor which occurs at logistic process, production process and maintenance service due to static electricity.

### 2. Basic Concept of Anti-Static Measures

#### 2.1 Prevention of semiconductor defect caused by static

- (1) Do not generate the static.
- (2) Do not bring in the charged objects.
- (3) Remove the static from the charged object with safe speed (0.001s to 1s).
- (4) Protect from electric field.

#### 2.2 Safety measures

- (1) Provide an earth for anti-static measure separate from power supply earth.
- (2) Protect the human body by inserting the resistance of 1MΩ, 1W to a hazardous point for the human body.

### 3. Scope of Application

All of logistic process, production process and maintenance service which handle semiconductors and semiconductor mounting boards (PCB).

### 4. Implementation Standards for Anti-Static Measure

Measures in the III. Measure Implementation Standards are implemented based on the following implementation level.

Class	∴	.....	Mandatory (required item) →Semiconductor in general
Class	∵	.....	When using a part whose ESD is 1000V or less →LSI, IC, Tr, etc.
Class	∶	.....	When using a part whose ESD is 100V or less →Communication IC, etc.

### 5. Establishment of Measure Process

Management representative shall review the following situations with Anti-Static Measure Checklist and keep the records.

- (1) When a new production line is established
- (2) When an operation and production line are changed
- (3) When semiconductors are handled by a process where they have not been handled
- (4) When a new equipment, jig or tool is installed

### 6. Maintenance of Anti-Static Measures

Anti-static measures must be maintained by conducting reviews and checks in order to protect semiconductors from the static even when there is no change in operation and production line.

#### 6.1 Review

Management representative shall conduct a voluntary review once a month based on the Anti-Static Measure Checklist. Also, QA department shall conduct a third-party review as needed. In each case the records must be kept.

#### 6.2 Check

Anti-static equipments can cause defect such as characteristic degradation and disconnection, and the leak from the equipments which contact semiconductors directly may destroy the semiconductors. Thus, daily check (once a day) is required for the following items.

- (1) Wrist strap: Checked by operator before the operation

- (2) Insulation resistance of soldering iron and soldering bit of solder extractor: Checked by operator before the operation
- (3) Confirmation of daily check and measure implementation: Checked by line leader

7. Control of Anti-Static Measures

Plant supervisor or department manager appointed by the plant supervisor shall grasp the entire situation of the section 3 to 6 and prescribe the measures as necessary.

8. Educations and Trainings

The anti-static measures cannot be maintained without correct instructions from the management representative and understanding of all operators. Therefore, the management representative must understand the anti-static measures thoroughly and teach the mechanism of electrostatic hazard, necessity of anti-static measures and its rules for all operators who handle the semiconductors to perform the correct operation.

- (1) Trainee: All operators (including management representative) who handle the semiconductors
- (2) Educational content: “Anti-Static Measure Training” text
- (3) Timing: At the time of new assignment by joining the company or personnel reshuffle, and at least once a year

## II. Definition of Anti-Static Materials

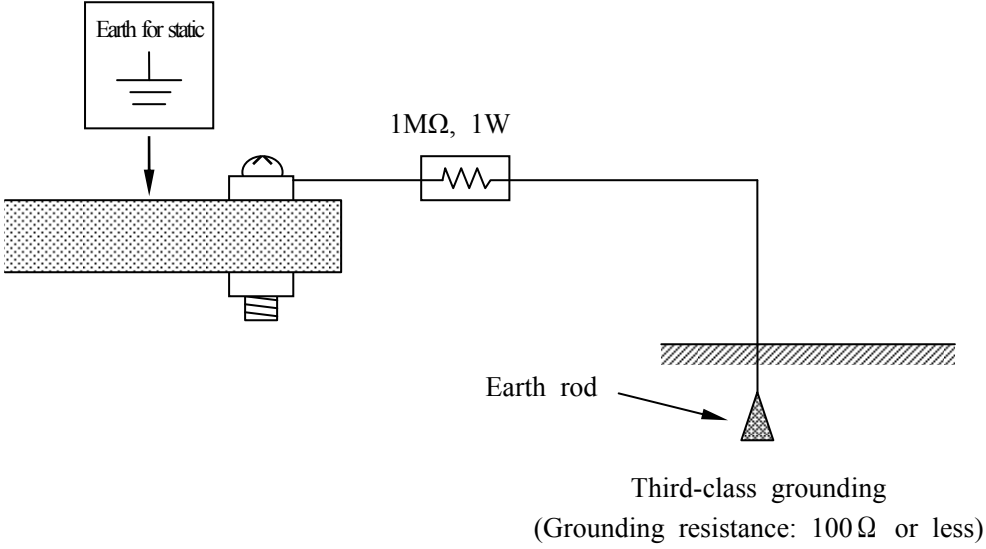
(○: Advantages, ●: Disadvantages)

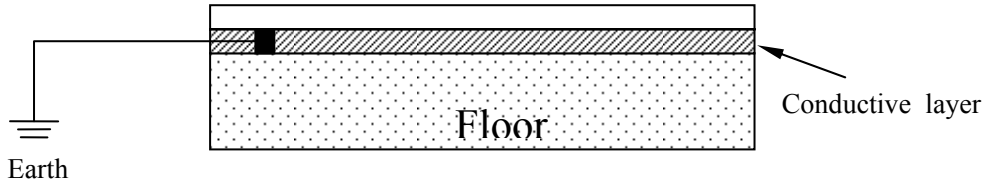
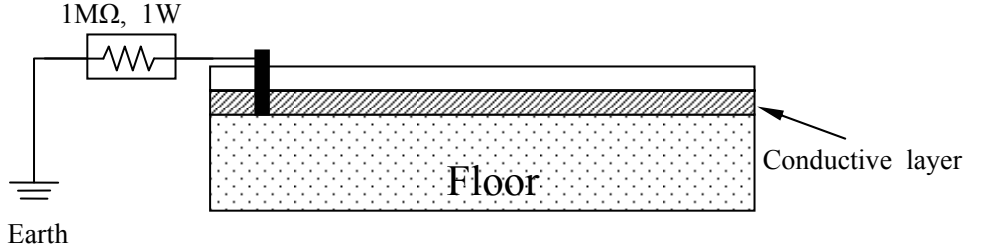
Material Classification	Definition	Features	Application
Conductive material	A material whose surface resistance is $10^5\Omega$ or less.	○Can protect semiconductor from electric field with the shield effect. ●Charged semiconductor will discharge in a short time and deteriorate due to low resistance.	-Returnable box, Storage box -Parts box -IC form
Static diffusion material	A material whose surface resistance is no fewer than $10^5\Omega$ , nor more than $10^9\Omega$ .	○Can discharge the static promptly without deteriorating the charged semiconductor. ●Shield effect is insufficient.	-Table mat -Floor mat -Wrist strap -Electrostatic shoes
Anti-static material	A material whose surface resistance is no fewer than $10^9\Omega$ , nor more than $10^{14}\Omega$ .	○Resistant to electrostatic charge due to friction. ●Takes time to discharge the charged object due to high resistance. ●No shield effect.	-Bag, magazine -Cushioning material -Working uniform
Insulating material	A material whose surface resistance is $10^{14}\Omega$ and above.	●Partial discharge only because of the high resistance and no charge transfer. ●Can be easily electrified by friction and peeling.	

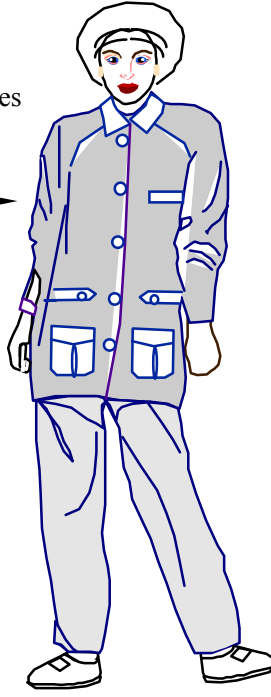
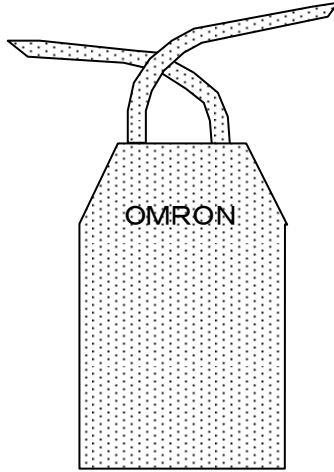

\*Use conductive, static diffusion, and anti-static materials properly for the anti-static measures.

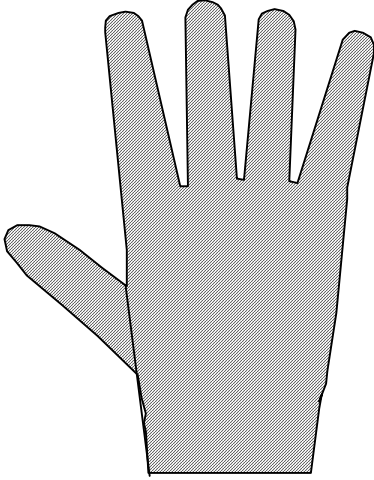
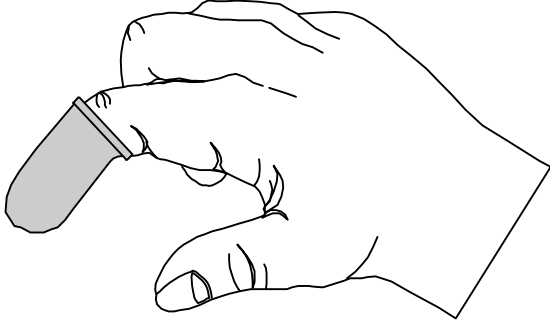
### III. Measure Implementation Standards

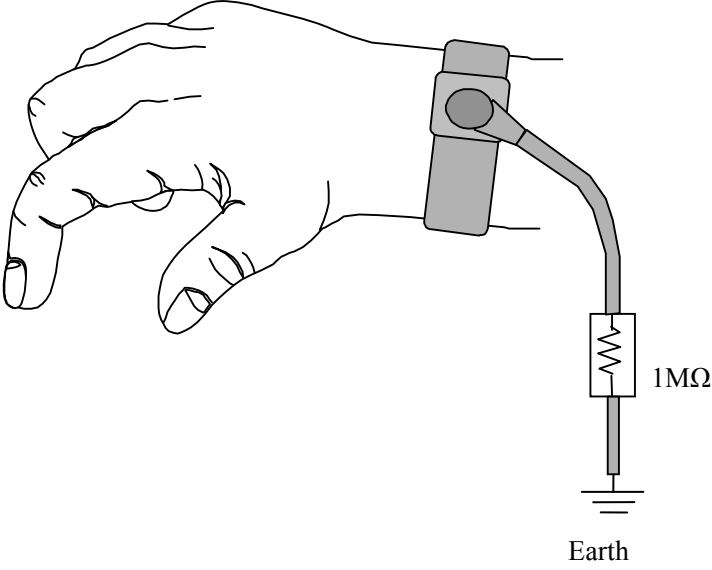
Item	1. Humidity Control	Class ∴∴																				
Measure	<p>(1) Keep the humidity of all processes which handle semiconductors and semiconductor mounting boards between 40 to 70%.</p> <p>(2) Control the humidity by making a graph and collecting the data at least once a day.</p> <p style="text-align: center;"><u>Connection between humidity and static</u></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <caption>Approximate data points from the graph</caption> <thead> <tr> <th>Humidity (%)</th> <th>Chemical fiber (kV)</th> <th>Silicon mat on a desk (kV)</th> <th>Anti-static treatment (kV)</th> </tr> </thead> <tbody> <tr> <td>30</td> <td>6.8</td> <td>8.5</td> <td>3.2</td> </tr> <tr> <td>50</td> <td>1.8</td> <td>1.2</td> <td>1.0</td> </tr> <tr> <td>80</td> <td>1.2</td> <td>0.8</td> <td>0.8</td> </tr> <tr> <td>100</td> <td>1.0</td> <td>0.8</td> <td>0.8</td> </tr> </tbody> </table>	Humidity (%)	Chemical fiber (kV)	Silicon mat on a desk (kV)	Anti-static treatment (kV)	30	6.8	8.5	3.2	50	1.8	1.2	1.0	80	1.2	0.8	0.8	100	1.0	0.8	0.8	
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100	1.0	0.8	0.8																			
Points to concern	<p>(1) Be careful about condensation when using a humidifier.</p> <p>(2) For the object which was treated with antistatic agent, the effect will decrease rapidly due to its humidity dependency when, in most cases, the humidity drops to below 40% and the moisture in the air lessens.</p>																					
Reason	To control static generation caused by dryness.																					

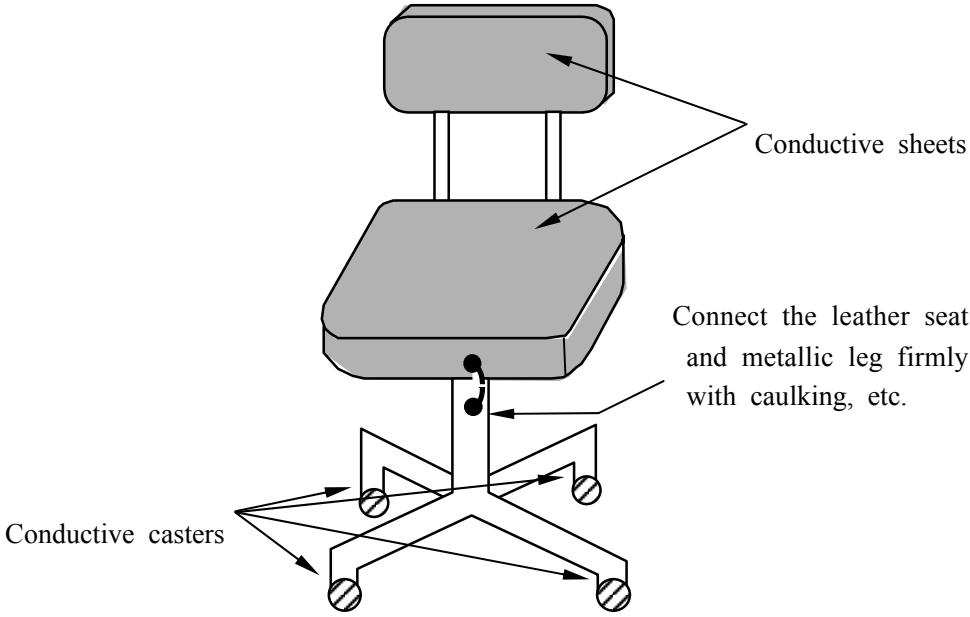
Item	2. Earthing Method	Class ∴∴
Measure	<p>(1) Provide an anti-static earth separate from power supply earth.</p> <p>(2) Use a grounding wire (1.25mm<sup>2</sup> or more) of IV line equivalency, and the coating color should be a combination of green and yellow to distinguish it from other grounding line.</p> <p>(3) Grounding for each point where measures were taken must maintain enough tensile strength with coupling snap connector or fixable terminal. (Alligator clip is not allowed)</p> <p>(4) Measure the grounding resistance at least once a year.</p> <p>(5) Stick a label of "earth for static" at the ground point.</p>  <p>The diagram illustrates the earthing method. On the left, a box labeled 'Earth for static' with a ground symbol is connected to a terminal on a device. A wire runs from this terminal through a resistor labeled '1MΩ, 1W' to a ground point. This ground point is connected to an 'Earth rod' which is driven into the ground, labeled as 'Third-class grounding (Grounding resistance: 100Ω or less)'. The ground is represented by a hatched area.</p>	
Points to concern	<p>(1) Provide a third-class grounding for the anti-static earth.</p> <p>(2) Do not share the grounding electrode with power supply earth.</p> <p>(3) Install a wire wound resistor of 1MΩ, 1W in series as close to the grounding as possible to protect the human body.</p>	
Reason	<p>To prevent electric shock to the human body due to short circuit as well as to prevent characteristic degradation and fracture defect of semiconductor caused by noise. Also, to control static generation caused by dryness.</p>	

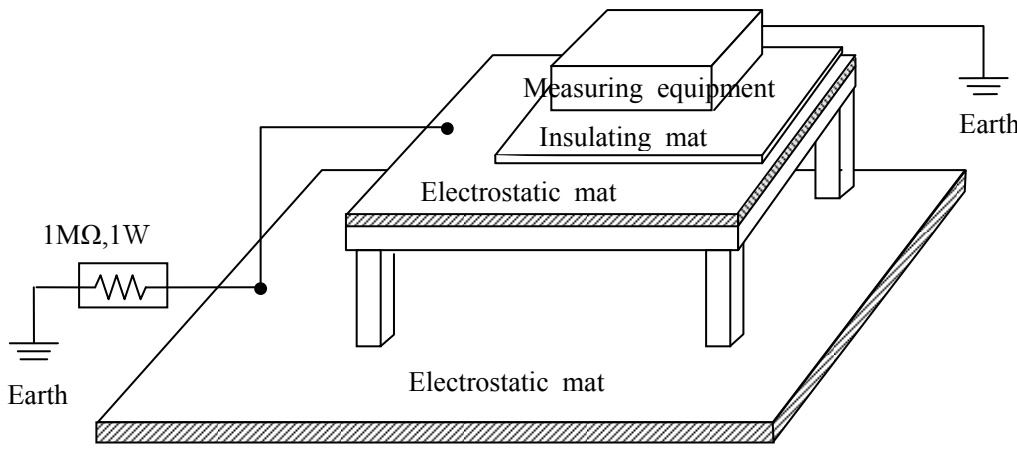
Item	3. Floor	Class ∴∴
<p>Measure</p>	<p>(1) Ground the floor of the process to handle the semiconductors and semiconductor mounting boards by applying conductive materials.</p> <p>(2) Earthing resistance should be <math>2.5 \times 10^4</math> to <math>1 \times 10^9 \Omega</math>.</p> <p>(3) Remove the stain with mild detergent or special cleaner since the stain can increase the resistance.</p> <p>(4) Make a checklist and measure the resistance every six months.</p> <p>&lt;Grounding for the unexposed ground point&gt;</p>  <p>&lt;Grounding for the exposed ground point&gt;</p>  <p>* For the exposed grounding point, connect it to ground with the resistance of <math>1M\Omega</math>, <math>1W</math>.</p> <p>* Grounding must be connected to the conductive layer.</p>	
<p>Points to concern</p>	<p>(1) The followings are the type of floor material.</p> <ul style="list-style-type: none"> <li>-Plastic tile (conductive/anti-static)</li> <li>-Lengthy sheet (conductive/anti-static)</li> <li>-Electrostatic coating</li> <li>-Electrostatic mat</li> </ul> <p>(2) When using multiple tiles, sheets and mats, make sure that each of them is connected and grounded surely. (Control of conductive adhesive)</p> <p>(3) When waxing, apply anti-static wax after removing the old one. (Amount of coating: up to third layer) Make sure that the resistance of the waxed floor is within the reference value. Install a wire wound resistor of <math>1M\Omega</math>, <math>1W</math> in series as close to the grounding as possible to protect the human body.</p> <p>(4) Be careful of anti-static type because of the low anti-static effect and poor constancy.</p>	
<p>Reason</p>	<p>To prevent static generation from the human body as well as to eliminate the static charged by the use of electrostatic shoes from the human body.</p>	

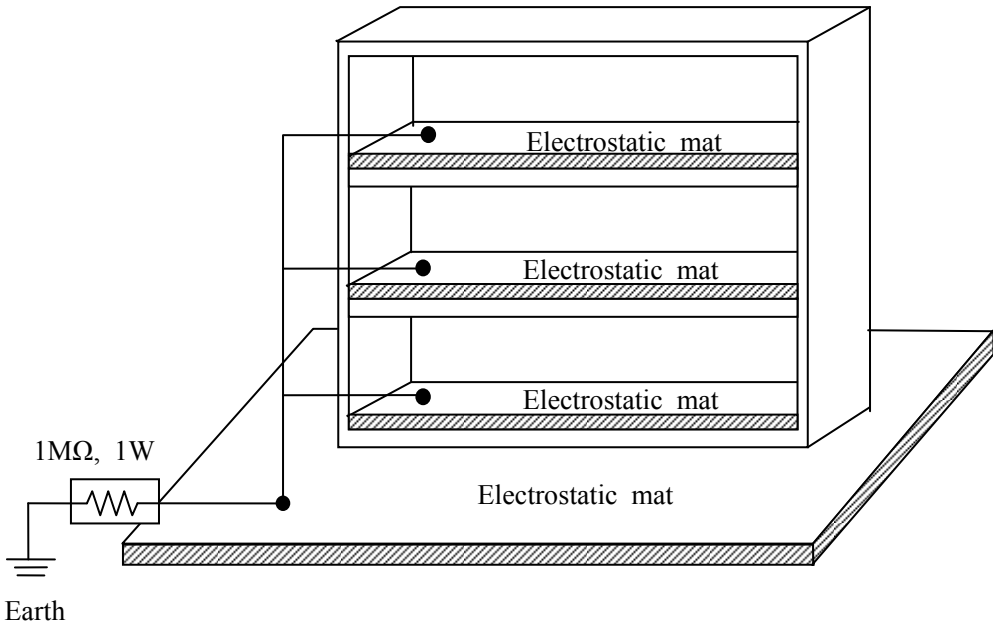
Item	4. Working Uniform		Class ∴∴
Measure	<p>(1) Operator who handles semiconductors and semiconductor mounting boards must wear anti-static clothes and electrostatic shoes (resistance: <math>1 \times 10^5</math> to <math>1 \times 10^8 \Omega</math>).</p> <p>(2) Do not use the materials that can be easily electrified (e.g. chemical fiber, wool) for apron, arm cover, cushion, etc.</p> <p>(3) Make a checklist and measure the resistance before the operation every day.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Anti-static clothes (OC. uniform)</p>  </div> <div style="text-align: center;"> <p>Anti-static apron (OC. apron)</p>  </div> <div style="text-align: center;"> <p>Electrostatic shoes</p>  </div> </div>		
Points to concern	<p>(1) Keep the shoe sole on the floor where anti-static measures were taken during the operation.</p> <p>(2) Attach conductive materials to the footrest, height adjuster, etc. and connect it to ground.</p> <p>(3) Do not bleach or coat (clearstarch) the anti-static clothes.</p> <p>(4) Always keep the shoe sole of electrostatic shoes clean since the dirty shoe sole will lower the anti-static effect. Also, avoid the use of shoe insole and thick socks.</p>		
Reason	<p>To prevent static generation from the human body and electrostatic charge to clothes as well as to eliminate the static charged in the human body.</p>		

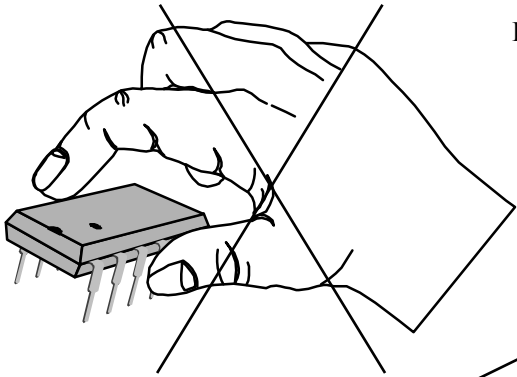
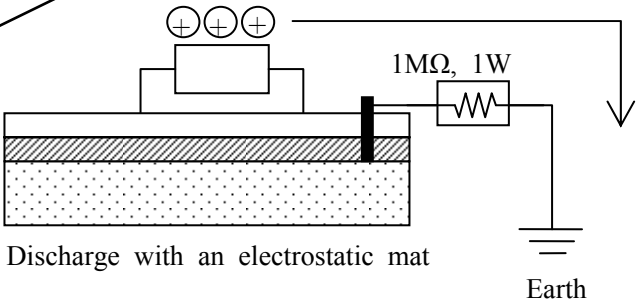
Item	5. Gloves / Finger Cot		Class ::::
Measure	<p data-bbox="376 360 1394 421">Use conductive or cotton type for gloves and finger cot used by the operator who handles semiconductors and semiconductor mounting boards.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p data-bbox="533 477 743 506">Conductive glove</p>  </div> <div style="text-align: center;"> <p data-bbox="1106 477 1369 506">Conductive finger cot</p>  </div> </div>		
Points to concern	<ul style="list-style-type: none"> <li data-bbox="392 1402 1414 1435">(1) Do not use nylon gloves since they easily generate static by human movement.</li> <li data-bbox="392 1451 1414 1547">(2) When a rubber finger cot is used as a substitute for conductive (cotton) finger cot, measure the amount of electrostatic charge and make sure that it does not generate static.</li> </ul>		
Reason	<p data-bbox="376 1861 1062 1895">To prevent static generation from gloves and finger cot.</p>		

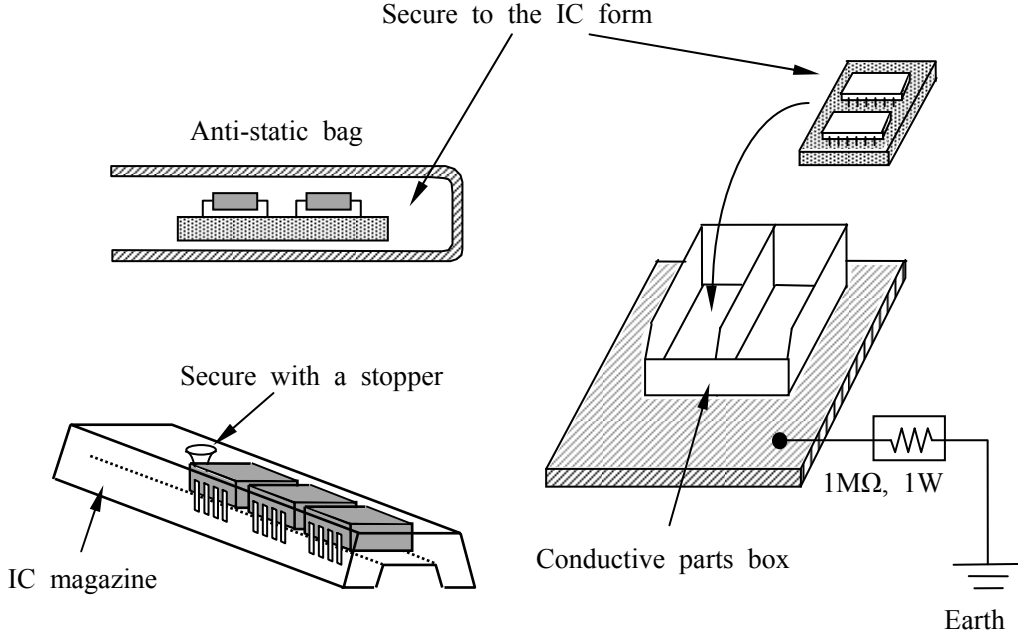
Item	6. Use of Wrist Strap	Class ::::
Measure	<p>(1) Wear a wrist strap on the either right or left hand for the sedentary operation or standing operation on the non-antistatic floor which handles semiconductor and semiconductor mounting boards.</p> <p>(2) Make a checklist and measure the resistance (disconnection) before the operation every day.</p> <p>(3) Grounding must maintain enough tensile strength with banana jack, etc.</p>  <p>The diagram shows a right hand wearing a wrist strap. A cable extends from the strap, passes through a rectangular component containing a resistor symbol, and is labeled '1MΩ'. The cable then connects to a ground symbol labeled 'Earth'.</p>	
Points to concern	<p>(1) Use a wrist strap of correct size and unslacked belt since it cannot remove the static unless the belt touches the skin. Also, do not wear it on the clothes.</p> <p>(2) Clean the noticeable stain since the stain increases the resistance and makes the grounding difficult.</p>	
Reason	To eliminate the static charged in the human body.	

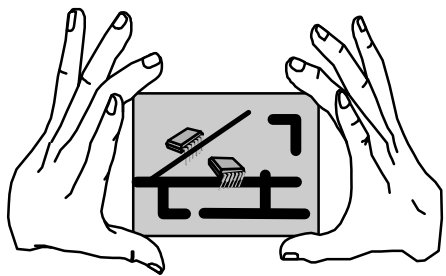
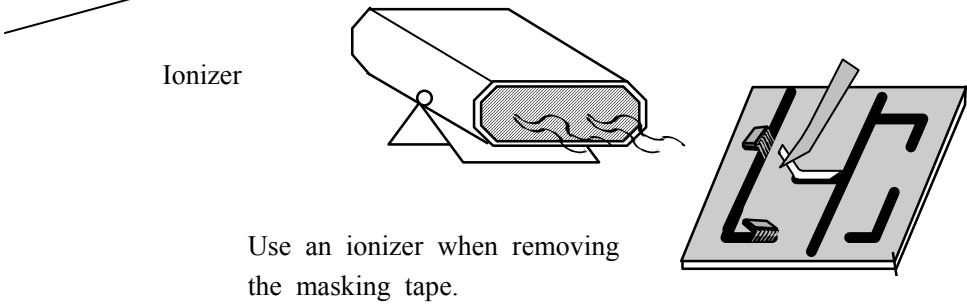
Item	7. Chair	Class :
Measure	<p>(1) Use a conductive chair for the sedentary operation which handles semiconductor and semiconductor mounting boards.</p> <p>(2) Provide a conductive chair cover for the chair which uses plastic materials for the seat and backrest.</p> <p>(3) Use of cushion is prohibited.</p> 	
Points to concern	<p>(1) Ground the seat and backrest part surely.</p> <p>(2) Make sure to check the effect by measuring the amount of electrostatic charge in the human body since the effect can change depending on the floor resistance.</p> <p>(3) Use of wrist strap may be discontinued by keeping the year-round demonstration data if the static can be removed surely within a second.</p> <p>(4) Remove the dust and stain from the casters periodically.</p>	
Reason	To prevent static generation from chair as well as to eliminate the static charged in the human body.	

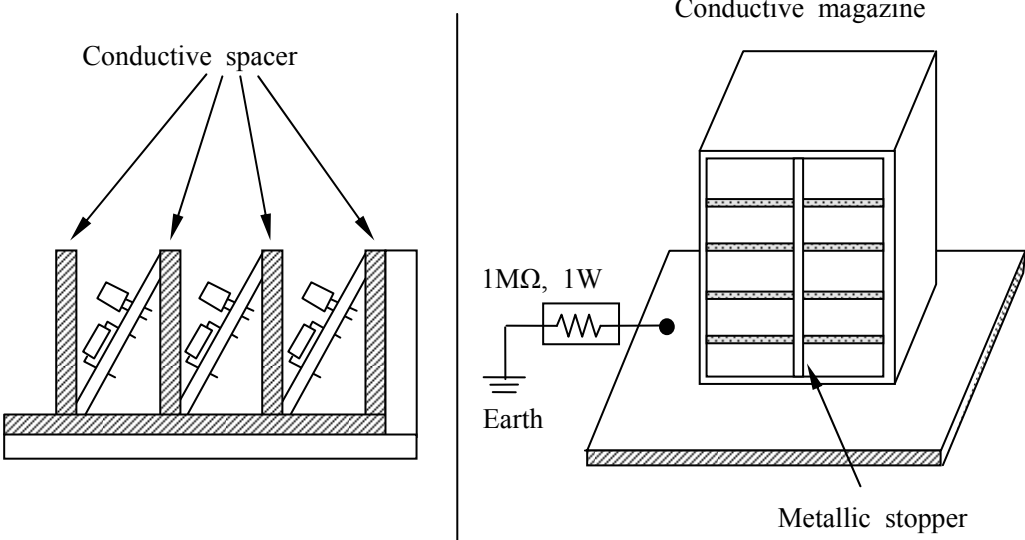
Item	8. Workbench	Class ∴∴
Measure	<p>(1) Put an electrostatic mat (<math>1 \times 10^5</math> to <math>1 \times 10^9 \Omega</math>) on the table which handles semiconductors and semiconductor mounting boards, and connect it to ground with the resistance of <math>1M\Omega</math>, <math>1W</math>.</p> <p>(2) Grounding must maintain enough tensile strength with coupling snap connector or fixable terminal.</p> <p>(3) Remove the stain with mild detergent or special cleaner since the stain on a mat can increase the resistance.</p> <p>(4) Isolate the equipment on the desk from the electrostatic mat, and connect it to power supply earth.</p> <p>(5) Do not put an insulator on the desk.</p> <p>(6) Make a checklist and measure the resistance of the mat every 6 months.</p> 	
Points to concern	<p>Be careful in handling a battery mounting board since the mat resistance can burn battery power. (No problem if the surface resistance is <math>1 \times 10^7 \Omega</math> or above)</p>	
Reason	<p>To prevent static generation from the desk as well as to remove the static charged in the semiconductor with safe speed.</p>	

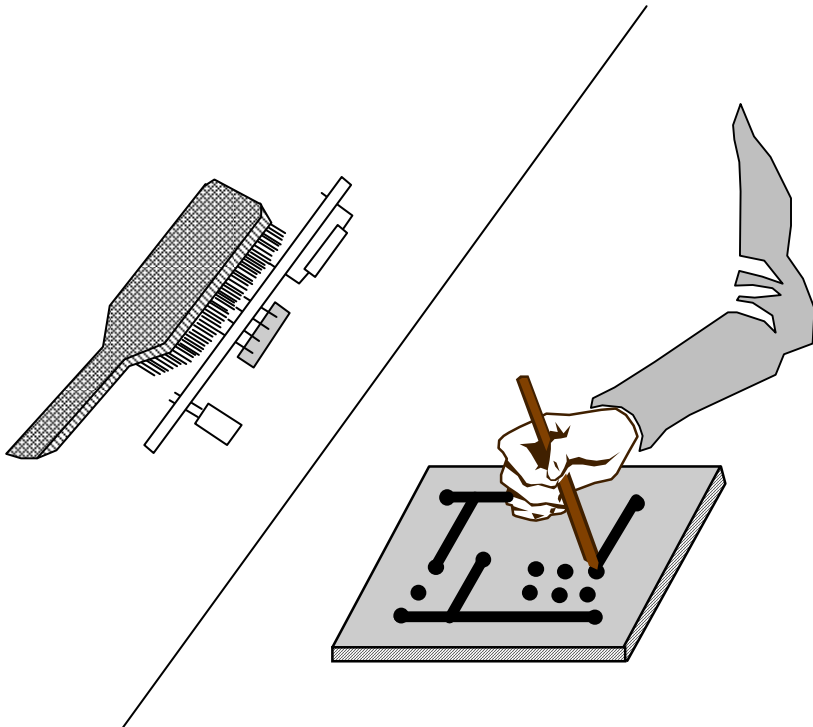
Item	9. Storage Shelf	Class ∴∴
Measure	<p>(1) Put an electrostatic mat (<math>1 \times 10^5</math> to <math>1 \times 10^9 \Omega</math>) on the shelf which stores semiconductors and semiconductor mounting boards, and connect it to ground with the resistance of <math>1M\Omega</math>, <math>1W</math>.</p> <p>(2) Grounding must maintain enough tensile strength with coupling snap connector or fixable terminal.</p> <p>(3) Remove the stain with mild detergent or special cleaner since the stain on a mat can increase the resistance.</p> <p>(4) Do not place the object that can be easily electrified in the storage area.</p>  <p>The diagram shows a three-tiered storage shelf. Each shelf is covered with an 'Electrostatic mat'. A fourth mat is placed on the floor. A circuit diagram shows a resistor labeled '1MΩ, 1W' connected between the mats and a ground symbol labeled 'Earth'.</p>	
Points to concern	<p>Do not put the parts that are not stored in a storage box or packing box on the insulation such as cardboard.</p>	
Reason	<p>To prevent static generation from a shelf as well as to remove the static charged in the semiconductor with safe speed.</p>	

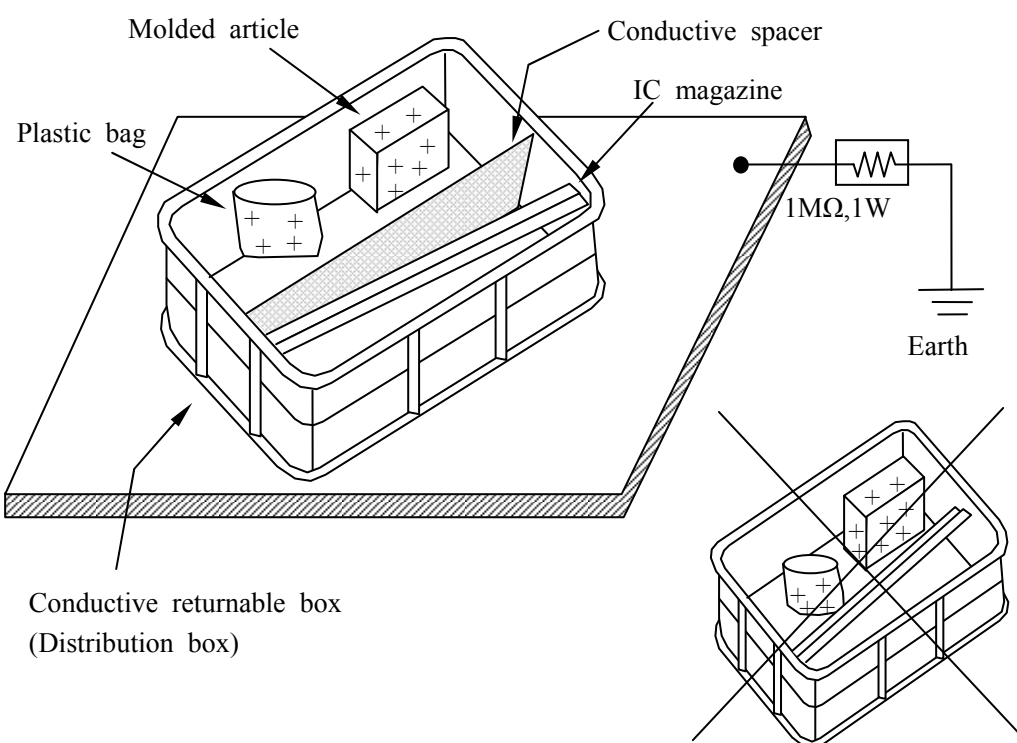
Item	10. Handling of Semiconductor	Class ∴∴
Measure	<p>(1) Do not touch the lead of semiconductor directly with your fingertips.</p> <p>(2) Do not let the lead of charged semiconductor touch metallic and conductive materials.</p> <p>(3) Discharge the static by placing the semiconductor on an electrostatic mat when removing a semiconductor from the magazine.</p>   <p style="text-align: center;">Discharge with an electrostatic mat</p>	
Points to concern	<p>(1) Move a semiconductor by “Magazine to Magazine” method when moving the semiconductor from a magazine to another.</p> <p>(2) Do not place or bring the object that can be easily electrified near semiconductor and in the storage area for semiconductors.</p>	
Reason	To prevent static discharge and remove the static with safe speed.	

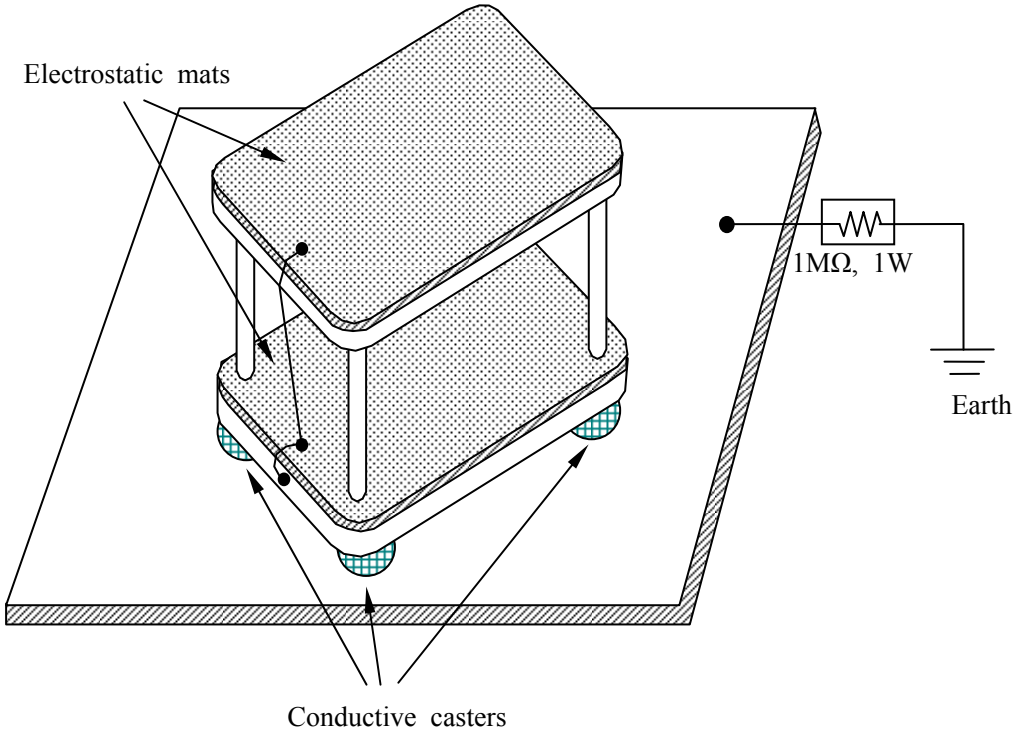
Item	11. Packing/Storage of Semiconductor	Class ∴∴
<p>Measure</p>	<p>(1) Place a semiconductor into an anti-static or conductive magazine, and secure with a stopper to keep it from moving. Secure odd semiconductors to a conductive IC form and put it into an anti-static or conductive bag.</p> <p>(2) Anti-static magazine can be reused only once. (Conductive magazine is reusable)</p> <p>(3) Use anti-static or conductive type for protective cushioning.</p> <p>(4) Use a conductive resin case to store the semiconductor parts and place it to a place where anti-static measures were taken.</p>  <p>The diagrams show: 1. An anti-static bag containing an IC magazine with a stopper. 2. An IC magazine with a stopper. 3. A conductive parts box containing an IC form, with a 1MΩ, 1W resistor connected to ground (Earth).</p>	
<p>Points to concern</p>	<p>(1) Humidity control at the time of storage and use is important since the effect of anti-static materials deteriorates with age. Check the effect when using the old materials.</p> <p>(2) Discharge the static through an electrostatic mat when storing a semiconductor into a case.</p> <p>(3) Use of IC form is desirable to prevent the contact between leads of semiconductors.</p> <p>(4) Use a cross-linked polyethylene form for IC form. Use of polyurethane form is prohibited since the dropping of semiconductor from the form occurs frequently and causes a defect.</p> <p>(5) Ground the cabinet body when using a conductive cabinet.</p>	
<p>Reason</p>	<p>To prevent static generation from magazine, bag and case. Also, to protect semiconductor from electric field by the use of conductive materials.</p>	

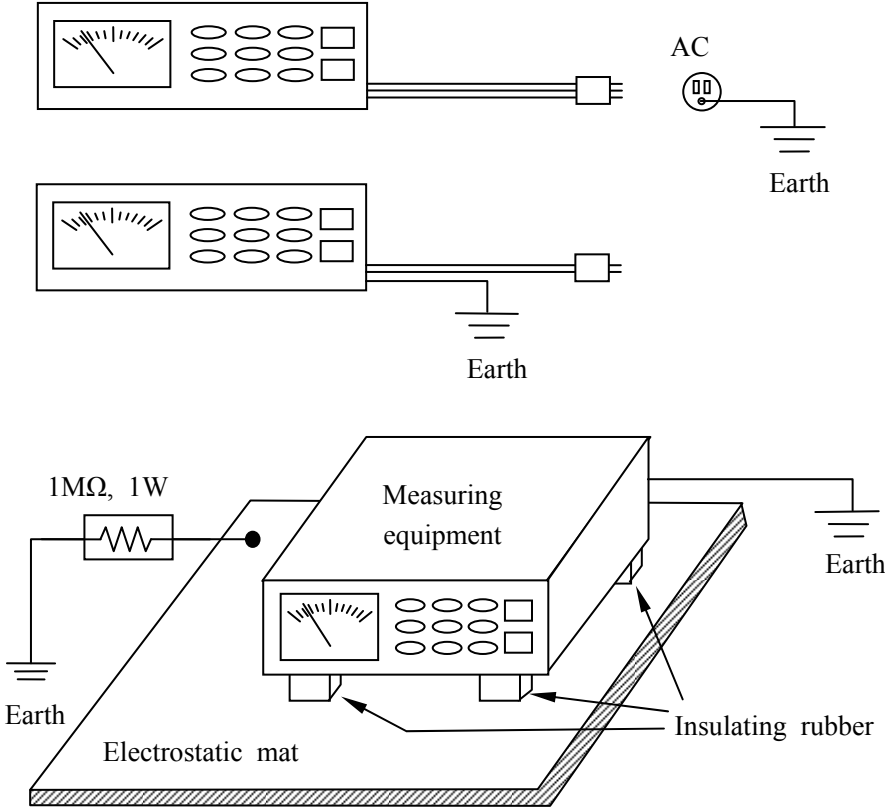
Item	12. Handling of PCB	Class ∴∴
Measure	<p>(1) Hold the edge of a board with both hands so as not to touch the wiring of solder surface, test pin and connector pin.</p> <p>(2) Use an ionizer when removing the masking tape from the board.</p> <p>(3) Use a conductive or anti-static type when placing PCB in a bag.</p>  	
Points to concern	<p>(1) Refer to the section of “Ionizer” (P.25) for ionizer’s usage.</p> <p>(2) Use a bag with the surface resistance of <math>10^7\Omega</math> or above when storing a battery-equipped substrate.</p>	
Reason	To prevent static generation and static discharge from a substrate.	

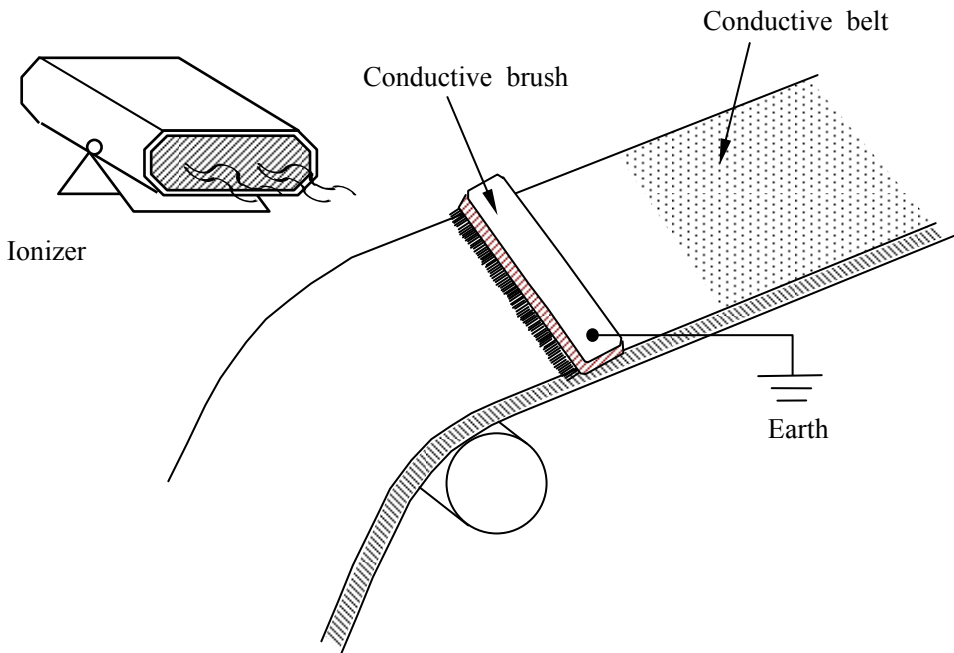
Item	13. Placement of PCB		Class ∴∴
Measure	<p>(1) Insert a conductive spacer between boards to prevent the solder surface contact when placing boards and storing boards in a returnable box.</p> <p>(2) Use conductive type for PCB magazine and rack, and put them to the place where anti-static measures were taken.</p>  <p>The diagram on the left shows several PCBs stacked vertically. Between each board, a vertical rectangular 'Conductive spacer' is placed to prevent the solder surfaces of adjacent boards from touching. The diagram on the right shows a 'Conductive magazine' (a rack for PCBs) sitting on a 'Metallic stopper' which is grounded to 'Earth'. A circuit diagram shows a 1MΩ, 1W resistor connected between the magazine and the ground.</p>		
Points to concern	<p>(1) Do not stack the PCBs.</p> <p>(2) Do not place or bring the object that can be easily electrified near PCB and in the storage area for semiconductors.</p> <p>(3) Do not use vinyl tape or packing tape for the stopper of PCB magazine.</p>		
Reason	<p>To protect substrate from electric field and prevent characteristic degradation and fracture defect of semiconductor from residual voltage of the board.</p>		

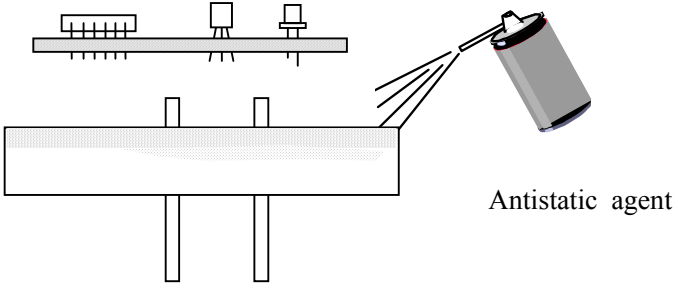
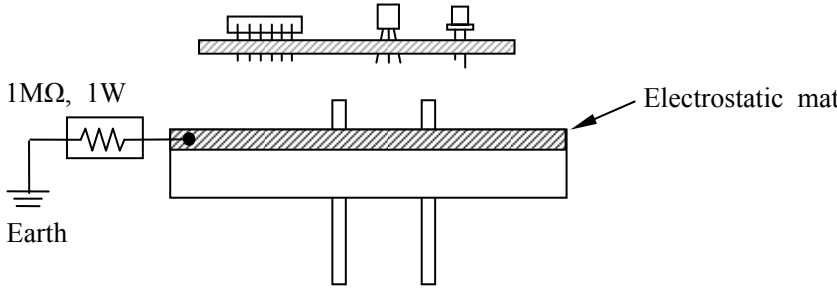
Item	14. Cleaning Brush/Inspection Rod		Class ∴∴
Measure	<p>(1) Use anti-static, conductive, or animal and vegetable (e.g. Kamenoko scrubber, pig bristles) brush for solder surface cleaning.</p> <p>(2) Use a bamboo or wooden inspection rod for solder surface inspection.</p>  <p>The illustration is split into two parts by a diagonal line. On the left, a brush with a wooden handle and a head of bristles is shown cleaning a PCB. On the right, a hand is shown holding a wooden rod and inspecting a PCB.</p>		
Points to concern	<p>(1) Do not use resin or metallic brush since resin type such as nylon brush can generate high static by friction, and metallic brush can scratch the solder surface. Also, provide a third-class grounding for the anti-static earth.</p> <p>(2) Control the amount of electrostatic charge with periodical measurement. (100V or less)</p>		
Reason	<p>To prevent static generation caused by scrubbing the board. Also, to prevent characteristic degradation and fracture defect of semiconductor from residual voltage of the board.</p>		

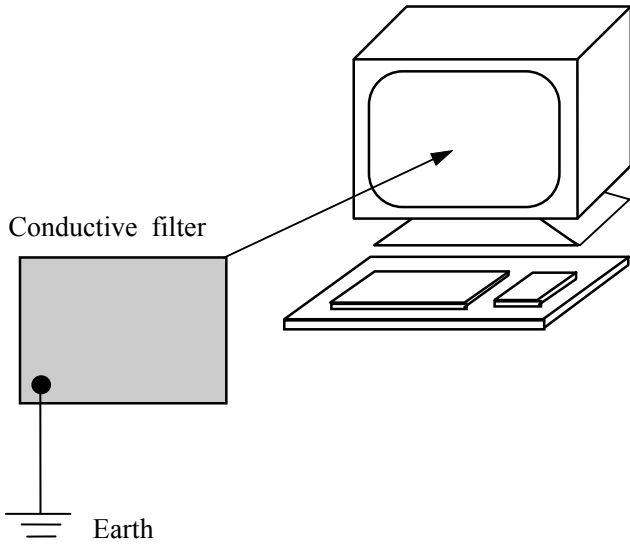
Item	15. Returnable Box (Distribution Box)	Class ∴∴
Measure	<p>(1) Use conductive type for the returnable box and distribution box which puts semiconductors and semiconductor mounting boards, and place the box on the object which anti-static measures were taken.</p> <p>(2) Do not store semiconductor and semiconductor mounting board with the object that can be easily electrified (plastic bag, molded article). Separate with conductive object when putting them together in a box out of necessity.</p>  <p>Molded article</p> <p>Conductive spacer</p> <p>IC magazine</p> <p>Plastic bag</p> <p>1MΩ, 1W</p> <p>Earth</p> <p>Conductive returnable box (Distribution box)</p>	
Points to concern	<p>When a packaging of parts is delivered in a cardboard box from a maker, storage in untouched packing state is possible. However, do not put the unpacked parts on the cardboard box.</p>	
Reason	<p>To prevent static generation from box and protect semiconductor from electric field.</p>	

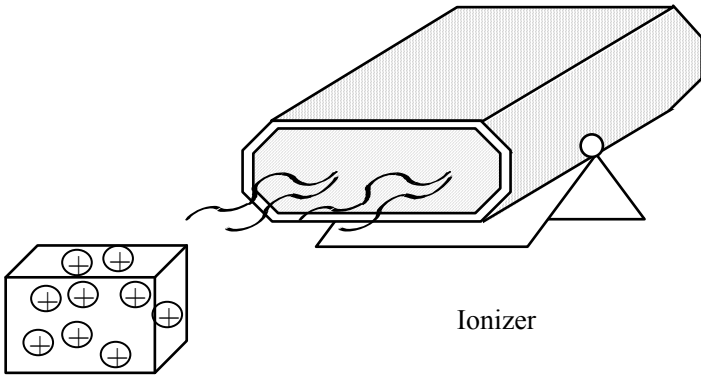
Item	16. Cart	Class ∴∴
Measure	<p>(1) Place an electrostatic mat (<math>1 \times 10^5 \sim 1 \times 10^9 \Omega</math>) on the cart which carries semiconductor and semiconductor mounting board and connect it to the floor with conductive casters.</p> <p>(2) Connect it to the floor with conductive casters if the movement of M/C (ModularComponent) rack (for movement and operation use) or products can generate static to the products.</p>  <p>The diagram shows a cart with a top layer labeled 'Electrostatic mats' and four legs with 'Conductive casters' at the bottom. A wire connects the mat to a resistor labeled '1MΩ, 1W', which is then connected to 'Earth'.</p>	
Points to concern	<p>(1) Anti-static measures for the conveyance aisle is the prerequisite.</p> <p>(2) Install two or more chains or conductive rubbers when conductive casters are not available. Check the effect before use.</p> <p>(3) Clean the casters, chains, and conductive rubber periodically since an insulating layer made by the adhesion of stain or dust is unable to remove the static.</p> <p>(4) Keep in mind that the effects of chain vary with its material, shape and installation method. Also, be careful about the rust.</p> <p>(5) Use of aluminum chain is prohibited since it has no grounding effect.</p>	
Reason	<p>To remove the static that was generated during transportation.</p>	

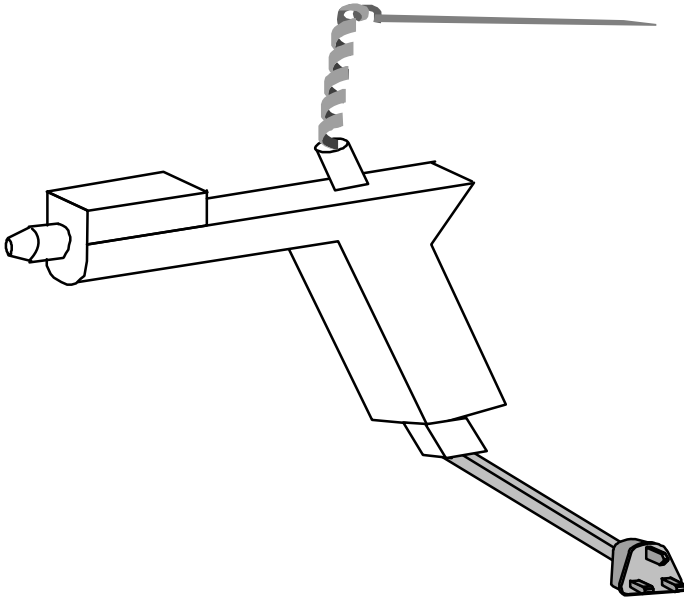
Item	17. Earth for Equipment	Class ∴∴
Measure	<p>(1) Inspection equipment, solder tank, measuring equipment, automated machine and conveyor must be grounded to the power supply earth, and they should be isolated surely from the anti-static earth.</p> 	
Points to concern	<p>(1) Chassis grounding for the non-3P equipment.                      (2) Insulate the equipment from floor or workbench.</p>	
Reason	<p>To eliminate static generation from the equipment. Also, to separate the earth to prevent semiconductor from characteristic degradation and fracture defect due to unexpected short circuit.</p>	

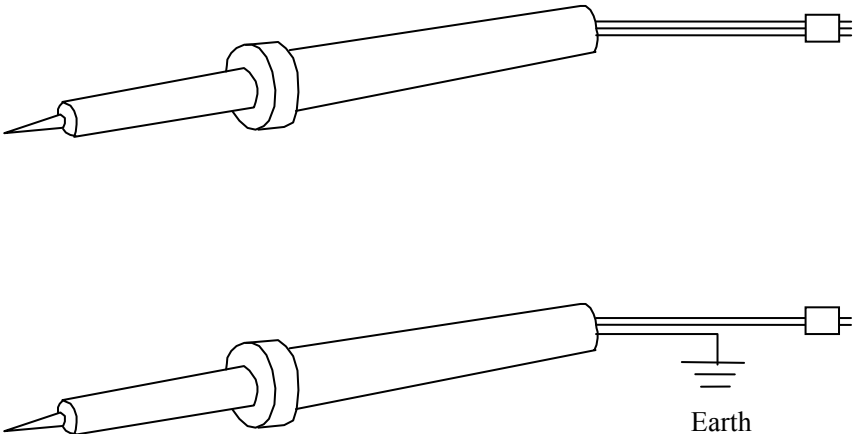
Item	18. Belt Conveyor	Class ∴∴
Measure	<p>(1) Provide any of the following anti-static measures for the belt conveyor which conveys semiconductor mounting boards.</p> <ol style="list-style-type: none"> <li>1) Use conductive belt (resistance: <math>1 \times 10^5 \sim 1 \times 10^9 \Omega</math>).</li> <li>2) Connect to ground by installing an anti-static brush.</li> <li>3) Install an ionizer.</li> </ol> <p>(2) Do not use the object that can be easily electrified for stopper, guide, etc.</p> 	
Points to concern	<ol style="list-style-type: none"> <li>(1) Ionizer is more effective than conductive brush since it can remove the static only with a point at once.</li> <li>(2) Use anti-static earth for the grounding of anti-static brush where possible. However, it must be isolated surely from the power supply earth in principle.</li> <li>(3) Refer to the section of “Ionizer” (P.25) for ionizer’s usage.</li> </ol>	
Reason	To prevent static generation caused by the friction of board and belt.	

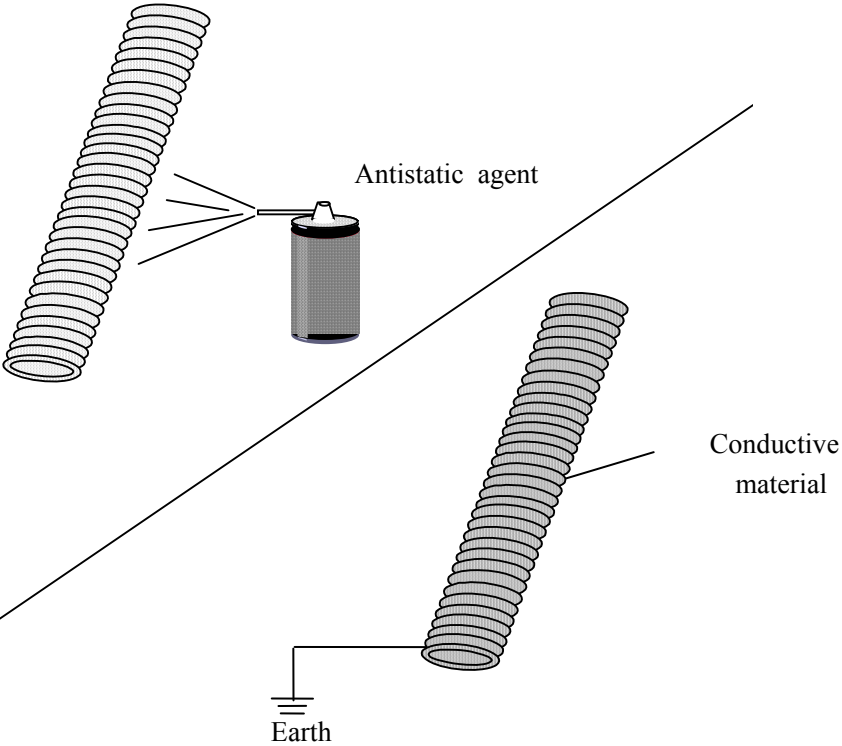
Item	19. Acrylic Board for Jig		Class ∴∴
Measure	<p>Provide any of the following antistatic measures for the acrylic board for jig.</p> <ol style="list-style-type: none"> <li>(1) Use antistatic resin.</li> <li>(2) Apply antistatic agent.</li> <li>(3) Connect to ground with electrostatic mat.</li> </ol> <div style="text-align: center;">  <p>Antistatic agent</p> </div> <div style="text-align: center;">  <p>Electrostatic mat</p> </div>		
Points to concern	<ol style="list-style-type: none"> <li>(1) Periodic maintenance is necessary since the effect of antistatic agent will be reduced with age. Also, in most cases, the effect will lower when the humidity drops to below 40% due to its humidity dependency.</li> <li>(2) Make sure the resistance is not too low since it may result in short circuit when using antistatic resin and electrostatic mat.</li> </ol>		
Reason	To prevent static generation from jig.		

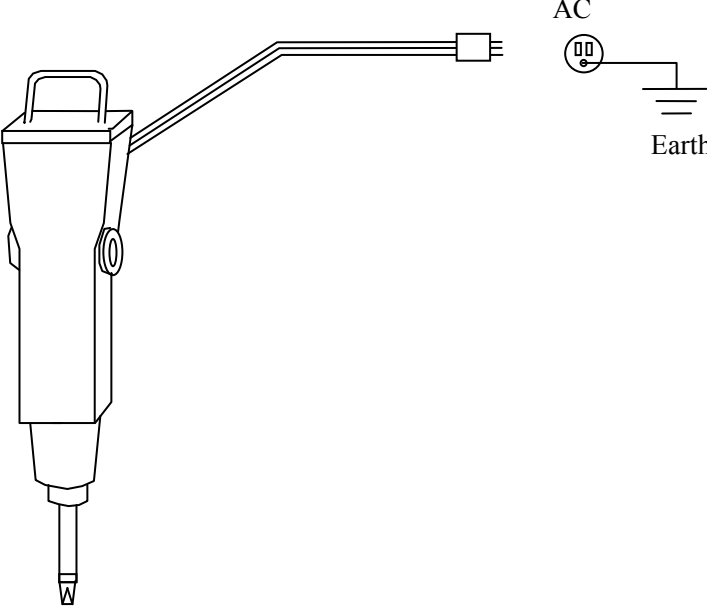
Item	20. CRT	Class ☺☺
Measure	<p>As for CRT of OA equipment used in process which handles semiconductor and semiconductor mounting board, install conductive filter and connect to power supply earth.</p>  <p>The diagram illustrates the installation of a conductive filter. On the left, a rectangular grey box labeled 'Conductive filter' has a black dot representing a connection point. A vertical line from this dot leads to a standard electrical ground symbol labeled 'Earth'. An arrow points from the top-right corner of the filter box towards the back of a CRT monitor, indicating where the filter should be placed. The monitor is shown on a stand with a keyboard in front of it.</p>	
Points to concern	<ol style="list-style-type: none"> <li>(1) Adoption of filter with radio interference-prevention is recommended.</li> <li>(2) Do not power on/off while putting a semiconductor and semiconductor mounting board before CRT.</li> </ol>	
Reason	<p>To prevent the object which comes close to CRT from electrostatic charge as well as to prevent semiconductor from static induction.</p>	

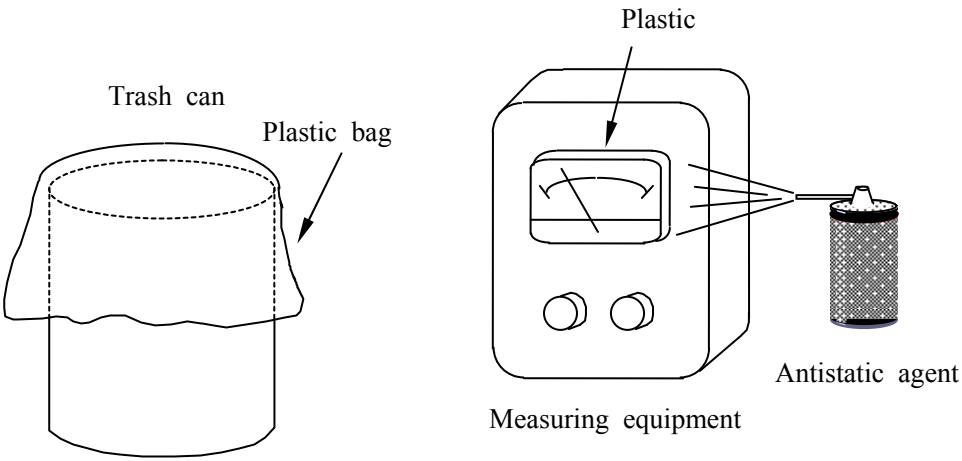
Item	21. Ionizer	Class ::
Measure	<p>(1) Use ionizer when effective grounding for discharging the static charge cannot be implemented.</p> <p>(2) Clean the filter and polar zone at least once a week.</p> <p>(3) Measure the amount of electrostatic charge every six months or more to check the anti-static effect.</p> <div style="text-align: center;">  <p style="margin-left: 100px;">Charged insulation</p> <p style="margin-left: 200px;">Ionizer</p> </div>	
Points to concern	<p>The following points must be considered when purchasing an ionizer.</p> <p>(1) Choose a high-frequency electromagnetic compatibility type.</p> <p>(2) Select an ionizer that generates less ozone for health reasons.</p> <p>(3) Choose a model based on the usage.</p> <p>(4) Check with the maker regarding the cleaning and maintenance methods of filter and polar zone for the correct handling.</p>	
Reason	To remove static in a short time.	

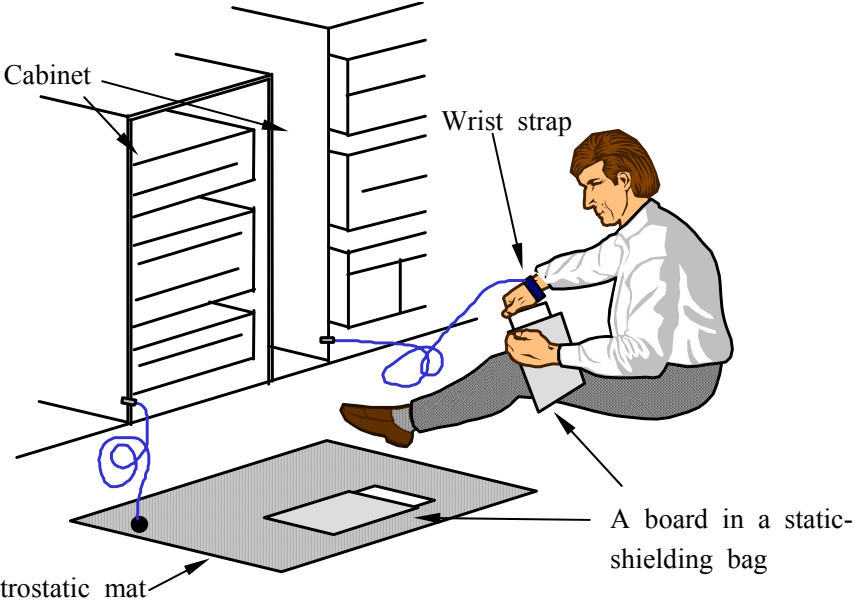
Item	22. Air Gun	Class ::
Measure	<p>(1) Use air gun with ionizer for air cleaning of semiconductor mounting board and product.</p> <p>(2) Connect the entire gun to power supply earth surely.</p> <p>(3) Clean the filter and polar zone at least once a week.</p> <p>(4) Measure the amount of electrostatic charge every six months or more to check the anti-static effect.</p> 	
Points to concern	<p>The following points must be considered when purchasing an air gun with ionizer.</p> <p>(1) Choose a high-frequency electromagnetic compatibility type. (regulations such as FCC and VCCI)</p> <p>(2) Select an air gun that generates less ozone for health reasons.</p> <p>(3) Check with the maker regarding the cleaning and maintenance methods of filter and polar zone for the correct handling.</p>	
Reason	<p>To control static generation caused by air spraying.</p>	

Item	23. Soldering Iron	Class ∴∴
Measure	<p>(1) Connect soldering iron and solder extractor to power supply earth.</p> <p>(2) Use soldering iron whose insulation resistance between soldering bit and heater is 10MΩ or more.</p> <p>(3) Make a checklist and measure the insulation resistance, leak current, or leak voltage between soldering bit and heater once a day. (It must be measured in high-temperature state.)</p> 	
Points to concern	<p>(1) Soldering iron of ceramic heater also requires daily measurement since the insulation resistance may lower.</p> <p>(2) Conductive body is desirable for soldering iron and solder extractor.</p>	
Reason	<p>To prevent characteristic degradation and fracture defect of semiconductor due to short circuit.</p>	

Item	24. Duct for Solder Smoke		Class :
Measure	<p data-bbox="376 353 1374 421">Apply antistatic agent for plastic duct, or wrap up around the duct in conductive material and connect it to ground.</p> 		
Points to concern	<p data-bbox="376 1400 1417 1496">Periodic maintenance is necessary since the effect of antistatic agent will be reduced with age. Also, in most cases, the effect will lower when the humidity drops to below 40% due to its humidity dependency.</p>		
Reason	<p data-bbox="376 1854 1158 1888">To prevent duct from electrostatic charge caused by air current.</p>		

Item	25. Electrical Tool		Class :
Measure	<p data-bbox="376 360 1342 427">(1) Connect electrical tools such as air nipper, air driver and electric driver to a power supply earth.</p>  <p>The diagram illustrates an electrical tool, specifically an air driver, connected to an AC power source. The tool is shown on the left with a handle and a bit. A cable extends from the tool to a three-pronged AC plug. This plug is connected to a power source labeled 'AC' with a circle containing a sine wave symbol. The power source is also connected to a ground symbol labeled 'Earth'.</p>		
Points to concern			
Reason	<p data-bbox="376 1861 1398 1928">To prevent semiconductor from characteristic degradation and fracture defect due to static generation and unexpected short circuit.</p>		

Item	26. In-Process Equipment	Class ::
<p>Measure</p>	<p>(1) Use conductive or anti-static type for card case and transparent case which keep work guidance sheet and other documents. (OC. recommended product is available)</p> <p>(2) Use conductive or metallic type for trash can. (Use of plastic trash can is prohibited.) Though use of plastic bag in a trash can is not preferable, make sure the plastic bag does not stick out from the trash can when using it out of necessity.</p> <p>(3) Apply antistatic agent for the insulation in process such as resin solder extractor, meter part of measuring equipment, and tape cutter.</p> <p>(4) Use anti-static bag for all parts distribution (including the parts other than semiconductor). (OC. recommended product is available)</p> <div style="text-align: center;">  <p>The diagrams show: 1. A trash can with a plastic bag inside, labeled 'Trash can' and 'Plastic bag'. 2. Measuring equipment with a plastic cover and an antistatic agent applicator, labeled 'Plastic', 'Measuring equipment', and 'Antistatic agent'.</p> </div>	
<p>Points to concern</p>	<p>(1) Periodic maintenance is necessary since the effect of antistatic agent will be reduced with age. Also, in most cases, the effect will lower when the humidity drops to below 40% due to its humidity dependency.</p> <p>(2) Make sure that antistatic agent does not attach to the part other than meter part when applying the antistatic agent.</p>	
<p>Reason</p>	<p>To eliminate the factors of static generation from the process.</p>	

Item	27. Field Operation	Class ∴∴
Measure	<p>Operation procedure is as follows.</p> <ol style="list-style-type: none"> <li>(1) Place an electrostatic mat on the floor or workbench which operation is taken place and connect it to the ground line or cabinet.</li> <li>(2) Operator must wear a wrist strap and connect it to the ground line or cabinet.</li> <li>(3) Remove the board suspected of defect and put it in a static-shielding bag right away.</li> <li>(4) Set the replacement board.</li> <li>(5) Repair the removed board in the anti-static environment.</li> </ol>  <p>The diagram illustrates the setup for an anti-static environment. A person is sitting on a 'Portable electrostatic mat' on the floor. They are wearing a 'Wrist strap' that is connected to a 'Cabinet' (likely a metal cabinet or ground line). A 'board in a static-shielding bag' is shown nearby. Labels with arrows point to the 'Cabinet', 'Wrist strap', 'Portable electrostatic mat', and 'A board in a static-shielding bag'.</p>	
Points to concern	<ol style="list-style-type: none"> <li>(1) Keep the insulation away from the operation area.</li> <li>(2) Be careful not to bring the clothes closer to the semiconductor by taking off a coat and jacket or rolling up the sleeves when anti-static clothes are not used.</li> <li>(3) Never handle or unpack the boards at a place where anti-static measures were not taken.</li> <li>(4) Do not remove the wrist strap until the whole operation is over.</li> <li>(5) Always use the static-shielding bag for the conveyance or transportation of the replacement board and defect board.</li> <li>(6) Pack the board with anti-static or conductive cushioning which generate less static when returning a board to a factory.</li> </ol>	
Reason	To prevent static discharge and remove the static with safe speed.	

Operation Process and Main Anti-Static Measures

Operation process  Anti-static measures	Production											Distribution		Maintenance	
	Incoming inspection	Storage/Distribution	Automatic insertion	Manual insertion	Soldering	Substrate inspection	Conveyance	Product assembly	Outgoing inspection	Repair	Packing/Shipping	Storage/Distribution	Shipping	Repair	Field
Humidity	○	○	○	○	○	○	-	○	○	○	○	-	○	○	-
Earthing method	○	○	○	○	○	○	-	○	○	○	○	-	○	○	-
Floor	○	○	○	○	○	○	○	○	○	○	○	-	○	○	△
Working uniform	○	○	-	○	○	○	○	○	○	○	○	-	○	○	△
Gloves/Finger cot	○	○	-	○	○	○	○	○	○	○	-	-	○	○	-
Use of wrist strap	○	○	-	○	○	○	-	○	○	○	-	-	○	○	○
Chair	○	-	-	○	○	○	-	○	○	○	-	-	-	○	-
Workbench	○	○	○	○	○	○	-	○	○	○	○	-	○	○	△
Storage shelf	-	○	-	-	-	-	-	-	-	○	-	-	○	○	-
Handling of semiconductor	○	○	-	○	○	-	○	-	-	○	-	-	○	○	-
Packing/Storage of semiconductor	-	○	-	-	-	-	○	-	-	○	-	-	○	○	-
Handling of PCB	-	-	-	○	○	○	○	○	○	○	-	-	○	○	○
Placement/Storage of PCB	-	○	-	○	○	○	○	○	-	○	-	-	○	○	○
Cleaning brush/ Inspection rod	-	-	-	-	○	○	-	-	-	○	-	-	-	○	-
Returnable box (Distribution box)	-	○	-	-	-	-	○	-	-	○	-	-	○	○	-
Cart	-	○	-	-	-	-	○	-	-	○	-	-	○	○	-
Earth for equipment	○	○	○	○	○	○	○	○	○	○	-	-	○	○	-
Belt conveyor	-	-	○	-	○	-	-	-	-	-	-	-	-	-	-
Acrylic board for jig	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-
CRT	-	-	○	-	-	○	-	-	○	○	-	-	-	○	-
Anti-static blower	-	-	○	○	○	○	-	○	-	○	-	-	○	○	-
Air gun	-	-	-	-	○	-	-	○	-	○	-	-	-	○	-
Soldering iron	-	-	-	-	○	-	-	-	-	○	-	-	-	○	-
Duct for solder smoke	-	-	-	-	○	-	-	-	-	○	-	-	-	-	-
Electrical tool	-	-	-	-	-	-	-	○	-	○	-	-	-	○	-
In-process equipment	○	○	○	○	○	○	○	○	○	○	○	-	○	○	-
Field operation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○