

ESD Capability Verification

DST 1.1.5

Scope:

This document applies when **ESD Acceptance Verification** is requested on the component drawing, applicable tests are referenced within the **Product Classification** section of **ESD Product Classification (DSF 3.2.5)**; Additionally, an overview of the **ESD Standards, Effects of ESD** and product **Acceptance Criteria** can be found within the above document.

Test Methods:

The test methods found within this document are in a simplified format in accordance with **EN 61340**:

- **Temperature and Humidity**
- **Point to Point Resistance (Large Probe)**
- **Point to Point Resistance (2-pin Probe)**
- **Point to Point Resistance (3mm Round Belt)**
- **Resistance to Ground (Large Probe)**
- **Resistance to Ground (2-pin Probe)**
- **Surface Tribocharging**

Selected tests indicated by the **Product Classification (DSF 3.2.5)** are to be completed in order as listed, each **Test Method** will list the **Test Equipment** required to complete it.

Results:

Test Results are to be recorded in a format similar to the **Test Report** template (**DSF 3.2.5**), indicating if the item under test is compliant or not according to the tests **Acceptance Range**.

Test Conditions:

ESD tests are to be performed within the following environmental conditions unless authorized to exceed accordingly:

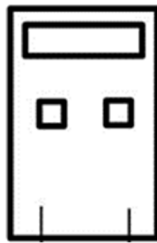
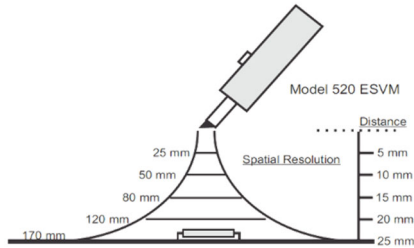
- **Temperature:** >20°C to <25°C
- **Relative Humidity:** >20% to <60%

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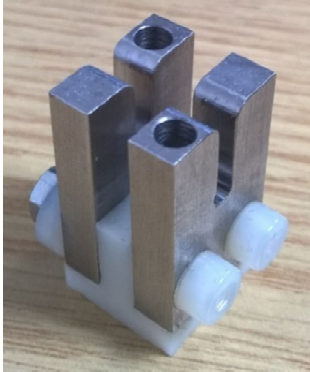
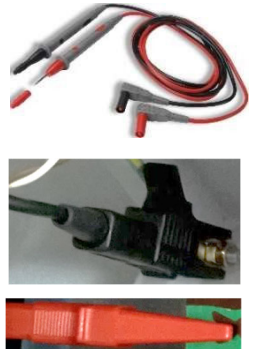


Test Equipment

The following table details the types of test equipment required for the various **Test Methods**:

Category	Description
Hygrometer Meter	• RS PRO 1364 Temperature-Humidity Meter • ESD Resistance Meter with built in Hygrometer • ESD Resistance Meter with plug-in Hygrometer module (Metriso 3000) • Similar Hygrometer Meter  Used to record the environmental conditions before test: 1. Temperature (°C) 2. Relative Humidity (% R.H.) Note: Must have in-date calibration.
ESD Resistance Meter	• Metriso 2000 ESD Resistance Meter • Metriso 3000 ESD Resistance Meter • TREK 152 ESD Resistance Meter • Similar ESD Resistance Meter  Image right will be used to denote an ESD Resistance Meter used in accompanying images. Note: Must have in-date calibration.
Electrostatic Voltmeter	• Trek Model 520 Handheld Electrostatic Voltmeter • Similar Electrostatic Voltmeter  Non-contact measurement of charged surfaces. Measurement Voltage Range: 0 to ± 2 kV Probe-to-Surface Separation: 15 mm $\pm$ 10 mm Operation: Typical operation of the Model 520 can be seen right, normal operating distance for item under test is 5-10mm.  Note: Must have in-date calibration.

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Category	Description
Large Probe	- Trek 152BP-5P 2.5kg Weighted probes - Similar 2.5kg Weighted probes (60mm dia.) Large surface probes, 60mm Diameter 2.5kg weighted probes. Used for Point-to-point (2-off) or resistance to ground (1-off) measurements on large surfaces. Note: Ensure contact pads are undamaged and clean before use 
Small Probe	152P-2P 2-point resistance probe - SRM Mini Probe 410 - Similar 2-point resistance probe Performs measurements on surface areas too small to be measured with larger probes. Note: Ensure contact probes are undamaged and clean before use Image right will be used to denote a 2-point resistance probe used in accompanying images. 
Custom test fixtures	Custom test fixtures may be required to complete a test, these have been designed in accordance with standard ESD practices to enable repeatable imperial measurement. Test fixtures: 3mm Round Belt test fixture 
Leads & clips	Additional leads and clips are used to connect test probes as follows: - Large probes to Resistance Meter 2 leads (typically banana plugs) - Resistance Meter to an earth point 1 lead and clip - Resistance Meter to 3mm Round Belt test fixture 2 leads (typically banana plugs) 

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Category	Description
Anti-static wrist-strap	An anti-static wrist-strap should be worn where recommended by the test process and connected to an earth point accordingly during the testing. Note: Ensure it is safe to wear the earth strap during testing, comply with health and safety regulations to avoid accidents.
ESD mains earth plug	Used to couple an anti-static wrist-strap or earth cord to the mains earth potential. 
ESD grounding cord	Used to couple ESD items (E.g., Anti-static mat's and equipment) to the mains earth potential
Tribocharging Cloth	Tribocharging testing will require the following: • 100% Polyester cloth

Pre-test:

Before performing any tests, ensure the following:

- Meters have sufficient power to conduct testing (replace batteries if required)
- Equipment is within its calibration period, clean and functional
- Test probes are undamaged, clean of debris and contaminants
 - Large/small soft pads, replace probe if required
- Test leads are undamaged and checked for continuity regularly
- Wrist-strap has been tested on an ESD wrist-strap tester
- Products to be tested have been within the same atmospheric climate for >3 hours prior to testing
 - ESD qualification requires 48 hours, >3 hours will ensure the product closely matches the local climate prior to test verification

Contact Protocol:

Should clarification be required for any issues, contact Supplier Quality or Manufacturing Engineering who will note the issue and assist with resolution. Please email details of your request to engineering_enquiries@asmpt.com

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Test: Temperature and Humidity

Measure local temperature and humidity conditions prior to performing ESD verification tests.

Note: This test is typically completed at the start of testing, any significant breaks in testing should record a new set of environmental conditions to accompany the test results due to possible atmospheric changes.

Test Equipment:

- Hygrometer Meter

Test:

1. Record the following to the **Test Report**:
 - a. Product description/part number
 - b. Date of test
 - c. Operator conducting test
 - d. Equipment to be used during testing
 - e. Test probe type to be used during testing (if applicable)
2. Measure the following local environmental ambient conditions with the Hygrometer Meter:
 - a. Temperature (°C)
 - b. Relative Humidity (% R.H.)
3. Record results from the Hygrometer Meter to the **Test Report**

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Test: Point to Point Resistance (Large Probe)

Point-to-Point resistance (Rp-p) is the measurement of resistance between two calibrated electrodes, attached to the same surface at a pre-defined distance.

Note: Surface resistance can be distorted by surface texture and the volume resistance of the underlying material. Paint and lacquers can give varying results dependent on their thickness across a large panel.

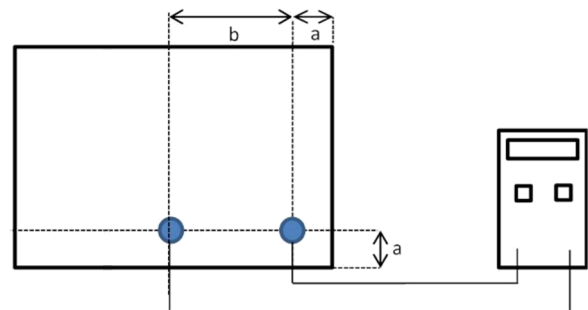
Test Equipment:

- ESD Resistance Meter
- Large Probes
- Two Leads
- Anti-static wrist-strap

Test Configuration:

Right is a schematic for **Point-to-Point** measurements giving recommended **Large Probe** positions:

- Distance from edge: **a > 50mm**
 - Note: Where possible
- Distance between probes **b = 300mm**

**Test:**

1. Connect ESD resistance meter, leads and large probes together as follows with reference to the **Test Configuration** above:
 - a. One lead per Large Probe to Positive (+) and Negative (0V) terminals of the meter
2. Configuration:
 - a. Place the Large Probes onto the product to be tested as indicated by the **Test Configuration** above
3. Measure the resistance using a **10V** setting for a maximum of 15-seconds or until the meter completes the test
4. Examine results as follows:
 - a. If resistance meter indicates to change to **100V** setting, skip to 5
 - b. If resistance meter indicates a reading of $>1 \times 10^6$ ($>1\text{M}\Omega$) then skip to 5
 - c. Skip to 6
5. Measure the resistance using a **100V** setting for a maximum of 15-seconds or until the meter completes the test
6. Record resistance value from resistance meter to the **Test Report**
7. Remove large probes from product and check for contamination (clean)
8. Repeat from 2 if further locations/products are to be tested
9. Disconnect leads and store equipment

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Test: Point to Point Resistance (2-pin Probe)

Point-to-Point resistance (Rp-p) is the measurement of resistance between two calibrated electrodes, attached to the same surface at a pre-defined distance.

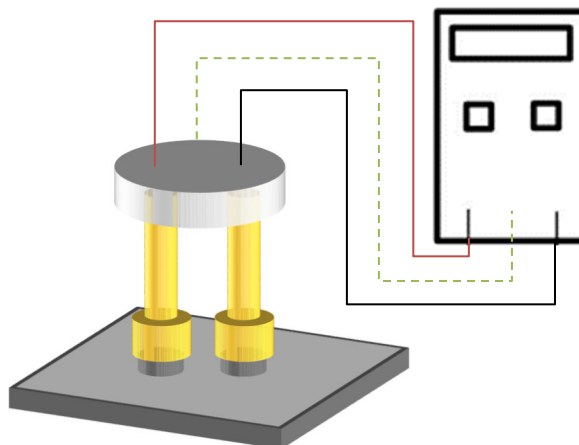
A two-point test probe is a smaller version of the Large Probe using a scale that fixes the two probe contacts at a set distance apart so that it can be applied to smaller items of various material types. Note: recommended for smooth surfaces only.

Test Equipment:

- ESD Resistance Meter
- Small Probe
 - Additional leads if required
- Anti-static wrist-strap

Test Configuration:

Right is a schematic for a **Point-to-Point** measurement using a small two-point probe.

**Test:**

1. Connect ESD resistance meter and a small two-point probe as follows with reference to the **Test Configuration** above or refer to the probe's user manual:
 - a. Red (Positive) to the Positive (+) terminal of the meter
 - b. Black (Negative) to the Negative (0V) terminal of the meter
 - c. Optional: Green (Shield) to the Shield terminal of the meter
2. Configuration:
 - a. Place the Small Two-Point Probe onto a flat surface of the product to be tested as indicated by the **Test Configuration** above
3. Measure the resistance using a **10V** setting for a maximum of 15-seconds or until the meter completes the test
4. Examine results as follows:
 - a. If resistance meter indicates to change to **100V** setting, skip to 5
 - b. If resistance meter indicates a reading of $>1 \times 10^6$ ($>1\text{M}\Omega$) then skip to 5
 - c. Skip to 6
5. Measure the resistance using a **100V** setting for a maximum of 15-seconds or until the meter completes the test
6. Record resistance value from resistance meter to the **Test Report**
7. Remove small probe from product and check for contamination (clean)
8. Repeat from 2 if further locations/products are to be tested
9. Disconnect leads and store equipment

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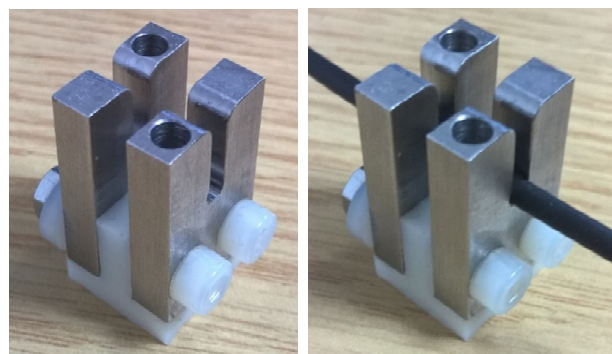
Test: Point to Point Resistance (3mm Round Belt)

Point-to-Point resistance (Rp-p) is the measurement of resistance between two calibrated electrodes, attached to the same surface at a pre-defined distance.

A custom 3mm round belt test fixture is used to measure a 3mm round belt with known geometry similar to that of a small two-point test probe.

Test Equipment:

- ESD Resistance Meter
- Two Leads (banana plugs preferred)
- 3mm Round belt Custom test fixture
 - Right 1: Empty test fixture
 - Right 2: Belt inserted in fixture
- Anti-static wrist-strap

**Test:**

1. Configuration:
 - a. Fully insert a 3mm round belt to be tested into the 'U' channel of the 3mm Belt Test Fixture
2. Connect ESD resistance meter and leads as follows:
 - a. Connect first lead from one side of the test fixture to the Positive (+) terminal of the meter
 - b. Connect second lead from the other side of the test fixture to the Negative (0V) terminal of the meter
3. Measure the resistance using a **10V** setting for a maximum of 15-seconds or until the meter completes the test
4. Examine results as follows:
 - a. If resistance meter indicates to change to **100V** setting, skip to 5
 - b. If resistance meter indicates a reading of $>1 \times 10^6$ ($>1\text{M}\Omega$) then skip to 5
 - c. Skip to 6
5. Measure the resistance using a **100V** setting for a maximum of 15-seconds or until the meter completes the test
6. Record resistance value from resistance meter to the **Test Report**
7. Remove leads from 3mm round test fixture and 3mm belt from 'U' channel
8. Repeat from 1 if further locations/products are to be tested
9. Disconnect leads and store equipment

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Test: Resistance to Ground (Large Probe)

Resistance to Ground (Rg) is the resistance between an operational surface and an electrical ground point or uncoated surface. An 'operational surface' will be any surface that either the product and/or an operator will have some contact.

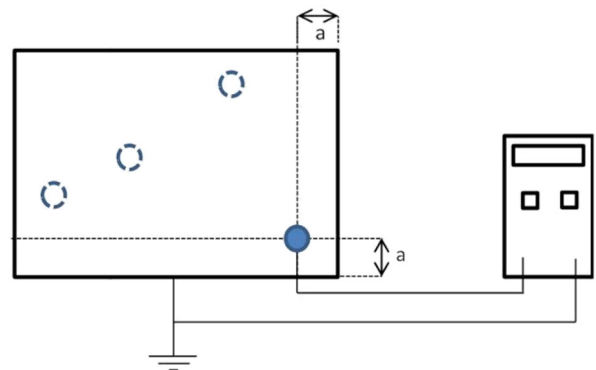
Test Equipment:

- ESD Resistance Meter
- Large Probe
- Two Leads & Clip
- Anti-static wrist-strap

Test Configuration:

Right is a schematic for **Resistance-to-Ground** measurements:

- Distance from edge: **a > 50mm**
 - Note: Where possible
- Dotted circles indicate possible test positions over a panel. Number of test points will be dependent on panel size and drawing positions indicated.

**Test:**

1. Connect ESD resistance meter, leads and large probes together as follows with reference to the **Test Configuration** above:
 - a. One lead and Large Probe to the Positive (+) terminal of the meter
 - b. Connect one lead with clip to the Negative (0v) terminal of the meter
2. Configuration:
 - a. Place Large Probe onto product to be tested as indicated by the **Test Configuration** above
 - b. Connect clip to the ground point/earth stud/uncoated surface of the product as indicated by the **Test Configuration** above
3. Measure the resistance using a **10V** setting for a maximum of 15-seconds or until the meter completes the test
4. Examine results as follows:
 - a. If resistance meter indicates to change to **100V** setting, skip to 5
 - b. If resistance meter indicates a reading of $>1 \times 10^6$ ($>1\text{M}\Omega$) then skip to 5
 - c. Skip to 6
5. Measure the resistance using a **100V** setting for a maximum of 15-seconds or until the meter completes the test
6. Record resistance value from resistance meter to the **Test Report**
7. Remove large probe from product and check for contamination (clean)
8. Repeat from 2 if further locations/products are to be tested
9. Disconnect leads and store equipment

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Test: Resistance to Ground (2-pin Probe)

Resistance to Ground (Rg) is the resistance between an operational surface and an electrical grounding point or uncoated surface.

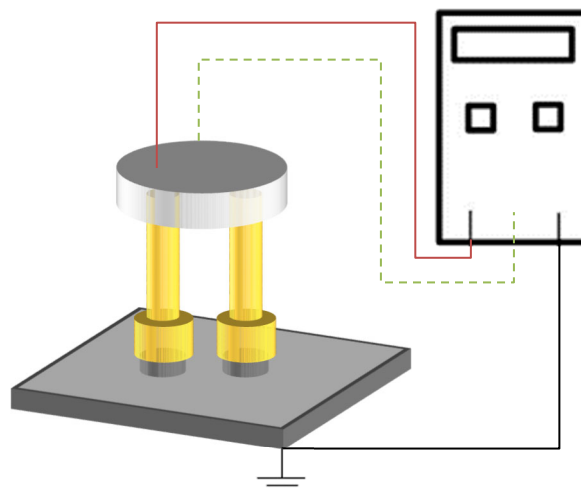
A two-point test probe can be used similar to a single Large Probe to measure smaller items of various material types with respect to ground. Note: recommended for smooth surfaces only.

Test Equipment:

- ESD Resistance Meter
- Small Probe
 - Additional leads if required
- Single Lead & Clip
- Anti-static wrist-strap

Test Configuration:

Right is a schematic for a **Resistance-to-Ground** measurement using a small two-point probe.

**Test:**

1. Connect ESD resistance meter and small two-point probe as follows with reference to the **Test Configuration** above or refer to the probe's user manual:
 - a. Red (Positive) to the Positive (+) terminal of the meter
 - b. Optional: Green (Shield) to the Shield terminal of the meter
 - c. One lead with clip from the ground point/uncoated surface to the Negative (0v) terminal of the meter
2. Configuration:
 - a. Place the Small Two-Point Probe onto a flat surface of the product to be tested as indicated by the **Test Configuration** above
3. Measure the resistance using a **10V** setting for a maximum of 15-seconds or until the meter completes the test
4. Examine results as follows:
 - a. If resistance meter indicates to change to **100V** setting, skip to 5
 - b. If resistance meter indicates a reading of $>1 \times 10^6$ ($>1\text{M}\Omega$) then skip to 5
 - c. Skip to 6
5. Measure the resistance using a **100V** setting for a maximum of 15-seconds or until the meter completes the test
6. Record resistance value from resistance meter to the **Test Report**
7. Remove small probe from product and check for contamination (clean)
8. Repeat from 2 if further locations/products are to be tested
9. Disconnect leads and store equipment

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Test: Surface Tribocharging

It is important plastic cover panels cannot sustain a 'static' electrical charge in excess of 100 volts when electrically grounded, this test will confirm that the machine cover package will perform within the limit.

During the cover panel painting process, an undercoat is applied that provides an electrically conductive layer to ensure that a static electrical charge on the outward facing surface of the panels is kept to a minimum.

The following procedure should be used to verify:

- There is a conductive undercoat
- The conductive undercoat is even over the entire surface of the panel
- The colour topcoat is not too thick making the conductive undercoat ineffective

Test Equipment:

- Electrostatic voltmeter (yellow cord)
- ESD mains earth plug
- ESD grounding cord with clip or probe capable of penetrating through the colour topcoat to the conductive undercoat (blue cord)
- Tribocharging Cloth

**Test Configuration:**

The panel to be tested must be electrically grounded:

- Connect an ESD grounding cord to the ESD mains plug, plug into a suitably earthed mains socket.
- Connect the Electrostatic voltmeter earth terminal to either the ESD mains earth plug or grounding cord.
- Connect the clip or hold the probe so that the conductive paint layer is exposed to electrical ground (earth).



Note: Once attachment to the panel is achieved, care should be taken to ensure that any penetration of the paint topcoat is as small and discrete as possible.

Test:

1. Connect a panel to be tested with reference to the **Test Configuration** above
2. Vigorously (quickly), rub the panel with the **Tribocharging Cloth** over each section of the external facing surface of the panel for 10 seconds.
3. Using an **Electrostatic Voltmeter**, check the voltage levels (as per the meter's user instructions) over each section of the panel.

Results:

Readings obtained over the surface of the panel should indicate no more than 100 volts within 2 seconds of removing the **Tribocharging Cloth**. It is possible that the panel may charge well above 100 volts during the rubbing process but this charge must have dissipated to below 100 volts within 2 seconds.

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