

PRODUCT SPECIFICATION

Electro Static Discharge (ESD) Tools and Equipment

| Product Name | Product Code(s) |
|------------------|---|
| Brooms | ASB1240, ASB1440, ASB1450, ASB24147 |
| Tube Brush | ASB2820, ASB3030, ASB3363, ASB3470, ASB3490, ASB3500, ASB3550 |
| Hand Brush | ASB5123 |
| Floor Brush | ASB5203, ASB5204 |
| Churn Brush | ASB5627 |
| Utility Brush | ASB6122, ASB6124 |
| Machine Brush | ASB6231 |
| Scrubbing Brush | ASB6421, ASB6530, ASB6731 |
| Ergonomic Handle | ASH4813, ASH4815, ASH4816, ASH4817 |
| Lobby Pan | ASW0050, ASW1050 |
| Shovel | ASP1718, ASP1728, ASP1748, ASP1768 |
| Scoop/ Spatula | ASP2075, ASP6113, ASP612, ASP6124, ASP6134, ASP6140, ASP6145, ASP6405, ASP6417, ASP6421 |
| Bucket | ASW4101, ASW4111 |

Material

PRE-ELEC® PP 1375 is a carbon black filled conductive thermoplastic compound based on polypropylene. In addition to a low electrical resistivity PRE-ELEC® PP 1375 has an excellent balance of mechanical properties and is easy to injection-mould. Typical applications include injection moulded ESD products such as crates, boxes and tote bins for electronic components.

Processing

PRE-ELEC® PP 1375 compound can be processed in the injection moulding machines using normal processing conditions as with polypropylene.

Physical Properties

| Pre-elec* PP 1375 | ISO | Unit | | ASTM | Unit | |
|--|------------------------------|----------------------|----------|--------|-----------------------|-------------|
| Specific Gravity Density | | g/cm ³ | 0.98 | | lb/in ³ | 0.035 |
| Melt Flow Index 230°C / 2.16 kg 230°C / 5.0 kg | 133 | g/10 min g/10 min | 12 60 | D-1238 | | |
| Tensile strength | 527 | MPa | 28 | D-638 | PSI | 4000 |
| Yield strength | 527 | MPa | | D-638 | PSI | |
| Elongation at break | 527 | % | 14 | D-638 | PSI | |
| Elongation at yield | 527 | % | | D-638 | | |
| Modulus of elasticity | 178 | MPa | 1300 | D-790 | 103 PSI | 190 |
| Impact strength, unnotched Izod 4.0 mm (0.156-in) thickness, 23°C / 73°F 4.0 mm (0.156-in) thickness, -20°C / -4°F | 180 | kJ/m ² | 59 | D-256 | ft-lb/in ² | 28 |
| | | | 55 | | | 26 |
| Impact strength, unnotched Izod 4.0 mm (0.156-in) thickness, 23°C / 73°F 4.0 mm (0.156-in) thickness, -20°C / -4°F | 180 | kJ/m ² | 9 | D-256 | ft-lb/in ² | 4 |
| | | | 5 | | | 2 |
| Vicat softening point Rate A Rate B | 306/ A50 B50 | °C | 150 | D-1525 | °F | 300 |
| Deflection temperature 0.45 MPa (66 psi) - load 1.8 MPa (264 psi) - load | 75 Method Bf Method Af | °C | 91 | D-648 | °F | 300 |
| | | | 54 | | | |
| Volume resistivity | D-257* | Ωcm | <103 | D-257 | Ωcm | |
| Surface resistivity | D-257* | Ω | <104 | D-257 | Ω | |
| Mould shrinkage | 294-4 | % | 1.5-2.0 | D-955 | in/in | 0.015-0.020 |
| Hardness Shore A Shore D | 868 | | 95 | D-2240 | | |
| | | | 65 | | | |

- Test specimen: 4.0mm (0.156in) thick, 10.0mm (0.391in) wide moulded rod.
- The heat content of the compound leaving the machine is high due to its relatively poor flow which leads to elevated temperatures and increased pressure, which when released raises the temperature of the material further. As the self-ignition temperature of polymer/carbon black compounds is around 350°C (660°F) care must

be taken that purged material does not catch fire.

- Overheated material can be cooled with eg water.
- The information in this data sheet represents typical values obtained by us and should not be regarded as a specification.
- The product must be inspected and qualified by the customer for their process to meet the specific requirements set by application, processing equipment and end product.

Measurement Results of Antistatic Hand Tools

Reference:

- Klipspringer catalogue of ESD/anti-static tools: <https://www.klipspringer.com/esd-tools/c-224.html>.
- ESD TR53-01-06: Compliance Verification of ESD protective Equipment and Materials, ESD Association (USA).
- ASTM D-257-78: electrical resistance measurement methods of insulating materials.
- CENELEC/TR 50404-2003: Electrostatics - Code of practice for the avoidance of hazards due to static electricity.

Background:

- Tested material: Several black polypropylene hand tools were selected for lab characterisation.
- According to CENELEC/TR 50404-2003 ESD standard (Ref 4) acceptable antistatic tools would have resistivity (measured from tool handle to its end making a contact with HAZMATs) less than $1.0 \times 10^8 \Omega$, as is presented in the following table:

| Sub Clause | Type of installation | Maximum resistance to earth, ohms |
|------------|--|-----------------------------------|
| 10.3.4 | Items fabricated from non-conductive or dissipative materials. | 10^6 to 10^8 |

Measurement Details:

- Measurement methods are per Ref.2 and Ref.3.
- Measurement voltage: 100V.
- Instrument: Resistance Meter, Prostate, Model PRS-812; Upper measurement range 1014 Ω .
- Tool electrical resistivity was measured from end to end (handle to tool's end making a contact with ESD sensitive material/component).

Measurement Results

- All measurements were conducted at 42°C and RH%39.
- K=1000
- M=106
- G=109

| Product Code | Product Description | End-to-end resistivity kΩ | Pass/Fail |
|--------------|--|------------------------------|-----------|
| ASP6405 | ESD - hand scoop 100 x 260 mm, 500g, black | 15 | Pass |
| ASP6417 | ESD - hand scoop 138 x 310 mm | 78MΩ | Pass |
| ASP6421 | ESD - hand scoop 160 x 360 mm | 4.1 | Pass |
| ASP6124 | ESD - spatula 110 x 250 mm | Not available | Pass |
| ASP6134 | ESD hand spatula - 3 sides x 100 mm, black | 11 | Pass |
| ASP6113 | ESD - spatula 75 x 250 mm | 2.5 | Pass |
| ASP6145 | ESD - dough scraper 160 x 125 mm | 9.1 | Pass |
| ASP6140 | ESD - dough scraper 146 x 98 mm | 6.4 | Pass |
| ASW0023 | ESD - dustpan 300 x 310 mm | 11 | Pass |
| ASP2075 | ESD - hand shovel 270 x 320 x 540 mm | 13 | Pass |
| ASW4101 | ESD - bucket, 15 litre | 14 | Pass |
| ASW4111 | ESD - lid for bucket | 10 | Pass |
| ASP1748 | ESD - shovel 330 x 380 x 1120 mm | 13 | Pass |
| ASB1440 | ESD - broom 400 x 60 mm, 0.50 | 32 | Pass |
| ASB2820 | ESD - tank brush 200 x 120 mm | 14 | Pass |
| ASB3470 | ESD - tube cleaning brush, ø70 mm | 91 | Pass |
| ASB6731 | ESD - round hand brush ø 125 mm | 28 | Pass |
| ASB6231 | ESD - machine brush 275 x 20 mm | 41 | Pass |
| ASB5123 | ESD - banister brush 340 x 35 mm | 4.9 | Pass |
| ASB6124 | ESD - long utility brush 410 x 55 mm | 3.3 | Pass |
| ASH4813 | ESD - ergo. one-piece handle 1300 x 32 mm | 1.9 | Pass |
| ASH4815 | ESD - ergo. one-piece handle 1500 x 32 mm | 280 | Pass |
| ASS4050 | ESD - single blade squeegee, 500mm | 16 | Pass |

Conclusion

All tested hand tools were found to have very good static dissipative characteristics. They are good quality tools and need only GMP approval for pharmaceutical materials. For other processing industries such as food*, hi-tech, chemicals, and petro-chemicals these hand tools are the best tools approved by our lab, so far, for ESD control.

* These tools are not approved for direct food contact.

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