ESLON DC ESD

# ANTISTATIC TRANSPARENT ESD PLASTIC SHEETS

www.eslon-dc.de/en

SEKISUI

**SEKISUI Chemical GmbH** | Roßstraße 92 | 40476 Düsseldorf | Germany
Phone +49 (0) 211 / 36 977 0 | eslon@sekisui.de

# ESLON®-DC ESD PLASTIC SHEETS

## PROTECTION AGAINST ELECTROSTATIC DISCHARGES IN PRODUCTION PROCESSES

Electronic manufacturing is always in motion. Therefore small and large electrostatic charges occur in the automation technology and **e**lectro-**s**tatic **d**ischarges (= ESD) take place at every production step.

The discharges have to be conducted properly, because otherwise irreparable functional failures, costly defects, contamination by dust and dirt or explosions may occur.

A reliable protection against electrostatic discharges (ESD) must be ensured.

Microchips, circuit boards and sensors can be damaged by even small electrostatic discharges of 20 volts and require a comprehensive safety concept (acc. to IEC 61340-5-1).

In clean room technology, no dust particles may enter the production process. Pharmaceutical manufacturing and food processing also require an clean and hygienic environment that is as particle-free as possible. ESLON®-DC ESD (DC = dust clean) plastic sheets are the best solution for this.

## ESLON®-DC ESD PROTECTS HIGHLY SENSITIVE COMPONENTS

ESLON®-DC ESD plastic sheets are available in four base materials:

- ⟶ Polycarbonate
- ⟶ PMMA (Acrylic)
- ⟶ PVC
- ⟶ C-PVC

The conductive surface layer on both sides of the sheets guarantees permanent ESD protection against uncontrolled electrostatic discharges.

ESLON®-DC ESD plastic sheets comply with „ATEX“ directive 94/9/EC, II 2 GD (explosion protection).

For the effective isolation of light-sensitive production processes (e.g. UV-exposures, laser beams) there are transparent clear variants and transparent colour variants available.

# ESLON®-DC ESD APPLICATION

### ESLON®-DC ESD plastic sheets protect highly sensitive components from production to application, e.g. in:

- electronics and semiconductor industry
- machine and plant engineering
- wafer processing
- clean room technology
- automation technology & automatic placement machines
- chemical and pharmaceutical industry
- food industry
- printing and paper sector

### Due to high tranparency, ESLON®-DC ESD plastic sheets are suitable as a material for:

- glazing
- inspection windows
- protective covers
- partition elements
- test equipment
- laminar flow units
- enclosures
- dry storage systems
- inspection systems

# PRODUCT OVERVIEW

ESLON®-DC ESD plastic sheets have a conductive surface layer on both sides to maintain all beneficial characteristics of the plastic material.

### ESLON®-DC ESD plastic sheets are available in:

- different plastic types
- different sheet thicknesses (from very thin to thick)
- multiple sheet formats (also in small quantities)
- tinted colours (besides the basic version „clear transparent“)
- three different ESD coatings (ESD Standard, ESD Hard Coat and ESD Thermoform)

### ESLON®-DC ESD

- electrostatically conductive on both sides
- excellent to process and work with
- flame-retardant types
- protection against damages caused by electrostatic discharge
- high transparency
- UV stability
- durability

ESLON DC ESD | ESLON DC ESD THERMOFORM | ESLON FM 4910

**ANTISTATIC. TRANSPARENT. ELECTROSTATIC DISCHARGE.**
(ELECTROSTATIC DISCHARGE = ESD)

**POLYCARBONATE**
ESD Standard | ESD Hard Coat | ESD Thermoform

**PMMA/ACRYLIC**
ESD Standard | ESD Hard Coat | ESD Thermoform

**PVC**
ESD Standard | ESD Hard Coat | ESD Thermoform

**C-PVC**
ESD Standard | ESD Hard Coat

Meets the high safety requirements of FM4910 („factory mutual“) regarding flammability and smoke development.

## ESLON®-DC ESD PLASTIC SHEETS: COATING ESD STANDARD, ESD HARD COAT & ESD THERMOFORM

ESLON®-DC ESD plastic sheets are available in ESD Standard, ESD Hard Coat and ESD Thermoform. ESD Standard series is suitable for heat forming of the material, for more complex deformations, ESD Thermoform is the best choice. ESLON®-DC ESD Hard Coat is recommended for flat applications. Due to UV-cross linking of the coating the material is scratch-resistant and resistant to organic solvents.

# INSTALLATION

## GROUNDING

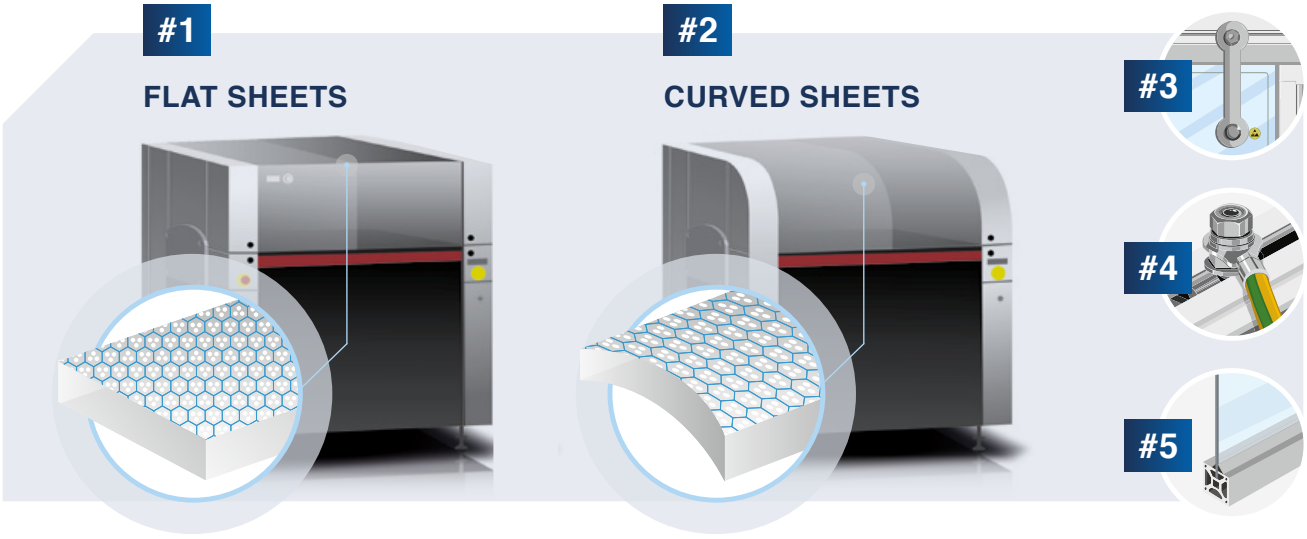
In order to achieve optimum dissipation of electro-static charges, ESLON®-DC ESD plastic sheets should be grounded on the upper side. The decay time while grounded is less than one second, the surface potential remains at a value between 0 and approx. 25 volts. Without grounding, the dissipation of static electricity may be delayed by several seconds.

A fixed contact point is sufficient for grounding.

**Exemplary connections:**

- screw connection with cable or grounding tape (with washer if necessary)
- mechanical contact with electrically conductive metal (e.g. profile frame)
- use of electrically conductive sealing compound or e.g. conductive silver paint
- metal clamp connection

# GROUNDING METHODS




**1** Flat panels offer better electro-static dissipation **2** Curved panels offer less efficient electro-static dissipation **3** Potential equipotential bonding by hinge **4** Ground connection Al-profile (ESD) **5** Grounding by panel element

## CLEANING AND CARE

For cleaning ESLON®-DC ESD Standard plastic sheets, we recommend cleaning agents like isopropyl alcohol (IPA), alcohol-based cleaning liquids and water. Do not use cleaning agents based on organic solvents (e.g. acetone, ketone, benzene or toluene) or abrasive cleaning agents.

ESLON®-DC ESD Hard Coat plastic sheets can be cleaned on the surface with organic solvents.

## SCRATCHES

After a while, in any production process, scratches may occur on ESLON®-DC ESD plastic sheets. Single scratches have no impact on the antistatic dissipation. A large number of scratches increases the surface resistance - however, the dissipative effect is lost if there are visibly more scratched areas than there are still transparent areas. If the material is heavily scratched due to polishing machines, the performance of the antistatic coating can no longer be guaranteed!

# PROCESSING

## MECHANICAL PROCESSING

ESLON®-DC ESD plastic sheets can be processed with common methods. The basic material qualities will remain during processing, but some recommendations should be followed.

### MACHINING

ESLON®-DC ESD sheets can be cut with either a **band saw** or a **circular saw** at normal speed:

**High-speed machines** achieve clean cutting edges.

Do not remove the **protective film** during machining to avoid scratching.

Use unrestricted or carbide-tipped saw blades for ESLON®-DC ESD PMMA and ESLON®-DC ESD Polycarbonate.

When drilling holes with twist drills or conical drills, work with slightly reduced speed to avoid hairline cracks.

### FORMING AND BENDING

**TIP:** To find out the optimal processing, carry out **initial trials** with test strips in advance.

When **bending** ESLON®-DC ESD plastic sheets, use lower temperatures than usual to prevent the edges from turning white. Whitening may indicate overheating, however, the static dissipative performance of the sheet will not be affected.

ESLON®-DC ESD Standard sheets can be bent up to a 90° angle (ESLON®-DC ESD Hard Coat up to 70°). If an edge is bent to 90°, the surface resistance usually increases to approx. 108 - 109 Ω. The antistatic effect remains.

ESLON®-DC ESD Polycarbonate can be **cold-folded** in general, if the sheet is thin enough.

ESLON®-DC ESD PMMA should be **annealed before processing** to reduce internal stress and to achieve better dimensional stability of the material.

Only ESLON®-DC ESD Thermoform sheets are suitable for **thermoforming** (deep-drawing), **bending** and all other **processes, which involve strong heating and stretching** of the material.

### BONDING

The surfaces to be bonded should be **pre-treated**:

**1.** Remove the coating of ESLON®-DC ESD Standard version with an acetone-soaked cloth; at ESLON®-DC ESD Hard Coat, the conductive coating must be removed mechanically. The width of the removed coating should be about 2-3 mm thicker than the sheet thickness of the counterpart. **2.** Cover parts not to be bonded with adhesive tape or similar. **3.** For a better adhesion, roughen the sheet surface and bevel the edges to be glued to increase the contact area.

A precision spraying device or fine brush is recommended for the application of the adhesive.

**Suitable adhesives:**

**PVC:** ESLON® Solvent Cement for PVC, Tetrahydrofuran, Cyclohexanone

**PMMA:** Solvent-based methylene chloride adhesives, 2-component polymer adhesives. Anneal PMMA before and after bonding.

**POLYCARBONATE:** Solvent-based methylene chloride adhesives. Subsequent baking necessary.

**Smaller parts can be bonded with cyanoacrylate adhesives if necessary.**

# PVC

PVC (polyvinyl chloride) is classified as an amorphous thermoplastic. There is a distinction between PVC-u (unplasticized / without softener) and PVC-p (plasticized / with softener). Many ESLON®-DC ESD PVC types comply with the international UL 94 V-0 fire protection classification. PVC is highly resistant to most acids, alcohol, petrol, lubricants and greases. PVC-C (post-chlorinated) has a higher temperature resistance and meets the fire protection standard FM4910.

## PRODUCT OVERVIEW I EXTRACT

| PLASTIC TYPE | Code | Colour | Standard Sizes (mm) | Sheet Thickness (mm) 1 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PVC** ESD Standard pressed | CS401AS | clear | 1000 x 2000 | | | ● | ● | ● | ● | ● | ● | | ● |
| | | | 1212 x 2424 | | | ● | ● | ● | ● | ● | ● | | |
| | C401AS | clear | 1000 x 2000 | ● | ● | | | | | | | | |
| | CS421AS | smoked-brown | 1000 x 2000 | | | ● | ● | ● | ● | | | | |
| | | | 1212 x 2424 | | | ● | ● | ● | ● | | | | |
| | CS491AS | smoked-grey | 1212 x 2424 | | | ● | ● | ● | | | | | |
| **PVC** ESD Standard extruded | CE401AS | clear | 1000 x 2000 | | | ● | ● | ● | ● | | | | |
| | | | 1212 x 2424 | | | ● | ● | ● | ● | | | | |
| **PVC** ESD Hard Coat Anti-Scratch pressed | VHS401AS | clear | 1000 x 2000 | | | ● | ● | ● | ● | ● | ● | | |
| | | | 1212 x 2424 | | | ● | | ● | ● | | | | |
| **C-PVC FM4910** ESD Standard | CS401ATM | clear | 1000 x 2000 | | | ● | ● | ● | ● | ● | ● | | |
| | | | 1212 x 2424 | | | ● | ● | ● | ● | ● | ● | | |

● Available from 1 piece in the format ● Available only in a minimum quantity and/or with longer delivery time ● To be discontinued

## TECHNICAL CHARACTERISTICS

| | | | | clear transparent | | | smoked-brown | clear transparent |
|---|---|---|---|---|---|---|---|---|
| | | | | **CS401AS** | **CE401AS** | **VHS401AS** | **CS421AS** | **CS401ATM** |
| **ELECTRICAL** | Method | | Unit | Standard | Standard | Hard Coat | Standard | Standard |
| Surface resistivity | ASTM D-257 | IEC 60093 | Ω/□ | $10^6$ ~ $10^7$ | $10^6$ ~ $10^7$ | $10^6$ ~ $10^7$ | $10^6$ ~ $10^7$ | $10^6$ ~ $10^7$ |
| Electrostatic discharge | MIL B-81705B | | s | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Dielectric constant | ASTM D-150 | IEC 60250 | | 3 | 3 | 3 | 3 | 3 |
| **PHYSICAL** | | | | | | | | |
| Density | ASTM D-792 | ISO 1183 | g/cm³ | 1,40 | 1,40 | 1,40 | 1,40 | 1,47 |
| Water absorption | ASTM D-270 | ISO 62A | % | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Pencil hardness | JIS K5400 | ISO 15184 | Scale | H | H | 2H | H | H |
| **OPTICAL** | | | | | | | | |
| Light transmittance | ASTM D-1003 | | % | 75 | 73 | 75 | 43 | 66 |
| Haze | ASTM D-1003 | ISO 14782 | % | 4 | 2-4 | 4 | 7 | 5 |
| **MECHANICAL** | | | | | | | | |
| Tensile strength | ASTM D-638 | ISO 527 | N/mm² | 70 | 76 | 64 | 70 | 73 |
| Flexural strength | ASTM D-790 | ISO 178 | N/mm² | 90 | 90 | 98 | 90 | 105 |
| Flexural modulus | ASTM D-790 | | N/mm² | 3100 | 2980 | 3300 | 3100 | 3150 |
| Charpy impact strength (23°C) | JIS K7110 | | kJ/m² | 3,8 | 3,4 | 3,1 | 3,8 | 2,1 |
| Notched impact strength (23°C) | ASTM D-256 | | J/m | 32 | 30 | 29,5 | 32 | 3 |
| **THERMAL** | | | | | | | | |
| Heat deflection temperature | ASTM D-648 | | °C | 63 | 60 | 62 | 63 | 82 |
| Flammability | UL 94 | | | V-0 | V-0 | V-0 | V-0 | V-0 |

Other colours upon requiry: 411AS orange, 441AS yellow, 132AS ivory opaque

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# POLYCARBONATE

Polycarbonate is classified as a member of the polyester family. Polycarbonate possesses a great degree of impact strength, excellent transparency and very good dimensional stability. Polycarbonate is chemically resistant against weak acids, ethanol and oils. The material has little to no chemical resistance against bases, methanol, or aromatic hydrocarbon.

## PRODUCT OVERVIEW I EXTRACT

| PLASTIC TYPE | Code | Colour | Standard Sizes (mm) | Sheet Thickness (mm) 1 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **POLYCARBONATE** ESD Standard | PC407AS | clear | 1000 x 2000 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | | | 1212 x 2424 | | ● | ● | ● | ● | ● | ● | ● | ● | |
| | PC427AS | smoked-brown | 1000 x 2000 | | | ● | ● | ● | ● | ● | ● | | |
| | | | 1212 x 2424 | | | ● | ● | ● | ● | | | | |
| | PC497AS | smoked-grey | 1212 x 2424 | | | ● | ● | ● | ● | ● | | | |
| **POLYCARBONATE** ESD Hard Coat Anti-Scratch | PH407AS | clear | 1000 x 2000 | | ● | ● | ● | ● | ● | ● | ● | ● | |
| | | | 1212 x 2424 | | | ● | ● | ● | ● | ● | ● | | |
| | PH427AS | smoked-brown | 1000 x 2000 | | | ● | ● | ● | ● | ● | | | |
| | | | 1212 x 2424 | | | | | ● | | | | | |

● Available from 1 piece in the format ● Available only in a minimum quantity and/or with longer delivery time ● To be discontinued

## TECHNICAL CHARACTERISTICS

| | Method | | Unit | clear transparent **PC407AS** Standard | **PH407AS** Hard Coat | smoked-brown **PC427AS** Standard | smoked-grey **PC497AS** Standard |
|---|---|---|---|---|---|---|---|
| **ELECTRICAL** | | | | | | | |
| Surface resistivity | ASTM D-257 | IEC 60093 | Ω/□ | $10^6$ ~ $10^7$ | $10^6$ ~ $10^7$ | $10^6$ ~ $10^7$ | $10^6$ ~ $10^7$ |
| Electrostatic discharge | MIL B-81705B | | s | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Dielectric constant | ASTM D-150 | IEC 60250 | | 3 | 3 | 3 | 3 |
| **PHYSICAL** | | | | | | | |
| Density | ASTM D-792 | ISO 1183 | g/cm³ | 1,20 | 1,20 | 1,20 | 1,20 |
| Water absorption | ASTM D-570 | ISO 62A | % | 0.3 | 0.3 | 0.3 | 0.3 |
| Pencil hardness | JIS K5400 | ISO 15184 | Scale | HB | H | HB | HB |
| **OPTICAL** | | | | | | | |
| Light transmittance | ASTM D-1003 | | % | 83 | 83 | 48 | 33 |
| Haze | ASTM D-1003 | ISO 14782 | % | 2 | 2 | 5 | 3 |
| **MECHANICAL** | | | | | | | |
| Tensile strength | ASTM D-638 | ISO 527 | N/mm² | 67 | 67 | 67 | 67 |
| Flexural strength | ASTM D-790 | ISO 178 | N/mm² | 90 | 90 | 90 | 90 |
| Flexural modulus | ASTM D-790 | | N/mm² | 2300 | 2300 | 2300 | 2300 |
| Charpy impact strength (23°C) | JIS K7110 | | kJ/m² | 80 | 80 | 80 | 80 |
| Notched impact strength (23°C) | ASTM D-256 | | J/m | 847 | 847 | 847 | 847 |
| **THERMAL** | | | | | | | |
| Heat deflection temperature | ASTM D-648 | | °C | 135 | 135 | 135 | 135 |
| Flammability | UL 94 | | | | | | |

Other colours upon requiry: PC417AS orange, PC447AS yellow. Special types: UL94 V-0 approval

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# PMMA/ACRYLIC

PMMA (Polymethylmethacrylate = acrylic glass) is created through the polymerization of monomeric methyl acrylate. PMMA distinguishes itself through its high transparency, durability and excellent weathering resistance, as well as a large range of application options (i.e. medical, automotive, optics, construction, light engineering, etc.). PMMA proves to be chemically resistant against acids and bases of light to medium concentration.

## PRODUCT OVERVIEW I EXTRACT

| PLASTIC TYPE | Code | Colour | Standard Sizes (mm) | Sheet Thickness (mm) 2 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 15 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PMMA/ACRYLIC** ESD Standard | AC405AS | clear | 1000 x 2000 | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | | | 1212 x 2424 | | ● | ● | ● | ● | ● | ● | | | |
| | AC425AS | smoked-brown | 1000 x 2000 | ● | ● | ● | ● | ● | | | | | |
| | | | 1212 x 2424 | | | | ● | ● | | | | | |
| | AC415AS | orange | 1000 x 2000 | | ● | | ● | ● | | | | | |
| | | | 1212 x 2424 | | ● | ● | | | | | | | |
| | AC105AS | smoked-grey | 1000 x 2000 | | ● | | ● | ● | ● | | | | |
| | | | 1212 x 2424 | | ● | | ● | ● | | | | | |
| **PMMA/ACRYLIC** ESD Hard Coat Anti-Scratch | AH405AS | clear | 1000 x 2000 | ● | ● | ● | ● | ● | ● | ● | | | |
| | | | 1212 x 2424 | | ● | ● | ● | ● | ● | ● | | | |

● Available from 1 piece in the format ● Available only in a minimum quantity and/or with longer delivery time

## TECHNICAL CHARACTERISTICS

| | Method | | Unit | clear transparent **AC405AS** Standard | **AH405AS** Hard Coat | smoked-brown **AC425AS** Standard | smoked-grey **AC105AS** Standard |
|---|---|---|---|---|---|---|---|
| **ELECTRICAL** | | | | | | | |
| Surface resistivity | ASTM D-257 | IEC 60093 | Ω/□ | $10^6$ ~ $10^7$ | $10^6$ ~ $10^7$ | $10^6$ ~ $10^7$ | $10^6$ ~ $10^7$ |
| Electrostatic discharge | MIL B-81705B | | s | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Dielectric constant | ASTM D-150 | IEC 60250 | | 3 | 3 | 3 | 3 |
| **PHYSICAL** | | | | | | | |
| Density | ASTM D-792 | ISO 1183 | g/cm³ | 1,19 | 1,19 | 1,19 | 1,19 |
| Water absorption | ASTM D-570 | ISO 62A | % | 0.3 | 0.3 | 0.3 | 0.3 |
| Pencil hardness | JIS K5400 | ISO 15184 | Scale | 2H | 5H | 2H | 2H |
| **OPTICAL** | | | | | | | |
| Light transmittance | ASTM D-1003 | | % | 85 | 85 | 24 | 27 |
| Haze | ASTM D-1003 | ISO 14782 | % | 2 | 2 | 3 | 2 |
| **MECHANICAL** | | | | | | | |
| Tensile strength | ASTM D-638 | ISO 527 | N/mm² | 74,5 | 74,5 | 74,5 | 74,5 |
| Flexural strength | ASTM D-790 | ISO 178 | N/mm² | 117,7 | 117,7 | 117,7 | 117,7 |
| Flexural modulus | ASTM D-790 | | N/mm² | 2900 | 2900 | 2900 | 2900 |
| Charpy impact strength (23°C) | JIS K7110 | | kJ/m² | 20,3 | 20,3 | 20,3 | 20,3 |
| Notched impact strength (23°C) | ASTM D-256 | | J/m | 2,0 | 2,0 | 2,0 | 2,0 |
| **THERMAL** | | | | | | | |
| Heat deflection temperature | ASTM D-648 | | °C | 90 | 90 | 90 | 90 |
| Flammability | UL 94 | | | | | | |

Other colours upon requiry: AC005AS black opaque, AC301AS blue, AC362AS green, AC445AS yellow

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