# Solar Cell Specialized EVA Sealing Film Technical Instruction

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# Catalog

# 1 Product Introduction

DuChamps SFX Series sealing film is the new generation of solar cell sealing film based on the research of EVA sealing film over years, combining the practical application demands. This sealing film can be applied on solar cell module, with extraordinary weather resistivity, electrical resistivity and PID-free property.The test results shows that under the laboratory conditions of 85℃, RH85% and -1000V, a regular solar cell module, with a reflex index of 2.03, has a power decay lower than 5% after 96 hours, which is a measurement of the PID-free property.

The sealing film has:

- Excellent PID-free properties;
- High light transmittance, ensuring the power of the solar cell;
- High volumetric resistivity, guaranteeing high insulation;
- Excellent adhesion with glass and backsheet;
- Extraordinary weather resistance (UV, high temperature, high humidity), meeting the demand of long-time outdoor operation.

# 2 Physical Properties and Specifications

## 2.1 Physical Properties

**Chart 1 Physical Properties of SFX Series Sealing Film**

| Parameter | | Testing Method | Unit | Standard Value |
|---|---|---|---|---|
| Thickness | | GB/T 6672 | mm | 0.45 |
| Melting point (before cross-linking) | | ISO 3146 | ℃ | 70 |
| Density (after cross-linking) | | ISO 1183 | $g/cm^3$ | 0.94 |
| Tensile Strength (after cross-linking) | | ISO 527 | MPa | ≥20 |
| Elongation upon Failure (after cross-linking) | | ISO 527 | % | ≥500 |
| Degree of cross-linking | | GB/T 18474 | % | ≥80 |
| Volumetric Resistivity | | GB/T 1410 | Ω•cm | $1.8\times10^{16}$ |
| Steam Transmittance | | GB/T 26253 | $g/m^2$•d | 1.38 |
| Visible-Light Transmittance (after cross-linking) | | GB/T 2680 | % | ≥90 |
| UV-Cutoff Wavelength | SFX-200 | GB/T 2680 | nm | 360 |
| | SFX-300 | GB/T 2680 | nm | No cutoff |
| PID-Free Property | Power Decay | 85 ℃, RH85% 96h, -1000V | % | ＜5 |
| Shrinkage Rate | | 120℃ oven, 3min | % | ≤3 |
| | | 85℃ waterbath, 1min | % | ≤30 |
| Adhesive Strength | Glass/EVA | GB/T 2790 | N/cm | ≥80 |
| | Backsheet/EVA | GB/T 2790 | N/cm | ≥40 |
| Hydrothermal Aging | Physical Observation | IEC 61215 85 ℃, RH85%, 2000h | --- | No color changing, bubbling, swelling |
| | Adhesive Strength/Glass | | N/cm | ≥40 |
| UV Aging | Physical Observation | IEC 61215 $120kWh/m^2$ | --- | No color changing, bubbling, swelling |
| | Adhesive Strength/Glass | | N/cm | ≥40 |

N.B.: The above data are for reference only, actual testing results are not guaranteed.

### 2.2 Product Specifications

**Chart 2 Product Specifications**

| Width (mm) | Thickness (mm) | Length (m) |
|---|---|---|
| 810, 1000, 1200 max | 0.45, 0.5 | 100 |

N.B.: The above specifications are common values, special sizes can be customized.

## 3 Lamination Parameters

The following chart shows the lamination parameters of SFX Series sealing films. The values are for reference only, possible variation can be derived from the model of laminator.

**Chart 3 SFX Series Sealing Film Lamination Parameters**

| Lamination Process | Process | Processing Temperature (℃) | Time (min) |
|---|---|---|---|
| One-Step | Vacuum | 145 | 5-6 |
| | Pressurized Cross-Linking | 145 | 10-12 |
| One-Step | Vacuum | 140 | 5-6 |
| | Pressurized Cross-Linking | 140 | 13-15 |

## 4 Aging Performance

### 4.1 Hydrothermal Aging Performance

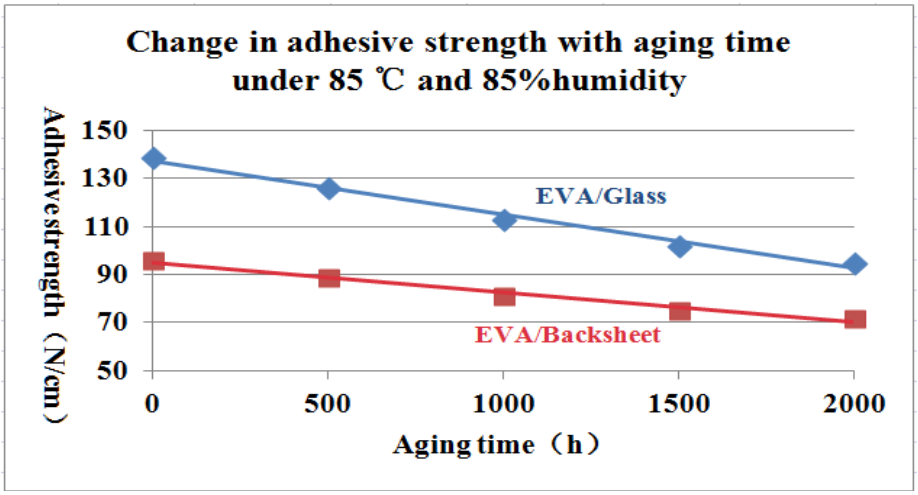



**Figure 1 Adhesive Strength vs. Aging Time**

Figure 1 shows the change in adhesive strength between EVA and glass (fuchsia), EVA and backsheet (red) with aging time under 85 ℃ and 85 % humidity. After 2000 hours, the adhesive strength between EVA and backsheet dropped from 96N/cm to 72N/cm, and that between EVA and glass dropped from 139N/cm to 95N/cm. The above data justify the excellent hydrothermal aging resistance of the SFX Series sealing film.

### 4.2 UV Aging Performance

**Chart 4 Testing conditions of the UV Aging of SFX Series Sealing Film**

| Temperature | Radiation Exposure (kWh/m$^2$) |
|---|---|
| 60℃ | 120 |

N.B.: The testing condition is beyond the IEC61215 standard.

**Chart 5 UV Aging Performance of SFX Series Sealing Film**

| Performance | | Adhesive Strength/Backsheet N/cm | Adhesive Strength/Glass N/cm |
|---|---|---|---|
| Before Aging | SFX-200 | 78 | 154 |
| | SFX-300 | 81 | 148 |
| After Aging | SFX-200 | 59 | 110 |
| | SFX-300 | 59 | 103 |

Chart 5 shows the change in adhesive strength after UV aging under 60℃ and 120kWh/m$^2$. The data justify the excellent UV aging resistance of the SFX Series sealing film.

### 4.3 UL Certificate

**Chart 6 UL Certificate Testing Results of SFX Series Sealing Film**

| Product Name | Testing Procedure | Thickness (mm) | Testing Level |
|---|---|---|---|
| SFX Series | HAI | 0.5 | 0 |
| SFX Series | HWI | 0.5 | 4 |

# 5 PID Resistance

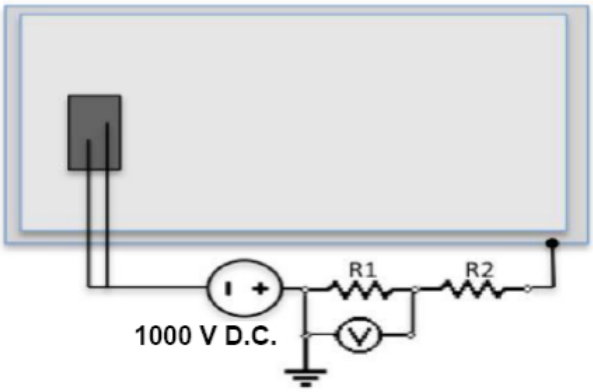
## 5.1 PID

Potential induced degradation (also called PID) is a potential induced performance degradation in crystalline photovoltaic modules, caused by so-called stray currents. The cause of the harmful leakage currents, besides the structure of the solar cell, is the voltage of the individual photovoltaic (PV) modules to the ground.

## 5.2 PID Resistance Testing Condition

**Chart 7 PID Testing Condition**

| Temperature (℃) | Humidity (%) | Applied Voltage (V) |
|---|---|---|
| 85 | 85 | -1000 |




The tested module is connected as shown in the above diagram.

## 5.3 Materials Used in PID Resistance Tests

The MPA-350 Backsheet is the extruded backsheet manufactured by Duchamps, with a steam transmittance of 0.38g/$m^2$•d. The grade A solar cells used in the tests has a reflex index of 2.03.

Chart 8 Materials Used in PID Resistance Tests

| Sealing Film | Solar Cell | Backsheet | Glass |
|---|---|---|---|
| DuChamps SFX Series Sealing Film | Polycrystalline 60 pieces Reflex Index 2.03 | MPA-350 | Ordinary PV Glass |

## 5.4 PID Resistance Testing Results

**Chart 9 PID Resistance Testing Results**

| Stage of Data | Before Testing | 0h | 24h | 48h | 96h | 128h |
|---|---|---|---|---|---|---|
| Power Decay (%) | ** | ** | 0.46% | 1.60% | 4.16% | 6.97% |

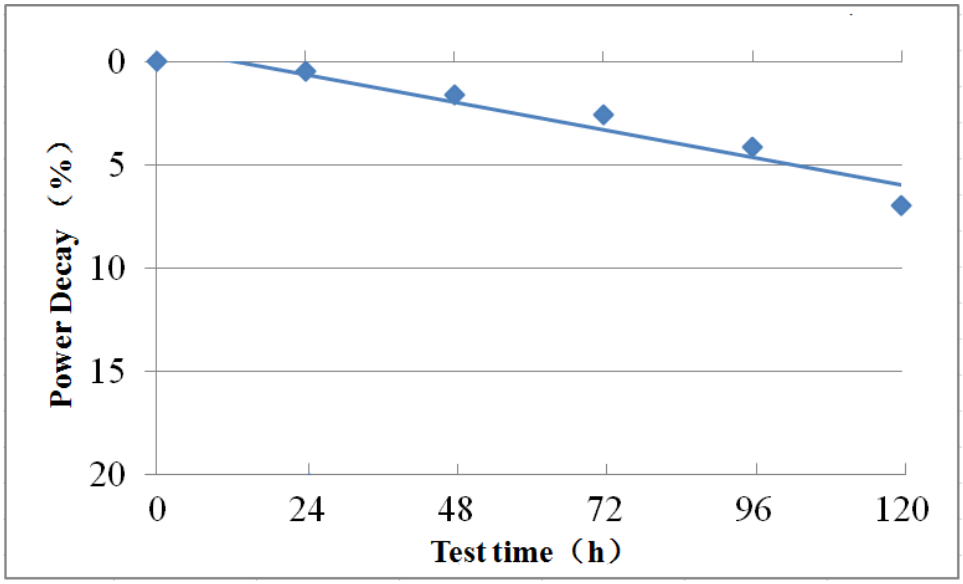



**Figure 2 Power Decay with Testing Time**

N.B.: The testing results may vary due to the different backsheet, solar cells and glass used in the tests.

# 6 Quality Control

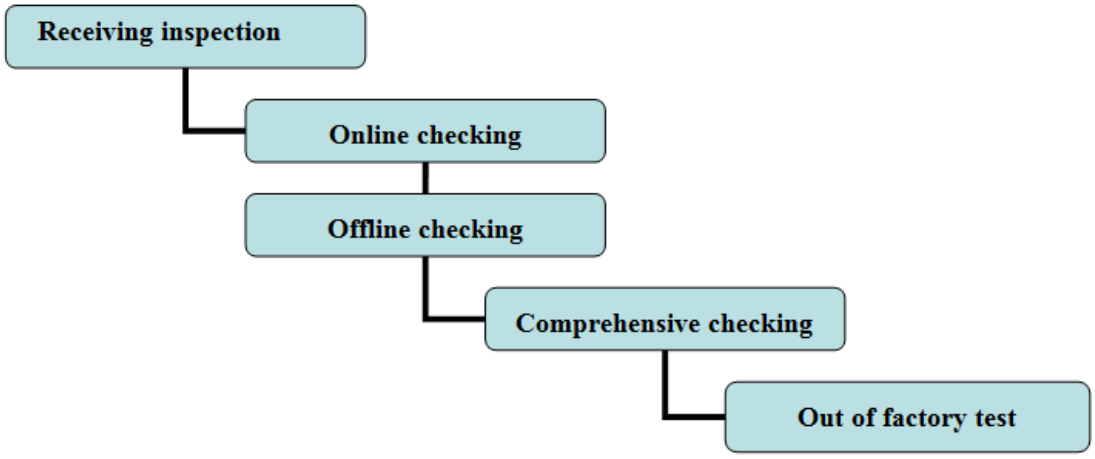



**Figure 3 Flow Chart of Quality Control**

SFX Series sealing film is strictly checked at the stage of raw materials import, manufacture, testing, packaging, storage etc. to ensure the consistency and stability of the quality and performance of the product.

It is also tested upon the relevant standards to ensure that the testing data are accurate and consistent.

## 7 Product Packaging

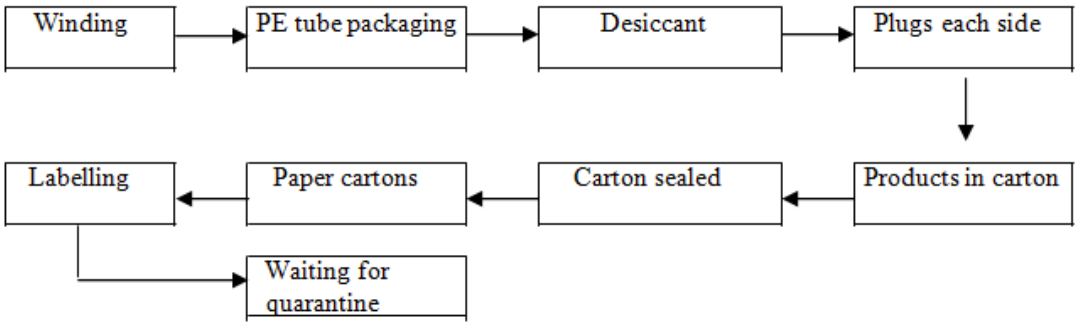



**Figure 4 Flow Chart of Packaging of POE Sealing Film**

The high-strength PE core tube used for packaging has 3-inch diameter and 10mm thickness, preventing deformation during transportation and storage. The inner packaging uses desiccant to protect the product from humid environment. The corrugated paper carton has high gram weight, ensuring the stability of the product.

## 8 Caveats

- SFX Series sealing film should be kept away from direct sunlight, heat and humidity, laid flat in storage. Avoid heavy weight, bending and packaging breakage.
- Unused SFX Series sealing film should be returned into the package bag and sealed. Avoid prolonged exposure to air.
- The optimum storage conditions are constant temperature in between 0 and 30℃, constant humidity of 60%, avoid direct sunlight, heated equipment and dusty environment.