SMC - Experts in the Photovoltaic Industry
Removes particles from the surface of the Si-substrate.

1. Cleaning

Removes any scratches from the surface of the Si-Substrate and then smoothes it out.

2. Saw Damage Etching

Forms a micro rough surface.

3. Texturing

Snaps: P.10, P.11, P.12, P.13, P.14

4. Load Cell

5. PSG Etching

6. Metallisation

7. Cleaning

8. Saw Damage Etching

9. Texturing

10. Diffusion

11. Metalisation

12. Chemical Delivery

13. Cell Sorting

14. Handling

15. Sintering

16. Edge Isolation

17. Handling

18. Cell Sorting

19. Chemical Delivery

20. Handling
Removes any scratches from the surface of the Si-substrate and then smooths it out.

**Saw Damage Etching**

Forms a micro rough surface.

**Texturing**

**Diffusion**

Implementation of pn-junction with gas under high temperature.

**Metallisation**

Screen printing forms electrodes on the surface on both the front and the back.

**Anti-Reflex Coating**

Anti-Reflection Coating

Deposition of Anti-Reflex coating.

**Sintering**

The silver electrode penetrates the anti-reflective coating and connects to the pn-Layer.

**Edge Isolation**

To prevent a short circuit a groove is cut using a Laser.

**Handling**

A handling system is used to transport the cell.

**Cell Sorting**

To measure and sort cells by performance.

**Chemical Delivery**

Chemicals are stored in tanks and delivered to the wet benches.
1. **Washing**
   - Removes particles from the surface of the glass.
   - Handling: P.10
   - Control: P.12
   - Transfer: P.12

2. **Storage**
   - Clean glass store.
   - Handling: P.10
   - Control: P.12
   - Transfer: P.12

3. **Stringer**
   - Electrical ribbons are soldering to cells and wired in series.
   - Handling: P.10
   - Control: P.12
   - Transfer: P.12
4 Lay Up

Cells are layed-up on the glass.

A Handling  P.10
B Control  P.12
C Transfer  P.12
D Static Control  P.14

5 Lamination

Under vacuum cells, glass and a foil is encapsulated.

A Handling  P.10
B Control  P.12
C Transfer  P.12
D Static Control  P.14

6 Module Transfer

The module is transferred to the next part of the process.

A Handling  P.10
B Control  P.12
C Transfer  P.12

7 Frame Station

An aluminum frame is formed around the panel and a junction box is installed.

A Handling  P.10
B Control  P.12
C Transfer  P.12

8 Sun Simulator

A sun simulator confirms the output performance and a final check for defects.

A Handling  P.10
B Control  P.12
C Transfer  P.12

Eva & Backsheet Dispenser
PIN-Layer Deposition

PIN-layer is deposited on the glass substrate.

- Handling
- Control
- Transfer
- High Vacuum

Layer-Deposition

Metallic rear electrode

A rear contact is deposited on the glass substrate.

- Handling
- Control
- Transfer
- High Vacuum

Bus Line Attachment

Assembly of the electrical bus line.

- Handling
- Control

Framing

An aluminum frame is formed around the panel and a junction box is installed.

- Handling
- Control
- Transfer

Module Handling

The module is transferred to the next process step.

- Handling
- Control
- Transfer

Lamination

Between a second glass substrate on top the Thin film stack is encapsulated.

- Handling
- Control
- Transfer
- Static Control

Sun Simulation

A sun simulator confirms the output performance and a final check for defects.

- Handling
- Control
- Transfer


## Handling

### Electric Actuators
Having both the operational ability of an air cylinder and the speed controllability of an electric actuator. Integrated controller type.

- e-Rodless Electric Actuator  
  Series E-MY
- Electric Actuator (Guide Rod Type)  
  Series LXP

### Low Speed & Low Friction
Low pressure, friction resistance and speed (less than 50mm/s) with reduced friction to meet the demands of reduced lurching that occurs during start up.

- Low Speed Cylinder  
  Series CX
- Low Speed Rotary Actuators  
  Series CRQ2X/MSQX
- Low Friction Cylinder  
  Series MQ
- Smooth Cylinder  
  Series CY

### High Speed
High Speed Actuators (more than 1,000mm/s) with improved cycle time.

- High Power Cylinder  
  Series RHC
- High Speed Rodless Cylinder  
  Series CY

### Intermediate Stop
Actuators with an intermediate stop mechanism.

- 3 Position Cylinder  
  Series RZQ
- 3 Position Rotary Table  
  Series MSZ
- 4 Position Cylinder  
  Series CXSJ
- Cylinder  
  Series CJ

### Shock Absorbing
In response to delicate workpieces transferred at high speed. Shock absorbing stroke end.

- Sine Cylinder  
  Series RHC
- Sine Rodless Cylinder  
  Series REA/REB
- Shock Absorber  
  Series RB/RJ
Handling

■ Other application

Water Resistant
For use in areas where there is water spray.
• Hygienic Cylinder .................................. Series HY
• Stainless Cylinders ............................... Series CJ-5/CG-5

Guide Cylinders
• Slide Table ........................................ Series MXS
• Guide Cylinders ................................. Series MGP

■ Directional Control Valves (IP65/67 Enclosures)

• 5 Port Solenoid Valve ............................ Series SV
• 5 Port Solenoid Valve ............................ Series VQC
• 5 Port Solenoid Valve ............................ Series SV/SYJ
• 5 Port Solenoid Valve ............................ Series SQ
• 5 Port Solenoid Valve ............................ Series VQZ
• 5 Port Solenoid Valve ............................ Series VQ
• 5 Port Solenoid Valve ............................ Series SY
• 5 Port Solenoid Valve ............................ Series VV100
• Serial Transmission System .................... Series EX

■ Fittings & Tubing (Stainless Products)

• SUS316 One-touch Fittings .................. Series KQG
• SUS316 Insert Fittings .......................... Series KFG
• One-touch Fittings .............................. Series K
• S-Couplers / Stainless Type .................. Series KKA
• Antistatic One-touch Fittings ................. Series KA
• Antistatic Tubing ............................... Series TA
• Miniature Fittings / Stainless Type .......... Series M/MS

■ Process Valves

• 2 Port Solenoid Valves ......................... Series VQ20/30
• 2 Port Solenoid Valves ......................... Series VCA

■ Clean Room Products

Products for use in clean rooms. Particle reducing products, assembled inside a clean room and shipped in double packaging.
• Clean Air Module ............................... Series LLB
• Clean Series Actuators ......................... Series 10-/11/12-/13
• Clean Speed Controller ....................... Series AS-FPQ/FPG
• Clean Exhaust Cleaner ......................... Series AMP
• Clean One-touch Fittings ..................... Series KPO/KPG
• Clean Air Filter ................................. Series SFD
• Clean Gas Filter .............................. Series SF
• Clean Regulator ................................. Series SRH
• Precision Clean Regulator .................. Series SRP
• Clean Tubing ..................................... Series TPH/TPS

Water Resistant
B Control

- **Sensors**
  For monitoring the flow of fluids, such as air, water oil, DI water chemicals, etc. Can detect vacuum pressure of lift and transfer lines.
  - Digital Pressure Switch (Integrated Sensor) ........................................ Series ZSE/ISE
  - Digital Pressure Switch (Separate Sensor) ........................................ Series PSE
  - Digital Flow Switch ............................................................................. Series PF
  - General Purpose Fluid Pressure Sensor ................................................ Series PSE560
  - Digital Flow Sensor Air ....................................................................... Series PF2A
  - Digital Flow Sensor Water .................................................................... Series PF2W
  - Digital Flow Sensor ............................................................................ Series PFMV

- **Flow Control Equipment**
  - Speed Controller .................................................................................. Series AS
  - Speed Controller / Stainless .................................................................. Series ASG

- **Pressure Control Equipment**
  - Regulator ............................................................................................... Series AR
  - Regulator Manifold ................................................................................ Series ARM
  - Electro-Pneumatic Regulator ................................................................. Series ITV

C Transfer

- **Non-Contact Transfer**
  Non-contact conveyance is possible for uneven surfaces and/or with varying textures (Solar cells).
  - Cyclone Pad (Made to Order)

  Operating Principle
  Air enters from supply port and is blown out of the pad’s nozzle to generate a whirlwind flow inside the pad and leading to the cyclone effect (vacuum). Supply air is discharged to the atmosphere from between the pad and the workpiece. A layer of air is generated between the Cyclone Pad and the workpiece, resulting in the workpiece being lifted without contact.

  To prevent bending and vibration of thin workpieces.
  - Levitation Rail (Made to Order)

- **Low Vacuum**
  Products for vacuum lift and transfer.
  - Vacuum Ejectors .................................................................................. Series Z
  - Air Suction Filters ................................................................................ Series ZF
  - Vacuum Pads ......................................................................................... Series ZP
  - Peek Pads .............................................................................................. Series INO
**High Vacuum**

For use in 10 - 6 Pa high vacuum applications. Valves for high vacuum chamber vent, supply & isolation.

- **Vent**
  - Aluminum Angle Valves · Series XL
  - Two stage Control Angle Valve · Series XLD
  - Quick maintenance Angle Valve · Series XLAQ
  - Stainless Single/Inline Valves · Series XM/XY
  - Two stage Control Angle Valve · Series XMD

- **Gas Valve**
  - Smooth Vent Valve · Series XVD
  - High Vacuum Straight Valve · Series XSA

- **Transfer**
  - Gate Valve
  - Door Valve

- **Actuator**
  - Vacuum Rodless Cylinder · Series CYV
  - Bellow Actuator · Series XGL

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**Temperature Control**

Constant temperature control of the heat source.

- **Chillers**
  - Thermo Cooler · Series HRG/HRGC
  - Thermo Cooler · Series HRZ/HRW

- **Thermo Controllers**
  - Thermo Controller · Series HEC
  - Thermostat Bath · Series HEB
  - Chemical Thermo Controller · Series HED

Ex.) Temperature control of a laser oscillating device.
SMC Products for the Photovoltaic Industry

F  Chemical Products

- **Chemicals & Di Water**
  High purity products for use with chemicals and Di water.
  - **Process Valves**
    - Air Operated Chemical Valve  \( \text{Series LV} \)
    - Needle Valve  \( \text{Series LVN} \)
  - **Pressure Control Equipment**
    - Clean Regulator (Fluororesin Type)  \( \text{Series SRF/LVR} \)
  - **Flow Sensors**
    - Digital Control Switch  \( \text{Series PF2D} \)
  - **Pumps**
    - Process Pumps  \( \text{Series PAF} \)
    - Process Pumps  \( \text{Series PB} \)
  - **Fittings & Tubing**
    - Fluororesin Fittings  \( \text{Series LQ} \)
    - Fluororesin Tubing  \( \text{Series TL} \)
    - FEP Tubing  \( \text{Series TH} \)
    - Flexible Fluororesin Tubing  \( \text{Series TD} \)

G  Static Control

- **Antistatic Equipment**
  To prevent an electrical charge due to conductance and to reduce problems caused by the build-up of static electricity.
  - **Actuators**
    - Antistatic Cylinder  \( \text{Series CM2-X1051} \)
  - **Fittings & Tubing**
    - Antistatic One-touch Fittings  \( \text{Series KA} \)
    - Antistatic Tubing  \( \text{Series TA} \)
  - **Flow Control Equipment**
    - Antistatic Speed Controller  \( \text{Series AS-X260} \)
  - **Vacuum Products**
    - Vacuum Pads  \( \text{Series ZP} \)

- **Ionizers**
  Corona effect used to neutralize ions and eliminate the build up of static electricity.
  - Ionizer (Bar)  \( \text{Series IZS} \)
  - Ionizer (Nozzle)  \( \text{Series IZN} \)

- **Measuring Instruments**
  Measures the electrical charge potential of the workpiece.
  - Electrostatic Sensor/Monitor  \( \text{Series IZD/IZE} \)
  - Handheld Electrostatic Meter  \( \text{Series IZH} \)
SMC and Advanced Pressure Technology (APTech)

In spring 2007, SMC Corporation Japan purchased Advanced Pressure Technology – better known as AP-Tech - from its directors.

Based in Napa, California, USA, AP-Tech was founded in the late 1980’s by Rene Zakhour. Rene’s objectives were to provide products with uncompromising quality, performance and reliability from a company offering exceptional service and technical support – almost identical values to those which SMC has based its successful approach to business.

From July 2008, our European customers can now purchase – through SMC Pneumatik GmbH – AP-Tech’s excellent range of high quality products made exclusively for both the PV and Semiconductor Industries.

These include a great range of High Purity Gas Regulators which are made, tested and packaged in ultra high clean room conditions, thereby ensuring excellent levels of quality (ISO 9001 standard).

If you’d like more information of AP-Tech products ask your local representative for more information today.

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