



# SOLAR PANEL CELL PLANT

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Pol Industrial Malpica Alfinden, Calle Sauce nº 4  
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## 1.LINE DESCRIPTION

TURN KEY BY ROTH&RAU

ECN PROCESS

ENGINEERING BY AEP

CAPACITY: 60MW/YEAR (2.400 cells/h)

AVERAGE EFFICIENCY: 16,3

CLEAN ROOM: CLASS 8

STAFF: 6 10 workers/shift

GLOBAL SYSTEM FOR REMOTE CONTROL AND MONITORING:

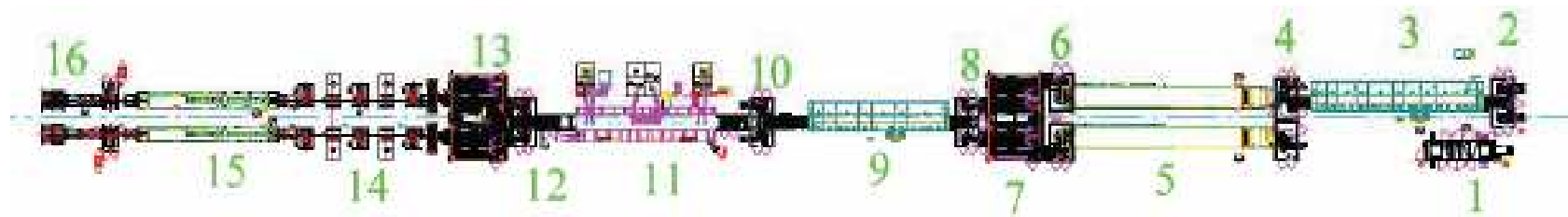
CONTROL ALL MACHINE PARAMETERS AND STATUS

PRODUCTION ANALYSIS (Nº CELLS, ELECTRICAL PARAMETERS, TRENDSINGS...)

DATABASE CONFIGURABLE QUERYS

LAY OUT:

- 1 Incoming wafer tester
- 2 Automation machine
- 3 Texturing
- 4 Automation machine
- 5 Doper-Difusión
- 6 Automation machines
- 7 Overhead Buffer
- 8 Automation machine
- 9 Oxide etch
- 10 Automation machine
- 11 Antireflection coating
- 12 Automation machine
- 13 Overhead Buffer
- 14 Printing lines
- 15 Firing furnaces
- 16 Lasers, testers & sorters



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## 2. PRODUCTION EQUIPMENT

### 2.1 WAFER INSPECTION

**MANUFACTURER:** MEIKLE

**NUMBER OF MACHINES:** 1

**THROUGHPUT:** 3.000 Wafers/h (cycletime <1s)

**INSPECTIONS:**

- GEOMETRY
- MICROCRACKS (IR GREY SCALE)
- THICKNESS
- TTV
- RESISTIVITY
- LIFETIME
- SURFACE

CUSTOMIZABLE CLASIFFICATION IN 7 STACKS

**METROLOGY:**

Lifetime Measurement: SINTON WCT 120



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## 2.PRODUCTION EQUIPMENT

### 2.2 TEXTURE

**MANUFACTURER:** SCHMID

**NUMBER OF MACHINES:** 1

**THROUGHPUT:** 2500 wafers/h

**LOAD:** Automatic from stacks to machine in 5 lanes

**UNLOAD:** Automatic to diffusion machines or to cassettes (selectable)

**DESCRIPTION:**

4 modules for chemical process:

4 modules for rinsing

1 module for drying

Automatic drag out prevent system in each module

Low breakage transport system

Double safety system

Exhaust gas detection safety system

High accuracy dosing system (ml)

Feed and bleed system



**METROLOGY:**

Analytical Balance Mettler Toledo XP205DR (etch dept calculation)

Microscope Olympus STM6 (surface inspection)

UV/Vis/NIR: Perkin Elmer Lambda 950 (Reflectivity measurement)

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## 2.PRODUCTION EQUIPMENT

### 2.3 DIFFUSION

**MANUFACTURER:** DESPATCH (DCF 6300)

**NUMBER OF MACHINES:** 2

**THROUGHPUT:** 1300 wafers/h

**LOAD:** Automatic from previous process in 5 lanes

**UNLOAD:** Automatic to overhead buffer

**DESCRIPTION:**

DOPER MODULE

In line doper. Dopant mixture (H3PO4+ethanol)

2 Spray nozzles for each lane (Top&bottom).

Nozzles independent volume & pressure control

Transport system: plastic rollers

Dryer device (independent exhaust)

Gas detection systems (O2 and \_LEL)

FURNACE

23 configurable infrared heating zones with independent PID control

1 Thermocouple for each heating and cooling zone

Ceramic isolation

Transport system: NiCrom belt

8 configurable Edge heaters

Radiation & convection cooling zones (adjustable)

**METROLOGY:**

4 point probe (Rsheet measurement): SUNLAB SheereScan



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## 2. PRODUCTION EQUIPMENT

### 2.4 PSG REMOVAL

**MANUFACTURER:** SCHMID

**NUMBER OF MACHINES:** 1

**THROUGHPUT:** 2500 wafers/h

**LOAD:** Automatic from Overhead buffer

**UNLOAD:** Automatic to next process

**DESCRIPTION:**

3 modules for chemical process

1 module for dry

Drag out prevent system in each module

Low breakage transport system

Double safety system

Exhaust gas detection safety system

High accuracy dosing system (ml)

Feed and bleed system

**METROLOGY:**

Chemical analysis Metrohm ProcessLab

SunLab SheerScan 4\_point probe



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## 2. PRODUCTION EQUIPMENT

### 2.5 ANTI-REFLECTION COATING

**MANUFACTURER:** ROTH & RAU (SINA XXL)

**NUMBER OF MACHINES:** 1

**THROUGHPUT:** 2500 wafers/h

**LOAD:** Automatic from previous process

**UNLOAD:** Automatic to Overhead buffer

**DESCRIPTION:**

LOAD CHAMBER

Infrared heating

Independent vacuum pump and buffer

PROCESS CHAMBER

Heating camera

Process camera: Independent control flow SiH<sub>4</sub>, H<sub>2</sub> & NH<sub>3</sub>

Safety gas cabinets controlled by PLC

8 Plasma sources

Cooling camera

UNLOAD CHAMBER

Water cooled

Independent vacuum pump and buffer

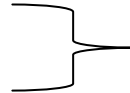
15 carriers to transport (9x5 wafers)

Dry scrubber connected

**METROLOGY:**

FTIR Bruker TENSOR 27

Ellipsometer Sentech 500adv



Return carrier automatic system

Pre-heating carriers and sample mode



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## 2.PRODUCTION EQUIPMENT

### 2.6 PRINTING

**MANUFACTURER:** BACCINI (APPLIED MATERIALS)

**NUMBER OF MACHINES:** 2 LOADERS 6 PRINTERS & 4 DRYERS (2 LINES)

**THROUGHPUT:** 1200 Cells/h (each line)

**LOAD:** Automatic from Overhead buffer

**UNLOAD:** Automatic to next step

#### **DESCRIPTION:**

#### PRINTERS

Screen printing technology

Rotary line system

Impression order: back bus bar, back aluminum, front grid

#### DRYERS

Vertical dryer

Infrared heating

2 different adjustable exhausts each machine

#### INSPECTIONS

2 ICOS Vision system (IVC4000 Camera 2048x2048 px.)

#### GLOBAL CONTROL SYSTEM

#### **METROLOGY:**

Precision Balance Mettler Toledo PB 602 S

Microscope Olympus SZX 61



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## 2. PRODUCTION EQUIPMENT

### 2.7 FIRING

**MANUFACTURER:** DESPATCH (CDF 7210)

**NUMBER OF MACHINES:** 2

**THROUGHPUT:** 1300 wafers/h

**LOAD:** Automatic from previous process in 1 lane

**UNLOAD:** Automatic to laser

**DESCRIPTION:**

DRYER

Infrared heaters for paste drying

VOC scrubber integrated

FURNACE

6 configurable infrared heating zones (top & bottom)

Ceramic isolation

Radiation & convection cooling zones adjustable

Independent PID control system for each parameter

Unique transport system (NiCrom belt)

**METROLOGY:**

CorRescan: SunLab



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## 2.8 TESTING & SORTING

**MANUFACTURER:** BACCINI (APPLIED MATERIALS)

**NUMBER OF MACHINES:** 2 UNLOADERS, 2 LASERS 2 TESTERS & 2 SORTERS

**THROUGHPUT:** 1200 Cells/h (each line)

**LOAD:** Automatic from Firing furnace

### DESCRIPTION:

#### LASERS

Laser Isolation

Rofin system

Exhaust adjustable

#### TESTERS

I V testers class AAA (H.A.L.M.)

ICOS inspection systems (IVC 14000 camera 3024x3024px)

#### SORTERS

24 different classes (BINS) each sorter

Optical and electrical parameters can be selected in classification

### METROLOGY:

Profilometer: Veeco Dektab 150

Lifetime Measurement: SINTON SUNS VOC

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## 2. PRODUCTION EQUIPMENT

### 2.9 AUTOMATION

**MANUFACTURER:** MEIKLE AUTOMATION

**NUMBER OF MACHINES:**

- 1 LOAD TEXTURING
- 2 TRANSFER TEXTURING DIFFUSION
- 2 UNLOAD DIFFUSION
- 2 OVERHEAD BUFFERS
- 1 LOAD PSG REMOVAL
- 1 ARC LOAD
- 1 ARC UNLOAD

**MACHINES GENERAL DESCRIPTION:**

ABB robots

Safety lock system

Traceability by batches

FIFO buffers

Buffer capacity: 10.000 wafers

Automatic load from stacks, cassettes or previous processes

Automatic load unload of stacks and cassettes

Selectable work mode (line, cassettes load or cassettes unload)

Inspection cameras (Cognex) for broken wafers (1 per robot)

Broken wafers automatic rejection

2 cameras for ARC color inspection (100% wafers tested). Automatic rejection



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**3.1 AIR TREATMENT**  
**AIR HANDLING UNITS:**

**MANUFACTURER:** SERVOCLIMA CTA 70  
**Nº MACHINES:** 2  
**CHARACTERISTICS:** 2x600kW, 70.000 m3/h



**MANUFACTURER:** SERVOCLIMA CTA 8  
**Nº MACHINES:** 2  
**CHARACTERISTICS:** 2x65kW, 9.000 m3/h

**MANUFACTURER:** SERVOCLIMA CTA 2  
**Nº MACHINES:** 2  
**CHARACTERISTICS:** 2x10kW; 2.450 m3/h

**MANUFACTURER:** SERVOCLIMA CTA 3  
**Nº MACHINES:** 2  
**CHARACTERISTICS:** 2x20kW; 3.690 m3/h



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### 3.1 AIR TREATMENT

#### STEAM BOILER & BURNER

**MANUFACTURER:** U C U: SINCAL – Weishaut HD 50

**Nº MACHINES:** 1

**CHARACTERISTICS:** 550 kg/h, 375 KW/h

#### COOLING TOWERS:

**MANUFACTURER:** EVAPCO ESW 142 331

**Nº MACHINES:** 2

**CHARACTERISTICS:** 885 kW

#### AIR CONDITIONER

**MANUFACTURER:** SANYO SPW C1405DXHN8

**Nº MACHINES:** 1



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**3.2 WATER TREATMENT**

**DI WATER PLANT**

**MANUFACTURER:** INTREC

**CHARACTERISTICS:**

MAX. FLOW: 10m<sup>3</sup>/h

MIN CONDUCTIVITY: 0,2 µs (15 MΩ)

4 TANKS 1,5 m<sup>3</sup>

1 TANK 35 m<sup>3</sup>

UV LIGHT

1 REVERSE OSMOSIS SYSTEM

2 PRE TREATMENT SYSTEM: Ion Exchange Resins (Anionic & Cationic)

2 FINAL TREATMENT SYSTEM: Ion Exchange Resins (Mixed)



**WATER SOFTENER**

**MANUFACTURER:** PEVASA 36X72

**Nº MACHINES** 2



**CLORINATOR**

**MANUFACTURER:** CRF INSTRUMENTS

**Nº MACHINES** 1



**FIRE PROTECTION SYSTEM**

**MANUFACTURER:** ITUR IN 80 / 315N6 2008

**CHARACTERISTICS:** 90 m<sup>3</sup>/h



**3. FACILITIES**

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**3.3 CHEMICAL SUPPLY  
SUPPLY CABINET**

**MANUFACTURER:** PURSTINGER

**Nº MACHINES:** 8

**CHARACTERISTICS:**

INDEPENDENT SUPPLY FROM 2 IBC (EACH CABINET)

STRUCTURE MADE IN PE. PIPING IN PVDF.

QUICK CONECTORS TO AVOID CHEMICAL SPLASH RISK

PLC SIEMENS CONTROL (EACH CABINET)

REDUNDANT FEED IN SYSTEM (PRESSURE AND MACHINE SIGNAL)



**MIXTURE AND SUPPLY CABINET (CHEMICALS)**

**MIXTURE AND SUPPLY CABINET (DOPANT)**

**MANUFACTURER:** PURSTINGER

**Nº MACHINES:** 1

**CHARACTERISTICS:**

PRECISION BALANCE TO MAKE MIXTURES

MIXTURES

MIXTURE PARAMETERS CONFIGURABLE

CONFIGURABLE

STRUCTURE MADE IN PE. PIPING IN PVDF.

PLC SIEMENS CONTROL

REDUNDANT FEED IN SYSTEM



**MANUFACTURER:** PURSTINGER

**Nº MACHINES:** 1

**CHARACTERISTICS:**

PRECISION BALANCE TO MAKE

MIXTURE PARAMETERS

STRUCTURE AND PIPING IN INOX

PLC SIEMENS CONTROL

REDUNDANT FEED IN SYSTEM

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## 3.FACILITIES

### 3.4 CHEMICAL DISPOSAL PUMPING STATION

**MANUFACTURER:** PURSTINGER

**Nº MACHINES:** 3 (RINSES, ACID AND BASIC WASTES)

**CHARACTERISTICS:**

1m<sup>3</sup> TANK AND PUMPING SYSTEM (EACH MACHINE)

ULTRASONIC LEVELS

PLC CONTROL

INTERCONNECTION: MACHINES, WASTE WATER & PUMPING STATION



### WASTE WATER

**MANUFACTURER:** AGUAMBIENTE

**Nº EQUIPMENTS:** 3

**CHARACTERISTICS:** 15m<sup>3</sup> P.E. TANK, DOSIFICATION PUMP

AND DISCHARGE PUMP, ULTRASONIC LEVELS

PLC CONTROL

INTERCONNECTION: MACHINES, WASTE WATER & PUMPING  
STATION

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### 3. FACILITIES

#### 3.5 REFRIGERATION

##### PROCESS REFRIGERATION MACHINE

**MANUFACTURER:** AXIMA QUANTUM E SCHRANK

**Nº MACHINES:** 1

**CHARACTERISTICS:** 600 Kw



##### COOLING TOWER

**MANUFACTURER:** EVAPCO ATW 48 3F

**Nº MACHINES:** 1

**CHARACTERISTICS:** 750 Kw



##### GENERAL REFRIGERATION MACHINE

**MANUFACTURER:** AXIMA QUANTUM E SCHRANK

**Nº MACHINES:** 1

**CHARACTERISTICS:** 1500 Kw



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### 3. FACILITIES

#### 3.6 CDA & VACUUM GENERATION COMPRESSOR

**MANUFACTURER:** ATLAS COPCO ZR250VD

**Nº MACHINES:** 2

**CHARACTERISTICS:** 250 Kw

#### VACUUM PUMPS

**MANUFACTURER:** BUSCH COBRA NC0400B

**Nº MACHINES:** 2

**CHARACTERISTICS:**

POWER: 7,5 Kw

FLOW: 300 m3/h

PRESSURE < 0,05 bar



#### DRYER & FILTER AIR

**MANUFACTURER:** ATLAS COPCO

**MOD.:** BD780

**Nº MACHINES:** 2

**CHARACTERISTICS:** 30 Kw



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#### REFRIGERATION MACHINE

**MANUFACTURER:** DONALDSON

**MOD.:** ULTRA\_COLD\_0800\_SP

**Nº MACHINES:** 1

**CHARACTERISTICS:** 30 Kw



#### AIR CONDITIONER

**MANUFACTURER:** FRIMETAL

**MOD.:** VLN-231

**Nº MACHINES:** 1

**CHARACTERISTICS:** 350 Kw



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## 4. ENVIROMENTAL PROTECTION SYSTEMS

### WET SCRUBBER

**MANUFACTURER:** TECNIUM ELFKK - 23

**Nº MACHINES:** 2

**CHARACTERISTICS:**

6.200 m<sup>3</sup>/h

EFFICIENCY 99,5% HF & 70% Nox

### CT SCRUBBER (BURNER WASHER)

**MANUFACTURER:** CENTROTERM

**MOD.:** CT BWOE 300K3 TWIN R (2 LINES)

**Nº MACHINES:** 1

**CHARACTERISTICS:**

REDUNDANT SYSTEM

O<sub>2</sub> OR NATURAL GAS BURNER

PLC CONTROL

SAFETY INTERRUPT PROCESS

INTERCONNECTION: GAS SYSTEM, SINA & SCRUBBER

### WASTE WATER TREATMENT PLANT

**MANUFACTURER:** AGUAMBIENTE

**CHARACTERISTICS:**

HOMOGENIZATION

PHYSICAL CHEMICAL TREATMENT

BIOLOGICAL TREATMENT

SLUG TREATMENT



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