

GERULUS

Wafer Block
Pre-Clean & Deglue System



SINGULUS TECHNOLOGIES focuses on Photovoltaics: Smart Solutions for Crystalline Silicon & Thin Film Solar Technology

SINGULUS TECHNOLOGIES is the world leader in manufacturing mass production equipment for Optical Discs CD/DVD/Blu-ray. In the Solar segment, SINGULUS and STANGL are cooperating with leading cell manufacturers in the development of new technologies and new plant concepts for improved cell concepts with higher efficiency and production technologies with decreasing production costs. The company's target is to position itself at the forefront for the introduction of new technologies with respect to silicon as well as thin film solar technology. During times of cost pressures in the photovoltaics market, the interest regarding new plant concepts increases. In the coming years, SINGULUS will offer a broad product range of new machines for the photovoltaics industry, which will offer manufacturers of both silicon and thin film cells new production technologies and particular cost advantages.

SINGULUS and STANGL will systematically expand the solar activities. Both companies complement each other ideally in being able to offer a broad product range of machines and equipment for the photovoltaics industry in the coming years.

Crystalline Silicon Solar Technology

In the area of Crystalline silicon solar technology SINGULUS TECHNOLOGIES delivered in November 2009 the first SINGULAR inline coating machine for anti-reflective coating of silicon solar cells as well as STANGL's newly developed inline cleaning system LINEA with the corresponding fully-automated wafer handling system. Since that time, SINGULUS realized the first installation of a so-called front-end system. A European solar cell manufacturer accepted the first setup in early July 2010 including two LINEA and one SINGULAR system.

The company's goal with respect to silicon solar technology is to assume a leading position in the market by launching new production technologies. In the future SINGULUS will not only supply individual machines and equipment for the silicon solar technology but will also actively market so-called front end systems as well as complete production systems for the cell production with process know-how in the solar market. SINGULUS and STANGL already possess the fundamental expertise for wet-chemical and AR-coating processes. This enhancement of the business model from single machines towards systems was also successful in the Optical Disc market some years ago.



Raw Material Cleaning

The common ground for all crystalline silicon solar cells is polysilicon as the raw material. Via several gas phase and furnace processes it is transformed in multicrystalline blocks or mono-crystalline silicon ingots. These are cutted to wafers by wire sawing technology.

STANGL has over 15 years of experience in building prototype machines for raw material etching & cleaning as well as for wafer cleaning. Due to the various shapes of the material, for most applications each machine has to be individually

planned together with the customer. This also includes individual carrier or basket design. STANGL has perfectionated prototype engineering when working together with major raw material and wafer producers in the last two decades.



Technical Features



Technical features of the STANGL GERULUS

Pre-Clean & Deglue System

- _ Proven, highly integrated design
- _ High throughput up to 7200 wph
- _ Built for non-stop utilization: 24/7, 365 days/year
- _ High availability (uptime > 95%)
- _ Sophisticated pre-cleaning concept for best process results and minimal process times
- _ Compliance with international safety regulations

High flexibility in

- _ Wafer size (up to 210x210 mm)
- _ Wafer thickness (down to 150 μm)
- _ Slurry type to be removed (PEG- or oil-based)
- _ Glue type to be deglued (water or acid soluble)
- _ Process control through detailed recipe control

By using optimized process cassettes

- _ Lowest breakage rate
- _ Optimal integration with subsequent separation processes

Superiously low cost-of-ownership

- _ Minimized fresh water consumption
- _ Use of patented recycling system
- _ Only 200 l of fresh water needed per block
- _ Minimal surfactant consumption

State-of-the-art material tracking by

- _ Network communication support
- _ Carrier tracking and data logging
- _ Manufacturing Execution System (MES) support

Main Components

1 Transport cart (for in- and output)

- _ For up to two carriers
- _ For wet transport from/to STANGL Pre-cleaner
- _ Discharge and filling at semi-automatic filling station at wet bench, minimized dripping due to optimized coupling devices
- _ Guide rolls matching to guidance system at STANGL Pre-cleaner

2 Input buffer

- _ Static bath for wet buffering of carriers
- _ Capacity: 4 carriers
- _ Media: DI water, recycling water, or glycol

3 Pre-clean bath

The wafer blocks are pre-cleaned in a patented pre-clean bath. This comprises:

- _ Moving spray bars aside the wafer block (spray image optimized for cleaning narrow gaps)
- _ Quick dump of bath in 1 second or less
- _ Optionally: motoric tilting of carrier
- _ Optionally: ultrasonic treatment with dual frequency
- _ Overflow bath
- _ Media: DI water or recycling water + surfactant
- _ Fresh water consumption optimized by use of centrifuge recycling water
- _ Automatic cover
- _ All of the special elements of the Pre-clean bath can be individually programmed to fit your individual cleaning needs

4 Deglue chamber

Any exposure to hazardous chemicals is minimized because in regular operation the process chamber is only loaded and unloaded when no acid is present.

- _ Recirculated overflow bath
- _ Capacity: 1 carrier
- _ Media: hot DI water or acid (e.g. acidic acid)

- _ Automatic cover with water sealing
- _ Acid is put in buffer tank during rinsing action
- _ Acid can be re-used several times
- _ All of the special elements of the Deglue chamber can be individually programmed to fit your individual deglueing needs for your glue.

5 Output buffer

- _ Overflow cascade for wet buffering and final rinsing of carriers
- _ Capacity: 4 carriers
- _ Media: DI water
- _ Carriers are final-rinsed by passing through this 4-step DI cascade

6 Installation area

- _ Fully PP covered installation area
- _ For electrics (fully encapsulated versus fluids)
- _ For process technology elements (pumps, dosage units, pneumatics, ...)
- _ Media connection points
- _ For supply tanks

7 Waste water pump stations (optional)

- _ If waste water cannot be disposed by gravity
- _ Flat reservoir tanks behind main machine
- _ Equipped with centrifugal pumps to provide necessary pressure to lift waste water to desired disposal level
- _ Full automatic control (no user interference necessary)
- _ Number of tanks depends on number of different waste water types

8 Hot DI water station (optional)

- _ To provide main machine with hot DI water
- _ Used if fab does not have sufficient hot DI supply
- _ Equipped with high performance DI inline heater

- _ Equipped with hot DI water storage tank (optionally equipped with an additional heating system)
- _ Autonomous operation with own PLC station
- _ Communication to main automat via Profibus coupling
- _ Can be coupled to several pre-cleaners

9 Surfactant dosage station

- _ To provide system with surfactant in pre-cleaning step
- _ High-precision dosage pump
- _ Equipped with 30 -60 liter buffer tank
- _ Can be connected to central supply line or to local surfactant drum (connection gear and suction pump included)

10, 11 Water recycling station

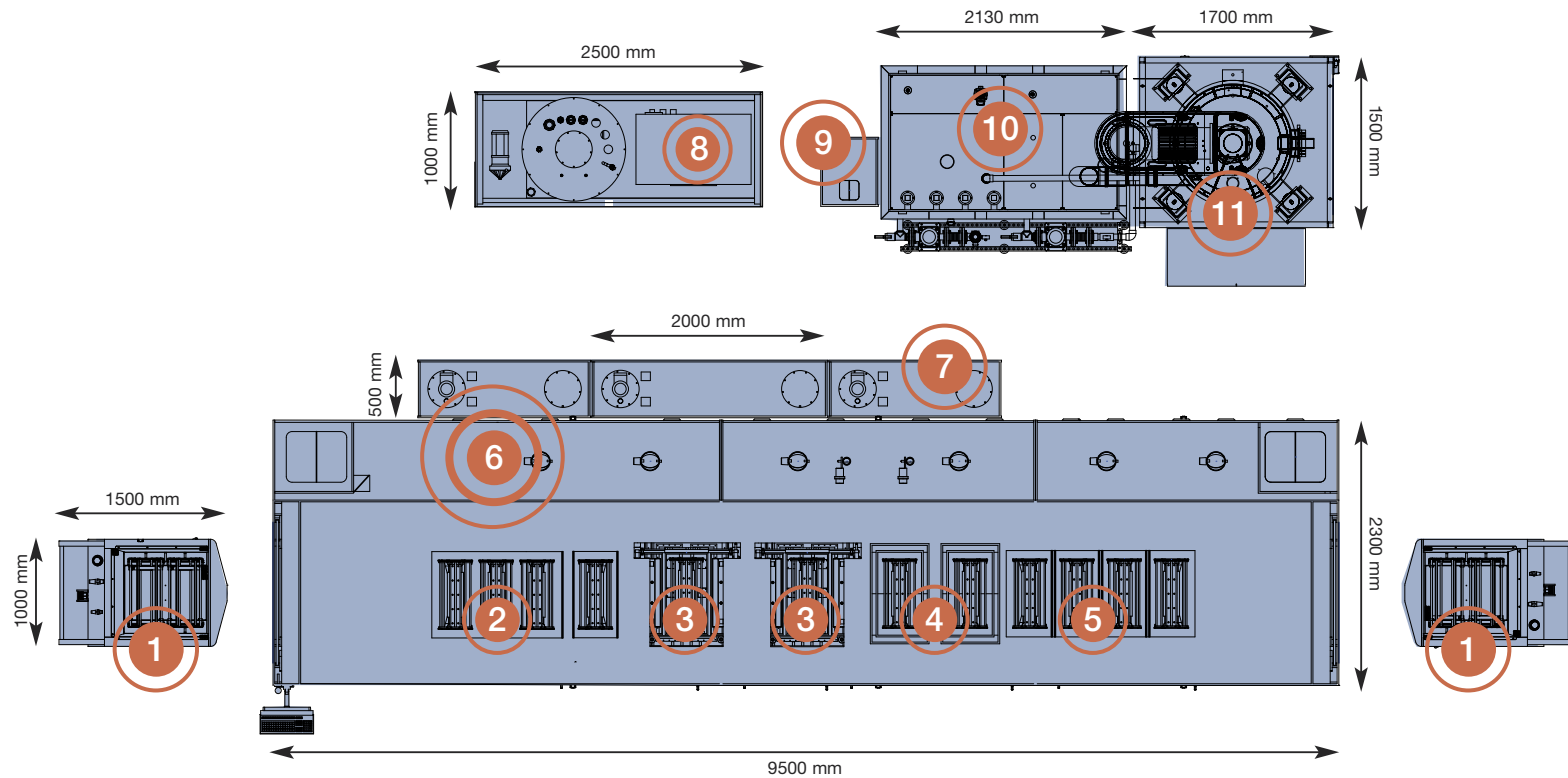
10 Dirt and pure water tanks

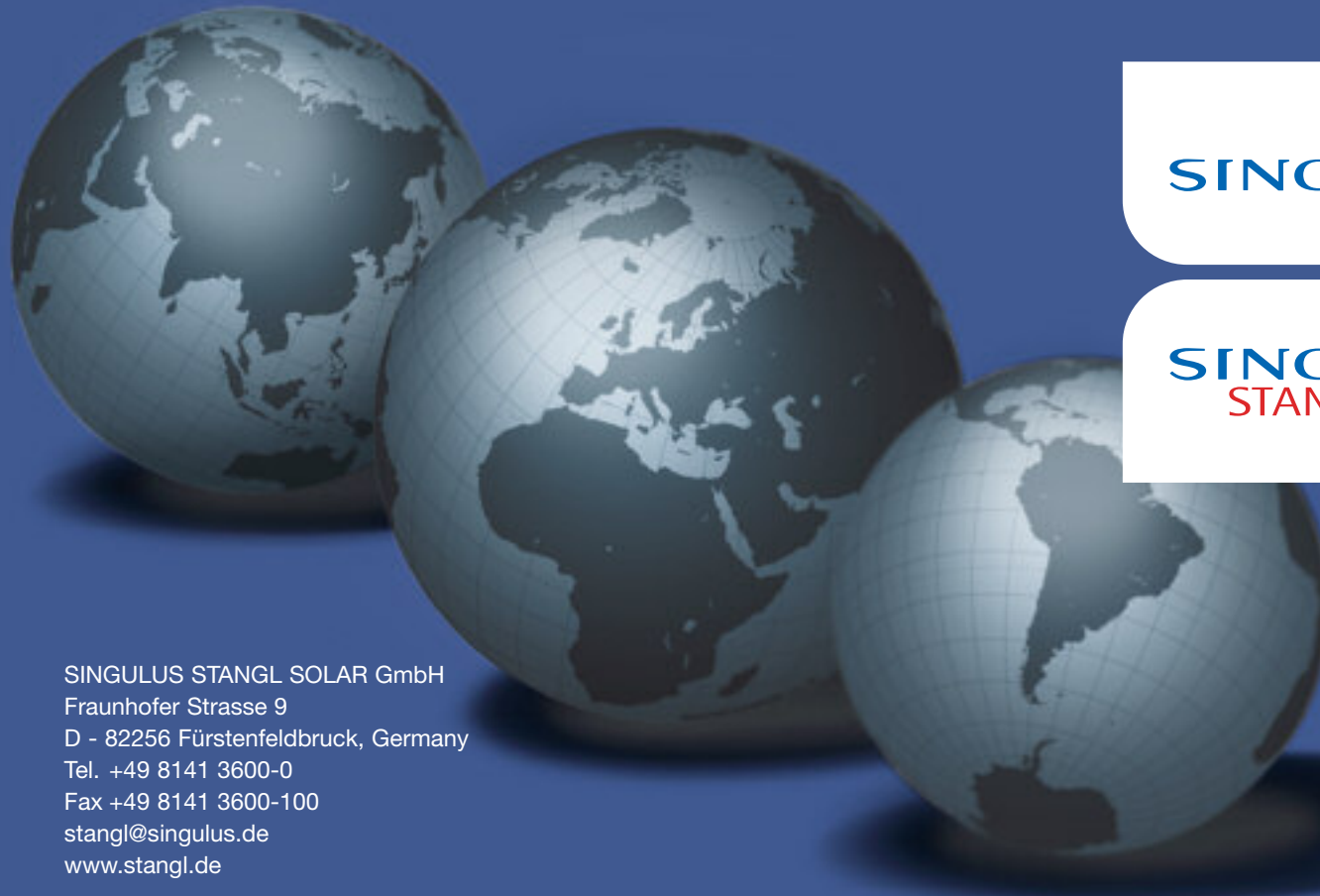
11 Centrifuge

- _ All discharge water from the first half of the STANGL Pre-Cleaner can be given to this recycling system.
- _ The system consists of
 - _ A professional centrifuge for separation of solid material from liquid
 - _ Sludge cake cart for disposal of solid material
 - _ Dirt water tank
 - _ Pure water tank with heating system
- _ The system can process up to 200 l/min of dirt water
- _ By the use of this system total fresh DI consumption per wafer block is approx. 200 liters (depending on cleaning cycle)
- _ Autonomous operation with own PLC station
- _ Communication to main automat via Profibus coupling
- _ Optional support for recycling of the SiC/Si sludge

Main Features	GERULUS PC/DG 3600	GERULUS PC/DG 7200
Dimension L/W/H mm:		
Wet bench	7000/2300/3060	9500/2300/3060
Hot DI Water Station	2460/1000/2000	
Recycling System/ Surfactant Station	3800/1900/2800	1000/1000/2500
Option: Waste Water Pump Tank	2000/500/600 per unit	
Capacity:	3 blocks per hour	6 blocks per hour
Wafer Material:	Si (multi & mono) t = 150–250 μm 100x100 mm, 125x125 mm, 156x156 mm, 210x210 mm	
Slurry Types:	PEG-based, water based, oil based	

Main Features	GERULUS PC/DG 3600	GERULUS PC/DG 7200
Glue Types:	water soluble acid soluble	
Batch Size:	1 block	1 block
Utilities:	N ₂ , CDA DI Water, tap water Surfactant, glycol (optional) HAC (glue dependant) Waste Drains Electrical power 400 VAC 3/PE	
Exhaust:	3400 m ³ /h	4900 m ³ /h
Typical Cycle Time:	20 min	10 min





SINGULUS 

SINGULUS
STANGL SOLAR 

Headquarters

SINGULUS TECHNOLOGIES AG
Hanauer Landstrasse 103
D - 63796 Kahl, Germany
Tel. +49 6188 440-0
Fax +49 6188 440-110
sales@singulus.de
www.singulus.de

SINGULUS STANGL SOLAR GmbH
Fraunhofer Strasse 9
D - 82256 Fürstenfeldbruck, Germany
Tel. +49 8141 3600-0
Fax +49 8141 3600-100
stangl@singulus.de
www.stangl.de

Affiliated Companies

China

SINGULUS MANUFACTURING
GUANGZHOU Ltd.
Tel. +86 20 34518-830
frank@singulus.com.cn

France

SINGULUS TECHNOLOGIES
France S.A.R.L.
Tel. +33 3 893111-29
singulus@club-internet.fr

Great Britain

SINGULUS TECHNOLOGIES UK LTD.
Tel. +44 1793 7842-00
brian.walsh@singulusuk.com

Italy

SINGULUS TECHNOLOGIES
ITALIA S.r.l.
Tel. +39 071 79303-12
info@singulus.it

Latin America

SINGULUS TECHNOLOGIES
Latin America Ltda.
Tel. +55 1121 6524-10
rodolfo.mignone@singulus.com.br

Netherlands

SINGULUS MASTERING B.V.
Tel. +31 407 5014-00
info@singulus.nl

Singapore

SINGULUS TECHNOLOGIES
ASIA PACIFIC PTE LTD.
Tel. +65 674 119-12
singulus@singnet.com.sg

Spain

SINGULUS TECHNOLOGIES IBERICA S.L.
Tel. +34 936 7500-25
singulus@singulusib.com

Taiwan

SINGULUS TECHNOLOGIES
ASIA PACIFIC PTE LTD.
TAIWAN REPRESENTATIVES OFFICE
Tel. +886 2 274833-66
sales@singulus.com.tw

United States and Canada

SINGULUS TECHNOLOGIES INC.
Tel. +1 860 68380-00
sales@singulus.com