



Special Plastic Module for
semiconductor industry

S.P.M. s.r.l.

Automatic Wet Benches

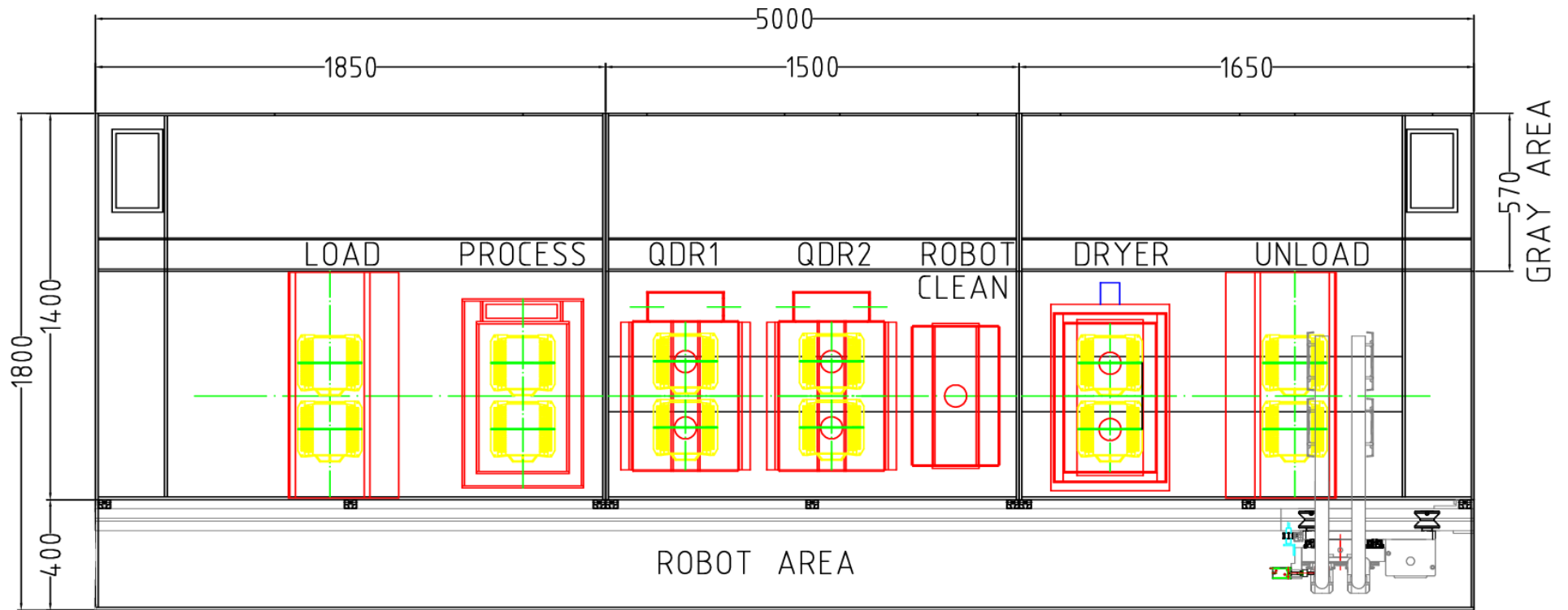


Acid - Alkaline

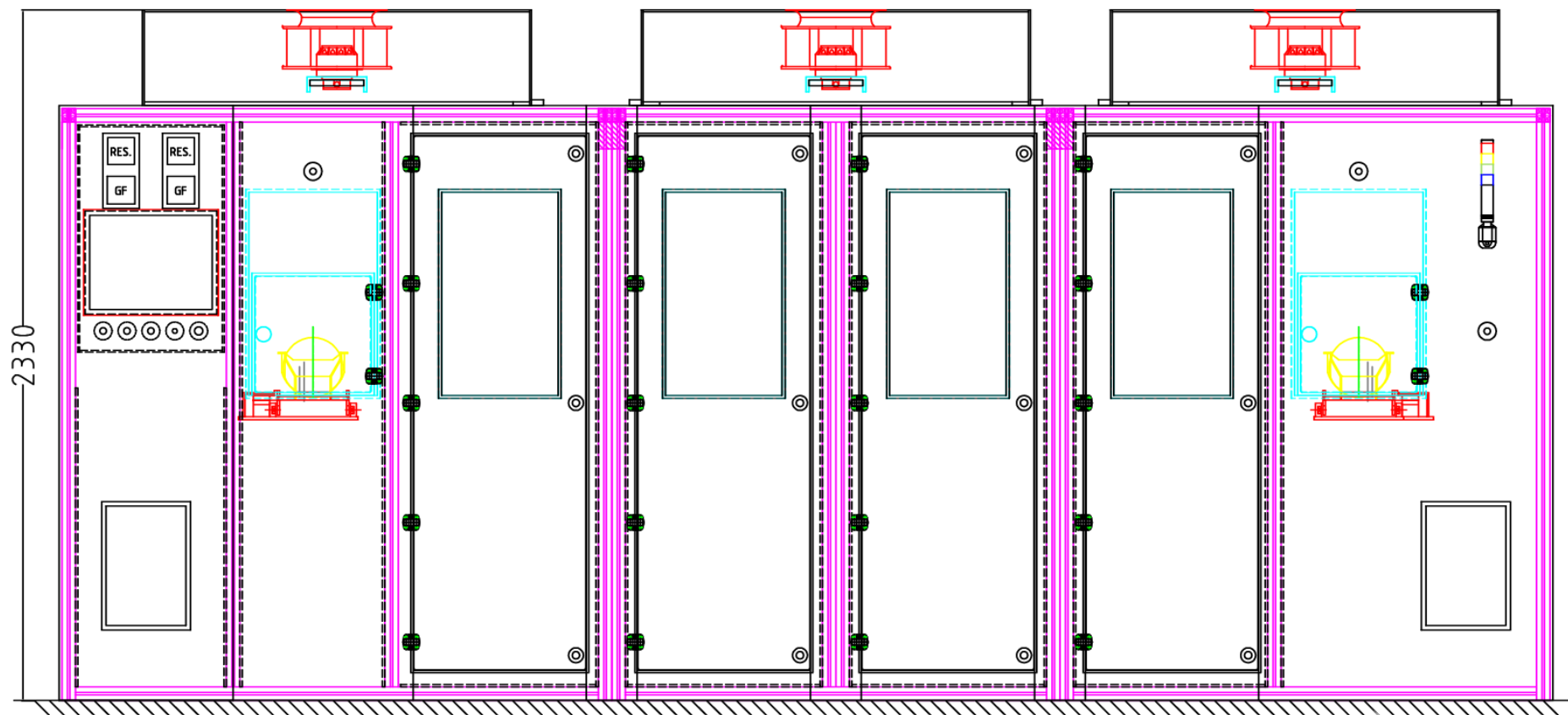


Solvent

Automatic Wet Benches can be realized in different versions according to customer needs and chemical types. For solvents we normally adopt stainless steel materials according with safety rules in term of anti-fire protection. With Acids-Alkalines we use specific corrosion resistant plastics materials. In both case we use just high performance material that guaranteed no chemical contamination or degradation.



Typical wet bench composition for BOE process. In this drawing: 1 process tank, 2 Quick Dump Rinse tank and 1 dryer.





Process tanks can be realized by SPM in agreement with customer specifications: we can shape tanks according to dimensions, materials, chemicals, and temperature.

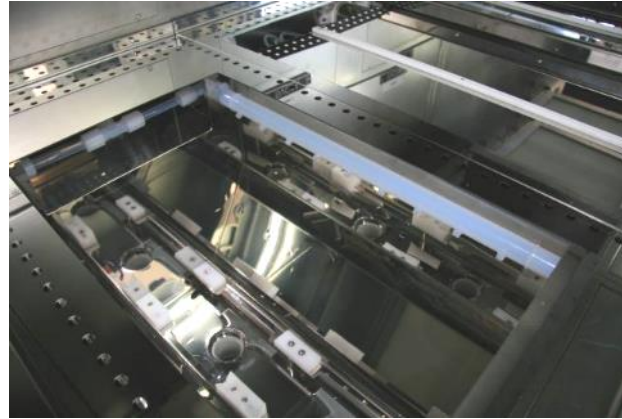
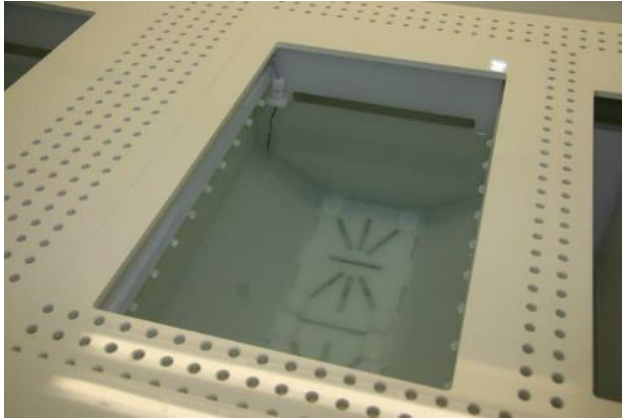


Process tanks can be equipped with:

- | | | |
|-----------------------------|---------------------------|------------------------|
| ▣ Level sensors | ▣ Heater | ▣ Solution preparation |
| ▣ Temperature sensor | ▣ Pump | ▣ Ultrasounds |
| ▣ Solution automatic refill | ▣ N2 Bubble | ▣ Chilling |
| ▣ Automatic cover | ▣ Up/Dw carrier agitation | ▣ Vapour condensation |



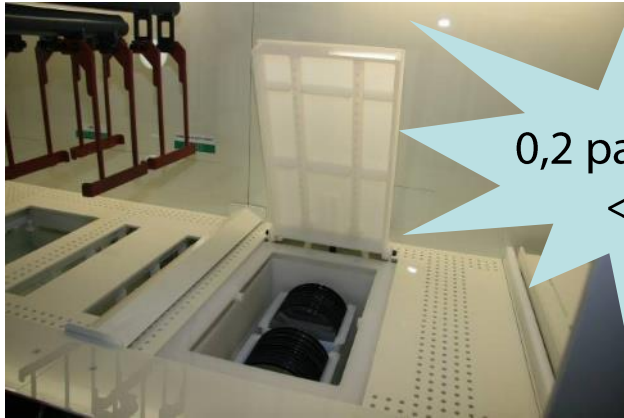
Rinse tanks can be realized by SPM in agreement with customer specifications: we can shape tanks according to dimensions and materials.



Rinse tanks can be equipped with:

- ▣ Level sensors
- ▣ Resistivity meter
- ▣ N2 bubble
- ▣ QDR: quick dump rinse
- ▣ PFA top spray bars
- ▣ Flowmeter
- ▣ HOT H2ODI
- ▣ Overflow 360°
- ▣ Ultrasounds

Different type of dryer can be installed into wet benches. SPM dryer can be configured in plastic material, SS316L or SS316L PFA covered.



0,2 particles/cm²
<0,3μm

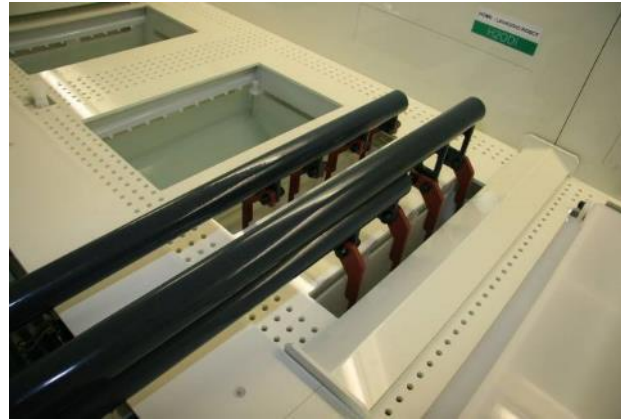


Dryer is equipped with:

- ▣ N2 Heat exchanger
- ▣ Temperature sensor
- ▣ PFA top spray bars
- ▣ Automatic cover



Robot arms cleaning is performed before carriers load and unload in order to warrant no contamination between process and on wafers.



Robot arms cleaning station is equipped with:

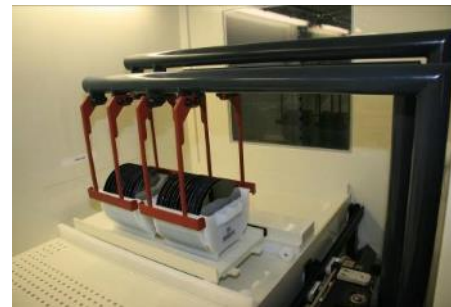
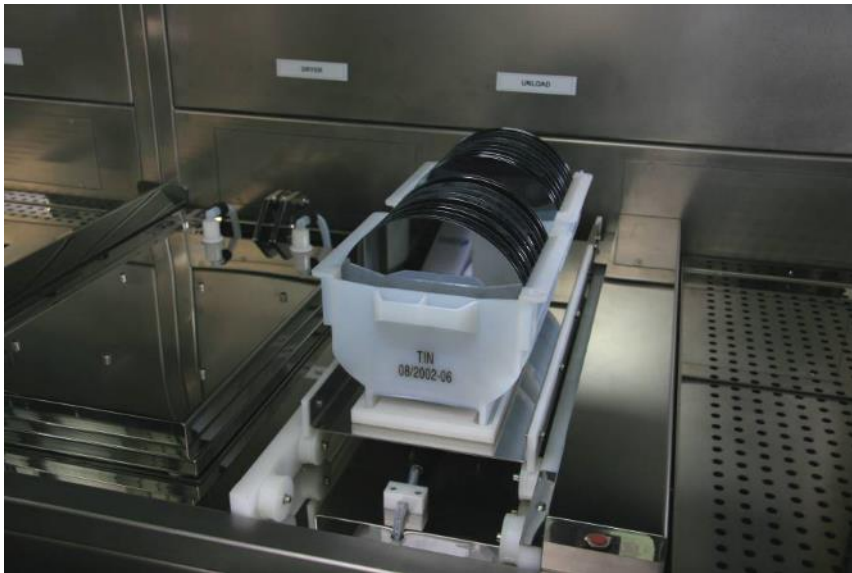
- ▣ Special rinse tank
- ▣ Level sensor
- ▣ PFA top spray bars for drying
- ▣ Automatic activation sequence

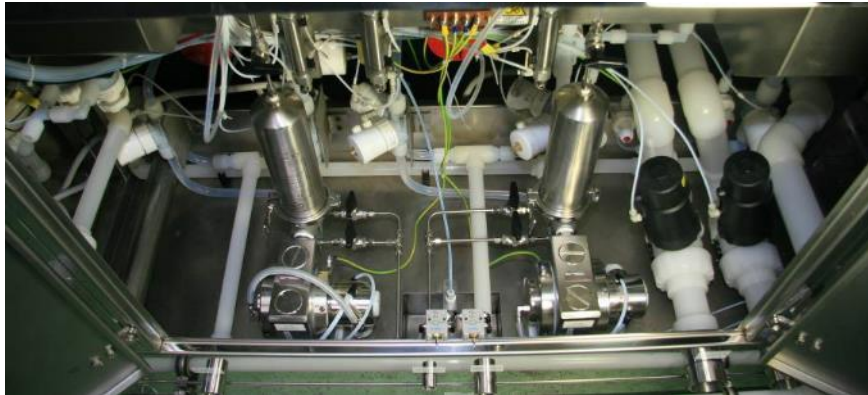


Robot is entirely assembled and designed by SPM. 2 servomotors control vertical and horizontal movements with extreme accuracy, high speed and smooth movements. Robot arms are made in SS316L for solvents process, PFA - HALAR covered for acids/alkaline process. 3 pneumatic actuators control arms movements. Carriers presence is always checked with reed sensors placed on actuators. Robot is installed in front section of wet bench ensuring better exhaust performance and easier maintenance operations.



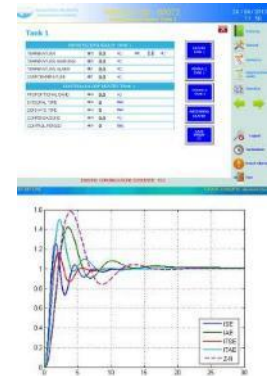
Load station is composed by a pneumatic actuator that moves a table capable of 2 carriers. Presence sensors confirm to the robot the quantity of carriers loaded. Safety electro-mechanical interlocks are placed on transparent door to avoid accidental openings while the robot is travelling to load area.







Tanks can be thermo-regulated if required by the process. There are several way to heat / chill the solution. Direct or indirect heating solutions can be configured according to chemical and required temperature. Stability of temperature is always ensured thanks to high performance thermo-regulators control card installed into PLC. Redundant temperature sensors warrant a total safe process.





Depending on preferred/available chemical filling method is possible to configure different options:



Automatic filling from CDS



**Automatic Filling from Canister-
Bottle-Buffer tanks**



Manual Filling

We can provide full support to dialogue with CDS, provide integrated filling system from bottles, canisters and custom buffer tanks. Manual filling is also possible. In case of automatic filling spiking behavior are fully customizable by touch screen parameters.

SPM has long experience with chemical mixing; we can provide dosing system integrated directly in tank filling-spiking:



**Electromagnetic
flowmeter**



**Coriolis Mass
flowmeter**



**Karman Vortex
flowmeter**



**Contactless Ultrasonic
flowmeter**



**Paddlewheel
flowmeter**



Volumetric

If necessary we can provide different types of automatic dosing systems that permit to create personal mixture of chemicals. With these systems is possible to practice automatic spikes with different percentages with extremely high precision directly programmed from touch screen.



Chemicals / H2ODI Dosing scope / benefits:

- On-Site-Mixing
 - Batching
 - Spiking
 - Overflow control
 - Process basin / recipe preparation
 - Automated / reproducible
 - Complete, integrated dosing process control system
-
- Process monitoring also in very dynamic flow situations
 - Controlling of specified plant consumption values
 - Measurement of consumption values as a basis for the logistics of inventories





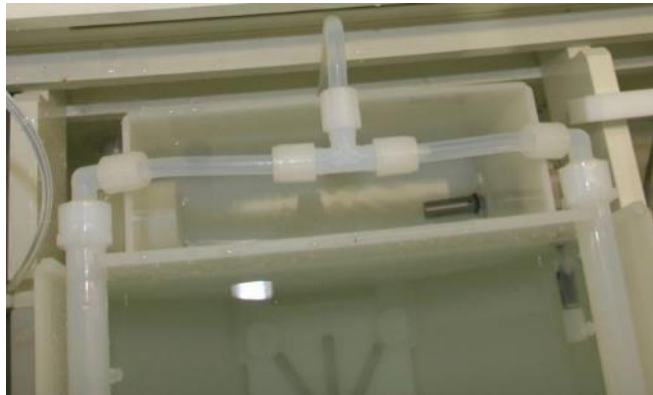
In-Line Chemical solution concentration monitor

SPM can provide a wide range of inline concentration monitors for the different high and low concentration wet etching processes for Low-k, Al, Oxide/Nitride, Poly Silicon etc. In addition to monitors for wet etching a wide range of monitors for the different cleaning steps, for example removal of particles, resist, metallic layer, organic layers, oxides, polymers etc. are also available.

HORIBA

Resistivity Meter

SPM can provide rinses tanks with resistivity meter in order to measure H2ODI quality and determine if all chemical traces has been removed.





Solution recirculation can be done with different types of pumps:



Diaphragm pumps



Centrifugal pumps



Magnetic levitation pumps



N2 Prepressurization

We can install different types of pumps according with chemical and process characterization/necessity. It's possible to install pressure and flow sensor to monitor pump and understand filters lifetime and pumps problems. Stroke counter sensor/ internal leaks are also available for diaphragm pumps.



Air operated diaphragm pumps are reciprocating pumps where the working elements are flexible diaphragms. The drive is by means of compressed air acting directly upon the diaphragm.

Diaphragm pumps:

- ▣ have good suction lift characteristics
- ▣ can handle sludges and slurries with a relatively high amount of grit and solid content.
- ▣ have good dry running characteristics.
- ▣ are low-shear pumps.
- ▣ can be up to 97% efficient.
- ▣ have good self priming capabilities.
- ▣ can handle highly viscous liquids.
- ▣ cause a pulsating flow





It's possible to use different pump materials according with chemicals:

Polyethylen (PE)

PE is very tough and exceptionally resistant to wear, has low water absorption capacity and displays good general resistance to chemicals. Only such strong oxidants as nitric acid, oleum and halogens can damage PE. For explosion-proof areas (ATEX conformity) and for flammable liquids, PE conductive as housing material is available.

Polytetrafluorethylen (PTFE)

PTFE has a smooth surface, very low friction coefficient, is physiologically safe, can be used over a wide range of temperatures and displays virtually universal resistance to chemicals. For explosion-proof areas (ATEX conformity) and for flammable liquids, PTFE conductive as housing material is available.

Stainless Steel

Stainless steel 1.4408/SS316 (G-X 6 CrNiMo 18 10) is a cast steel that is resistant to corrosion and acids and is frequently used for fittings and pump casings because of its good general chemical stability.





Mag drive centrifugal pumps are made of plastic materials (Polypropylene and PVDF) and are suitable for high corrosive liquids. Thanks to the innovative mag drive system the maintenance costs are reduced. The transmission of the motion occurs through magnetic joints without using mechanical seals. This guarantees the maximum safety and efficiency. The pumped liquid has to be clean and without solids in suspension.

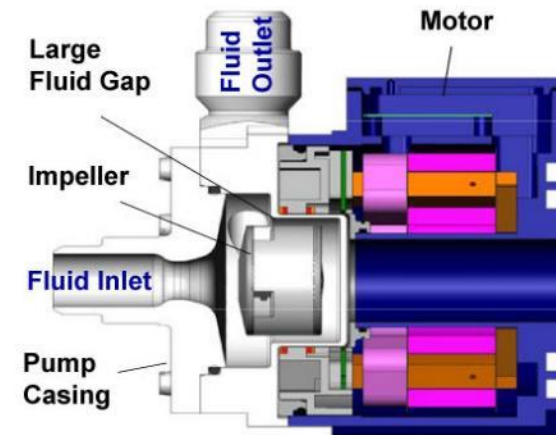
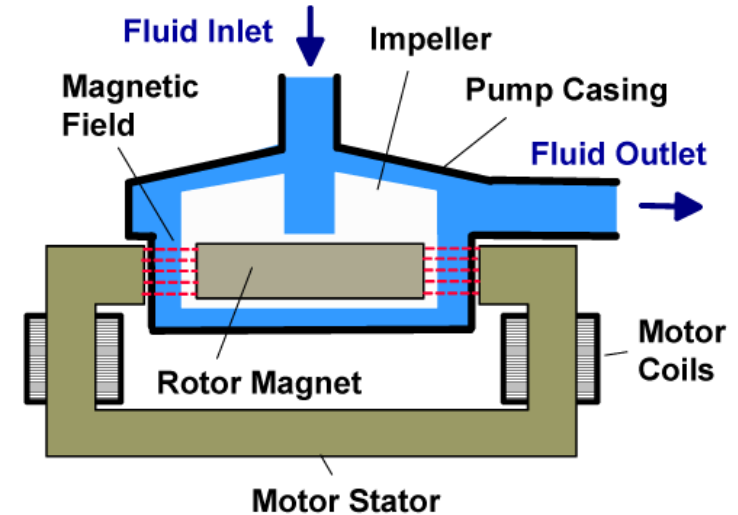
- ❑ Materials available: PP/PVDF
- ❑ Materials in contact with the liquid; Casing and impeller: PP/PVDF; O.ring EPDM/VITON; Static shaft Al203; Bushing PTFEC
- ❑ Max flow 50m³/h
- ❑ Temperature: PP max 70°C – PVDF: max 90°C
- ❑ Main problem: dry running





System Benefits:

- Extremely low particle generation due to the absence of mechanically contacting parts
- Increased equipment uptime
- Lower maintenance costs by eliminating valves, bearings, rotating seals and costly rebuilds
- Reduced risk of contamination due to the self-contained design with magnetic bearings
- Very gentle to sensitive fluids due to low-shear design
- No narrow gaps and fissures where particles or microorganisms could be entrapped
- Smooth, continuous flow without pressure pulsation
- Electronic speed control
- Compact design compared to pneumatic and magdrive pumps. Saves valuable space in process tools by having a smaller footprint
- Proven technology in medical and semiconductor industry (MTBF 50-100 years)





Valves involved into hydraulic circuit can be selected according to process necessity:



Metal free valves



SPM Valves



Stainless steel SS316L valves

We normally install air operated and manual valves. We use diaphragm, ball and butterfly valves according to needed flow/pressure and chemical characterization. For high purity we install metal free valve that are completely realized in plastic materials.



Metal free valves:

Metalfree valve pneumatically operated ultra pure diaphragm valve has a complete PFA-HP body. All medium wetted parts are made of PFA-HP or PTFE (diaphragm). The exterior actuator parts of the piston actuator are made of PVDF.

Features

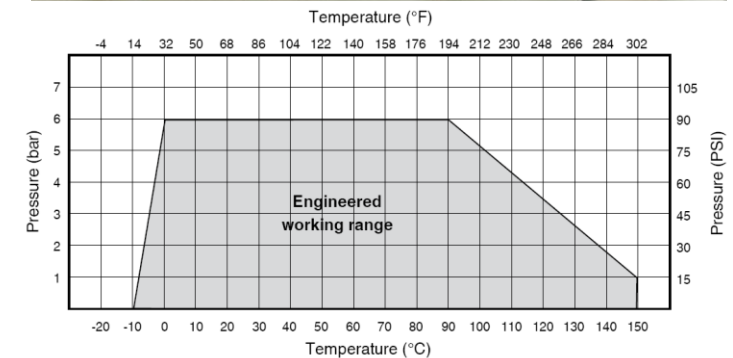
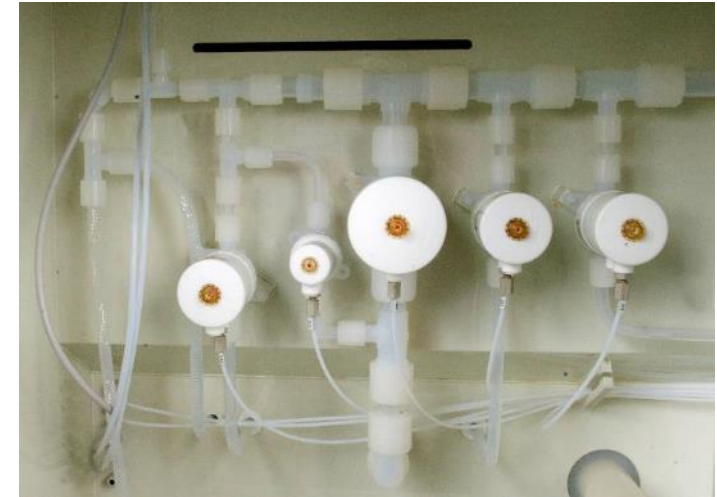
- Specifically designed for high purity media
- Metal free
- High flow capability
- Union nuts / flare connections compatible with all current designs
- Manufactured under cleanroom conditions

Advantages

- Minimal contamination
- High Cv/Kv value
- Minimal deadleg

Thus you achieve:

- Brief equipment rinsing times
- Clearly improved Kv values (High Flow)
- High "MTBF"
- Reduced costs



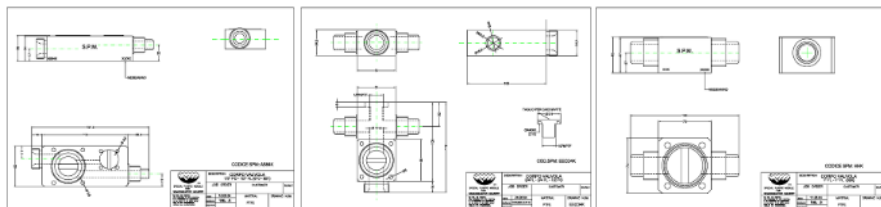


SPM valve bodies:

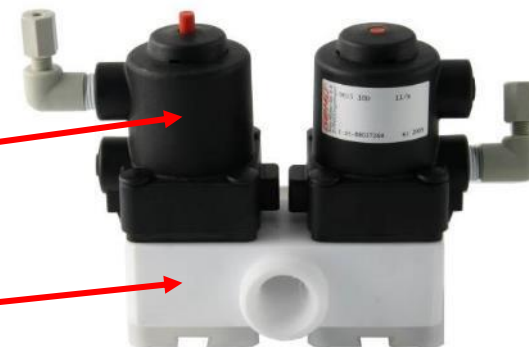
When metal free valves are not required we can install our homemade valve bodies. Also with that valves all medium wetted parts and housing made of plastic.

Advantages:

- ▣ Cheaper than metal free valves
- ▣ Custom bodies design (over 40 models)
- ▣ Compact design



SS316 assembly screws covered by PTFE protection



Diaphragm valve

PTFE body



SPM wet benches are equipped with exhaust depressure sensor(s). We can provide also automatic system to keep constant the exhaust value:



Automatic shutter controlled constantly by PLC according to value read from analog pressure sensor



Standard differential pressure switch

Automatic system include a differential pressure sensor with 4-20mA output. PLC constantly receive depressure value and change accordingly shutter opening/closing to keep constant wet bench internal depression. Set points can be programmed from touch screen. Standard sensor just rise up an alarm in case of low exhaust.



SPM wet benches can be equipped with laminar flow.



Brushless motor fan for: optimal flow regulation, low noise, reduced power consumption.



**Pressure sensor
with 4-20mA
output**



**HEPA filter for Class 100 Cleanrooms
(ISO5 for ISO 14644-1)**

Laminar flow permits to warrant a better exhaust control and safety for operators. Laminar flow ensure also lower particle contamination on wafers. With class 100 HEPA filter, air inside the wet bench is perfectly filtered.



The sixth selection regards the general control philosophy:

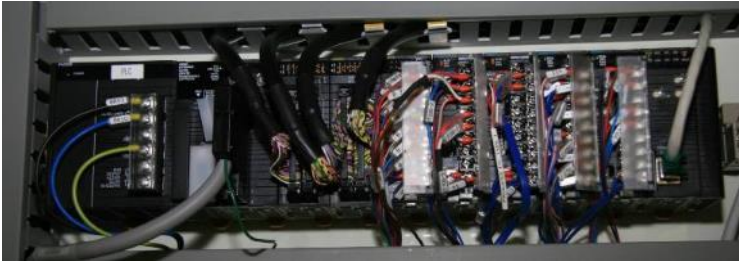


Integrated



**Separated according to ATEX
rules**

Our Automatic wet benches are ruled by PLC. Robot movements are ensured by servo-controlled motor. HMI interface is composed by a Omron o.s. proprietary touch screen or optionally by an industrial pc with touch screen that permit a more powerful and flexible software.



OMRON PLC



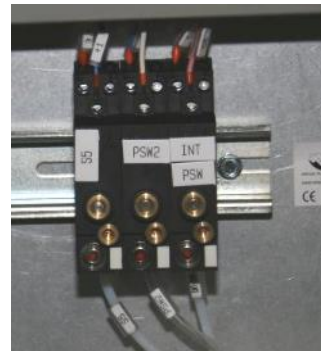
**SMC pneumatic
electrovalves**



**OMRON Safety relay for
emergency management**



**BOSCH REXROTH
SERVOMOTOR**



**CDA (and N2) pressure
switches**

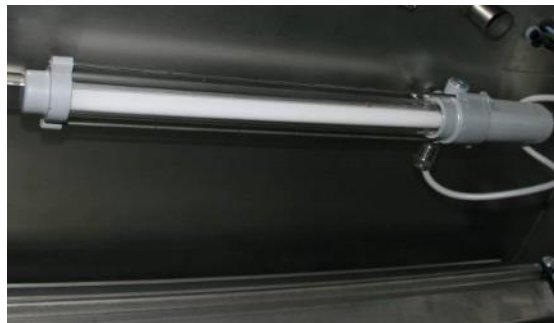


UPS

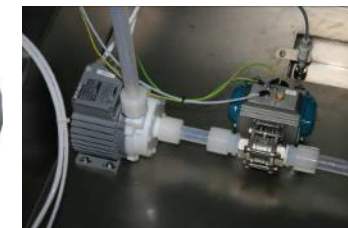
PLC control entire function of the WET bench. From the touch screen is possible to check the status of the system, change settings and do maintenance operations. All WET benches are provided with emergency buttons managed by safety relays.



Doors opening sensor in pneumatic version



Neon lamp(s) in ATEX version



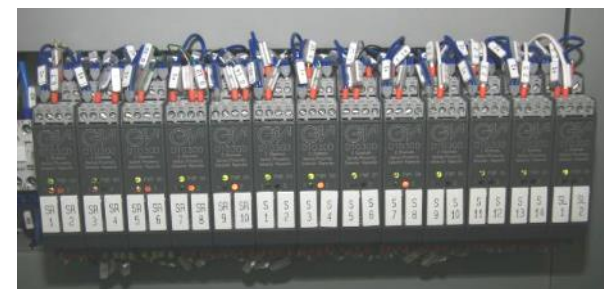
Special air valves ,Magnetic Levitation or Diaphragm pumps in ATEX version



FLAME DETECTOR fully ATEX compliant



Pressure and Flow sensors ATEX compliant



Intrinsic safety barrier for electrical sensor power supply ATEX compliant

We can build our equipment referring to ATEX rules. In this case we will use only pneumatic and/or certified components.





SPM Automatic wet benches are ruled by OMRON PLCs. HMI interface is an industrial pc with touch screen programmed with Wonderware Intouch or Progea Movicon.

Software is developed internally by SPM engineer and so it is fully customizable according to customer needs (even after installation). Optionally wet benches can be SECS-GEM compliant.



HSMS/SECSII
SECSI
GEM





We can provide our equipment with an industrial VPN router in order to establish a remote connection that permit to us to check and modify PLC software. This links is totally secure, in fact is based on a encrypted OpenVPN (SSL 128bit) between Talk2M servers (eWon) and your fab.



WET BENCHES FOR ACID/ALKALINE PROCESS

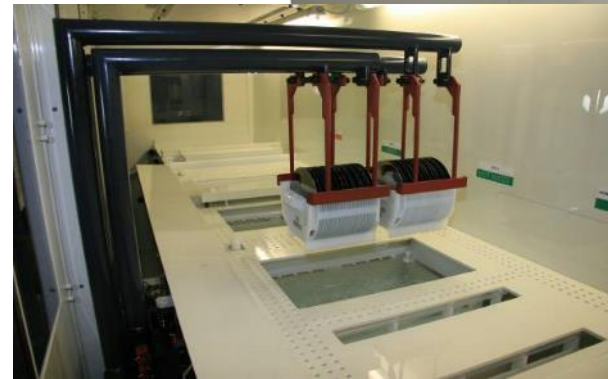


*Polyamide removal with
microstrip 5002 and
Photoresist removal with
microstrip 3001*

Full automatic wet bench "KOREA Model" with APET dryer
installed at STMicroelectronics– Agrate ITALY



Full automatic wet bench BOE 7:1 etch
installed at STMicroelectronics – Agrate ITALY





Automatic wet bench– Carousel version “PALANGA Model” installed at
VILNIAUS VENTOS PUSLAIDININKIAI – Vilnius LITHUANIA



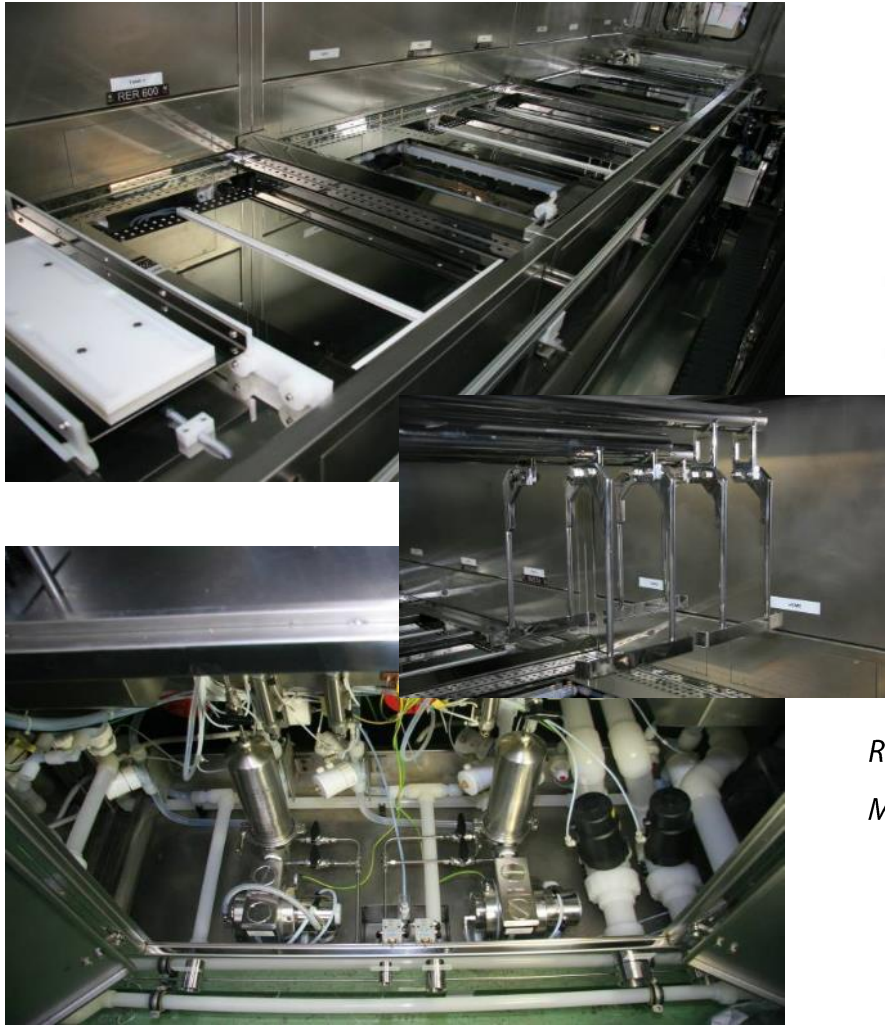


*Alkaline and Acidic texturing with
automatic chemicals dosing system*

Full automatic wet for Solar cells Texturing "JAKARTA Model"
installed at IRYSolar – Montpellier FRANCE



WET BENCHES FOR SOLVENT PROCESS



RER600

Microstrip 3001



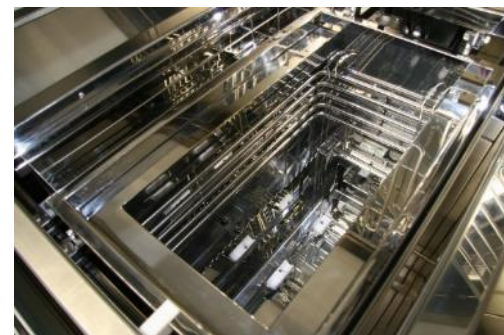
Full automatic wet bench for solvents
installed at STMicroelectronics – Agrate ITALY



Full automatic wet bench for solvents
installed at CEA LITEN – Grenoble FRANCE



*Wafer Bond removal
process*



Wet bench for MEMS installed at STMicroelectronics Agrate - ITALY



*Polimer removal
process*

Wet bench for MEMS installed at STMicroelectronics Agrate - ITALY



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Ambrogio Sala

President



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semiconductor industry

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