

Special Plastic Module for semiconductor industry s.r.l.



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

**TCO parts cleaning
department**



COMPANY OVERVIEW



▣ SPM, acronym of Special Plastic Module for semiconductor industry, is an Italian company engaged to provide help to semiconductor and solar cell industries, universities, medical , chemical and research labs.

▣ Combining expertise and latest technology with extreme cleanness, SPM obtain some of the most highly qualified equipment performances.

▣ SPM has 21 YEARS of experience in this sector and is every day up to date spending much time founding new technology and innovative solutions to perform better things at lower possible costs.

▣ The company spirit is to build machines perceiving real needing, to completely satisfy our customers.



COMPANY EXPERTISE

- ▣ Long term experience in CDS (Chemical Delivery System), premixing unit and microfiltration;
- ▣ Complete manufacturing of wet benches in different version completely tailored according with customer requirements (for semiconductor or solar industry);
- ▣ Automation robot and handling ecc.
- ▣ Innovated quartz cleaning systems and storage;
- ▣ Carrier and box for wafer clean up machines to perform a fully cleaned process;
- ▣ Special filling system to distribute chemicals;
- ▣ Installation of double piping line;
- ▣ Service and complete assistance;
- ▣ Plasma etch (cleaning unit in vertical or horizontal version)



MAIN CUSTOMERS

U.S.A.



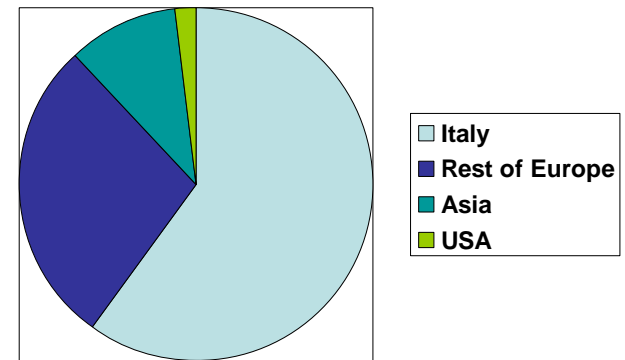
Europe



Asia



SPM has customers all over the world, best sales are in Europe, especially in Italy, following in Southern Asia, primary in Singapore and some customers in U.S.A.





U.S.A. MAIN CUSTOMERS



Dallas – TEXAS U.S.A.



FAIRCHILD
SEMICONDUCTOR

Boston – U.S.A.



(General Semiconductor)

Long Island – U.S.A.

EUROPE MAIN CUSTOMERS

SMC
Siae M. Milan -Italy

AIR PRODUCTS
Milan -Italy

DNP
Agrate B. (MI) -Italy

**B. KESSLER
FOUNDATION**
Trento



SUMITOMO ELECTRIC
Sumitomo Metal Epitech
Limay -France

AIR LIQUIDE
Milan -Italy

LPE
Bollate (MI) -Italy

CORECOM
Milan -Italy



VILNIAUS VENTOS PUSLAIDININKIAI

Vilnius -Lithuania

numonyx
ST

Agrate Brianza (MI) -Italy
Castelletto (MI) -Italy

**saes
getters** Lainate (M) -Italy

PIRELLI
Sesto S. Giovanni (MI) -Italy



Milan University -Italy



Mestre (VE) -Italy

Micron
Avezzano (AQ) -Italy



Catania -Italy

HelioSphera
M. Italy s.r.l. - TCO parts cleaning department - Version Dec. 2009

etc
Catania-Italy



MDM Agrate B.-Italy



Algeri University -Africa

VISHAY
Torino -Italy



Modena University -Italy

IRYSOLAR
Montpellier France

**SEMCO
ENGINEERING**

Bologna University -Italy



Arnad (AO) -Italy

olivetti

Novara -Italy

MEMC
TECHNOLOGY IS BUILT ON US

Solterra
Chiasso -Swiss



Rousset -France



PRAMAC
Chiasso-Swiss

AVANEX
San Donato (MI)

Bergamo -Italy

Oslo -Norway

Copenhagen -Denmark

Amsterdam -Netherlands

Brussels -Belgium

Paris -France

Lyon -France

Bordeaux -France

Madrid -Spain

Barcelona -Spain

Valencia -Spain

Sevilla -Spain

Casablanca -Morocco

Rabat -Morocco

Algiers -Algeria

Tripoli -Libya

Valletta -Malta

Sicily -Italy

Palermo -Italy

Naples -Italy

Rome -Italy

Genoa -Italy

San Marino -Italy

Forlì -Italy

Modena -Italy

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ASIA MAIN CUSTOMERS



Shanghai- China

Singapore



India



New Dehli



Shanghai- China



Taiwan



Cebu -Philippines



Philippines



Ho Chi Minh city -Vietnam



Saigon HIGH TECH PARK -Vietnam



VNU (Vietnam NATIONAL University)
Ho Chi Minh city -Vietnam



PHOTOVOLTAIC SECTOR

SOLAR CELLS



- Automatic wet benches for texturing and for PSG removal
- CDS
- Scrubbers
- Manual wet benches
- Semiautomatic wet for solar cells dummies recovery
- Hot drain buffer tanks
- Derivation boxes

THIN FILM



- Sydney Model – TCO parts cleaning
- CDS
- Scrubbers
- Ovens for TCO parts drying
- Sand blaster to clean TCO parts
- Insulation test for thin film panel
- Trolley and baskets for TCO parts
- Acid recovery modules



INTRODUCTION THIN FILM

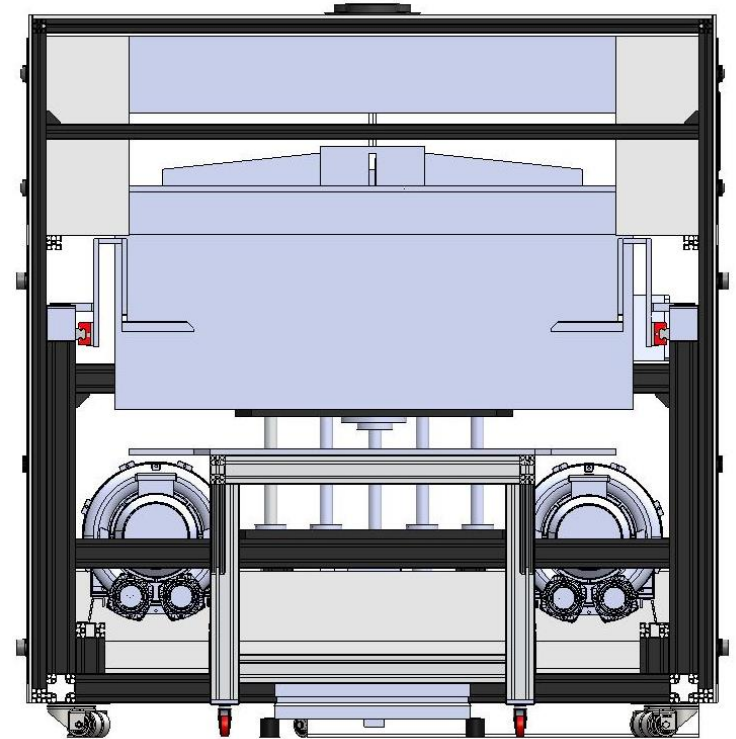
S.P.M. s.r.l. realizes a new machine for thin film technology.

The problem that we solved is how to clean metallic parts from the **œerlikon** TCO1200 machine (*Transparent Conductive Oxide High Performance Layers for Large Area Thin-Film Solar Modules*).

To study a machine that can clean from 1600x1600 300Kg plate to 10x30 20g small parts was a big problem.

What we projected is a completely automatic equipment that has 1 process tank for HNO₃ / Citric Acid, 1 rinse tank with ultrasounds and a dryer module with high air flow.

For the loading, SPM realized a specific trolley and a frame to support 6 customized baskets for small parts handling.



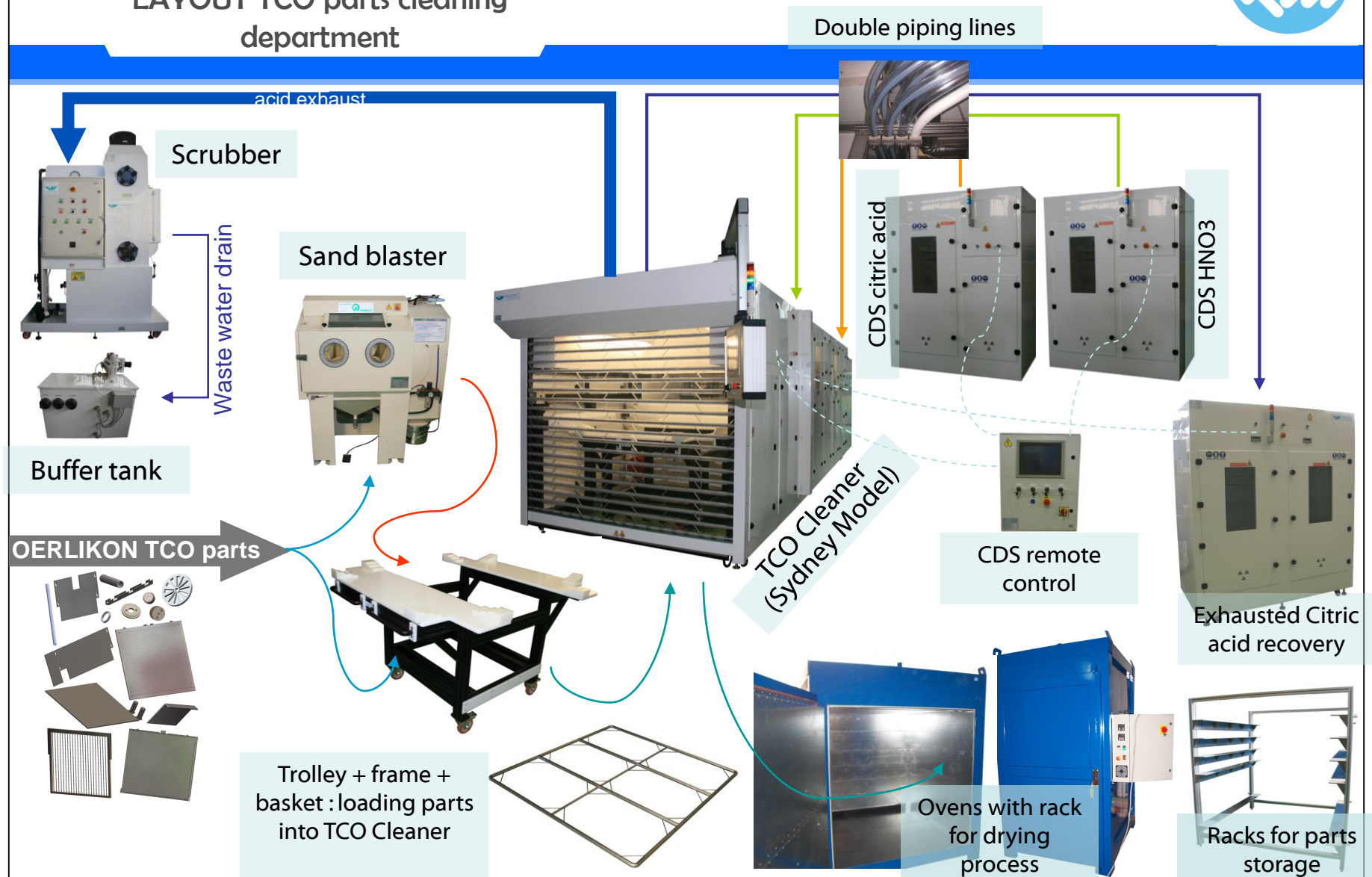


SPM can provide a working department to clean all TCO parts.

The department include:

- ▣ 1 TCO parts cleaning tool (SYDNEY MODEL – MALAGA MODEL – MODULAR SYSTEM)
- ▣ 1 Sand blaster
- ▣ 2 CDS (n°1 for HNO₃ and n°1 for CITRIC ACID) with remote control touch screen
- ▣ 1-2 SCRUBBERS for ecological exhaust fumes
- ▣ Citric acid recovery module (to recover exhausted citric acid in order to dismantle)
- ▣ 2 Ovens for parts drying
- ▣ 2 Racks to store parts (cleaned and dirty)
- ▣ Trolleys, frames and baskets to load parts into TCO cleaner
- ▣ Installation of double piping lines for safety chemical distributions
- ▣ Exhaust connections
- ▣ Eventually buffer tanks for drain problems

LAYOUT TCO parts cleaning department





WHAT WE CLEAN

Parts that need to be cleaned are contaminated by an exposure to a metal organic component (Diethyl zinc), water and Diborane in a vacuum chamber.

The contamination is mostly ZnO (zinc oxide) with some possible traces of metallic Zinc and Boron Oxide.

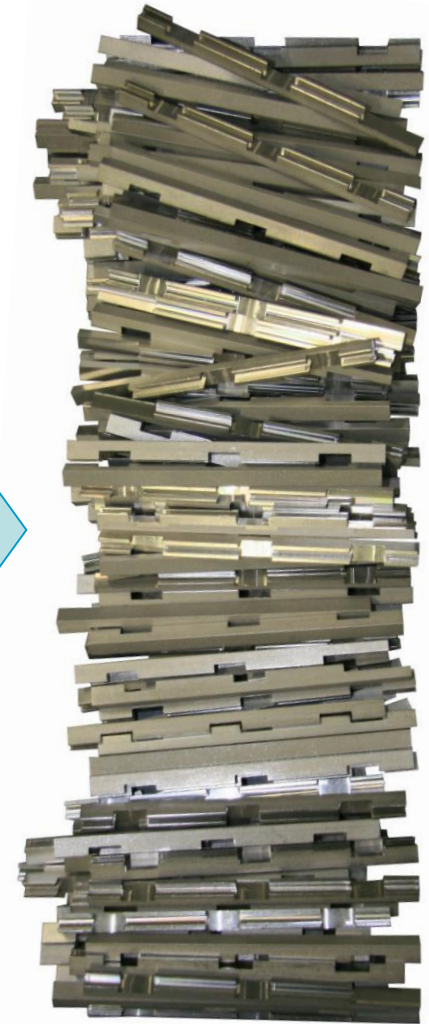
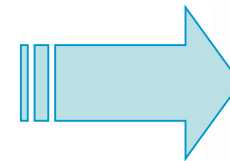
Depending on the process conditions the ZnO may appear as a solid layer, dust or fine particles.

After the cleaning procedures all parts are without any residual deposition, particle free and partially dried. For the completely dry procedure parts need oven treatment.





EDGE BARS



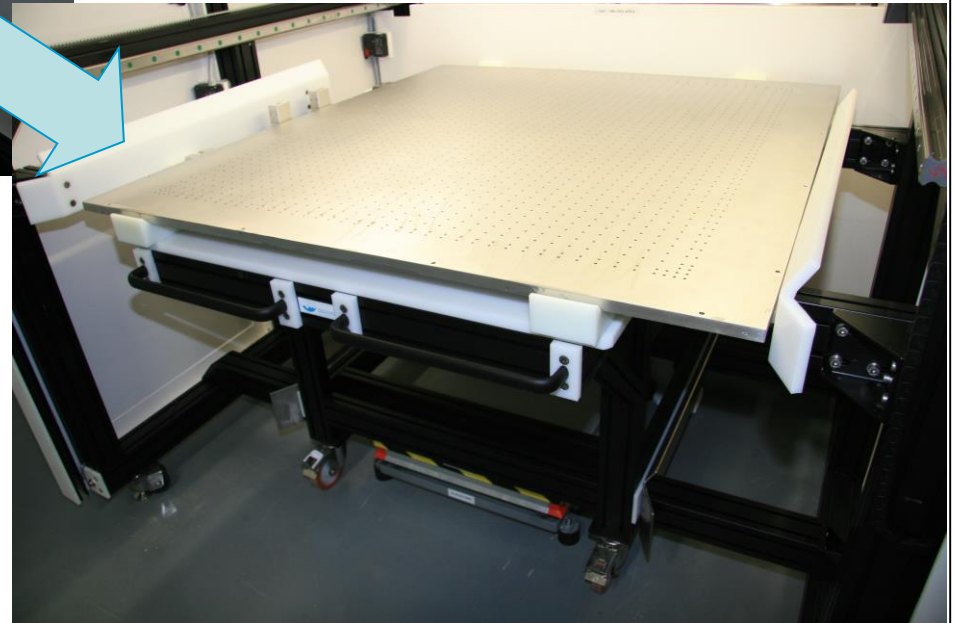
45 min. HNO₃ 15% cleaning process, 10 min.
pre-rinse, 10 min. rinse with ultrasounds



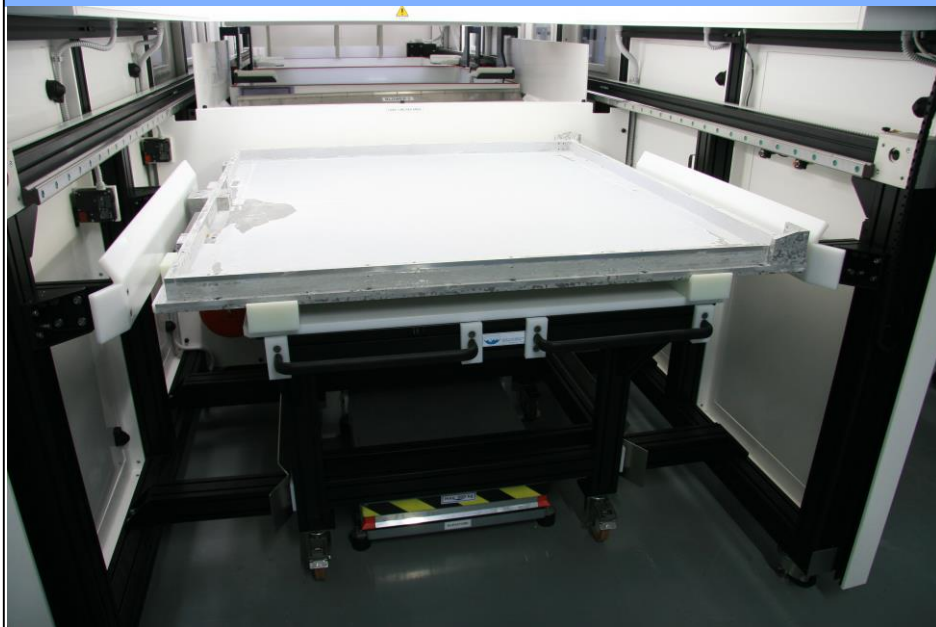
GAS SHOWER PLATE



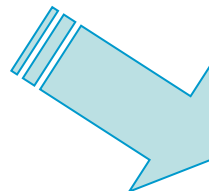
30 min. HNO₃ 15% cleaning
process, 10 min. pre-rinse, 10
min. rinse with ultrasounds



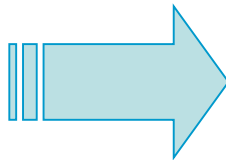
GAS DISTRIBUTION BACK PLATE AND WALLS



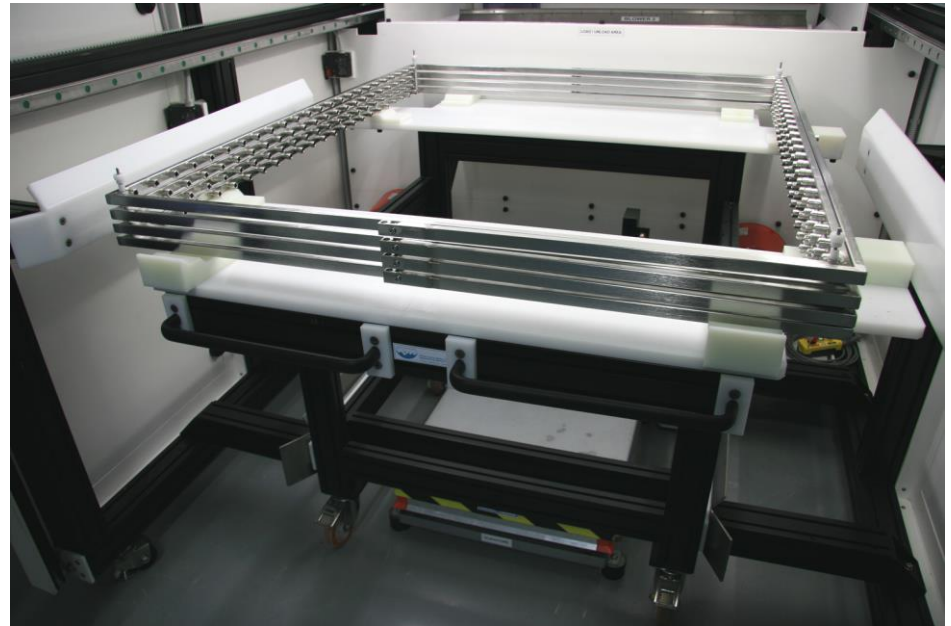
30 min. HNO₃ 15% cleaning
process, 10 min. pre-rinse, 10
min. rinse with ultrasounds



GAS DISTRIBUTOR FRAMES



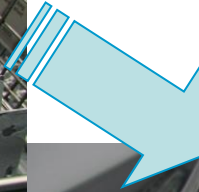
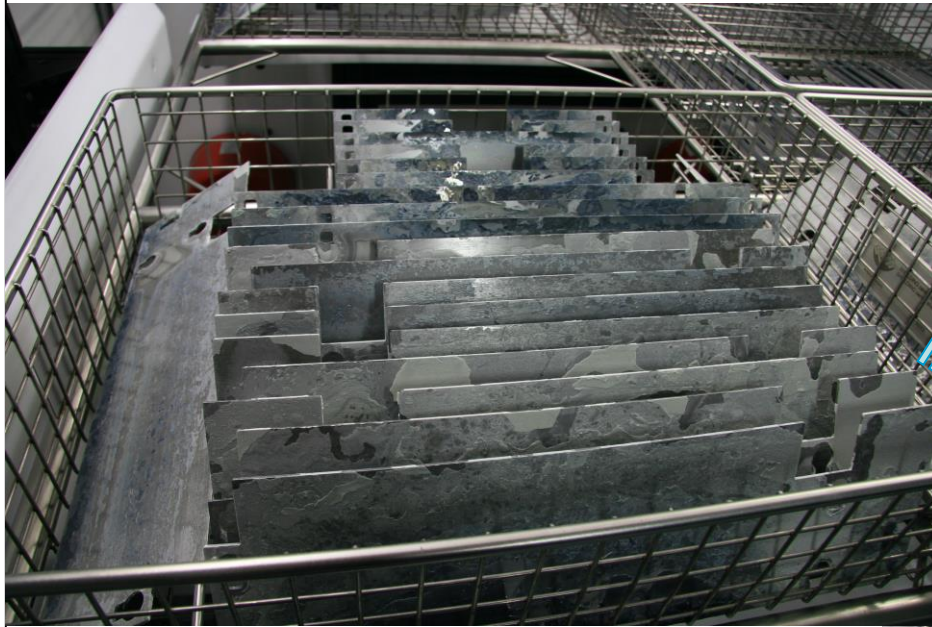
Support that
permits 4 frames
loading at same
time



30 min. HNO₃ 15% cleaning process, 10 min.
pre-rinse, 10 min. rinse with ultrasounds



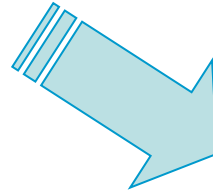
SHIELDINGS



45 min. HNO₃ 15% cleaning
process, 10 min. pre-rinse, 10
min. rinse with ultrasounds



ROLLERS



45 min. HNO₃ 15% cleaning
process, 10 min. pre-rinse, 10
min. rinse with ultrasounds





KIT TYPE "A"

For one TCO:

3 DAYS

56 Edge bar
4 Edge bar with hole

28 Corner edge bar
8 Cover sheet long 1
8 Cover sheet long 2
8 Cover sheet short 1
8 Cover sheet short 2

48 Roller

48 Roller side plate

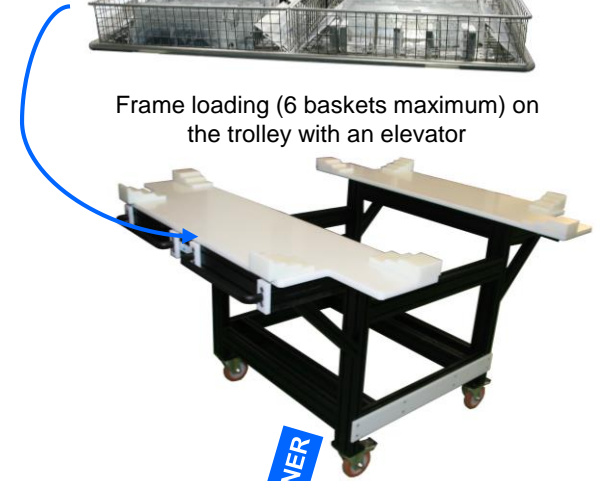


OERLIKON TCO

Baskets loading on the frame



Frame loading (6 baskets maximum) on the trolley with an elevator



TCO CLEANER

Citric acid/HNO₃ + H₂O₂ + dry

Oven for complete drying



KIT TYPE "B"

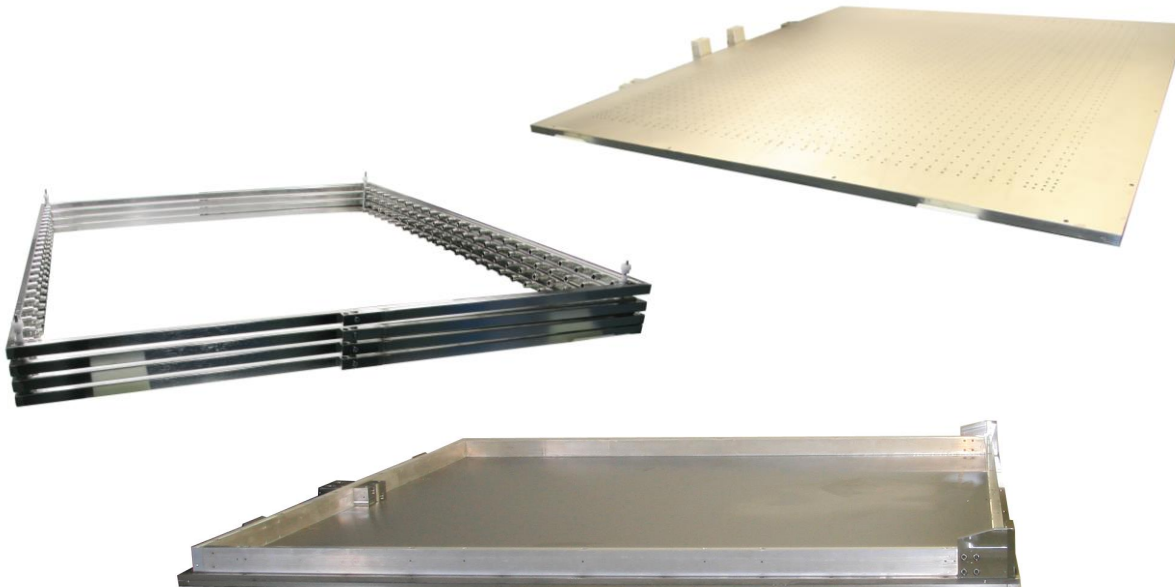
For one TCO:

9 DAYS

OERLIKON TCO

4 Gas mixing volume:

- 4 Gas distributor frames (with 48 holes)
- 4 Gas distributor frames (with 46 holes)
- 4 Gas distributor back plates and walls
- 4 Gas shower plates cpl.



Citric acid/HNO₃ + H₂O DI + dry



Oven for complete drying



KIT TYPE "C"

For one TCO:

90 DAYS

4 Hot plate cpl.

64 Lifting pin cpl.



8 Shielding center long

4 Shielding center short

4 Shielding center short 2

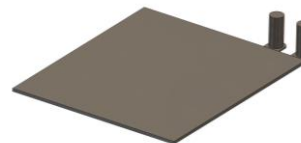
28 Shielding outer

4 Shielding outer with notch



OERLIKON TCO

Loading directly on trolley



Baskets loading on frame



Frame loading (6 baskets maximum) on trolley with an elevator



TCO CLEANER

Citric acid/HNO₃ + H₂O₂ + dry

Oven for complete drying



KIT TYPE "HT"

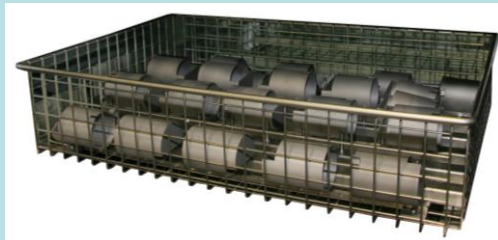
3 DAYS

For one TCO:

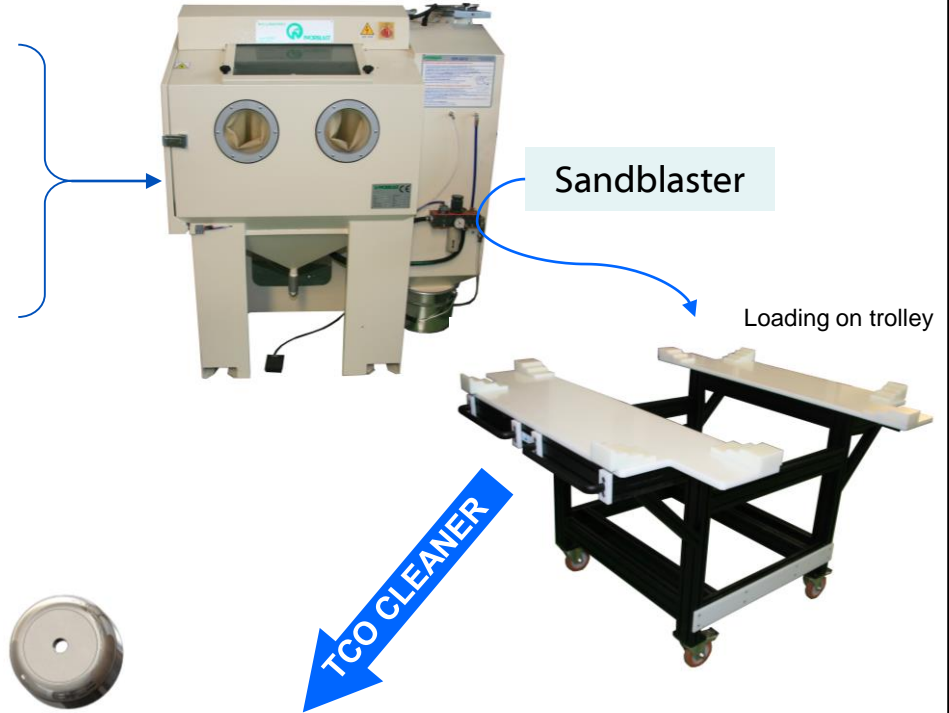
- 1 Aludisc DN200 V2 2-form
- 1 Aludisc DN200 V2 4-form
- 1 Aludisc DN200 V2 6-form
- 1 Aludisc DN200 V2 8-form
- 1 Aludisc DN200 V2 12-form



- 1 Hot trap holder
- 4 T-piece DN200 cpl. V12



OERLIKON TCO



- *H2ODI + dry*
- *Citric acid/HNO3 + H2ODI + dry*

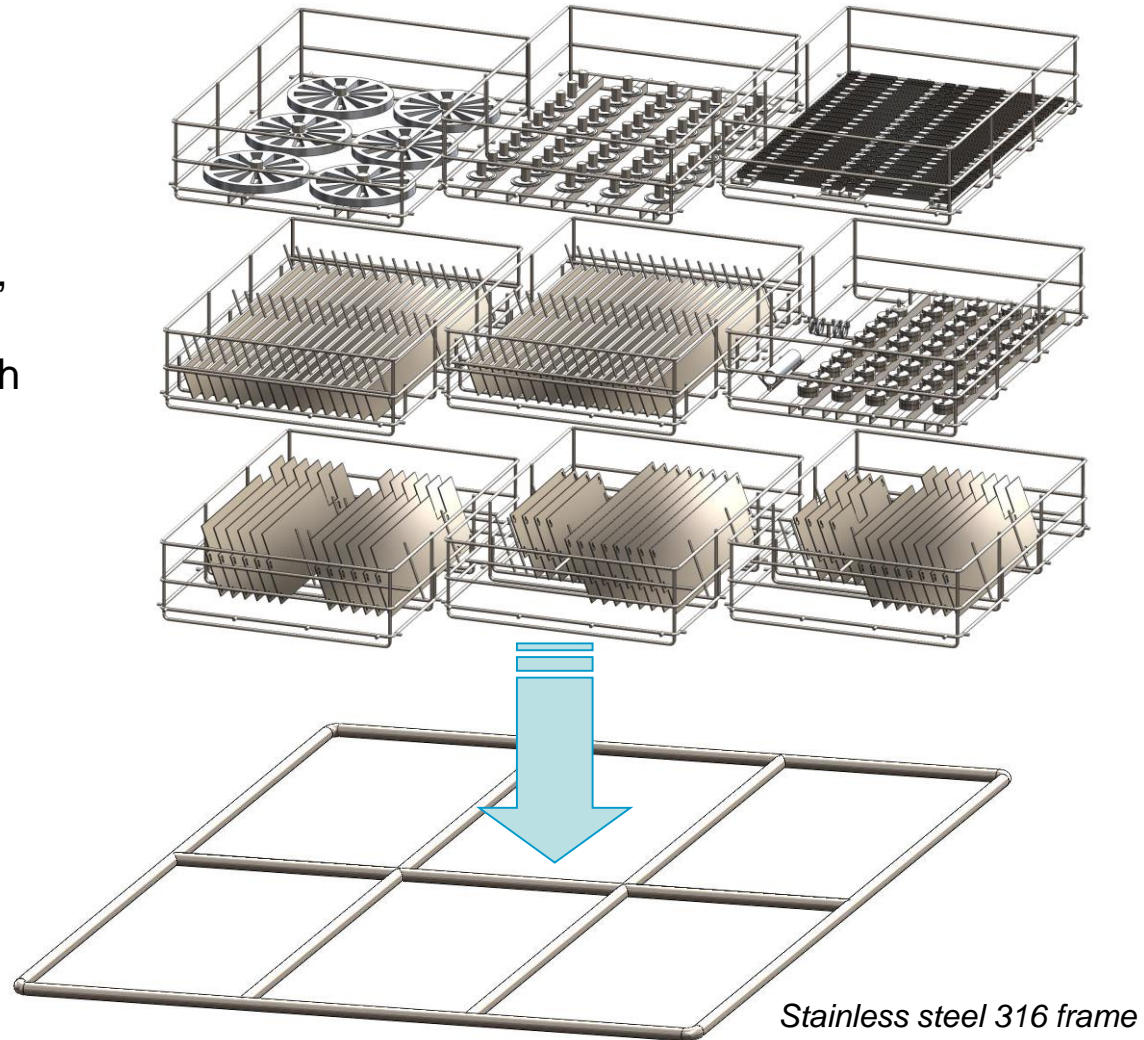
Oven for complete drying

BASKETS-FRAME FOR SMALL PARTS



In order to clean small parts, we have studied different types of basket (one for each type of part).

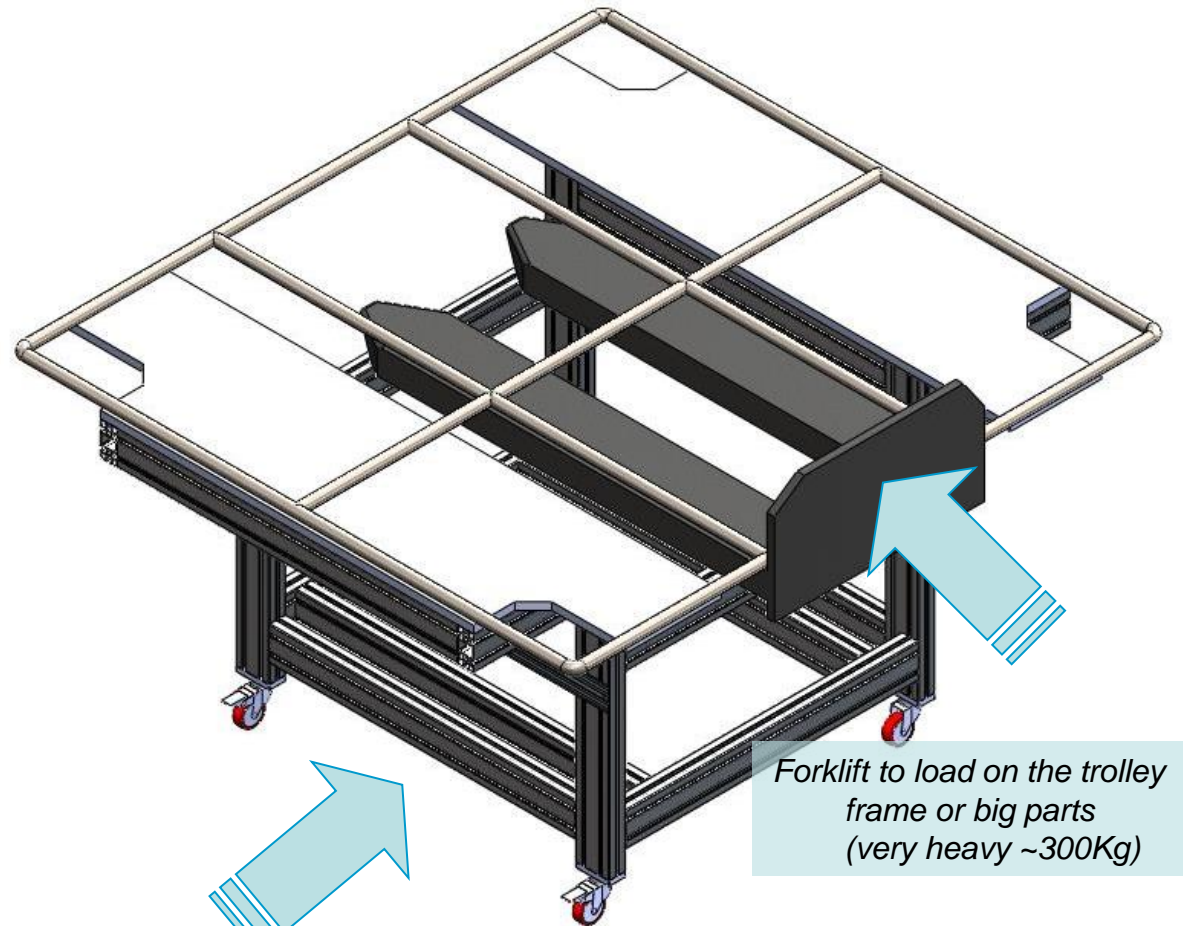
The frame has the same dimensions of the robot wheelbase and, of consequence, of the trolley.





TROLLEY

A very important component of the machine is the trolley. It permits to load and unload big parts and frame with baskets from/into the SPM TCO PARTS CLEANER.



Loading/unloading in SPM TCO parts Cleaner

Forklift to load on the trolley frame or big parts (very heavy ~300Kg)



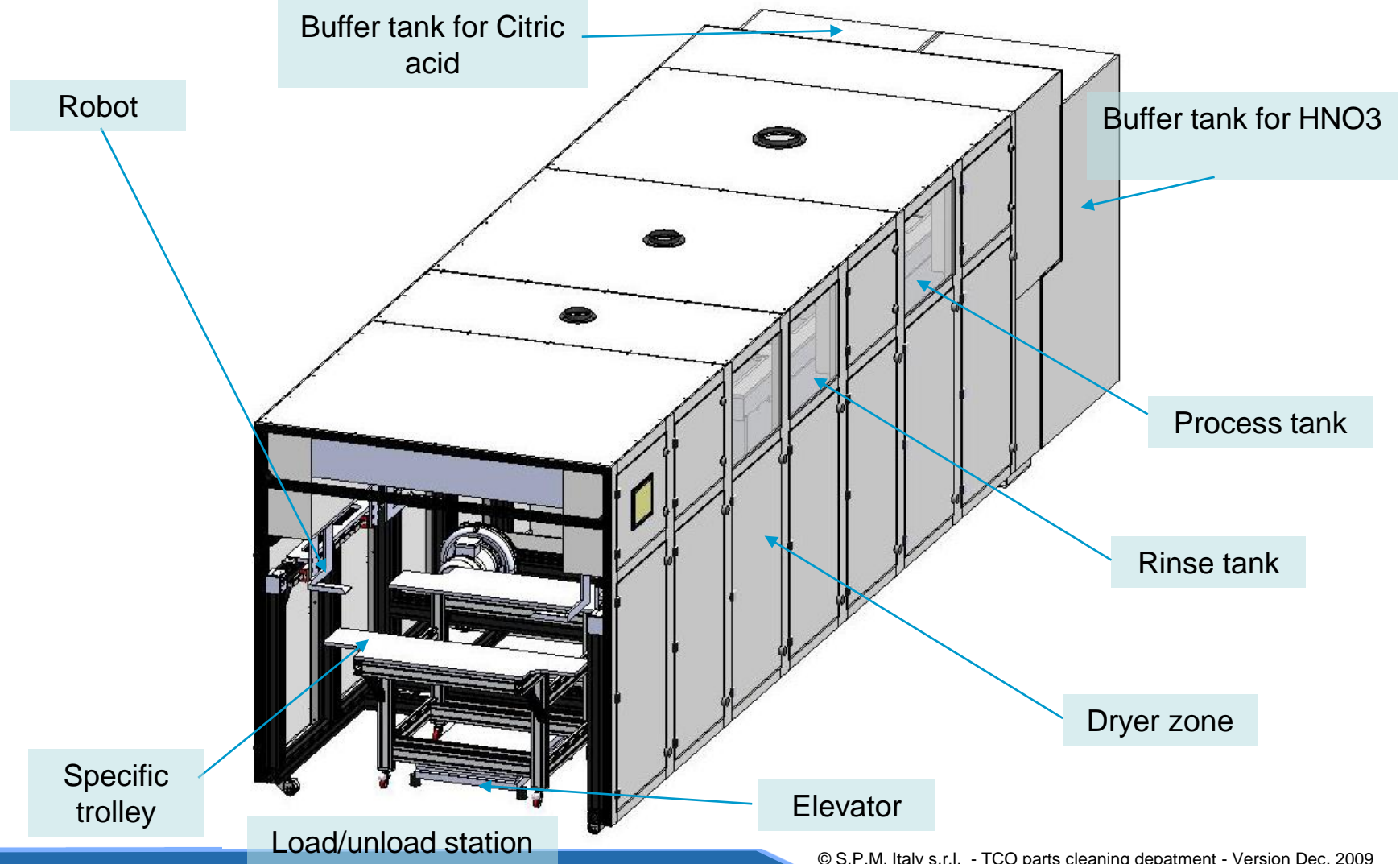
Sydney Model

Patent: MI2009A001033





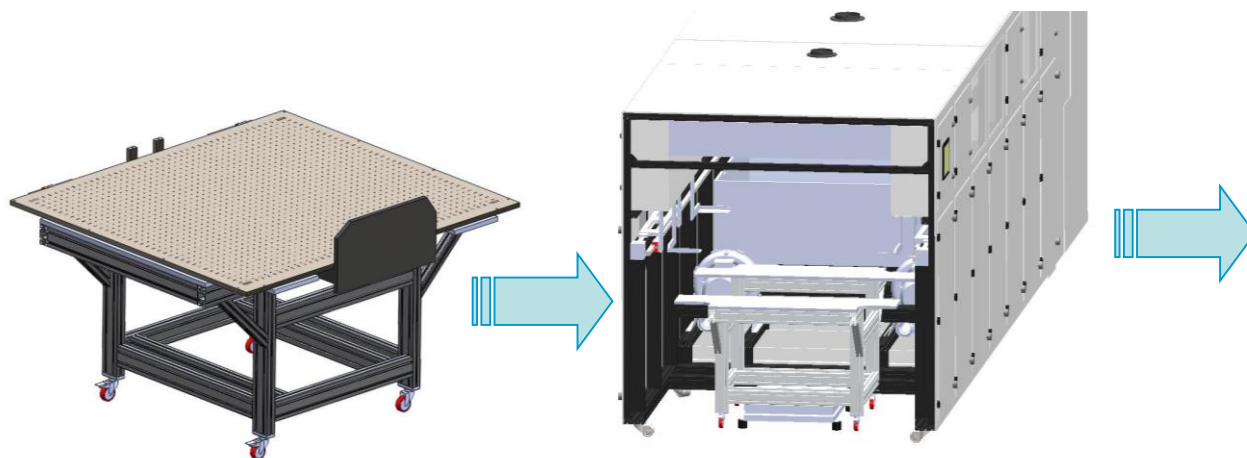
SYDNEY MODEL





The procedure to clean big parts that don't need the frame in SPM TCO Parts Cleaner is:

1. Load the part on the trolley with a forklift
2. Open the machine shutter in order to have the access to the load zone
3. Insert the trolley following the guides
4. Close the shutter
5. Select the recipe and launch it
6. Press Start Cycle button



The elevator will rise up the trolley and after that the robot goes on the load zone, the elevator goes down and so the part is carried on the robot arms. The robot can now process the part.

SYDNEY MODEL CLEANING SEQUENCE



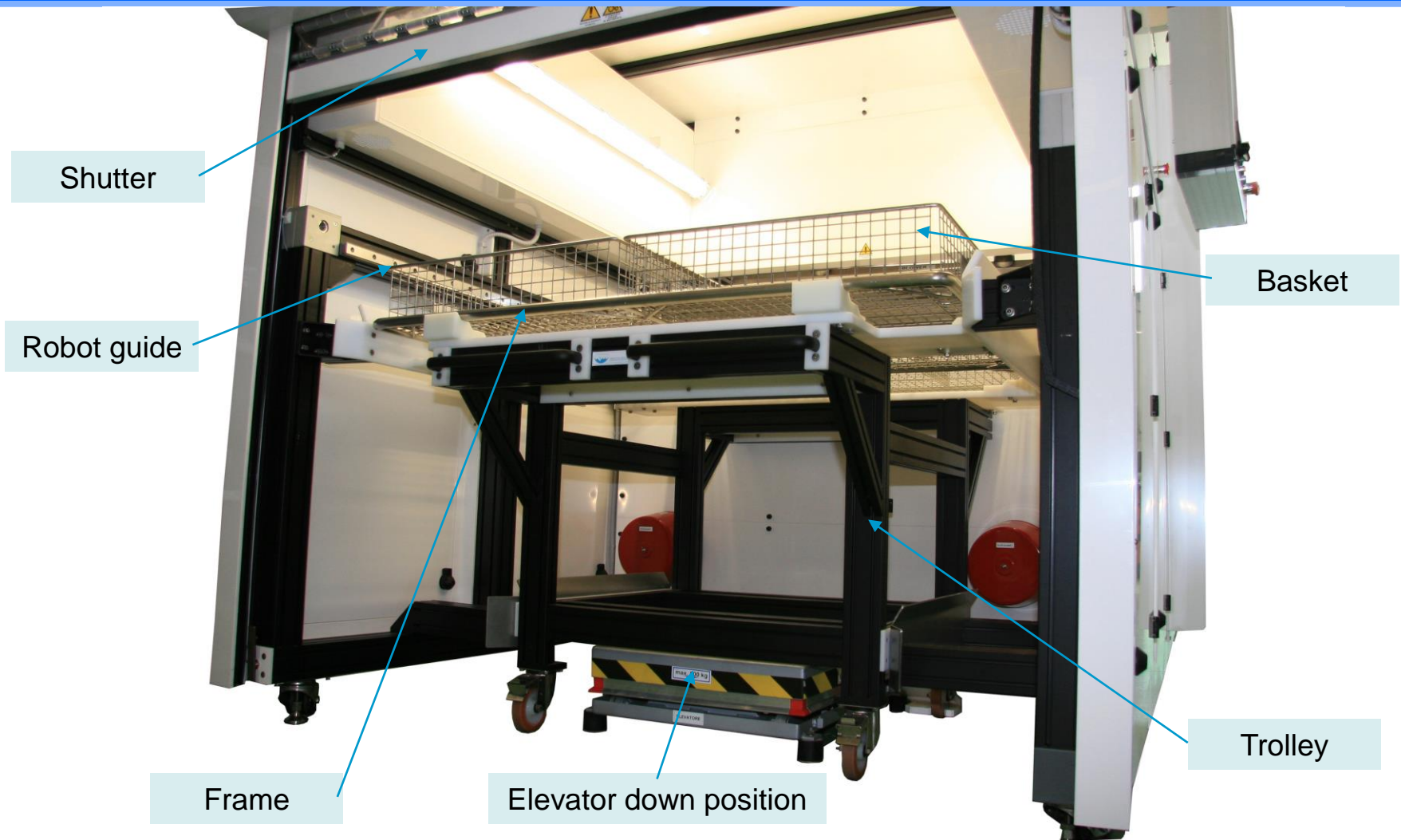
The cleaning part cycle follows this sequence:

1. The robot goes over the process tank
2. The jack rises up the process tank and closes the robot with the part forming a “sandwich”
3. Process tank filling with HNO₃ or Citric acid (coming from the recovery tank)
4. Static and spray process starts
5. Drain solution into the recovery tank
6. Pre-cleaning sequence: H₂ODI spray from the top
7. The jack goes down and the robot moves to the rinse tank
8. The jack rises up the rinse tank and closes the robot with the part forming a “sandwich”
9. Filling of the rinse tank with H₂O DI (never completely empty to permit the ultrasound to activate before parts introduction)
10. Start of rinse process
11. The jack goes down and the robot moves to the dryer zone
12. 2 big air flows start and the parts will dry



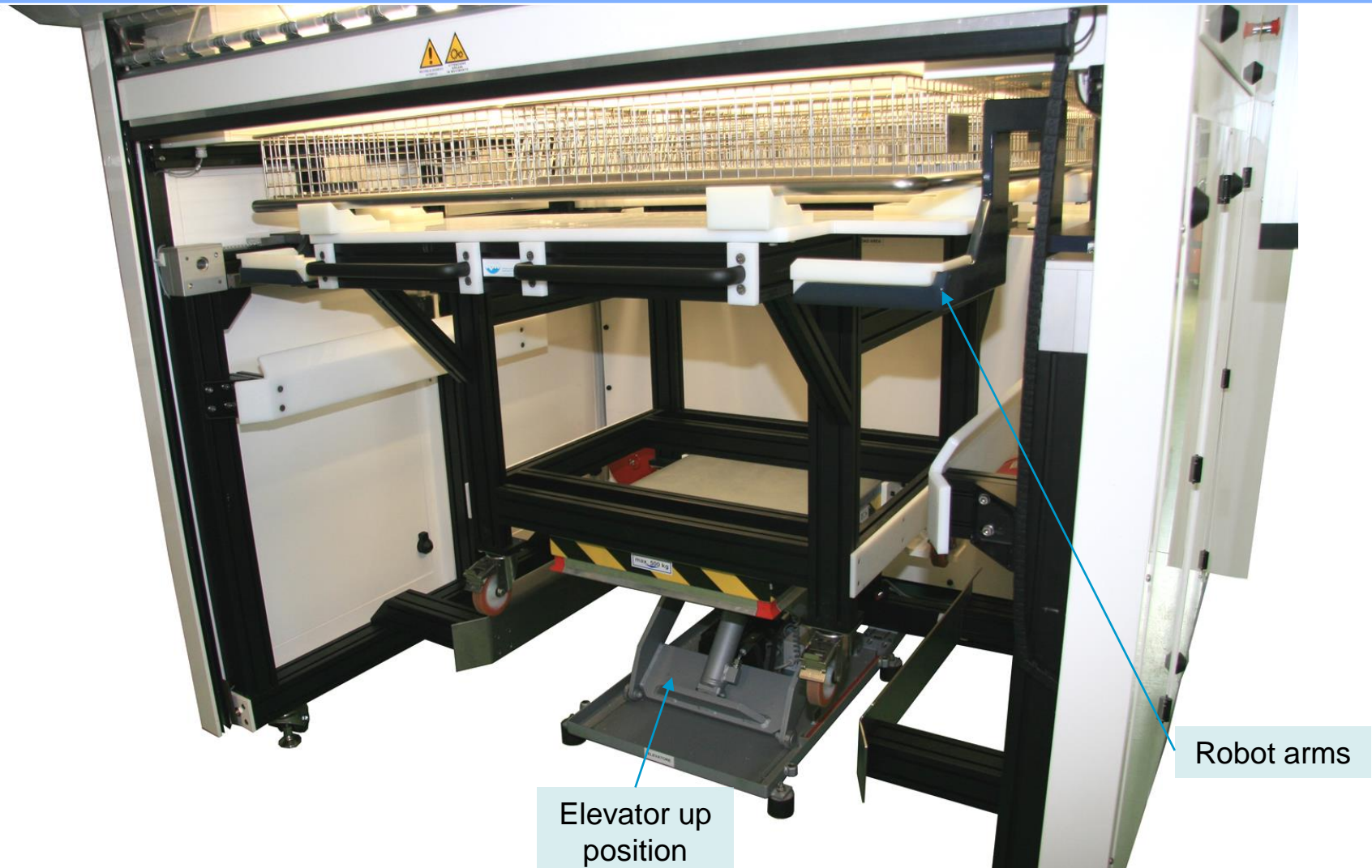


LOADING – insert the trolley





LOADING – elevetor rise up



Elevator up
position

Robot arms

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LOADING – robot



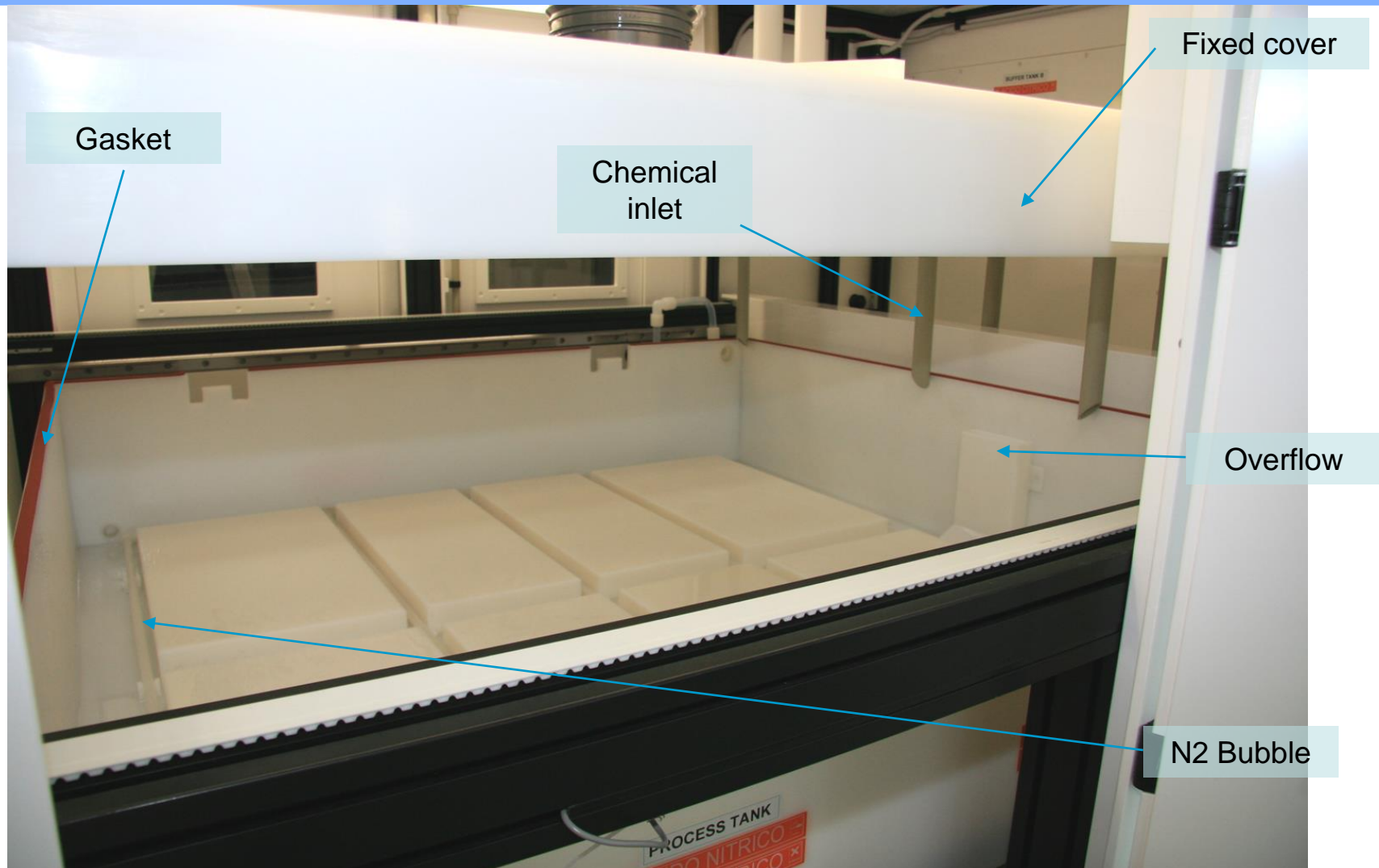
Elevator
down
position

Robot arms
carry the
frame

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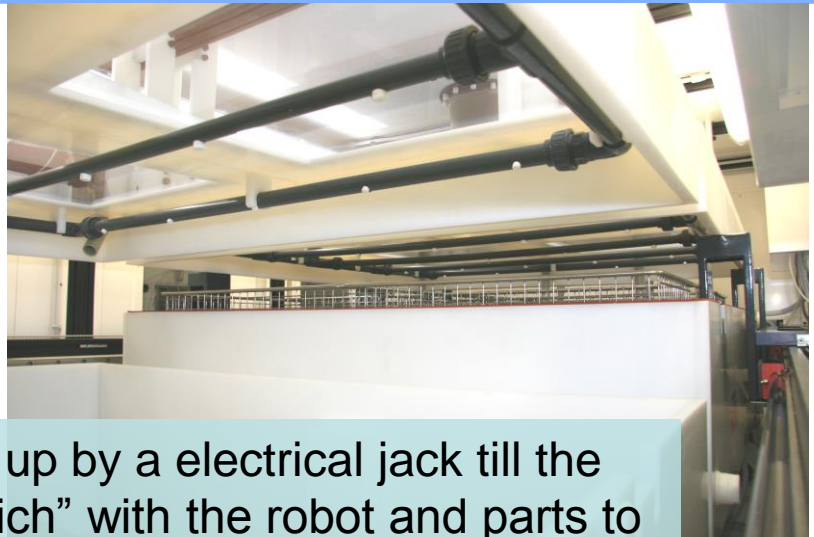
PROCESS TANK



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PROCESS TANK

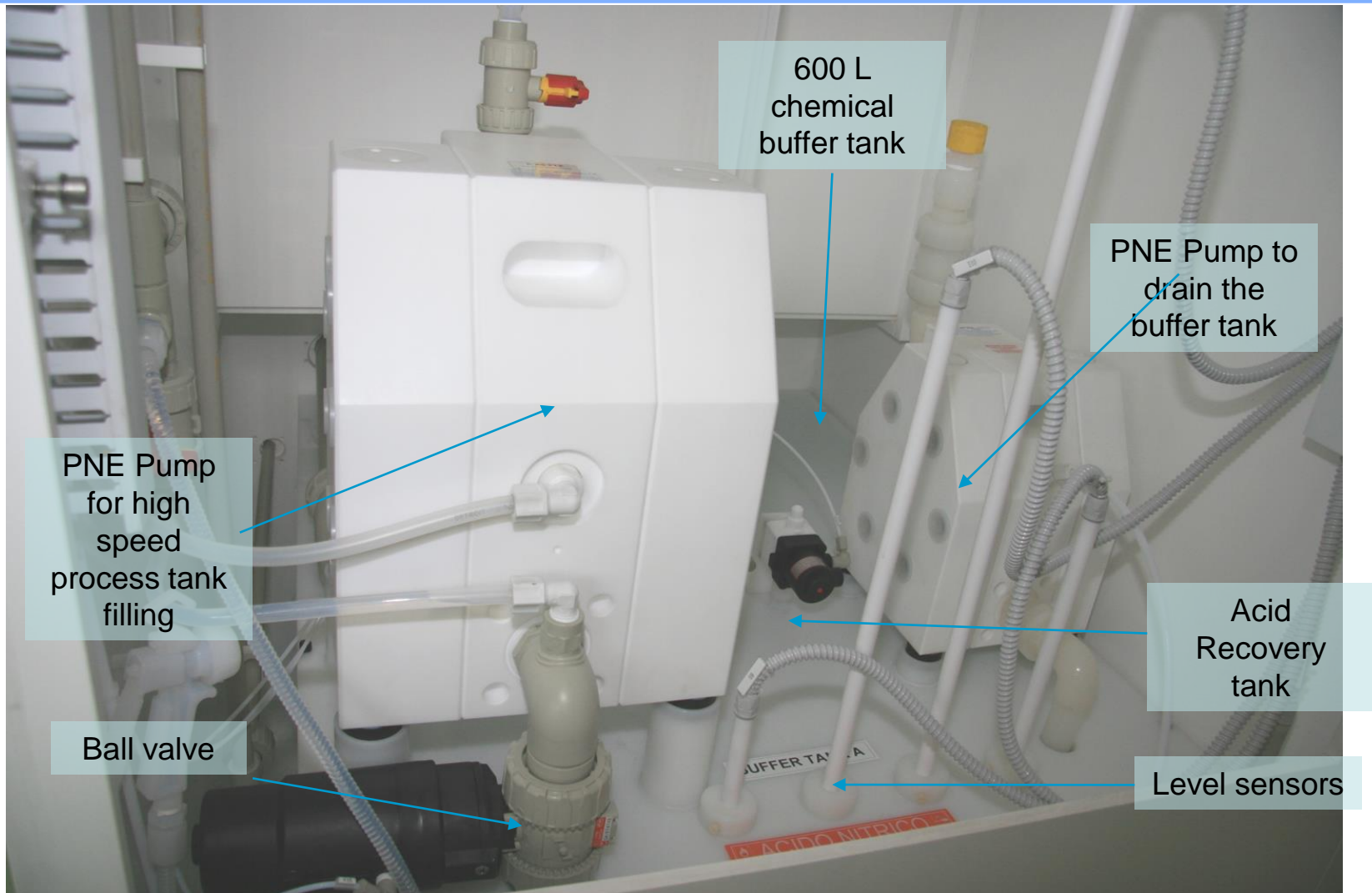


process tank is raised up by a electrical jack till the cover creating a “sandwich” with the robot and parts to clean, creating an air tight closure to avoid the exit of fumes and vapours



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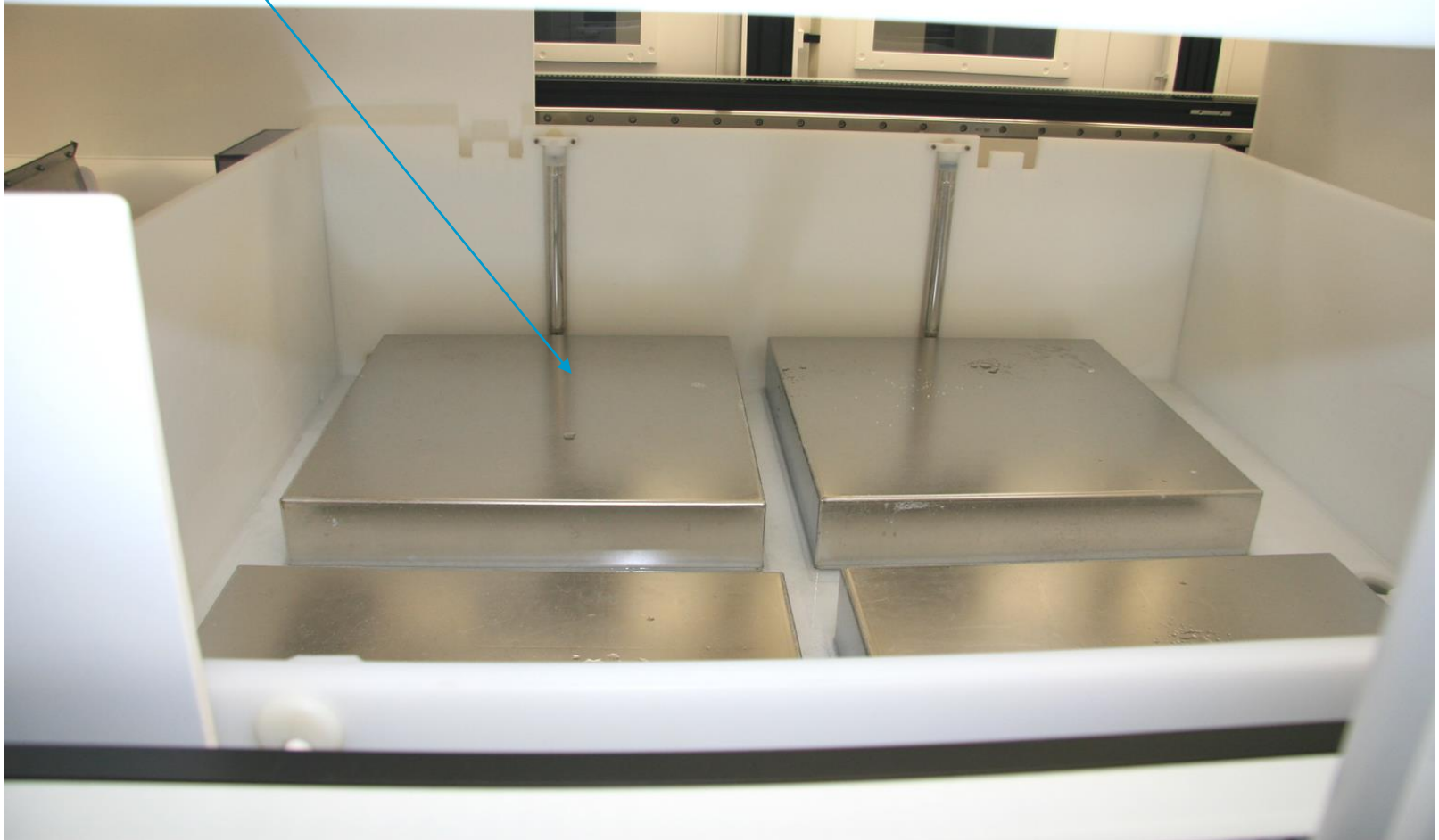
BUFFER TANKS – fill chemicals into the process tank





Rinse Tank

Ultrasound plates





Rinse Tank



Rinse tank is raised up by a electrical jack till the cover creating a “sandwich” with the robot and parts to clean, static and spray rinsing start with ultrasound system

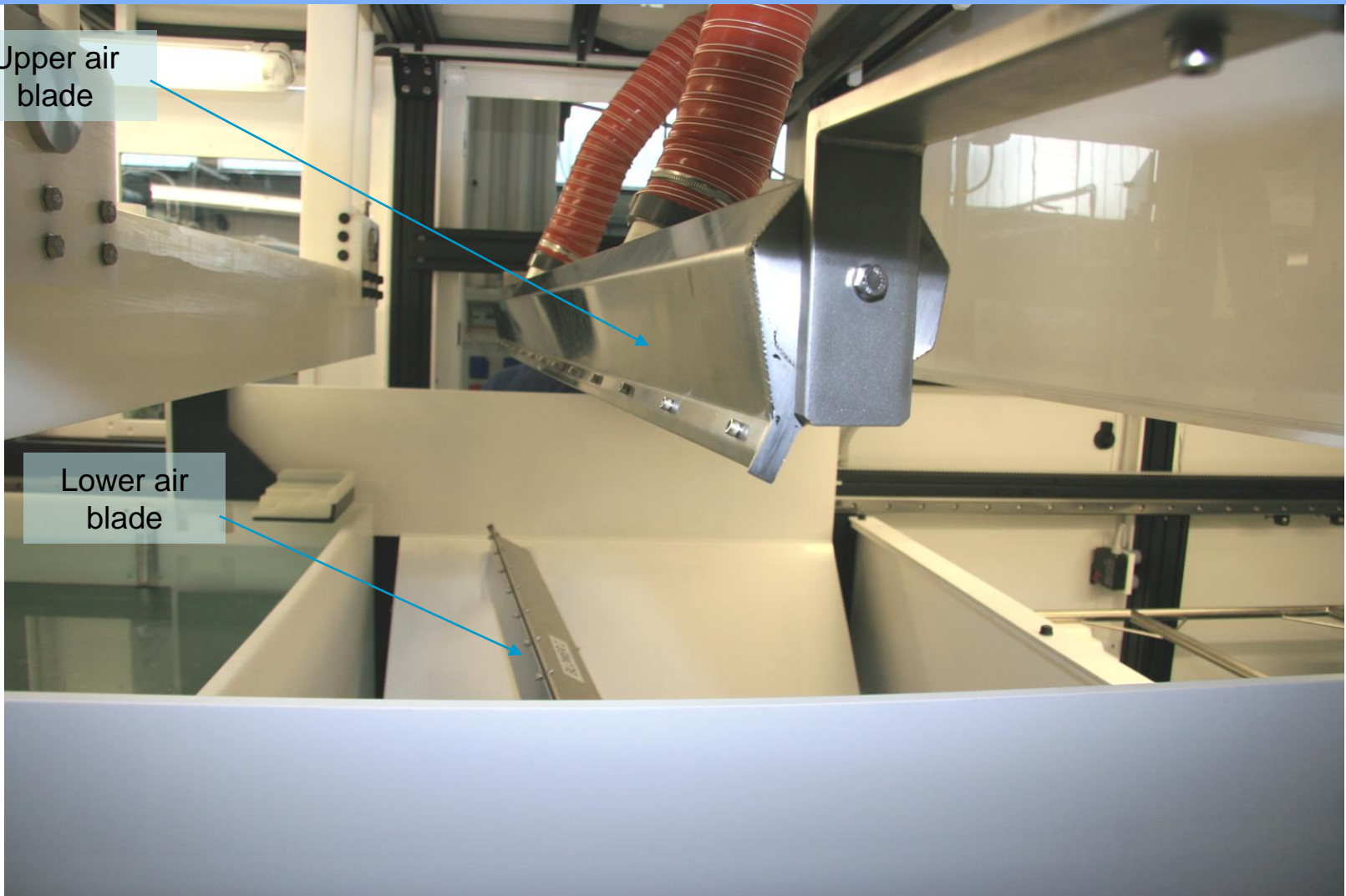




DRYER ZONE

Upper air
blade

Lower air
blade



BLOWER 1

BLOWER 2



CDS

Sydney Model
buffer tank

Chemical distribution system



200 liters drum



PNE plastic pump



Installation of double piping lines: external transparent PVC for safety, internal PFA.



50 liters day tank



CDS control with 8" touch screen





Exhausted Citric acid recovery module

Sydney Model citric acid buffer tank



200 liters drum

Special quick connector





SCRUBBER



Our scrubbers provide a maximum degree of reduction of toxic vapours, gases and fine particulates preventing the spread uncontrolled and dangerous in the workplace and in the atmosphere, thus ultimately to protect human beings and the environment for a better quality of life.





OVENS WITH RACKS



Oven is necessary in order to guarantee the complete drying of parts, in particular plates with a large amount of holes.

SPM provides two types of ovens:

- ▣ Small for baskets that contains little parts
- ▣ Big for huge parts or, if you want, for frames with baskets

To permit an easy parts loading SPM realizes special alluminum rack inside ovens.



DEPARTMENT PHOTOS



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DEPARTMENT PHOTOS



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INSULATION TEST MODULE



In order to test insulation of THIN FILM panels SPM realizes a portable module.



- 2 Kw heating resistance
- 2 Contacts to plug insulation tester
- Automatic H2O loading with PNE valve
- PNE drain valve
- Timer and Temperature controller
- Cover
- Pivoting wheels for easy transportation