Special Plastic Module for semiconductor industry

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

Deflashing technology

SPM developed two models:

- TOLEDO MODEL

  Chemistry part only. Robot transports basket, containing leadframes magazines, into process tanks

  Manual loading/Unloading

  Can process every leadframes formats

- LAGUNA MODEL

  Full deflashing process: chemistry part + Waterjet.

  Automatic loading/unloading

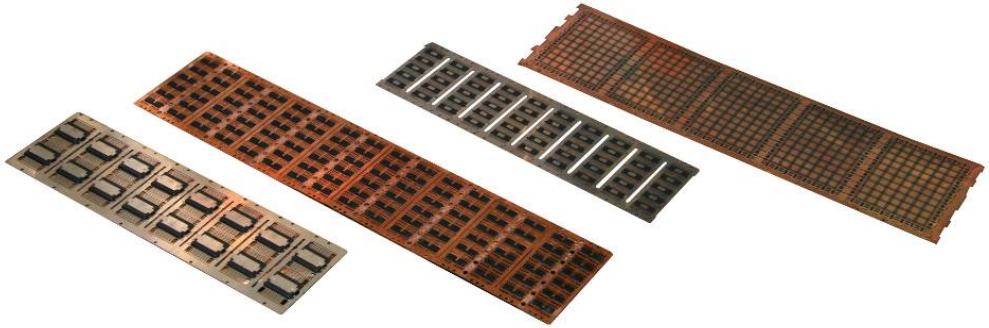
  Can process various leadframes formats

Multiformat Capability

Multiformat leadframes capability means that SPM equipments for deflashing can:

- Operate with different sizes MAGAZINES
- Operate with different LEADFRAMES FORMATS
- Perform FORMAT CHANGING OPERATION less than 10 minutes. (only manual operation needed is manifold exchanging on automatic load station)
- DIFFERENT RECIPES according with leadframes types to perform optimal deflashing

Leadframes



Laguna Model can process different format leadframes. As a standard Laguna Model has these specifications:

- Leadframes from 30mm to 100mm of width
- Leadframes up to 300mm of length

- OPTIONAL: single chip process

For other dimension is possible to study a custom solution.

Format Changing

The first target when SPM realized its first fully automatic equipment for deflashing was to design a machine capable to perform format exchanging procedure with just few simple and fast operations.

What we obtained is that only manual operations needed are:

- Change LOAD MANIFOLD
- Change PROCESS CARRIERS (MAX 4 carriers)

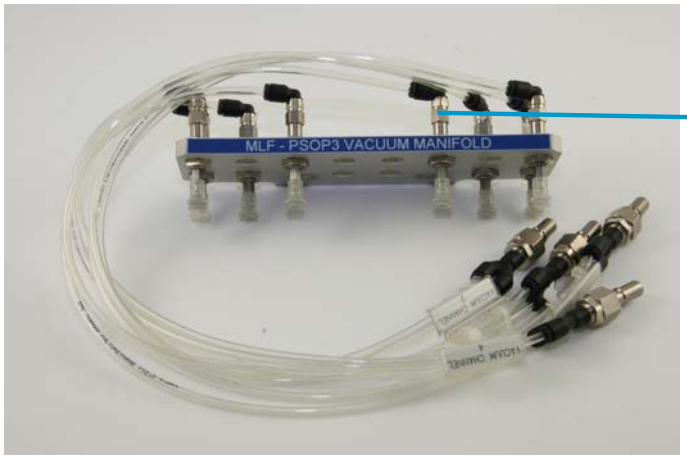
<u>Total time needed to format change: 10 min MAX.</u>

Format change procedure is needed only if leadframes dimensions are different. Otherwise no operations are necessary.

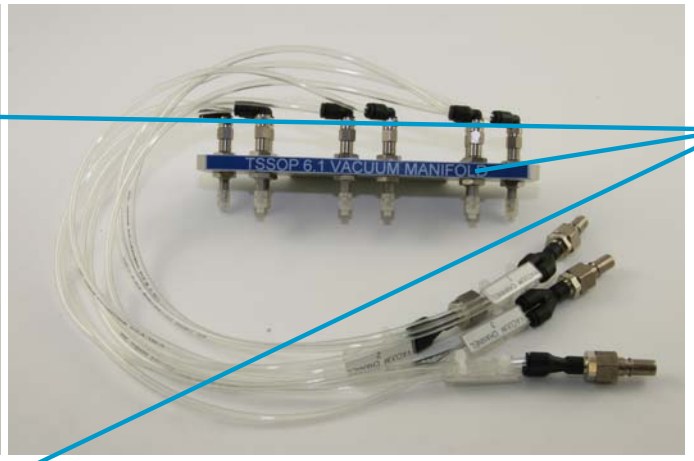
AUTO LOADING STATION

Example of realized manifolds:

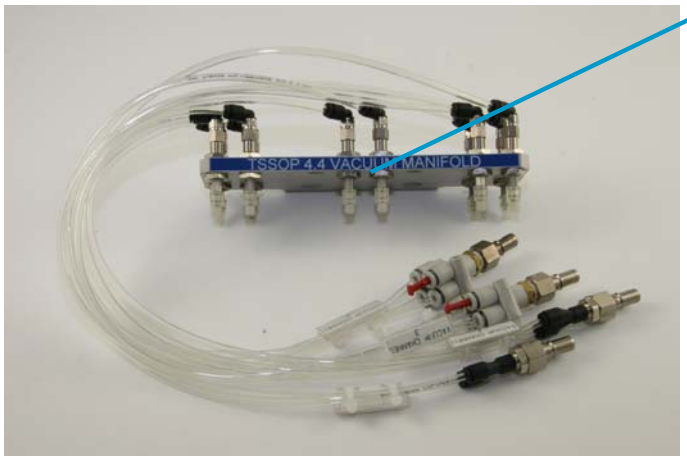
MLF – PSOP3



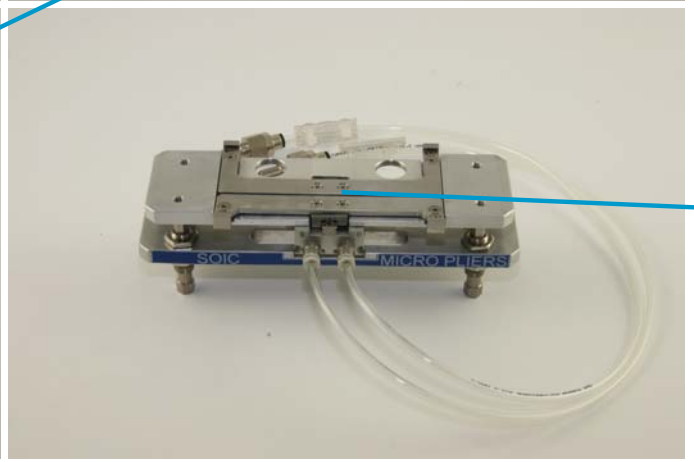
TSSOP 6.1



Vacuum gripping



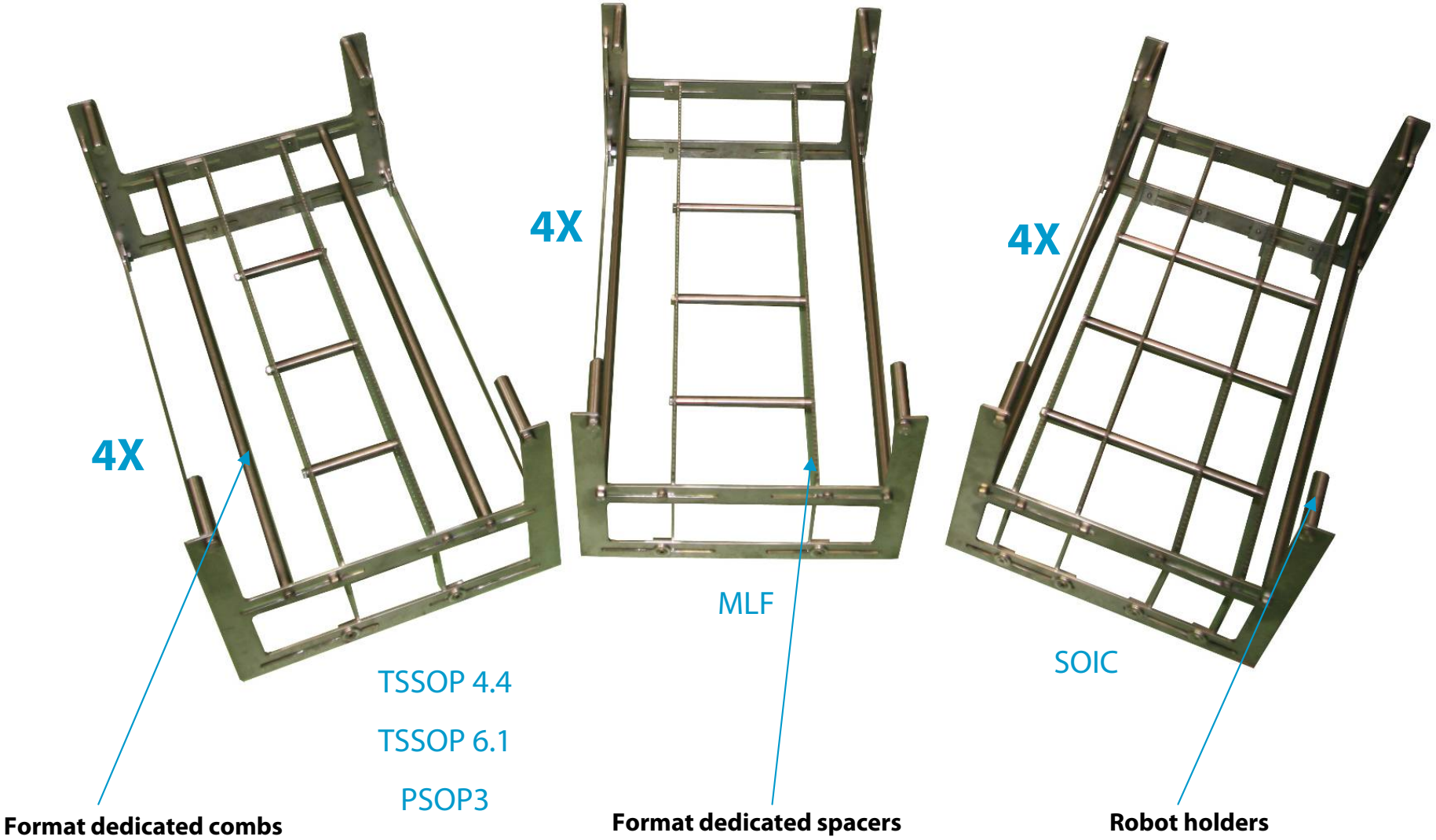
TSSOP 4.4



SOIC

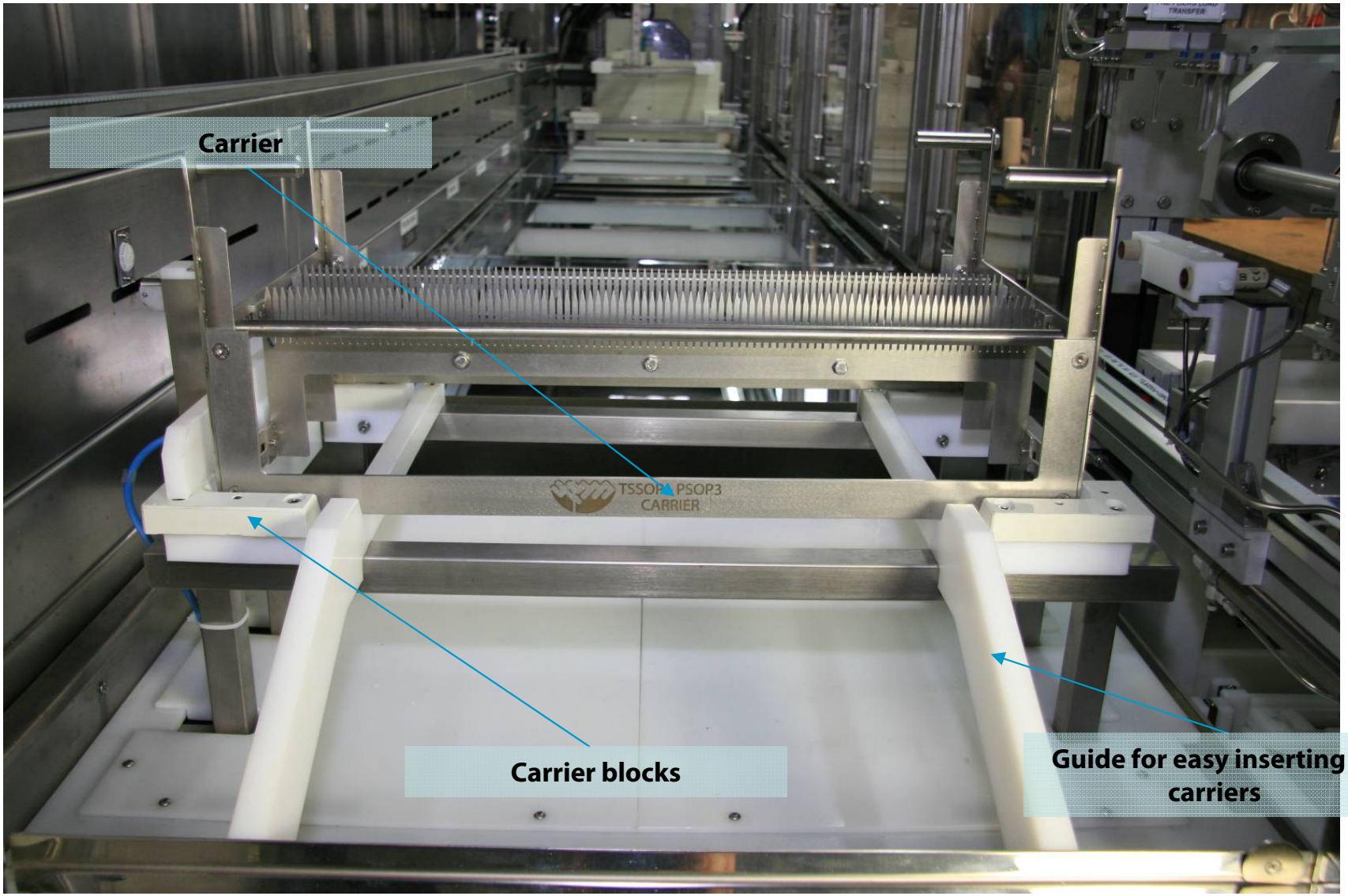
Mechanical gripping

Process Carriers

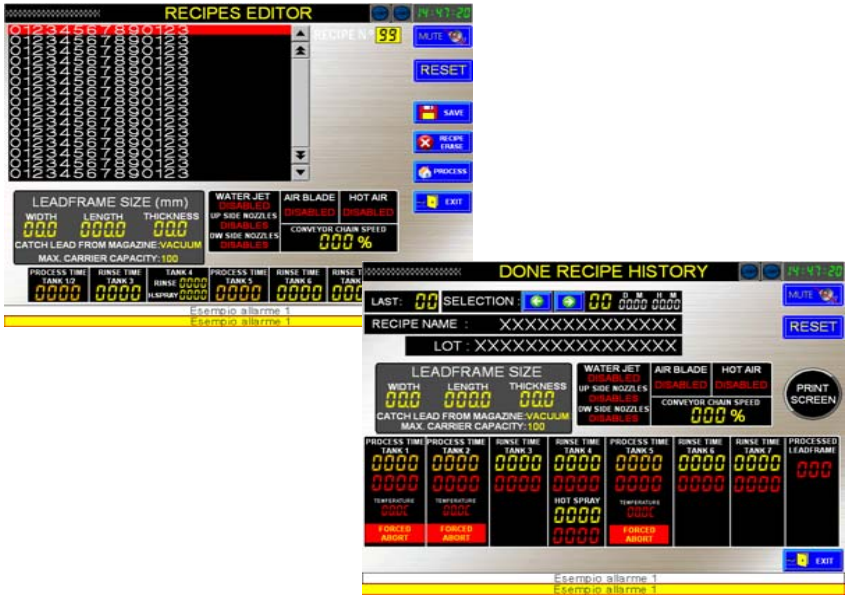


Every format has different dimension and so for every dimension there are 4 dedicated process carriers realized in SS316.

Load Carriers



Software Management



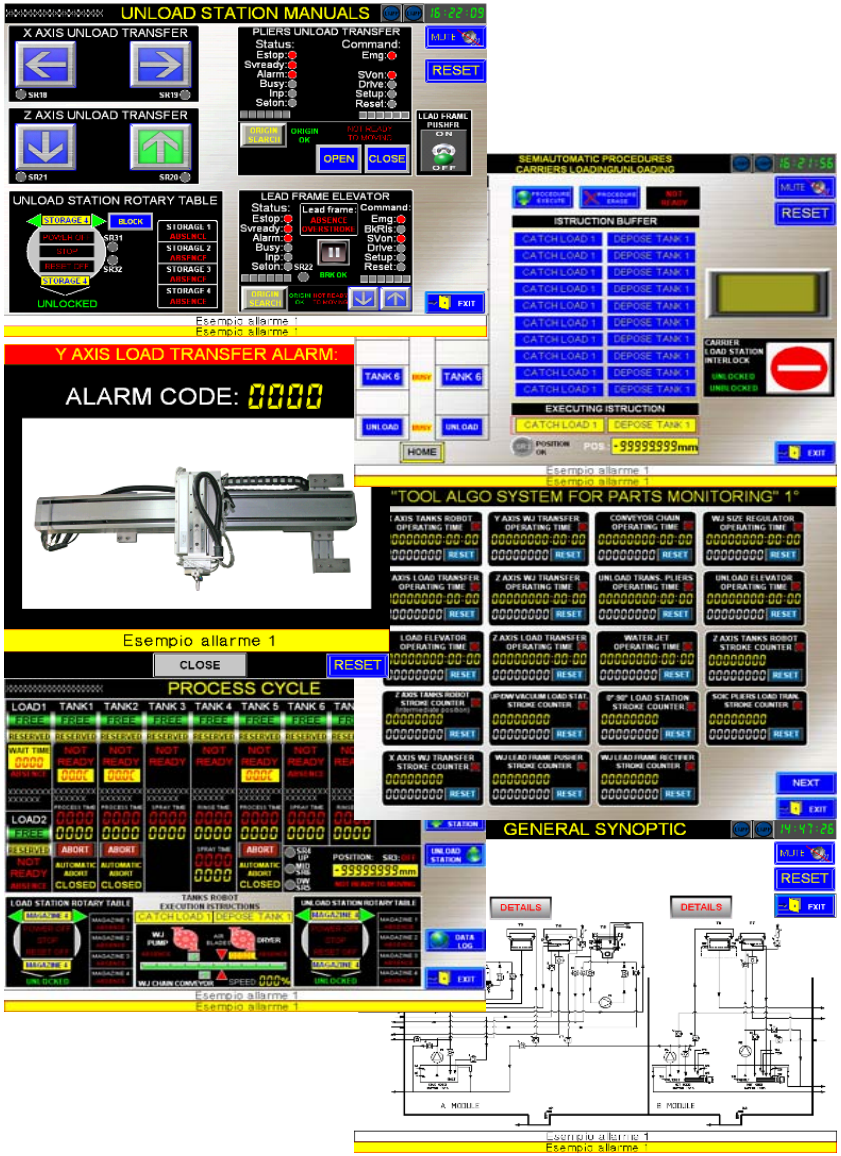
SPM develop itself PLC and HMI software. A special team is dedicated to develop and test machine functionalities according to leadframes and customer needs.

Flexibility is the term that define better SPM philosophy. We like challenge with difficulties to simplify our customer production.

Here some standard features on our software:

RECIPE MANAGEMENT is a functionality integrated in our software that permit to process engineer to set parameters like:

- Leadframe sizes
- Process parameters (timing, temperature…)
- Rinse parameters (Dump quantity, oveflow duration, bubble activation…)
- Waterjet conveyor speed
- Waterjet Nozzle blocks activation
- Waterjet operating pressure
- Dryer parameters
- …



USER MANAGEMENT permit to create custom users and set to them different permissions.

DATALOG storage of alarms and events to perform machine errors diagnosis and process monitoring.

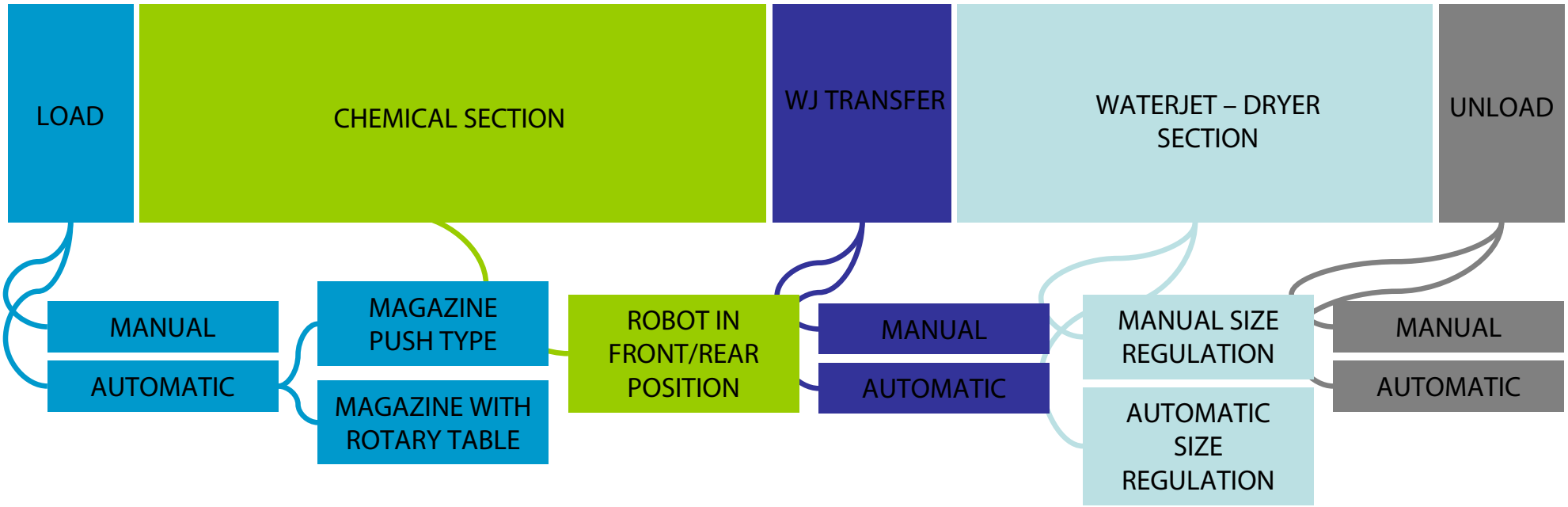
PIPING MANAGEMENT Every tanks has a dedicated page where it is possible to set parameters, watch status and start function like FILLING, DRAINING, PUMPING, HEATING…

AXES MANAGEMENT section dedicated to servo-driven axes movements and its parameters.

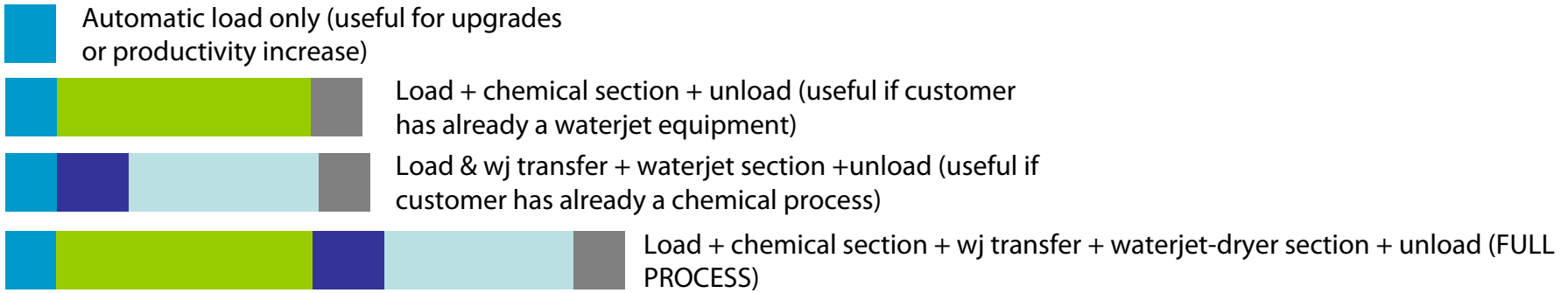
GENERAL MANAGEMENT specific sections to monitor equipment status with clear and simply to understand informations.

Equipment Composition

Our equipment are modular, that means customer can assembly the machine according to their needs.



Possible compositions:



Automatic load only (useful for upgrades or productivity increase)

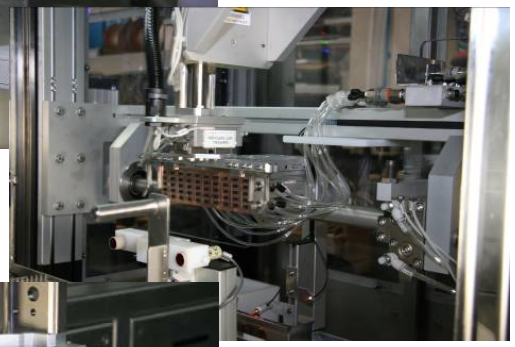
Load + chemical section + unload (useful if customer has already a waterjet equipment)

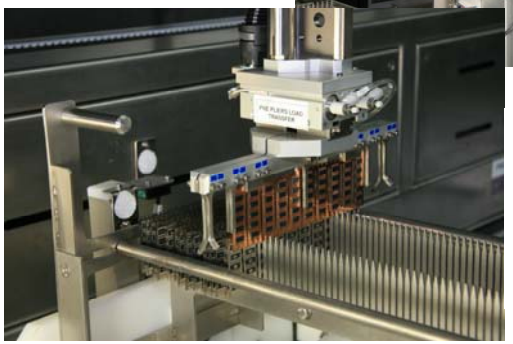
Load & wj transfer + waterjet section +unload (useful if customer has already a chemical process)

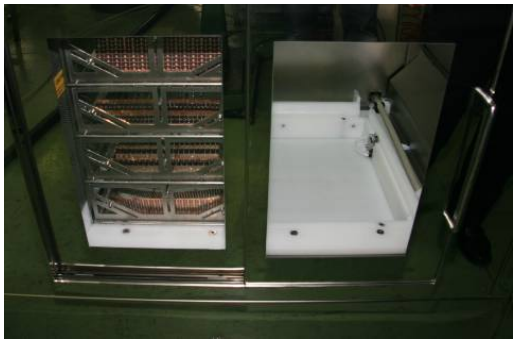
Load + chemical section + wj transfer + waterjet-dryer section + unload (FULL PROCESS)

Load, unload, wj transfer sections can be selected as fully automatic or manual.

Loading







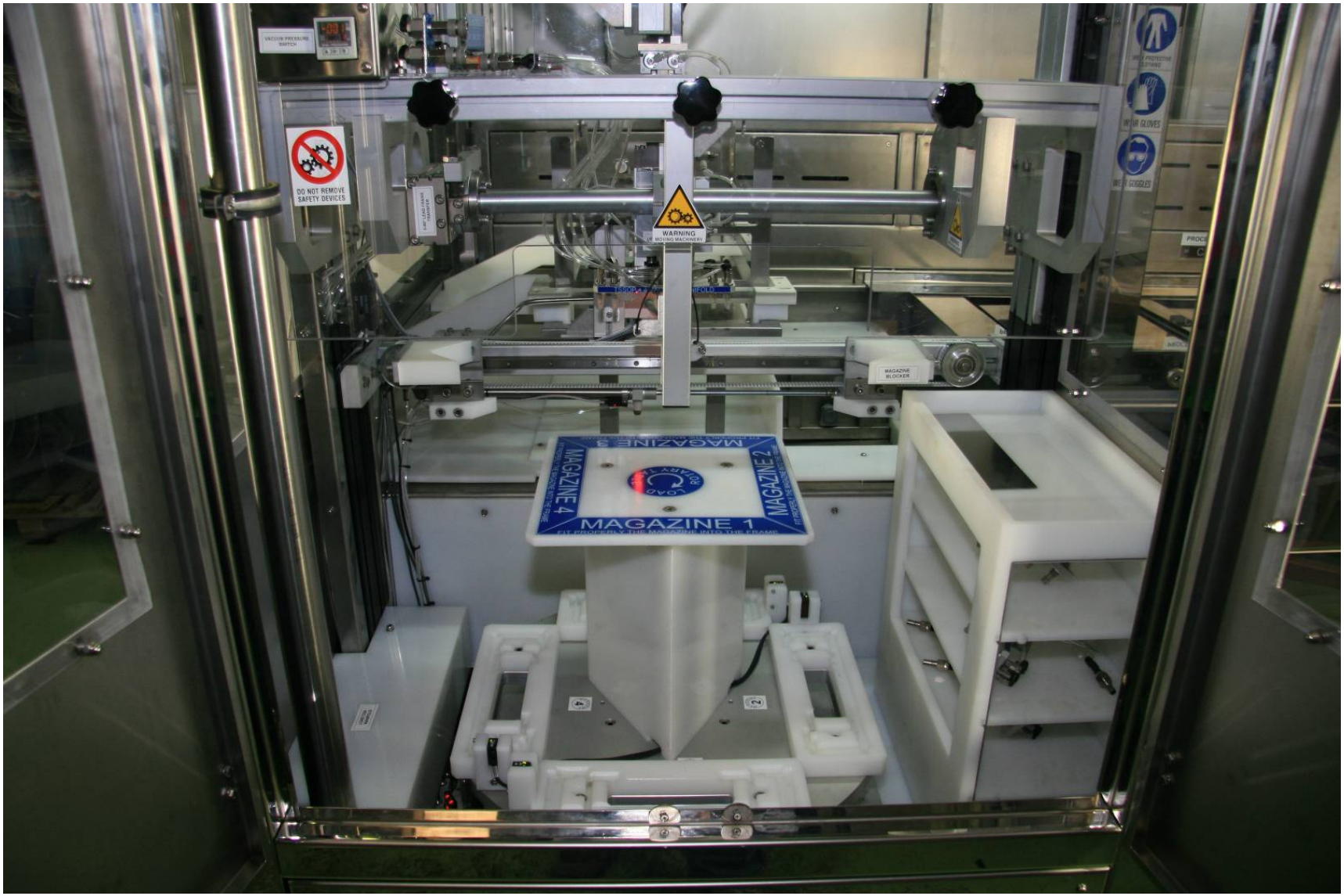
Leadframes loading section could be realized with several options according to leadframes, magazines and budget.

- AUTOMATIC LOAD STATION: we developed two types of automatic loading:
  - ROTARY TABLE for “standard” MAGAZINE
  - PUSH TYPE for “slot” MAGAZINE

Operator has only to insert magazine into special frame and select the recipe. Equipment will automatically load into the process carrier (one by one with ROTARY TABLE TYPE, or all together with PUSH TYPE)

- MANUAL LOAD STATION: In case you select manual station, operator has to manually load one by one leadframes into our process carriers.There are two options for manual load station:
  - Load a BASKET that contains up to 4 carriers with leadframes (this option cannot be selected with waterjet section)
  - Load a single process carrier

Automatic Leadframes Loading



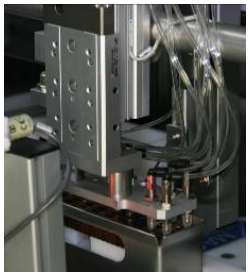
Automatic Leadframes Loading

1. ROTARY TABLE MOVES MAGAZINE IN POSITION

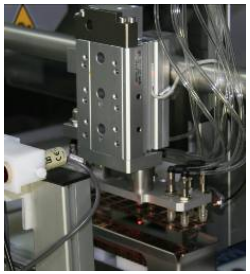
2. MAGAZINE BLOCKER LOCKS

3. LEADFRAMES ELEVATOR RISE UP

4. OPTICAL FIBER DETECTS LEADFRAME PRESENCE



5. MANIFOLD MOVES DOWN TO CATCH LEADFRAMES. Vacuum presence check

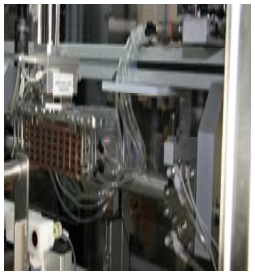


6. MANIFOLD MOVES UP

7. MANIFOLD ROTATES 90°

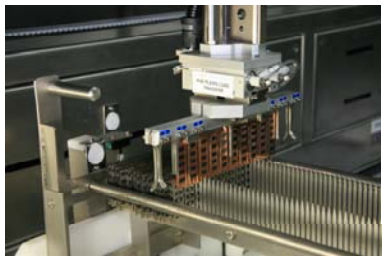
8. Y AXIS MOVES UP TO THE MANIFOLD

9. Y AXIS MOVES UP TO THE MANIFOLD



10. Z AXIS MOVES DOWN AND CLIP THE LEADFRAME

11. Y AXIS MOVES ON PROCESS CARRIER POSITION



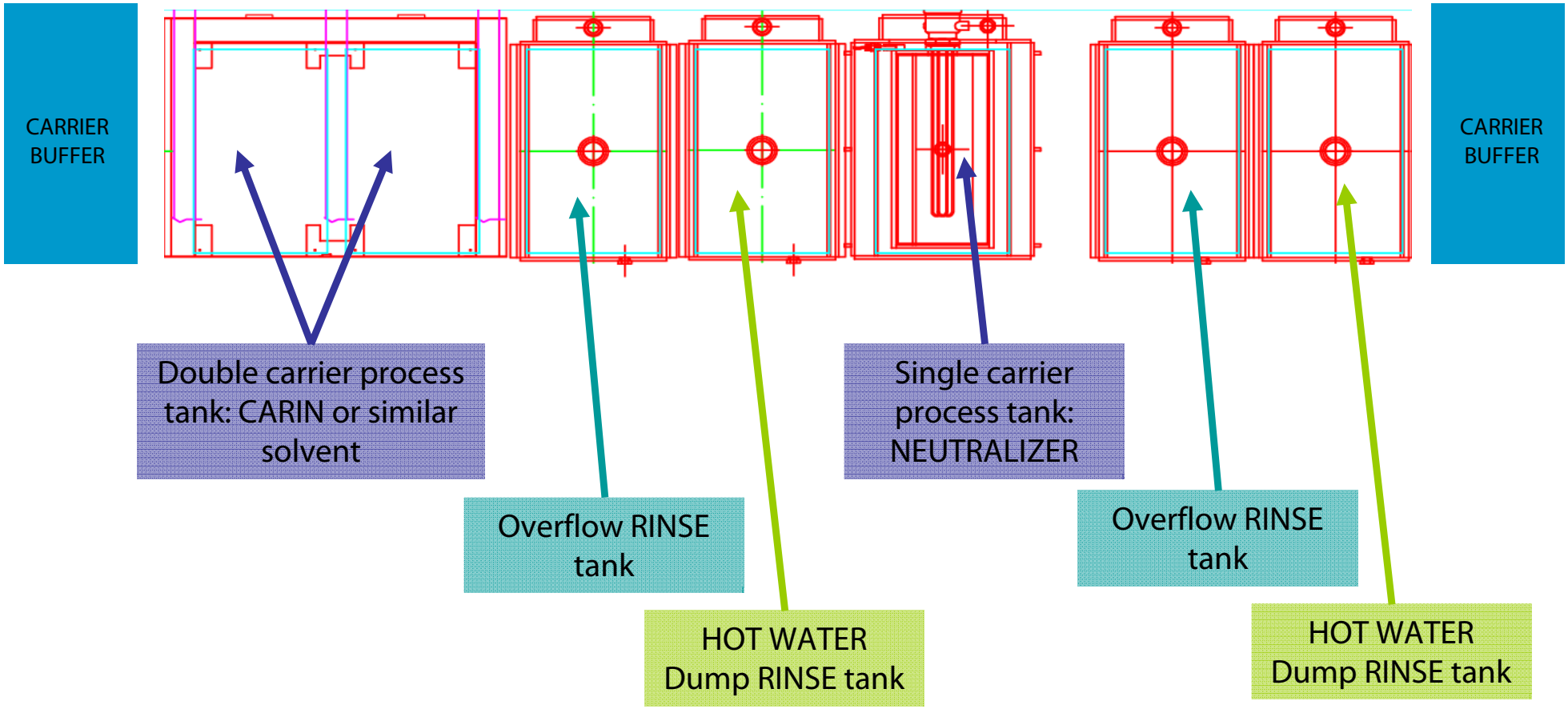
12. Z AXIS MOVES DOWN ON CARRIER COMB

13. GRIPPER RELEASE THE LEADFRAME AND Z AXIS GOES UP FOR NEXT CATCHING

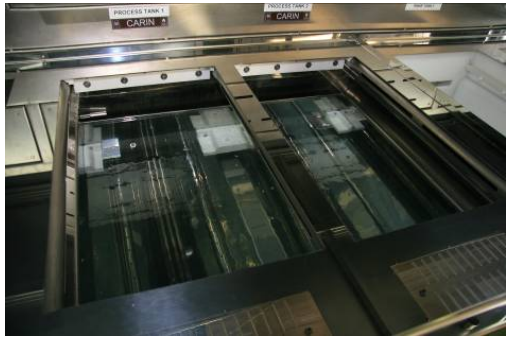
Every leadframe is loaded in less than 6 seconds: 100 leadframes (process carrier capacity) in less than 1 minute.

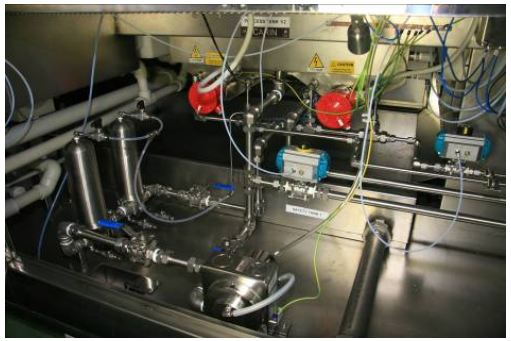
Chemical section could be configured with different tanks.

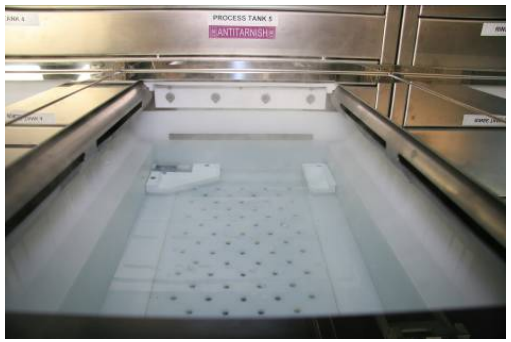
Typical composition is:



Chemical Section – Process Tanks







Process tanks could be realized with several options according to chemicals and process needs.

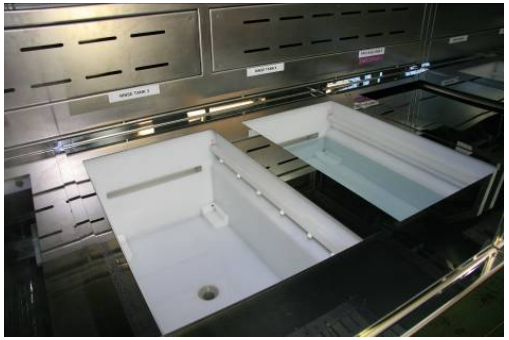
Options:

- HEAT EXCHANGER
- AUTOMATIC COVERS
- LOCALIZED EXHAUST
- PUMP
- FILTRATION
- N2 BUBBLE
- AUTOMATIC FILLING (available also solutions mixing)
- OVERFLOW 360°
- AUTOMATIC DRAIN

Materials:

- SS316L – for solvents
- Plastic materials: PE, PP, PVDF, PTFE (Teflon), Halar,… for non-solvent chemicals

Chemical Section – Rinse Tanks



Rinse tanks could be realized with several options according to process needs.

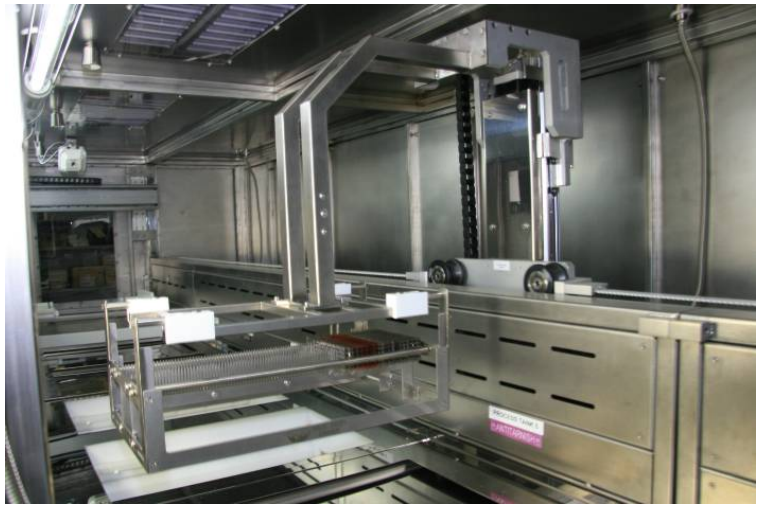
Options:

- HOT H2ODI
- USED WATER RECOVERY – FOR CONSUMPTION REDUCTION
- N2 BUBBLE
- AUTOMATIC FILLING
- OVERFLOW 360°
- SPRAY
- DUMP RINSE CYCLES
- AUTOMATIC DRAIN

Material:

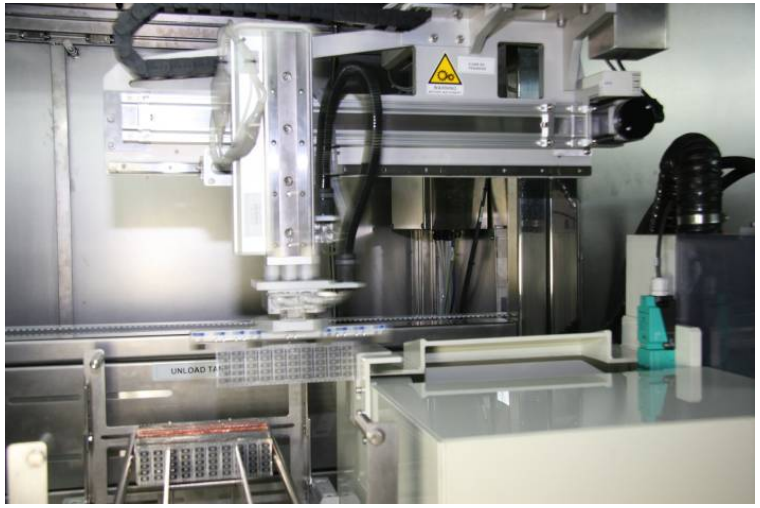
- Plastic material: PE

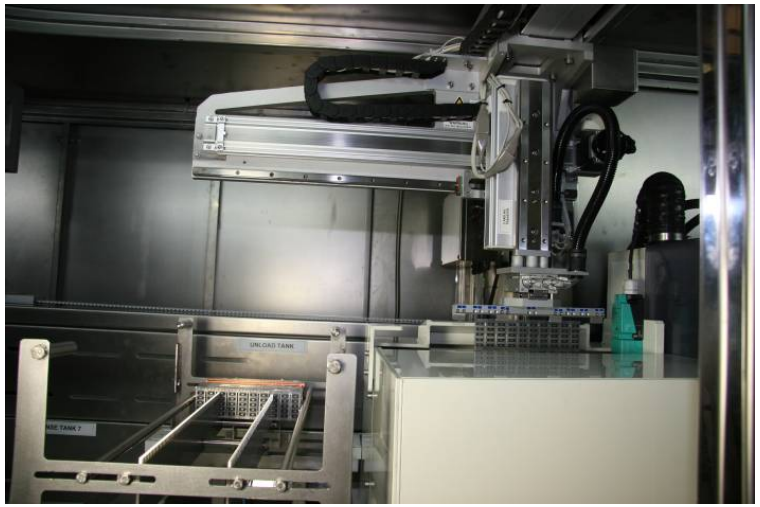
Chemical Section – Tanks Robot



Tanks robot accomplish the movement of carriers from different stations. It is composed by two servo-driven axis.

- Servo-controlled axis are extremely accurate
- smooth movement of carriers
- Software permits to the robot to manage up to 4 carriers in different stations. Timing for processing is exactly calculated without over soaking phonemes.
- Easy to change positioning quotes from touch screen without any needs of technicians help
- Fast move from tank to tank to avoid that leadframes remains at air contact for too much time



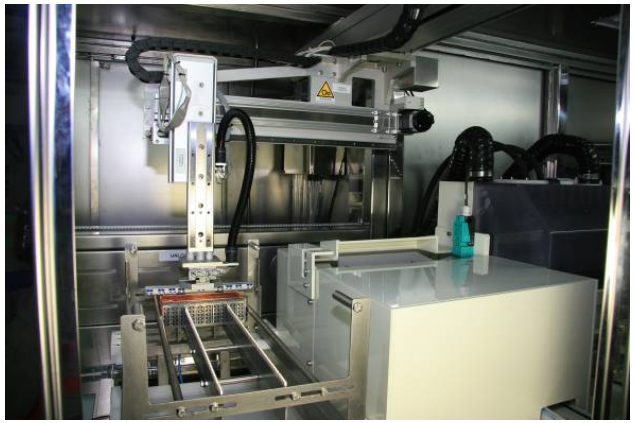


We call “WJ TRANSFER” the station that transfer leaframes from the process carrier to WATERJET conveyor one by one.

- AUTOMATIC WJ TRANSFER: The system will automatically transfer leadframes from carrier to waterjet conveyor. The conveyor will automatically change its guide dimension according to leadframe. The chain will also update its step according other axis.
- MANUAL WJ TRANSFER: Operator has to catch one by one leadframes from the carrier and put on the waterjet conveyor manually. A light will inform the operator when is the exact time to load leadframe on it.

Automatic WJ Transfer

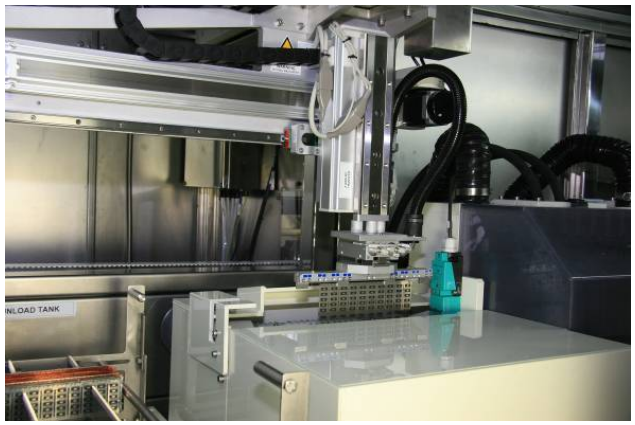
1. TANKS ROBOT DEPOSE THE CARRIER ON THE BUFFER STATION. Waterjet conveyor guides and chain will change dimension/steps according with leadframe format.



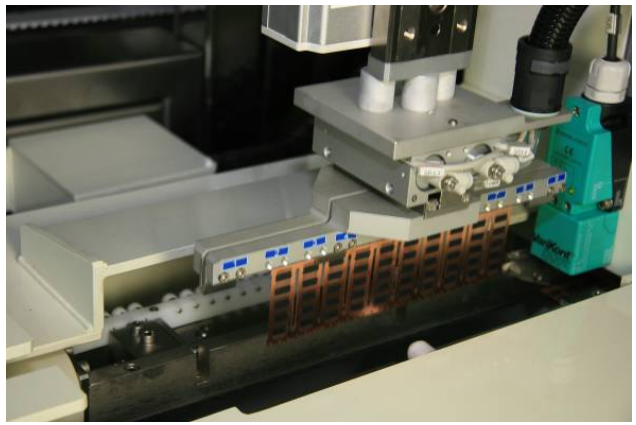
2. X AXIS MOVE ON THE LEFT AND Z AXIS GOES DOWN TO THE FIRST LEADFRAME. A PNE GRIPPER CATCHES THE LEADFRAME.

3. Z AXIS GOES UP AND X AXIS MOVE ON THE RIGHT (UP TO WJ CONVEYOR).

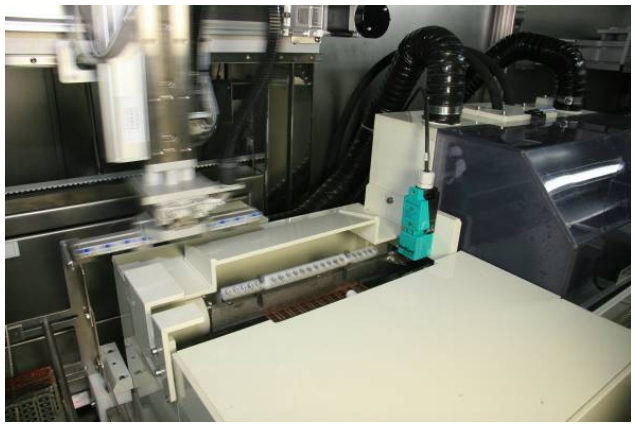
4. Z AXIS GOES DOWN ON THE CONVEYOR ENTRANCE. WAIT FOR CHAIN PIN.



5. PNE GRIPPER RELEASE THE LEADFRAME AND A PUSHER REVERSE FROM VERTICAL TO HORIZONTAL THE LEADFRAME



6. THE CHAIN PIN COMES AND STARTS TO MOVE LEADFRAME INTO THE WATERJET CONVEYOR



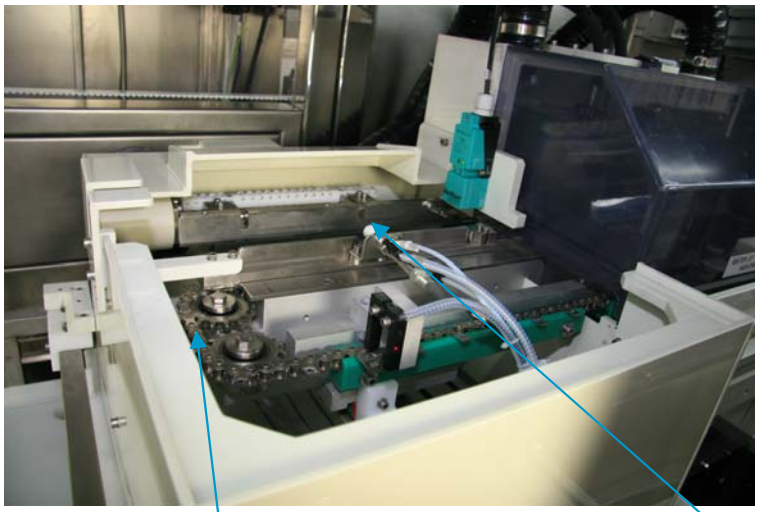
Waterjet Section

Waterjet section consist in several component that permits to spread Hi-pressure water on leadframes in order to complete the deflashing process. After the deflash, leadframes are dried and moves on the unload section.

Waterjet section is composed by:

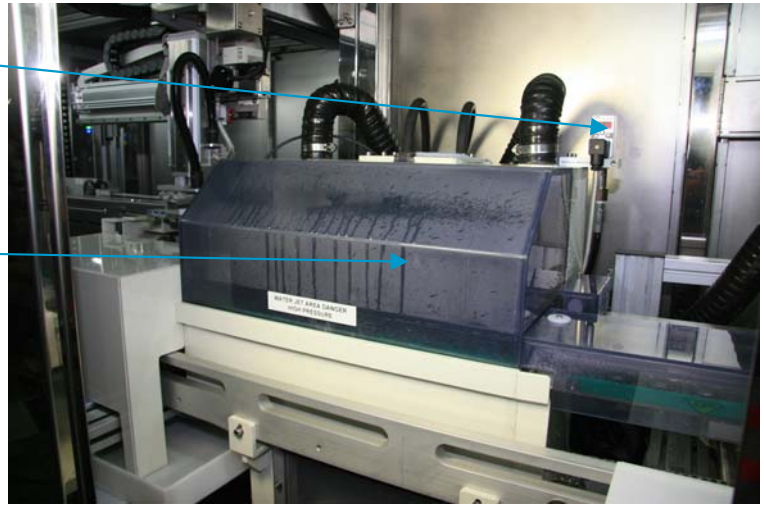
- Conveyor
  - AUTO-SIZING containment GUIDES thanks to a dedicated servo-motor and specific software management
  - TRANSPORT CHAIN ruled by a servo-motor. Steps are controlled by PLC software according to leadframes and cycle needs.
- Nozzle blocks
  - Distance from the leadframe regulation with 2 axys high precision guides
  - 16 diamond nozzles (to cover up to 80mm of width, 22 to cover up to 100mm)
- Waterjet pump
  - HI-PRESSURE pump up to 600Bar @30L/min
- Dryer

OLD LAGUNA MODEL



Waterjet pressure control

Transparent plastic protection cover with safety interlock



Transport chain

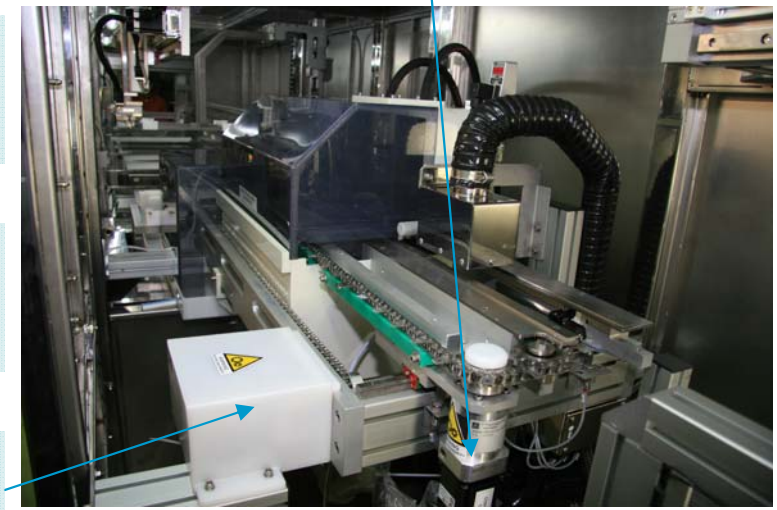
Conveyor loading area

Servo-motor for transport chain

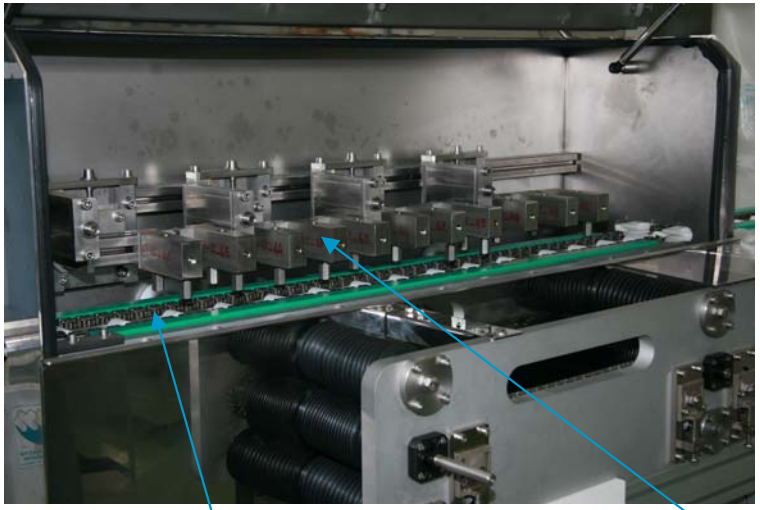
HOT air dryer (up/dw boxes) with dedicated heater and blower

AUTO-SIZING Leadframes containement guides.

Servo-motor for guide spacing

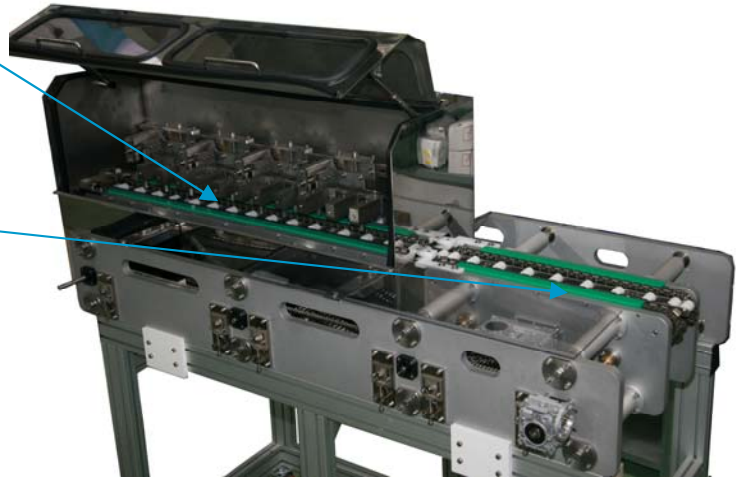


NEW LAGUNA MODEL



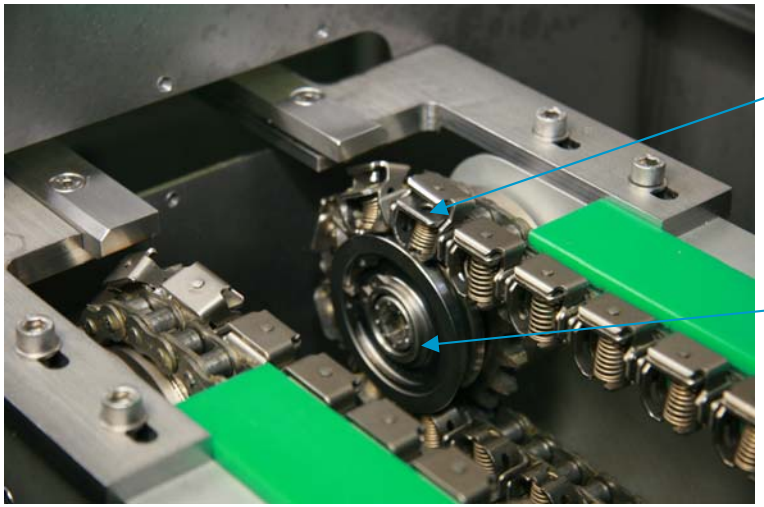
NEW: easy to exchange rollers support

NEW: Separated conveyor for dryer



NEW: Gripper chain

NEW: Multiple Nozzle Blocks

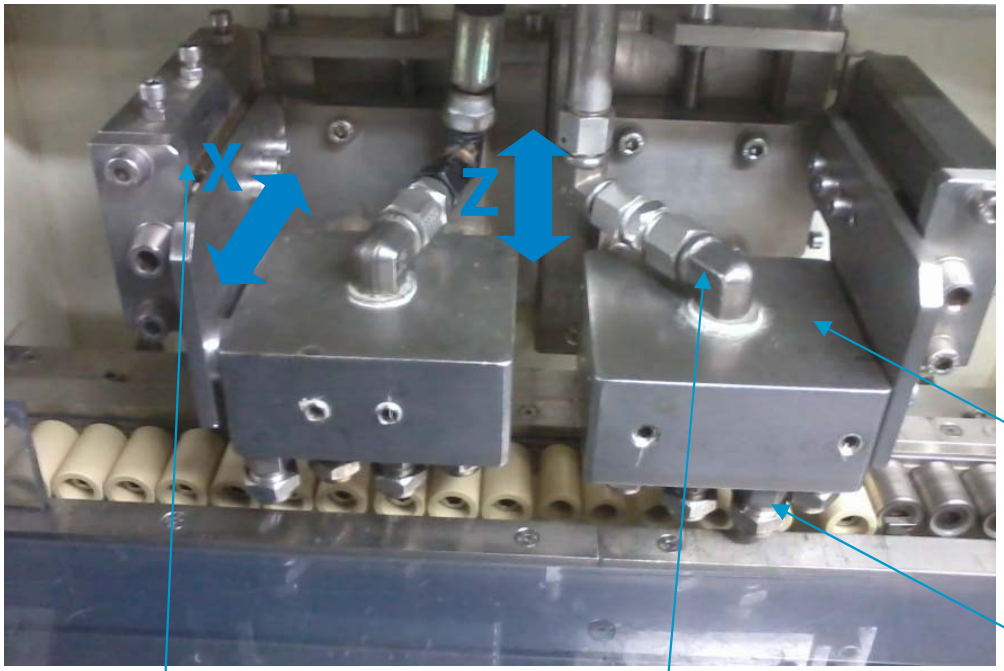


NEW: Gripper chain for a non-stop loading

NEW: Special pulley for gripper chain automatic openiong at load and unload

OLD LAGUNA MODEL

Nozzles blocks are realized with high precision CNC working center to ensure high precision: no leakage. After realization nozzle blocks are purged using water at 600 Bar for 24 hours to eliminate every milling residual that can damage diamond nozzles.



Nozzles fittings

Custom designed nozzle block

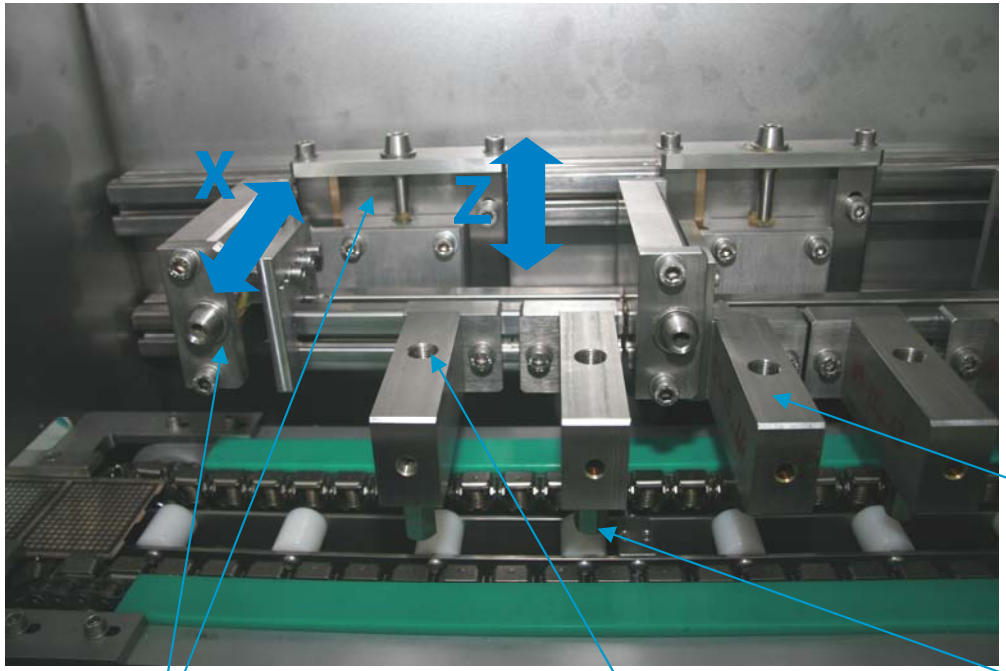
High precision guide for nozzle block position regulation Z, Y axis

High pressure SS316 pipings and fittings

Nozzles

NEW LAGUNA MODEL

NEW Laguna Model nozzle blocks has been redesigned to facilitate positioning, maintenance and also to increase the power action on leadframes.



Custom designed nozzle block

High precision guide for nozzle block position regulation Z, Y axis

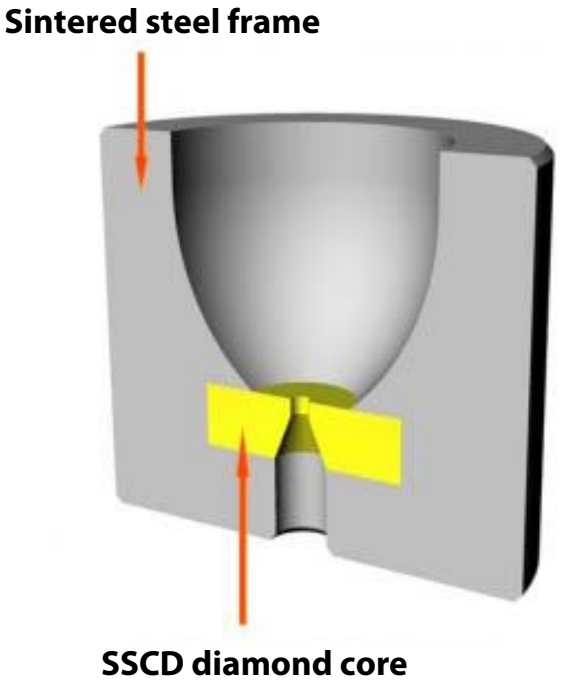
High pressure SS316 fitting

Nozzle fitting

Diamond nozzles *SSCD (Synthetic Single Crystal Diamond)* with optical orientation of the crystal.

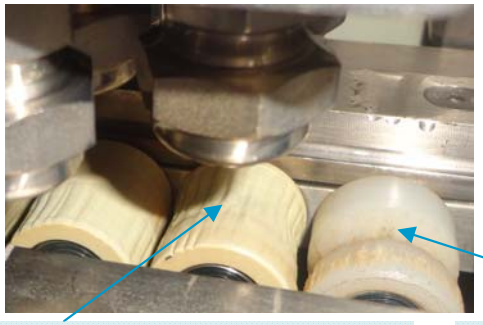
Resistance over 6.000 bar of pressure.

The special technique of diamond sintering grants the highest strength of the product during assembly and tightening phases and a higher resistance to mechanical stress. In addition, the specific geometry and positioning of the core, prevents from any water leakage between metal and diamond, due to erosion of steel and the stress of high pressure cycles.



Roller are realized with special polymer material with high precision turning starting from rectified bars.

- For extremely high service life in continuous operation
- Low coefficient of friction
- extreme high wear-resistance
- Dirt resistant



Special material rollers after 6 month of production

Standard PE rollers after 1 month of production

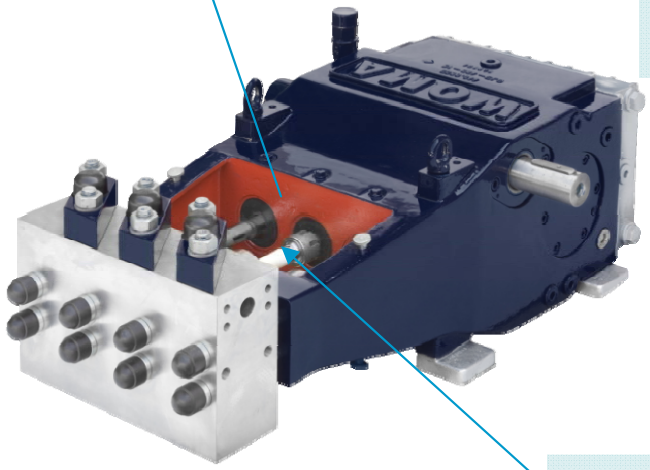
Lifetime is at least 10 times longer comparing to PE rollers.

Waterjet Section HI-Pressure Pump

Insoronized Enclosure

OIL forced refrigeration

H2O INLET FILTER. Optional also HI-PRESSURE FILTER



45Kw electric motor

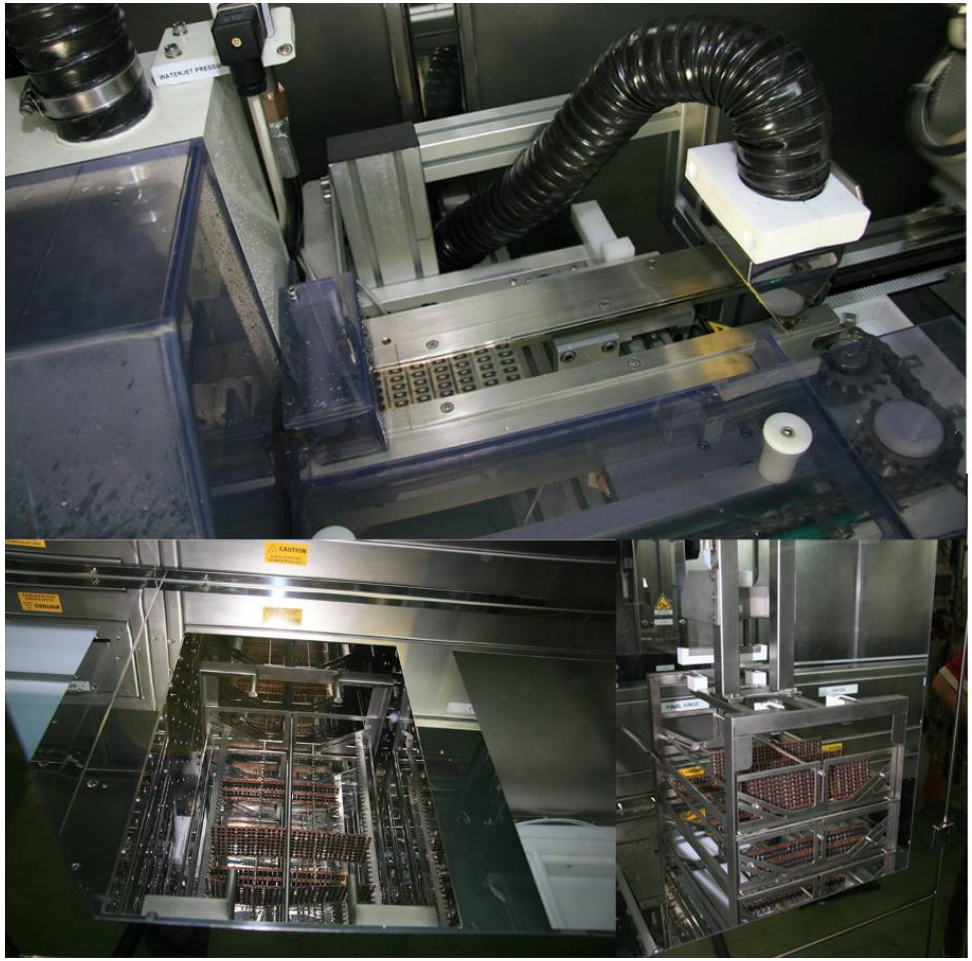
High quality ceramic plunger

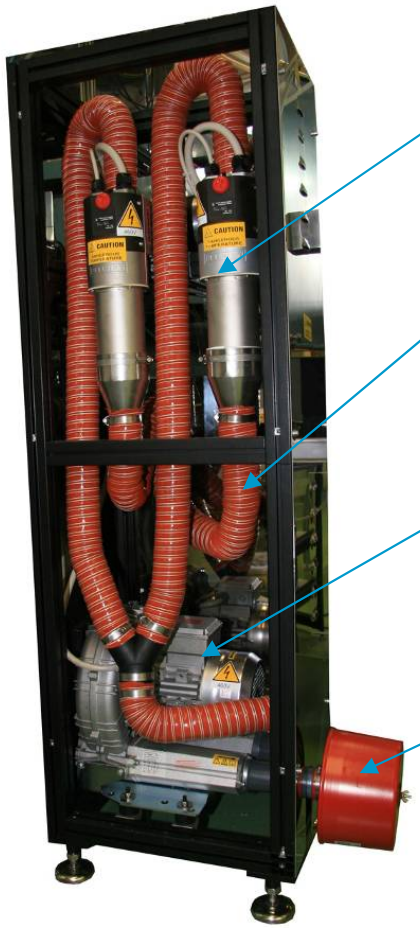
MAIN FEATURES:

- Pressured oil lubrification with cooling system
- Service-friendly pump head in block construction of treated forged steel
- Wear-resistant valve seats
- Maintenance-free plunger seals with lamellar seal packing
- High-quality ceramic plunger
- Long life
- Pressure regulation valve with pneumatic control
- Pneumatically controlled high-pressure valves for nozzle blocks selection (from recipe)

Dryer

Dryer ensure perfect results with all leadframes types. Depending on configuration dryer is for leadframe only (conveyor type) or for full basket with carrier.





Unloading

Leadframes unloading section could be realized with several options according to leadframes, magazines and budget.

- AUTOMATIC UNLOAD STATION: we developed two types of automatic loading:
  - ROTARY TABLE for “standard” MAGAZINE
  - PUSH TYPE for “special” MAGAZINE

Operator has only to insert magazine into special frame. Equipment will automatically unload leadframes from conveyor catching them one by one.

- MANUAL LOAD STATION: In case you select manual station, operator has to manually unload one by one leadframes into magazines. There are two options for manual unload station:
  - Unload a BASKET that contains up to 4 carriers with leadframes (this option cannot be selected with waterjet section)
  - Unload one by one leadframes from a plastic slide

Realizations

Toledo Model

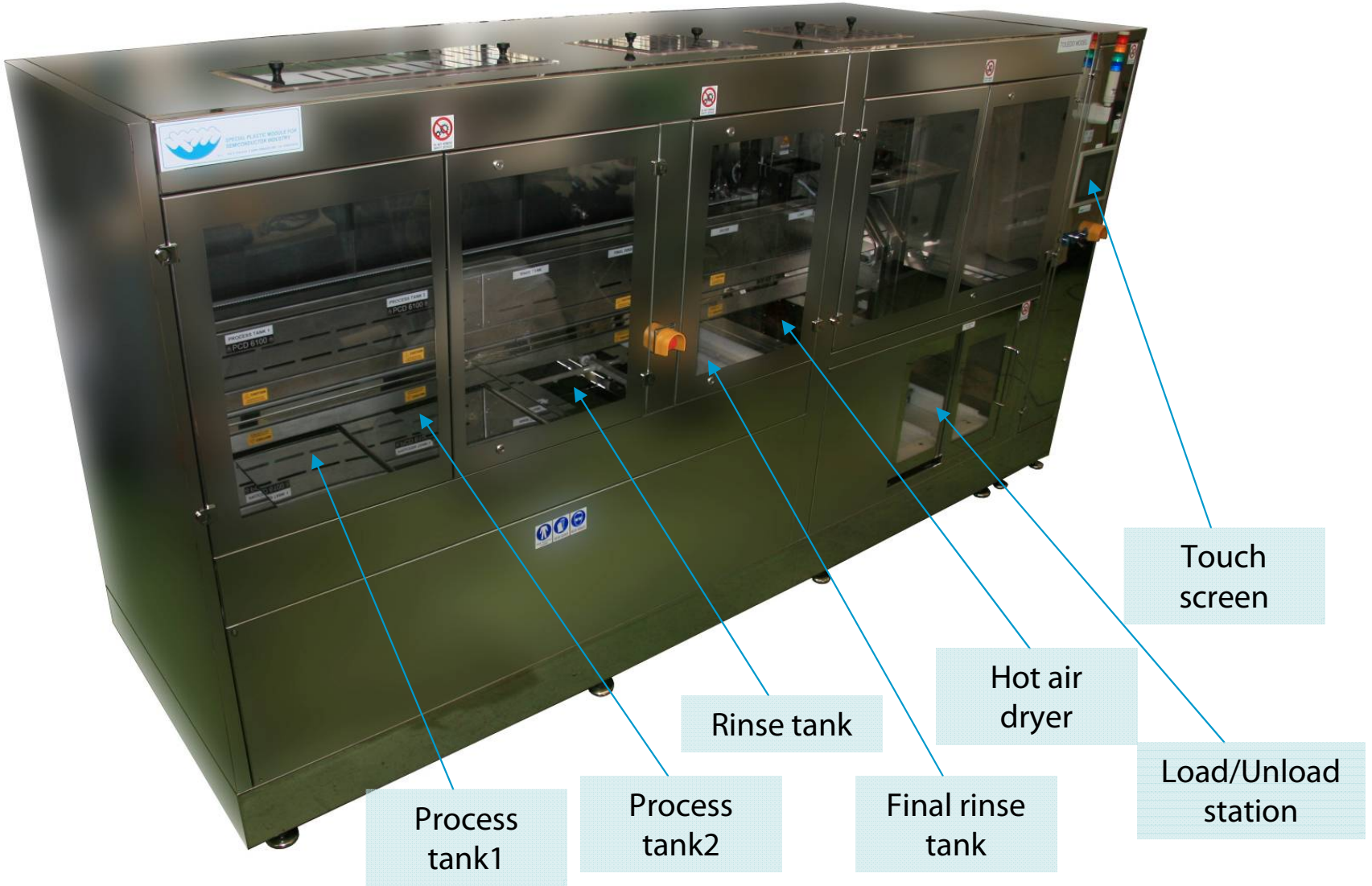
S.P.M. s.r.l. Automatic Leadframes Deflashing Machine – Toledo Model is composed by:

- 2 SS316 Process Tanks – 90°C
- 1 Rinse tanks SS316
- 1 Pe Final rinse tank (cold and hot water from buffer tanks)
- 1 dryer with HOT air
- Manual Load/Unload station

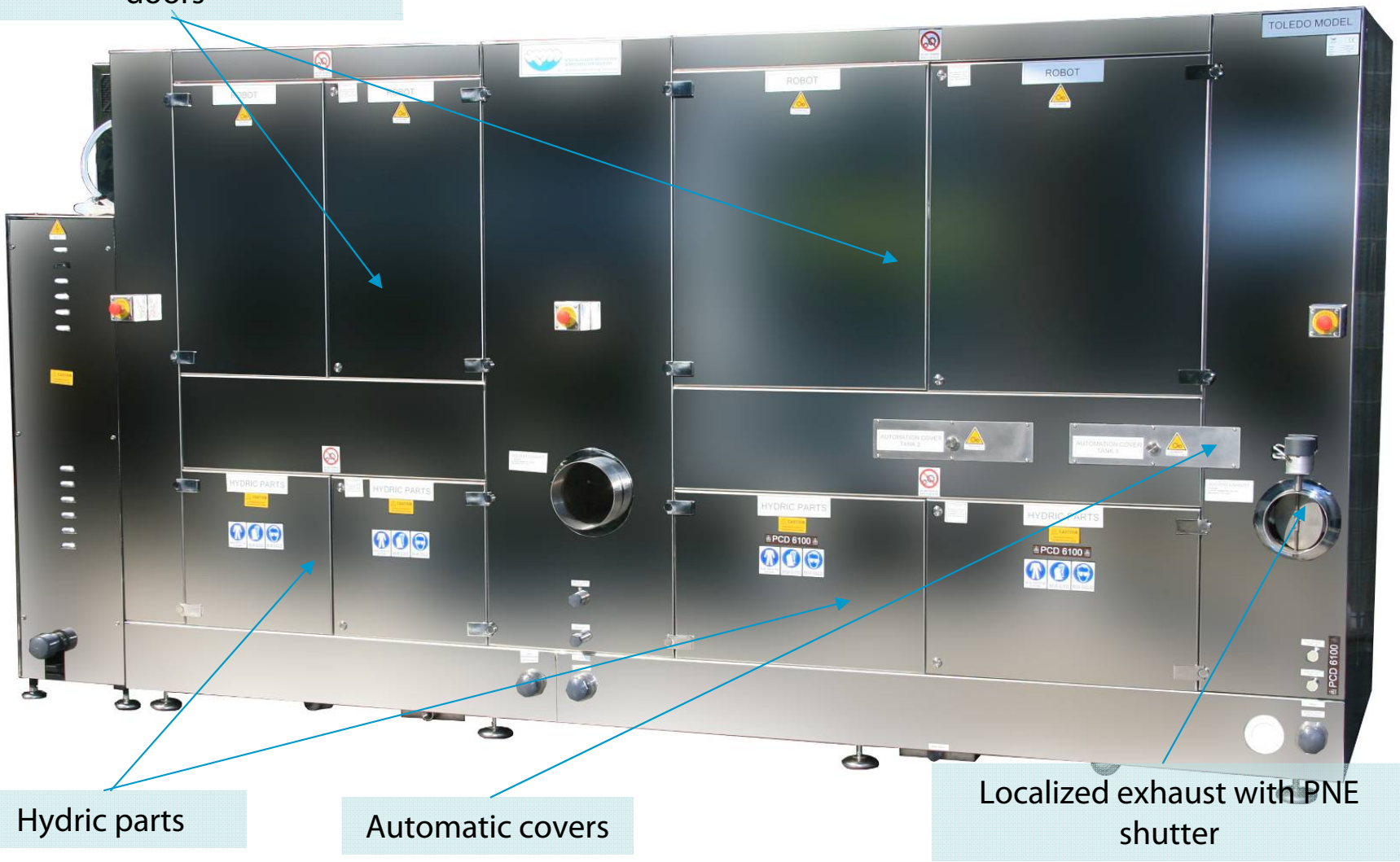
The entire structure is in SS304 and the machine is equipped with antifire system in order to guaranteed safety.

The machine is controlled by an OMRON PLC and one OMRON NS10 touch screen. The main robot is controlled by an OMRON servodrive.

Toledo Model : Front View



Toledo Model : Rear View



Laguna Model

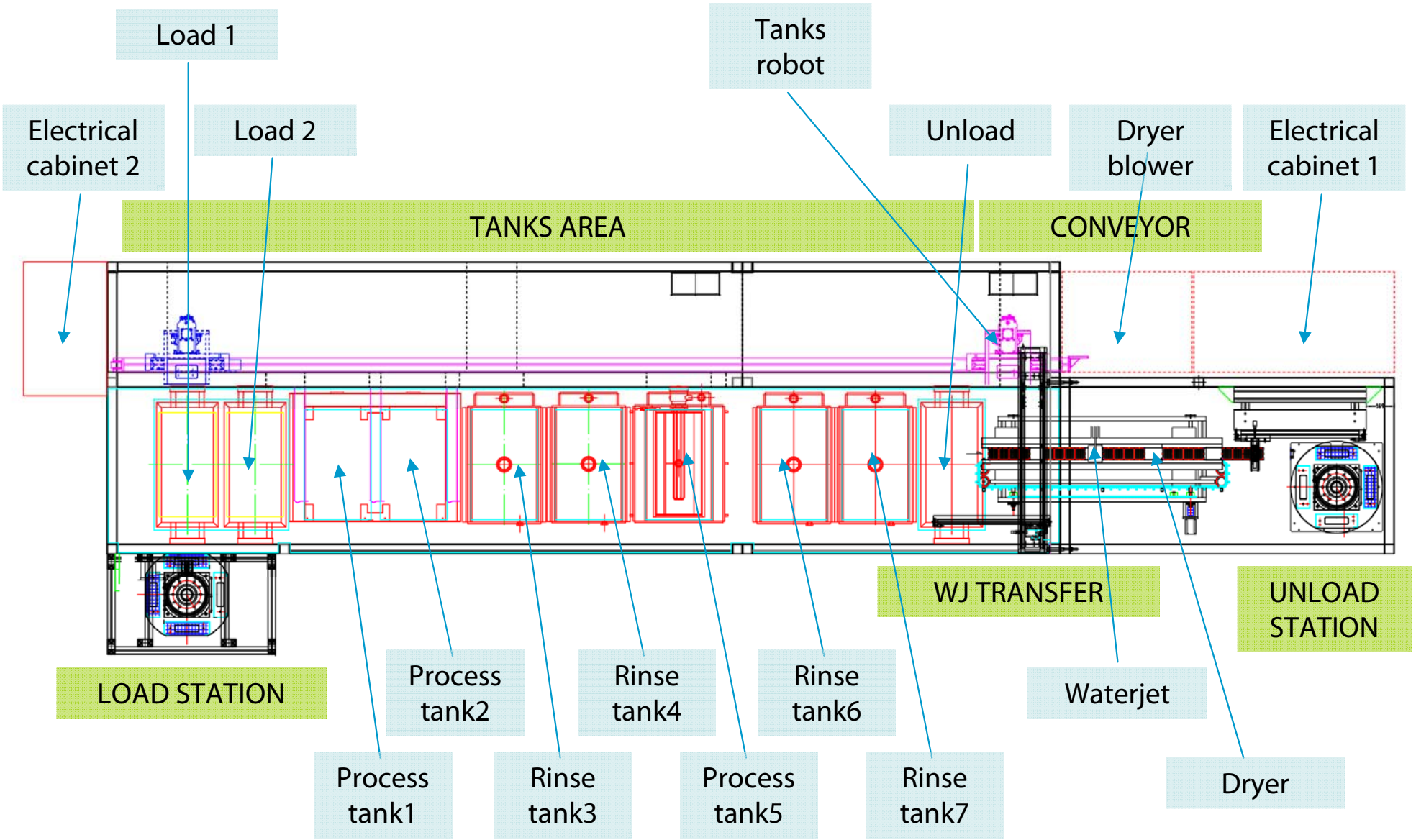
S.P.M. s.r.l. Automatic Multiformat Deflashing Machine with Waterjet – Laguna Model is composed by:

- Loading station
- 2 SS316 Process Tanks – 80°C
- 2 Rinse tanks
- 1 PVDF Process tank – 80°C
- Waterjet with special conveyor
- Dryer
- Unload station

The entire structure is in SS304 and the machine is equipped with antifire system in order to guaranteed safety.

The machine is controlled by an OMRON PLC and two OMRON NS12 touch screens. The main robot is controlled by an OMRON servodrive.

Laguna Model



Laguna Model : Front View

Laguna Model - Introduction

BUFFER FOR 4 LEAD FRAMES MAGAZINES (SAME FORMAT)

1

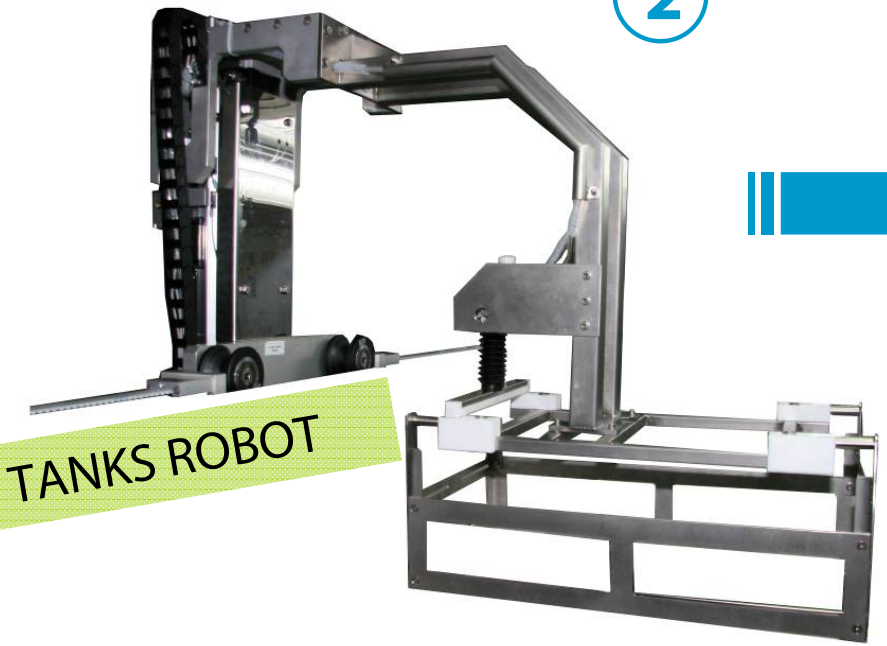
LOAD STATION

SS316 CARRIER FOR 100 LEADFRAMES (SAME FORMAT)

Loading Station can work with different Lead frames formats. Each format have a customized carrier.

Manual format change procedure are needed.

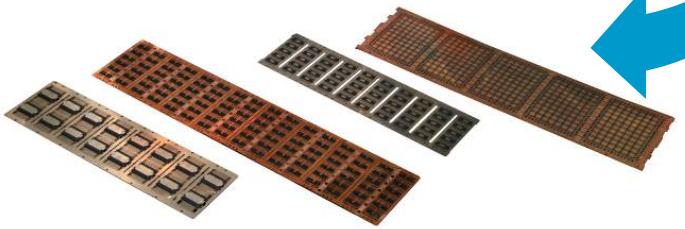
2



TANKS ROBOT

3

WJ TRANSFER



4

CONVEYOR

WATERJET

DRYER

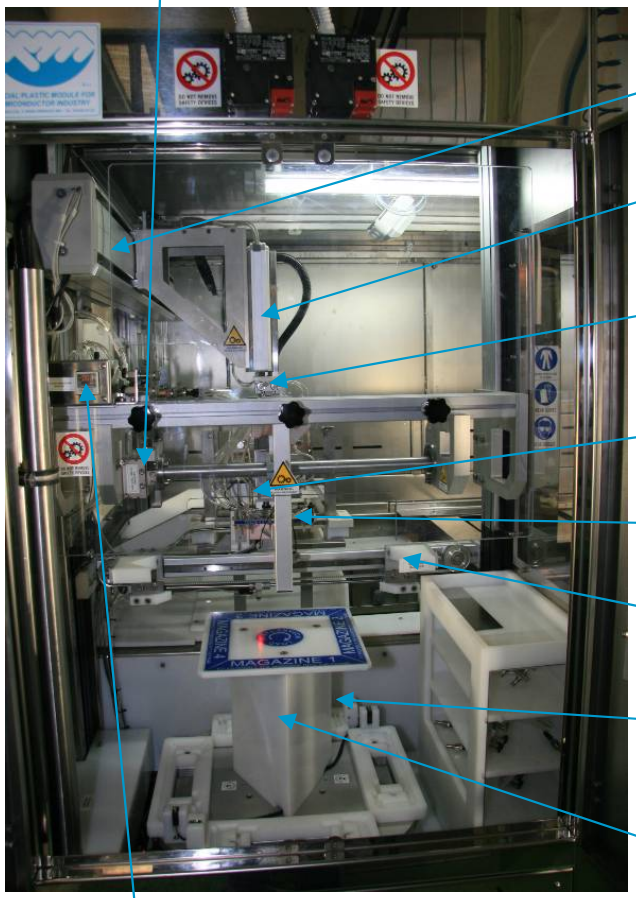
5

UNLOAD STATION

Tanks robot transort carriers into process and rinse tanks in order to make chemical attack and cleaning.

Laguna Model – Load Station

0-90° PNE Actuator



Vacuum pressure switch (4 channel)

Y axis Load Transfer

Z axis Load Transfer

PNE Pliers Load Transfer

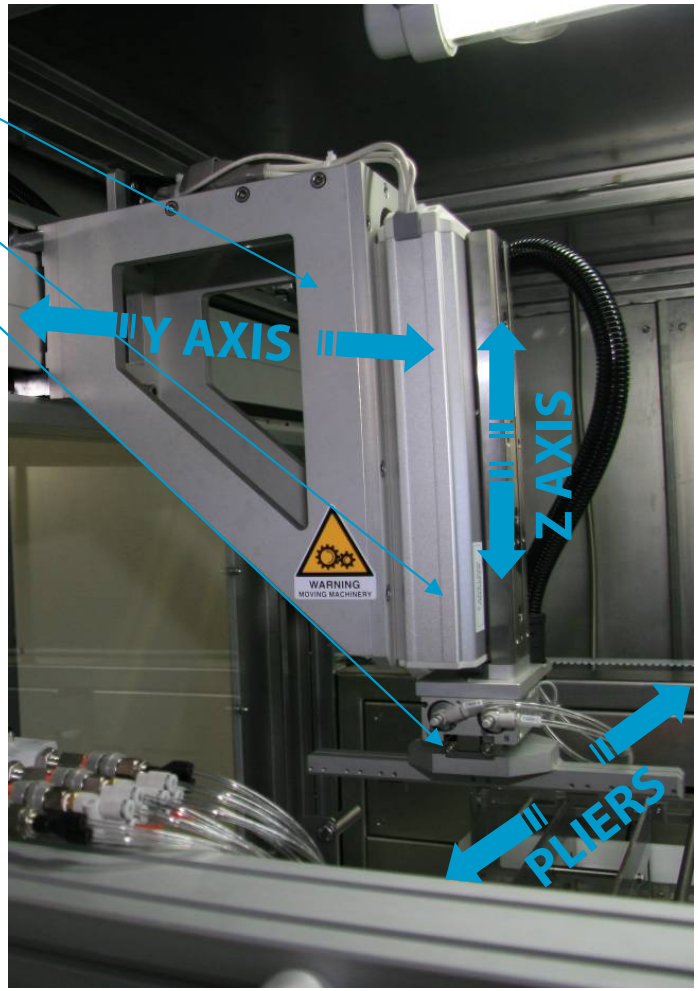
PNE vertical actuator

Vacuum suction cups

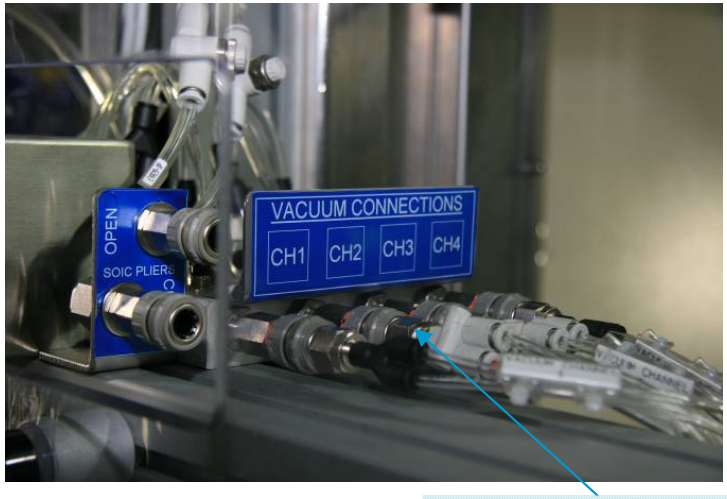
Carrier blocker

Lead frames Elevator

Rotary table for 4 Lead frames carriers



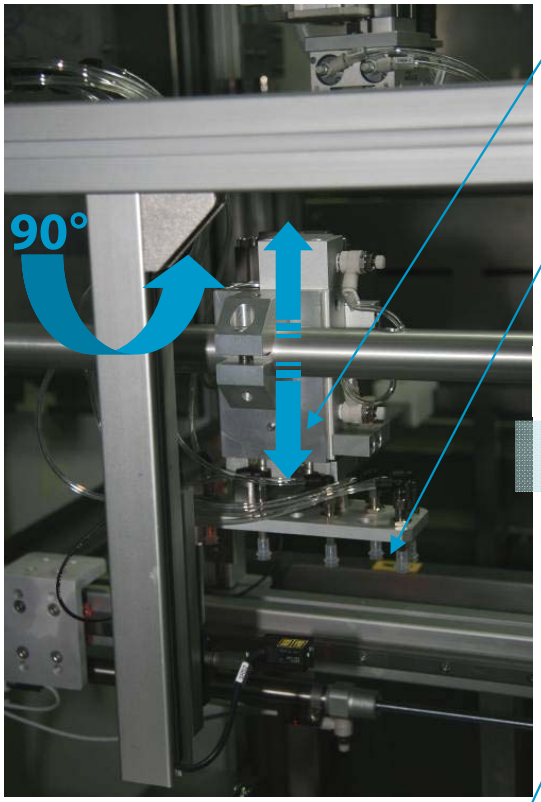
Laguna Model – Load Station



Quick connectors

PNE manifold LOAD station

Rotary table binary sensor

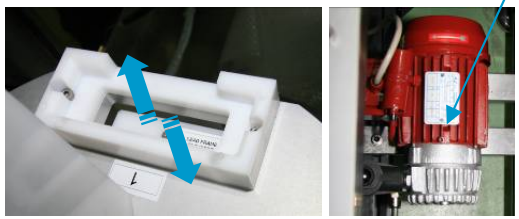


PNE vertical actuator to permit contact between leadframes and suction cups

Vacuum suction cups

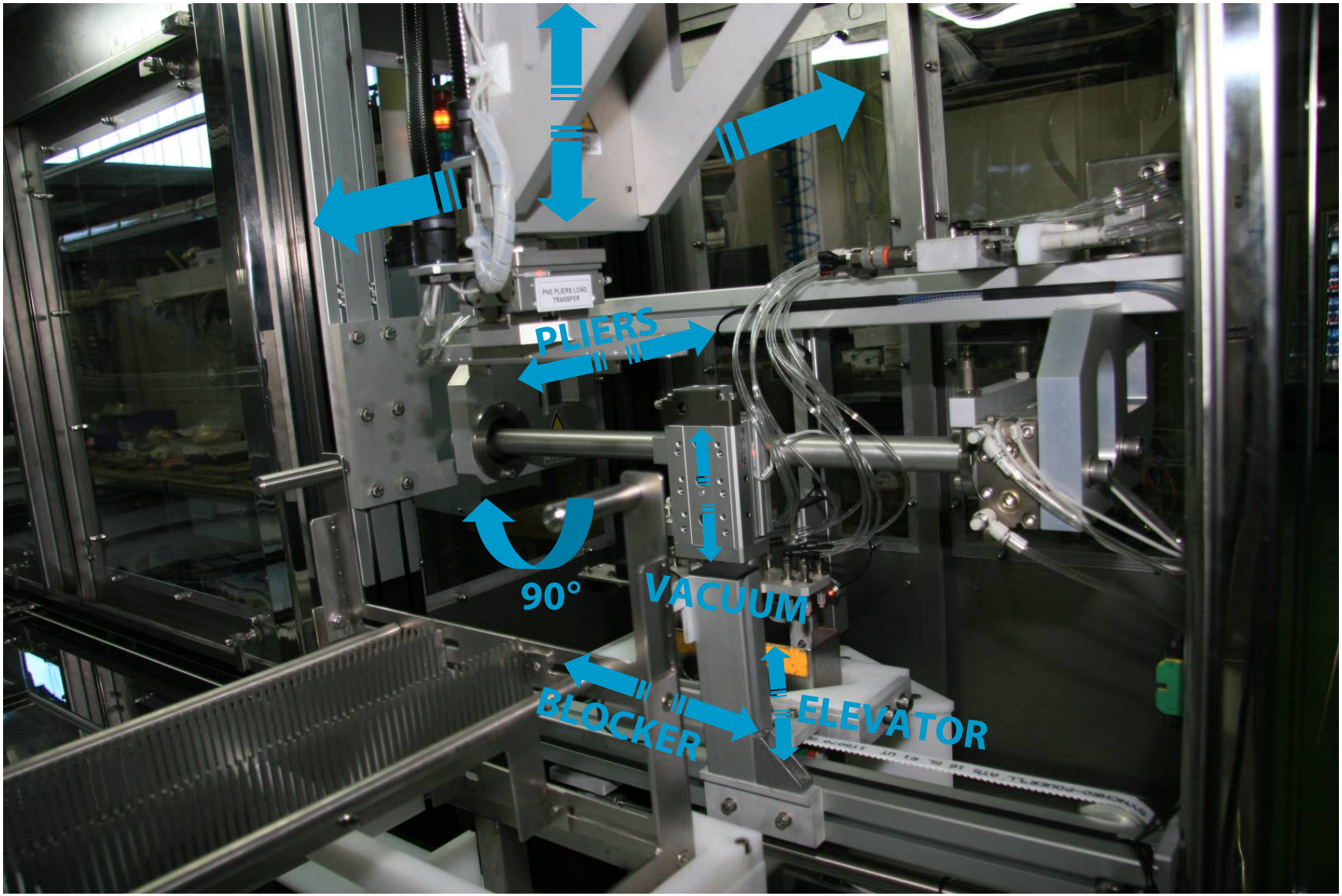
Vacuum pump

Carrier presence sensors



Lead frame Elevator

Laguna Model – Load Station



Laguna Model – Chemical Area

PNE cover

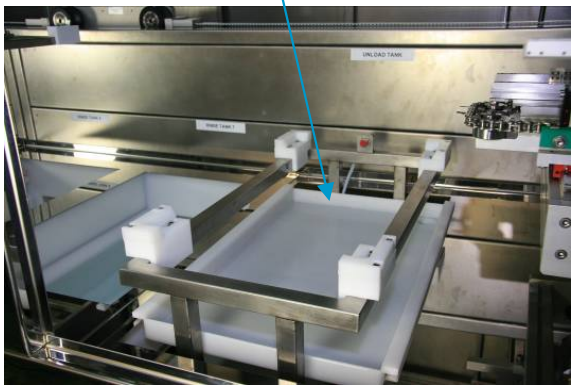
Tanks robot

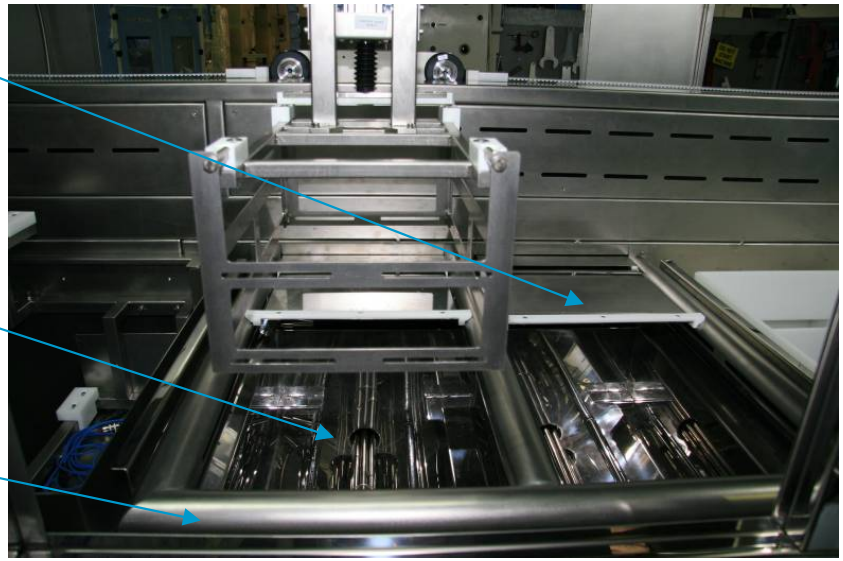
SS 316 Process Tanks 1-2
~ **90°C**

Localized exhaust

Exhaust plenum

Waterjet transfer position





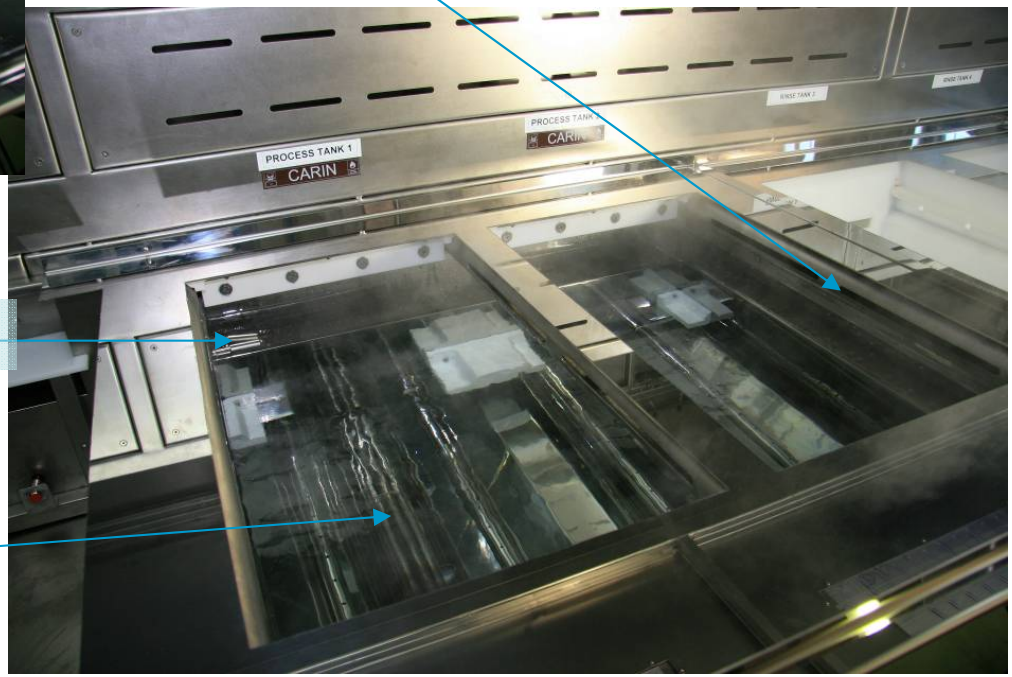
Laguna Model – Process Tanks 1-2

Automatic Open/Close PNE cover

Localized exhaust

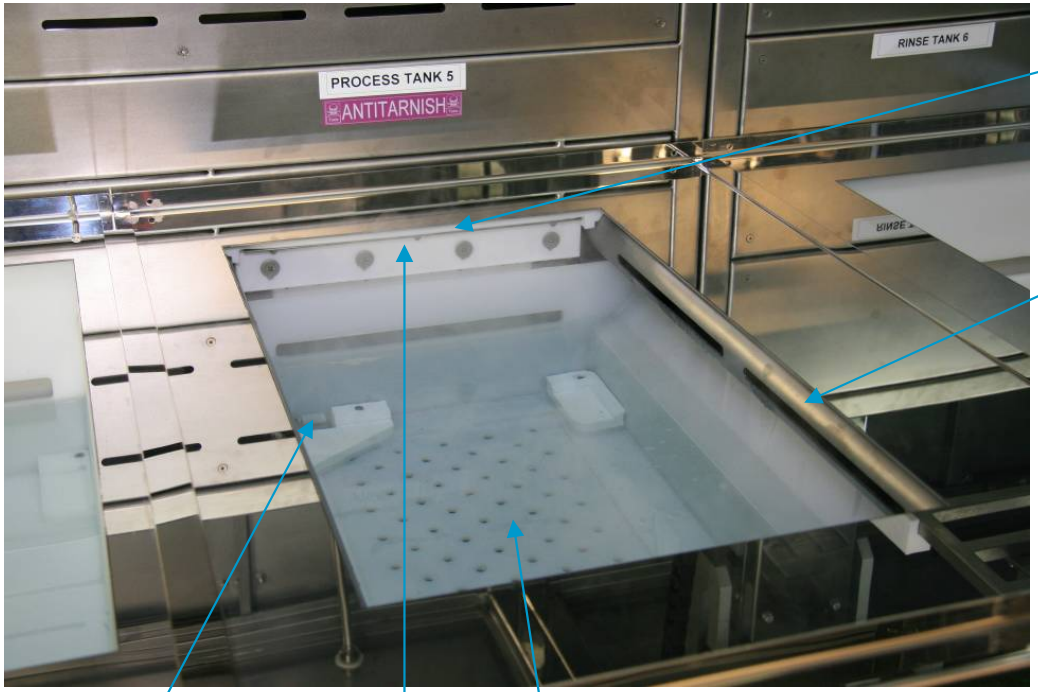
Automatic sliding covers

Level sensors



ATEX Heaters up to 90°C

Laguna Model – Process Tank 5

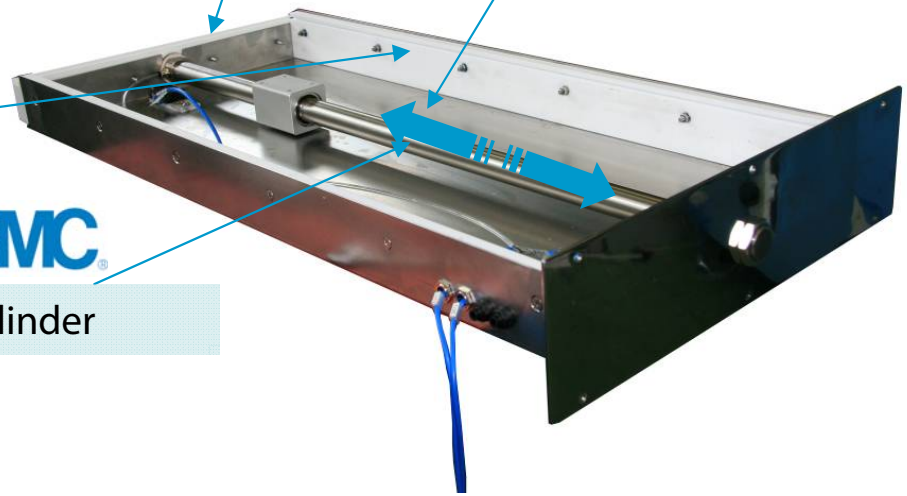


Automatic Open/Close PNE cover

Localized exhaust

SS 304 Cover Box

PTFE cover cleaning



Level sensors

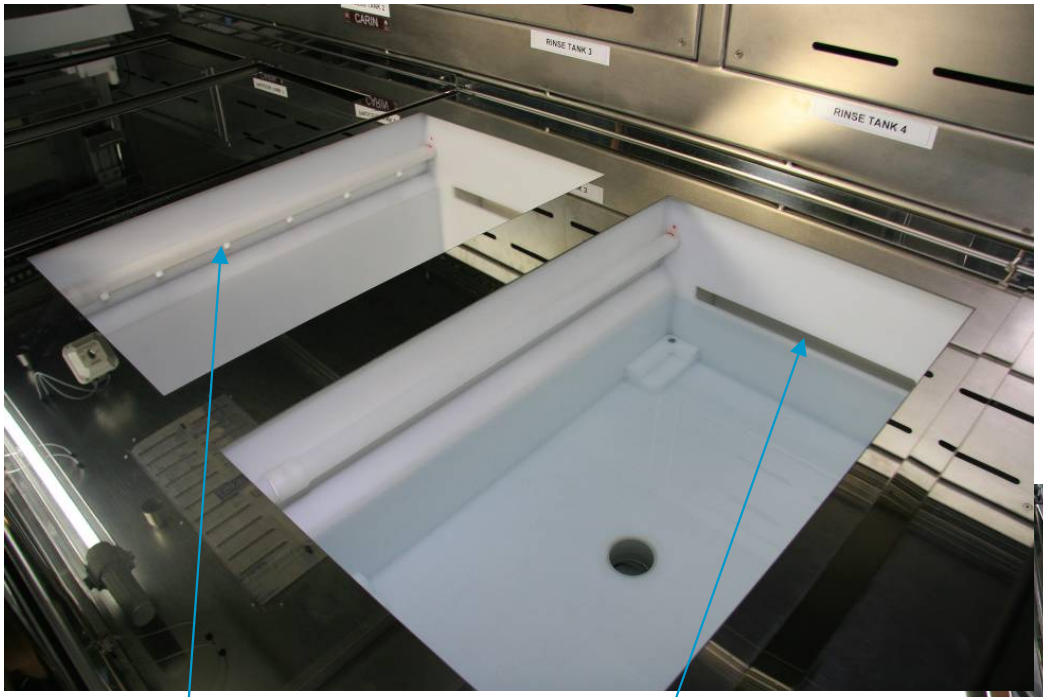
PTFE guides

PTFE lead

AIR cylinder

ATEX Heater up to 90°C

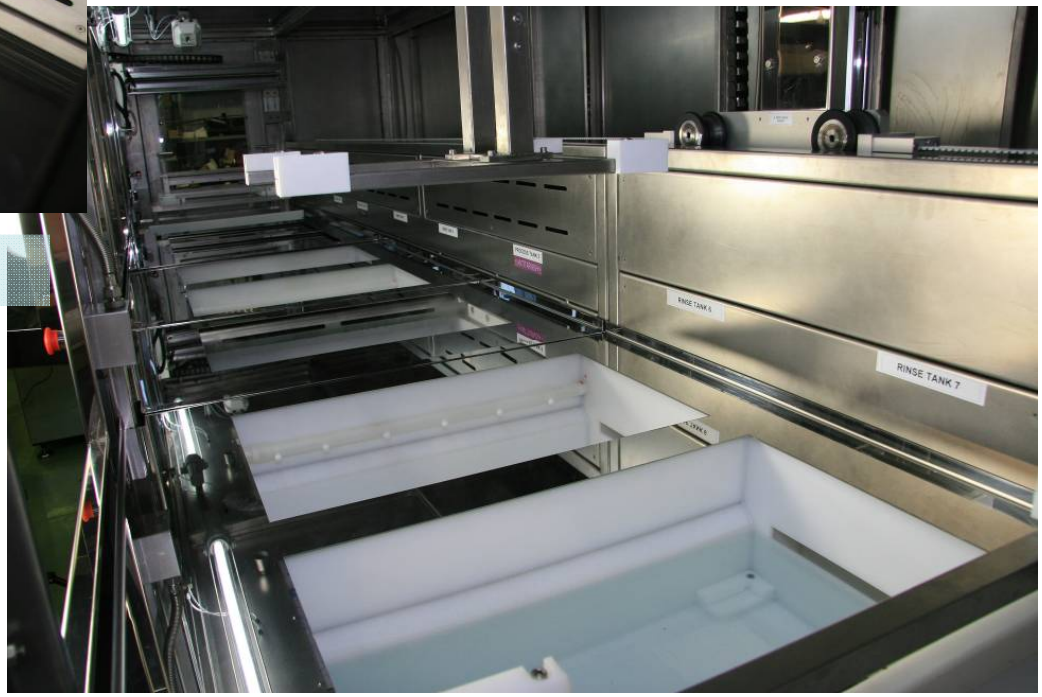
Laguna Model – Rinse Tanks



HOT Spray nozzles

Overflow with level sensor

COLD H2ODI buffer tank



HOT H2ODI buffer tanks

Laguna Model – Hydric Parts

External chemical filling tanks

ATEX Heat exchangers

ALMATEC A WILDEN COMPANY

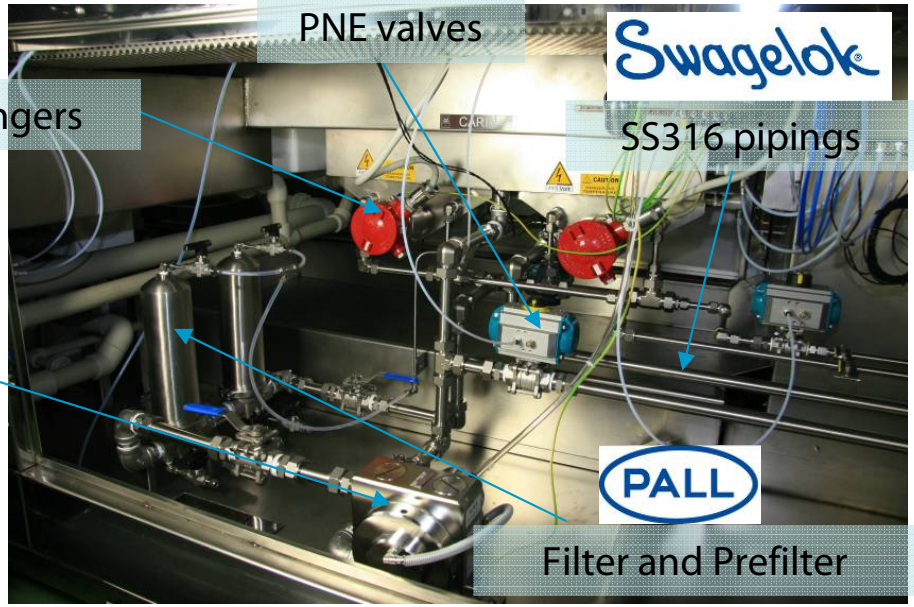
SS 316 pump

InterApp

PNE valves

Swagelok

SS316 pipings



PALL

Filter and Prefilter

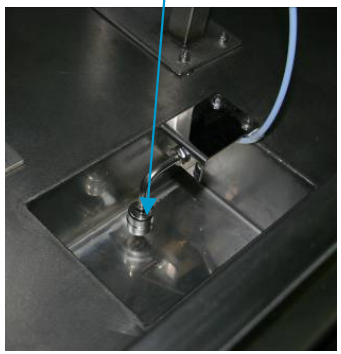
COLD H2ODI buffer tank

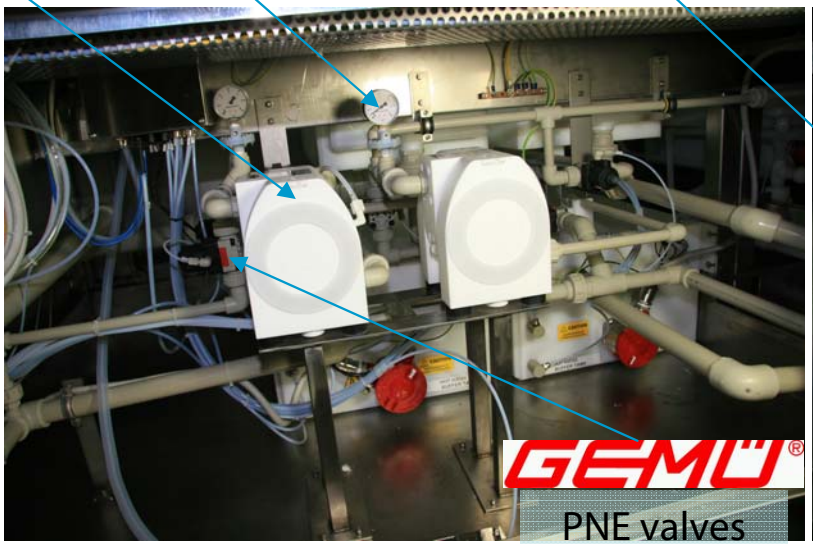
ALMATEC A WILDEN COMPANY

Teflon pumps

Pressure manometer

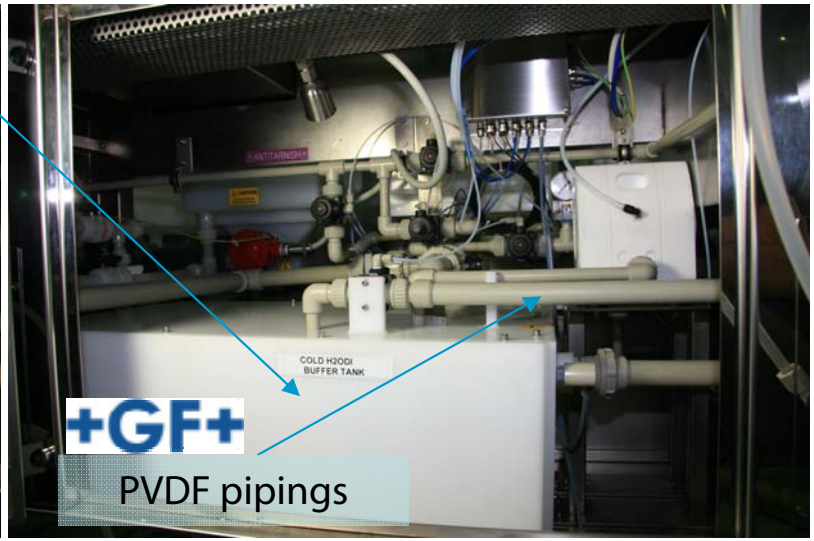
Leak sensor





GEMÜ

PNE valves



+GF+

PVDF pipings

Laguna Model – Tanks Robot

X axis ServoMotor + Reducer

SMC

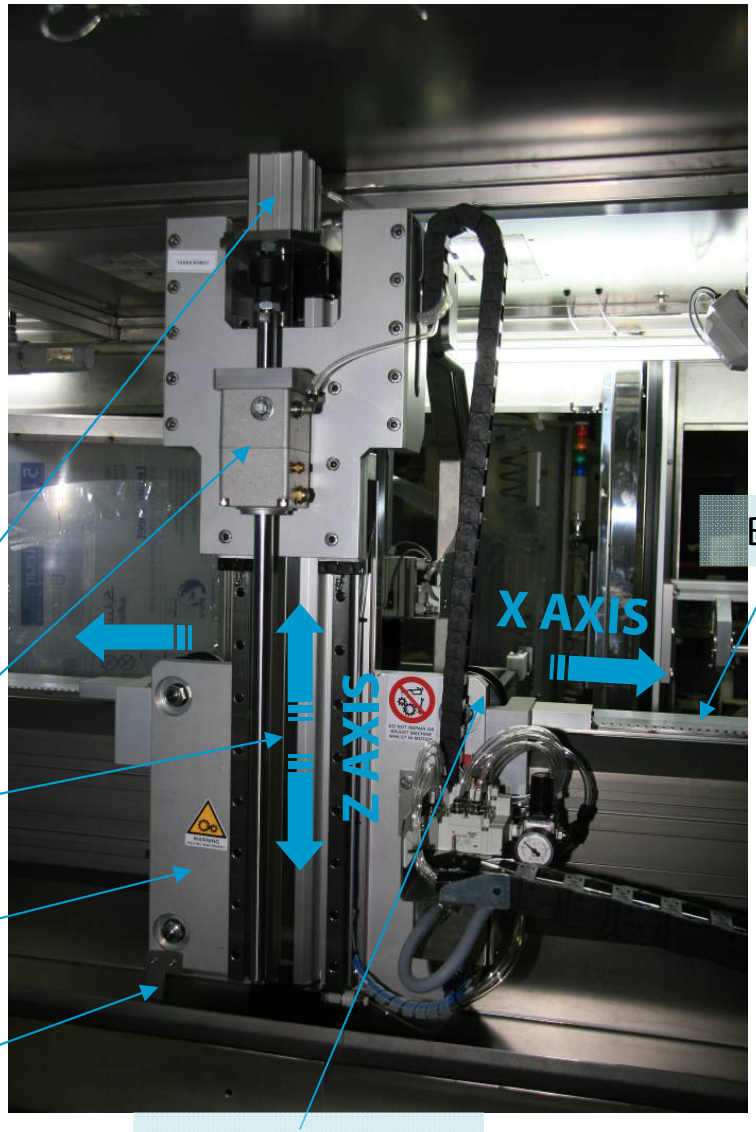
PNE medium position

Rod locking unit

PNE Z axis

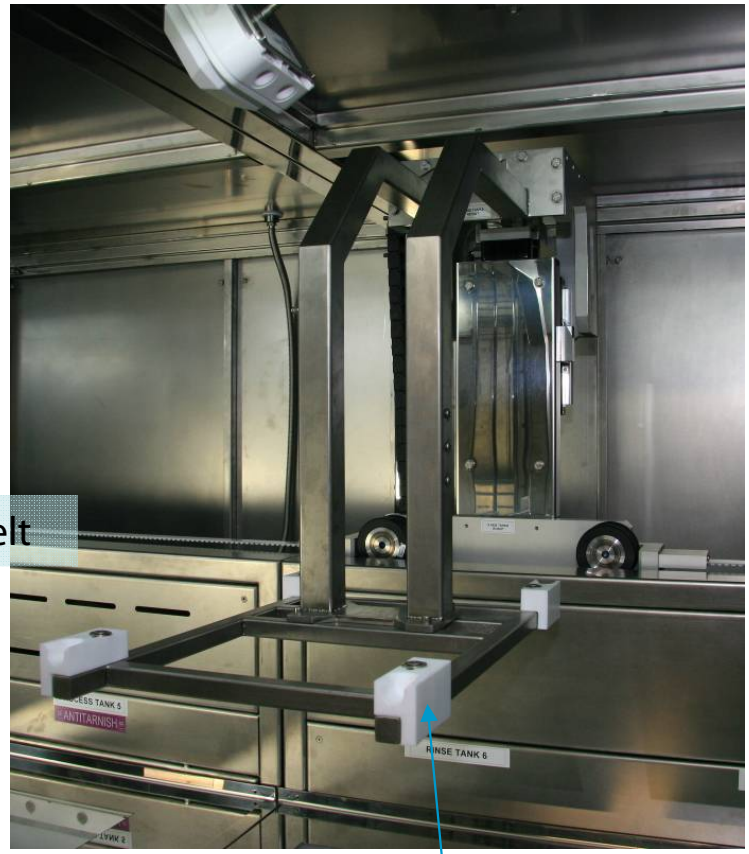
X axis

Origin Plate



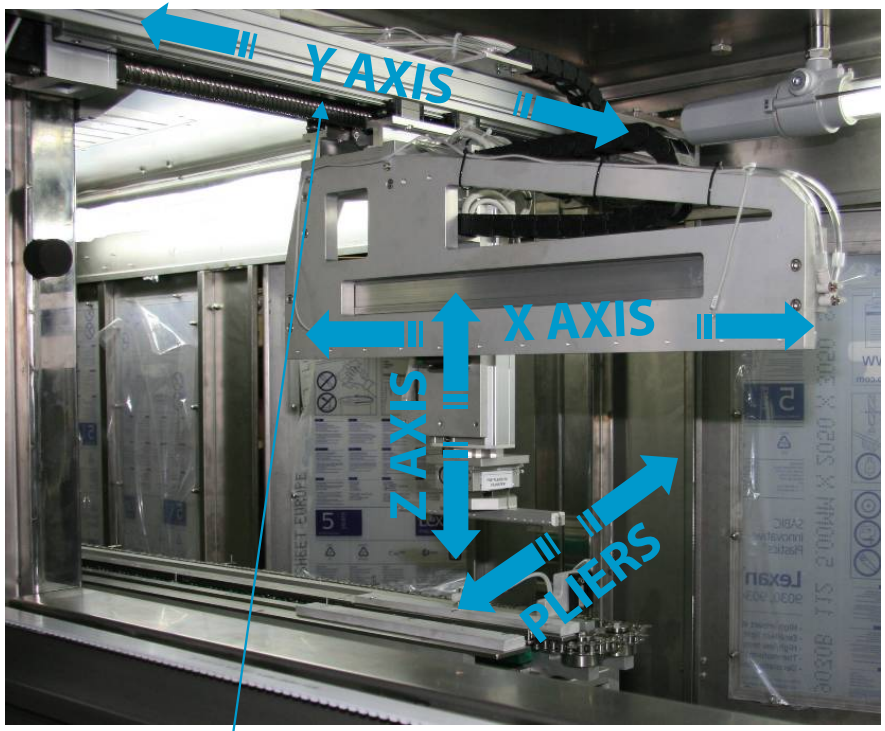
Rollers

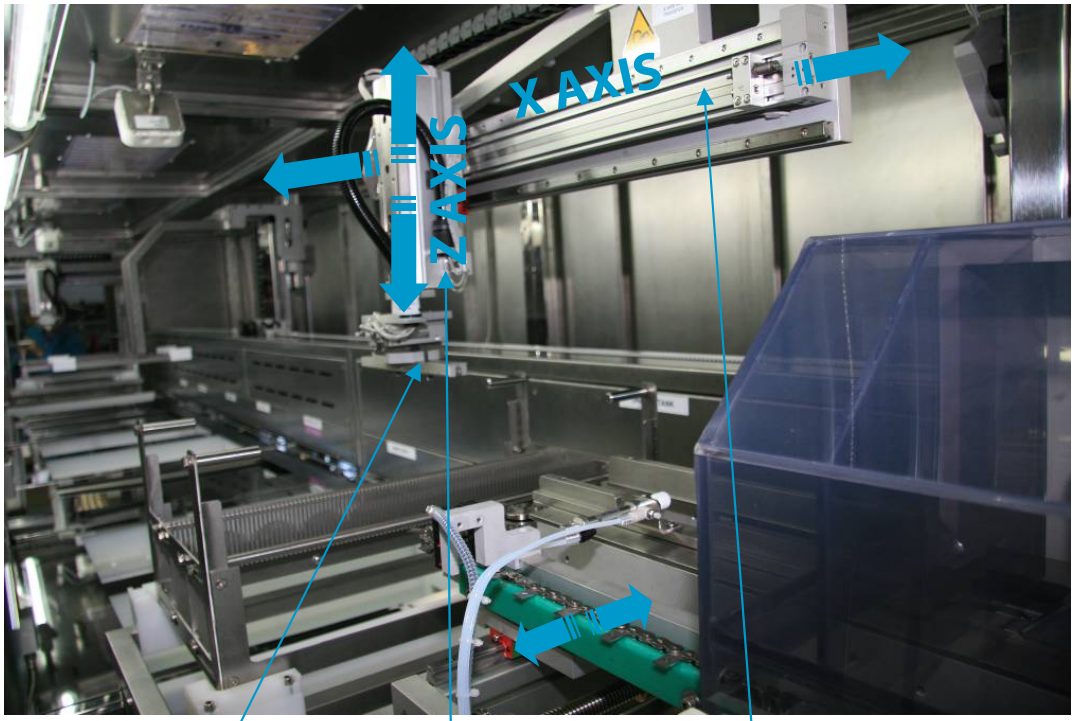
Belt



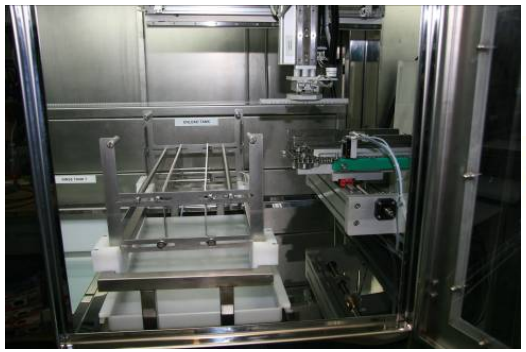
Carrier holders

Laguna Model – WJ Transfer System





Y Axis WJ Transfer

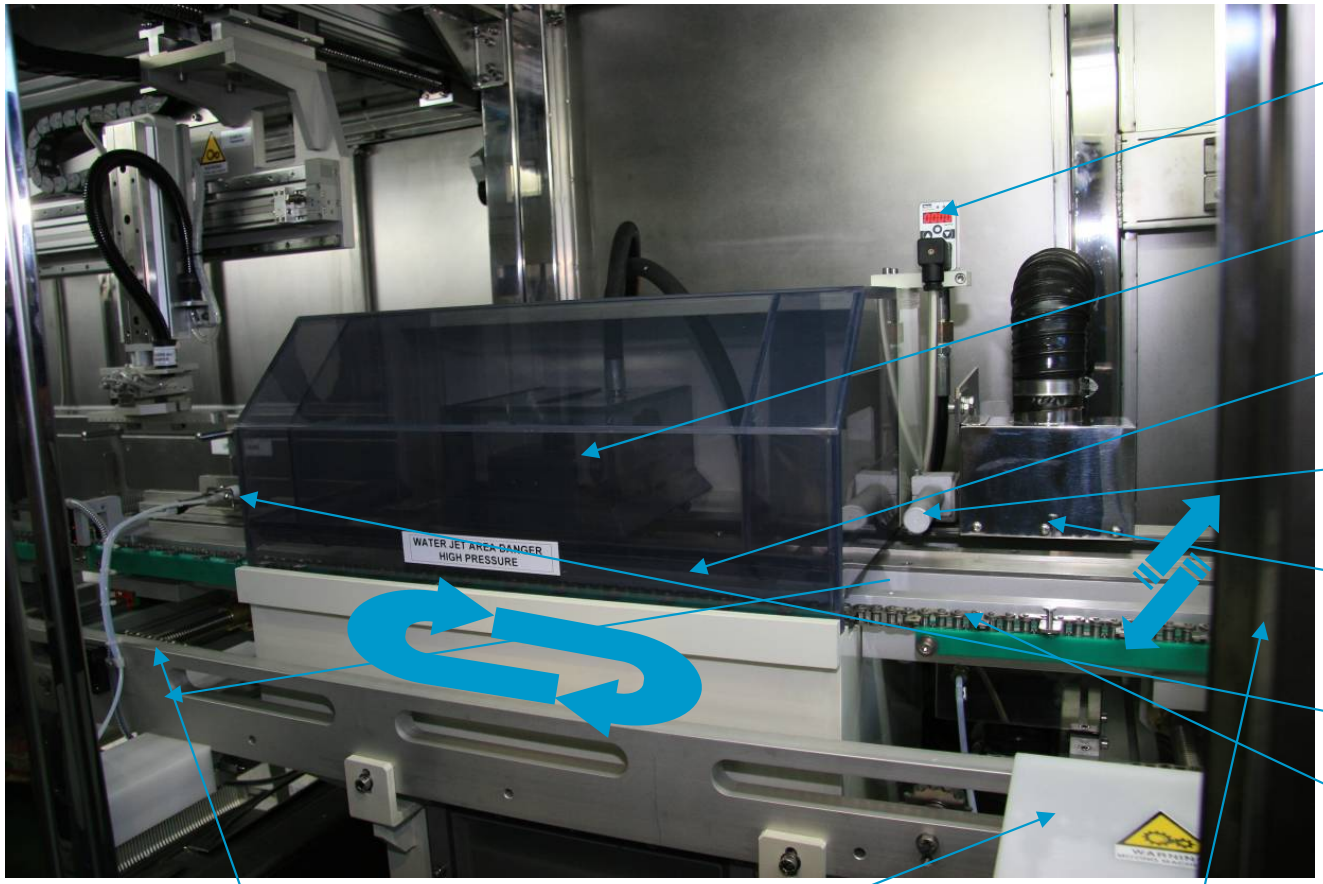


PNE pliers WJ Transfer

PNE X Axis WJ Transfer

Z Axis WJ Transfer

Laguna Model – Conveyor



WaterJet pressure manometer

WaterJet Up nozzles manifold

WaterJet Down nozzles manifold

Air Blades

HOT air

PNE Lead frame Pusher (vertical to horizontal)

Transport Chain

Size Chain

ServoMotor + reducer for automatic Lead frame size regulation

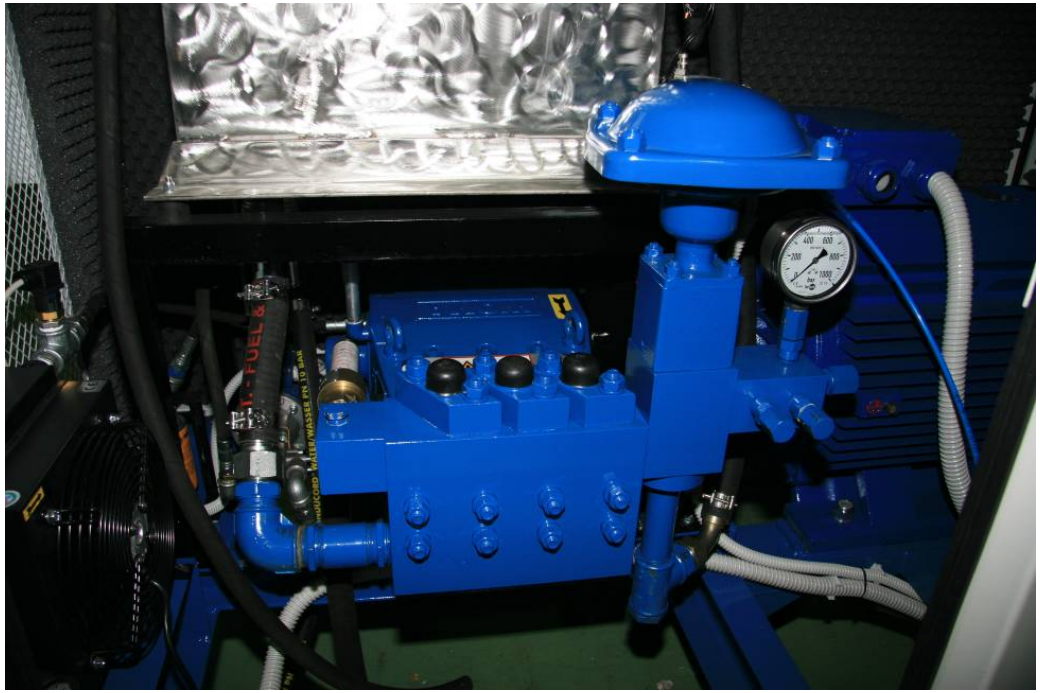
Chain ServoMotor + reducer

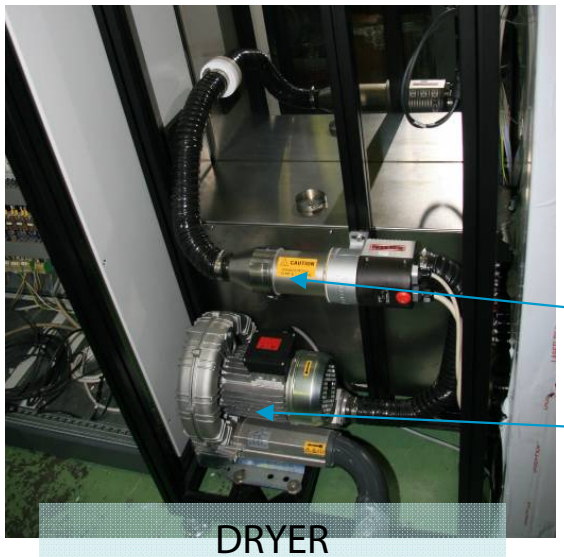
Laguna Model – Waterjet & Dryer

WOMA

WaterJet Pump Insoronized Enclosure

HI-Pressure water Plunger Pump





LEISTER

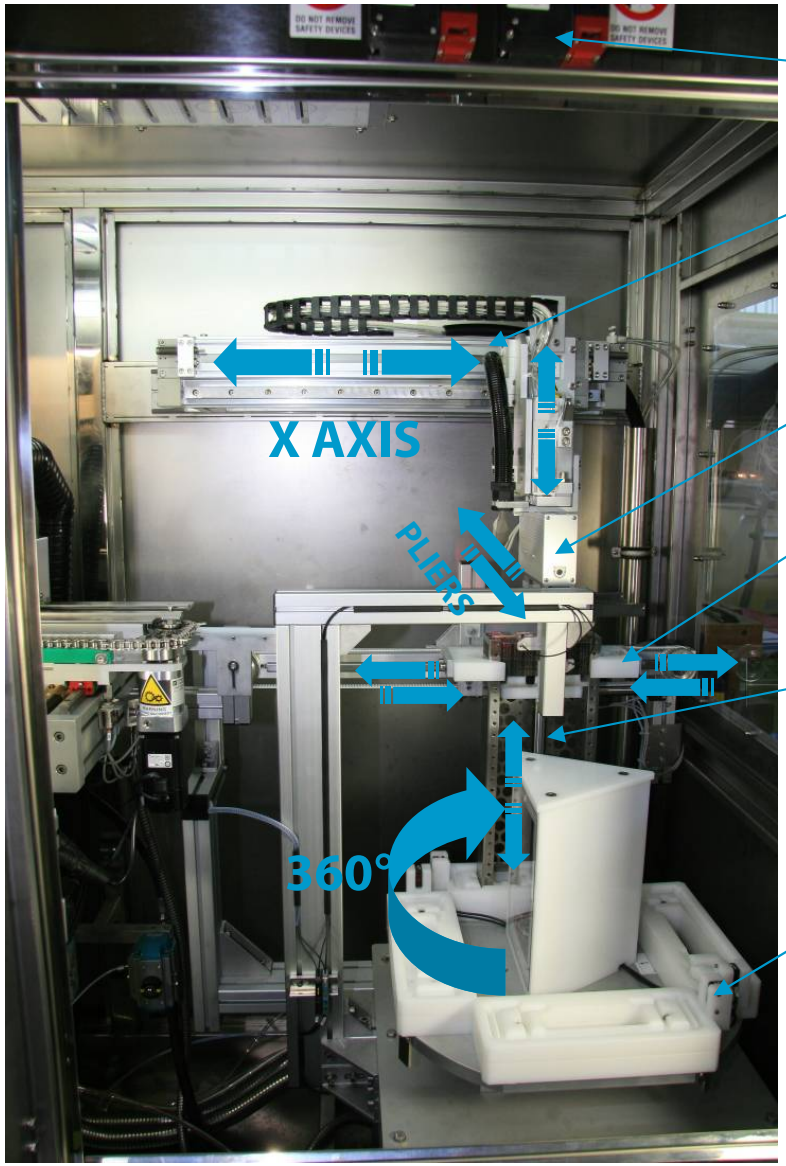
AIR Heating system

AIR Blower

DRYER

diamond nozzles

Laguna Model – Unload Station



Safety door interlocks with electro-mechanical lock

OMRON

PNE X axis for unload

SMC

Electric Pliers

SMC

PNE Carrier blocker

FESTO

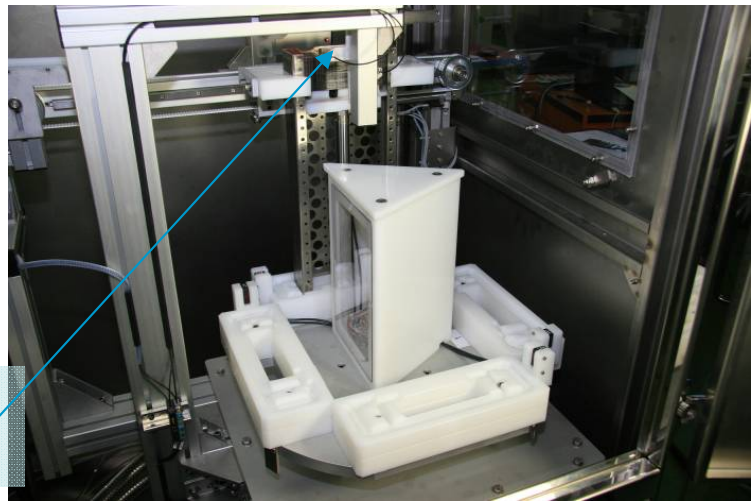
PNE Rotary table

Unload Lead frame Elebator

OMRON

Carrier presence sensors

Optical fibers for leadframes detecting



Laguna Model – General Control

Electric board 1 (PRINCIPAL)

ANTIFIRE CONTROL

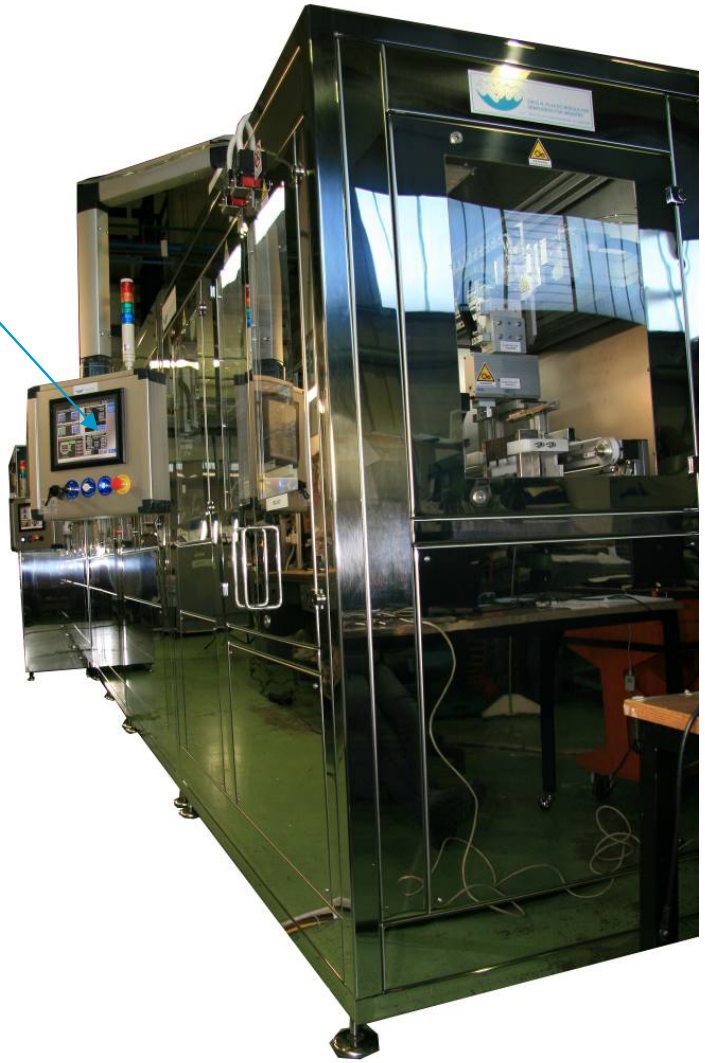
Electric board 2 (SECONDARY)

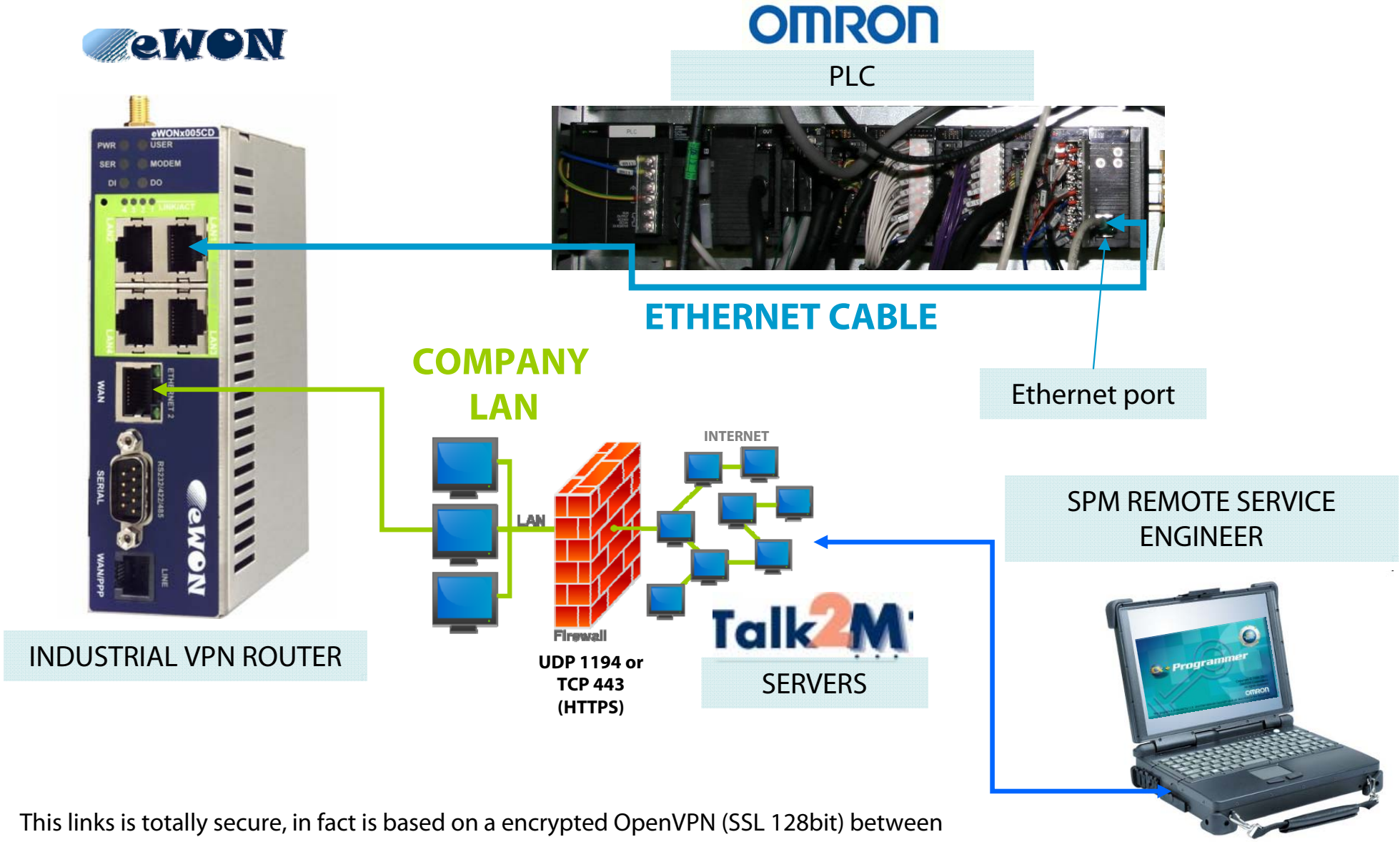
Laguna Model – HMI

SEMAPHORE

12″ TOUCH SCREENS

ANTIFIRE CONTROL STATION





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

Ambrogio Sala

President

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