

CLEAN-TECH FACTORY OF LIQUID CRYSTAL AND OTHER MANUFACTURING PROCESSES

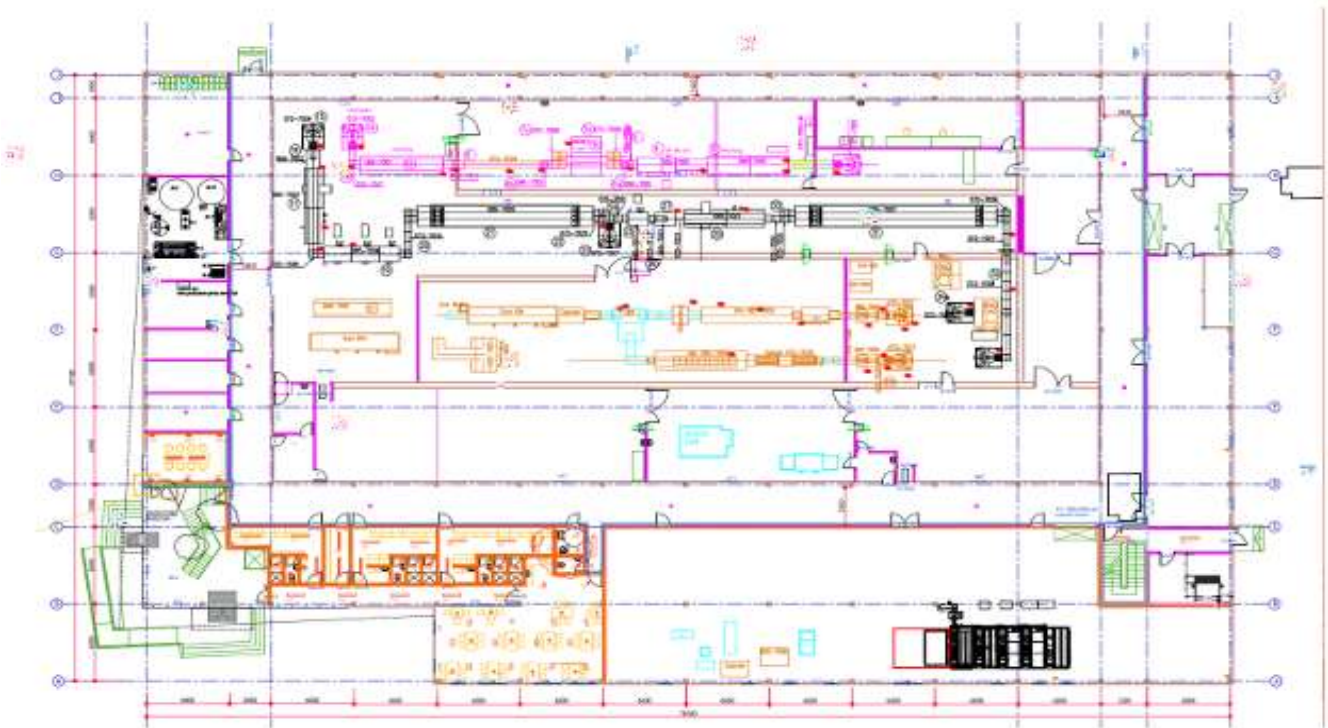
MAIN INFORMATION ABOUT INFRASTRUCTURE:

Factory built in 2013 and is located in Latvia, Ventspils city, primary designed to manufacture LCDs, where their production lines was created in by purchasing existing line from Germany. Cleanroom is modular, only the external pillars cannot be moved, they are spaced by 6m. The cleanroom is 60mx30m so a total surface of 1800m² split in 14 separated areas.

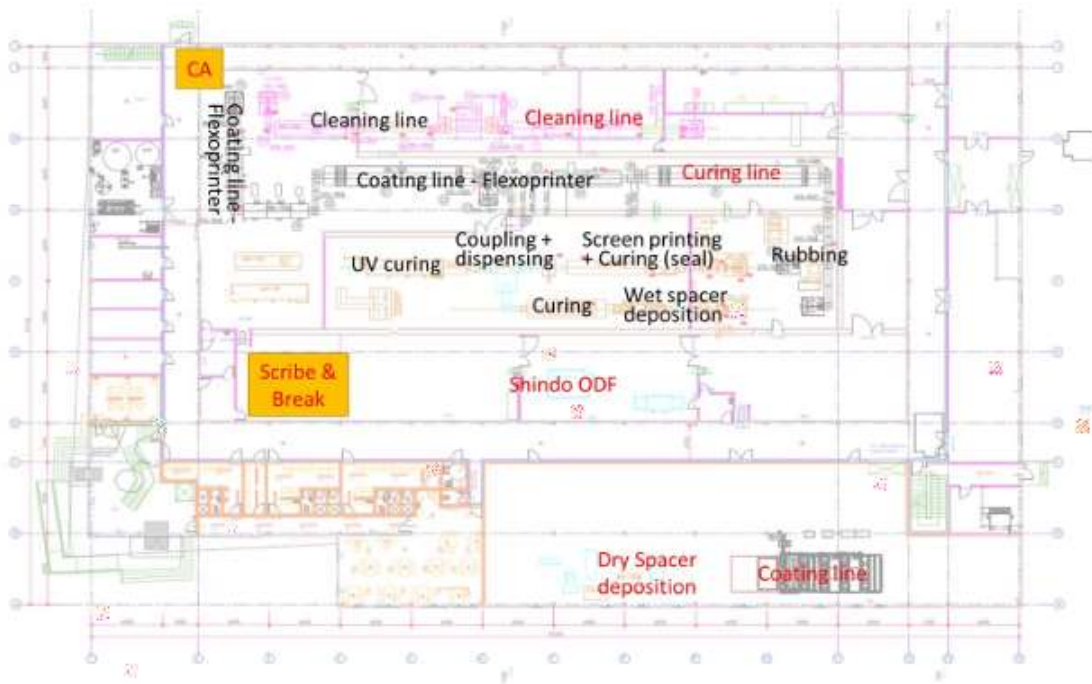
The facility is composed of 2 floors. On the 1st floor, there are 5 offices open (visitor, CEO office, secretary, and maintenance/equipment) and 4 extra offices after badge control for engineers. The 1st floor also gives access to the ceiling of the cleanroom to work out on all pipes, connections.

On the ground floor, the cleanroom is centralized. Around the cleanroom, various areas are present mainly for cleanroom utilities: managing temperature control, DI water treatment, cleanroom control monitoring including (electrical power, temperature, humidity, particle counting), packaging, changing rooms, a canteen. There is also a large room where equipment was placed like the sputtering machine.

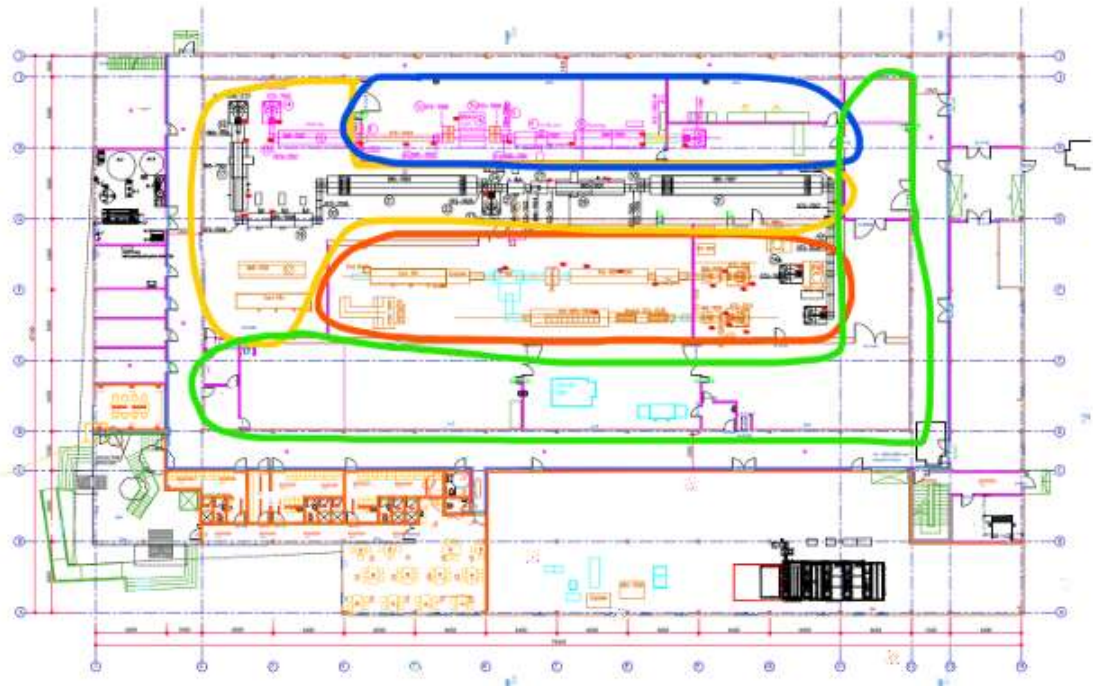
Water, heating and electricity are supplied via the city. There is a water source but the water turned to be too salty so it was more costly to treat it rather than utilizing the water provided by the city. The water is dionized at factory.



- in purple: cleaning line (part is former stripper line modified to be a cleaning line)
- In black: the coating line with 2 flexoprinter and inline heater/oven
- In orange (right): rubbing process
- In orange (middle): assembly line including screenprinting, Spacer dispensing, Seal/ink dispensing, Custom coupling unit, UV heating, and inline heater (and additional assembly unit for empty cells)
- In light blue (top): shindo ODF machine (and manual UV irradiation)
- Outside cleanroom in the large room on the bottom in black: sputtering machine for ITO, SiO₂ 1500x1200mm capable. The dry spacer process to be used for 600x400mm glass is also still present in this room.

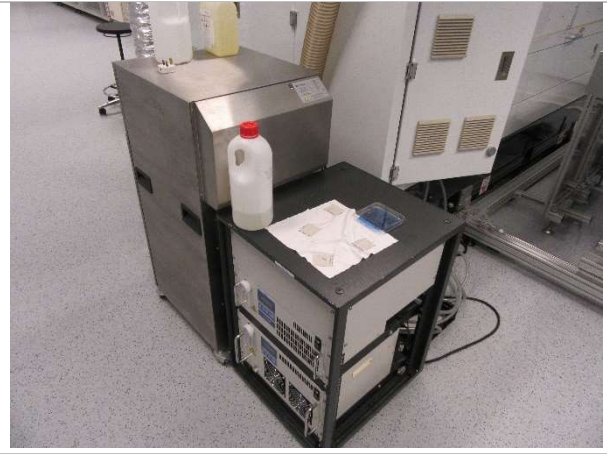


The cleanroom is managed in 4 different parts from cleanliness point of view. Cleanness of class 7-8 can be reached. Highlighted in color the various cleanroom area managed separately.



OVERALL CLEANROOM REMARKS:

- Since the factory locates so close to the sea, the air neutralization is the common practice and any major LCD factories have installed the dedicated system to prevent quality issues from happening due to the 'polluted' air by salts, but for the air intake system at this factory, no treatment is applied to 'neutralize' the air and so far there has been no quality issue related to the air intake system.
- Cleanroom is designed in such a way that the air outtake is through the wall, that the cleanliness is simply relied on how many times per unit time the air in the room is refreshed by the 'cleaned' air through the filtering system from the air intake to the air outtake.
- All entries in the cleanroom are made by doors with metal frames.



GENERAL INFORMATION:

This line's equipment is mostly manufactured in 1999, installed in the factory in 2013. The line consists of 18 sections. The line includes an integrated laser structuring device MSV 2502, manufactured in 2012, designed for structuring conductive layers (ITO), without which this processing line can only be used for washing glass and plastic sheets. The working size of the line is GEN 1 (300x400 mm). The laser equipment requires replacing the old laser source with a new one. Key equipment:

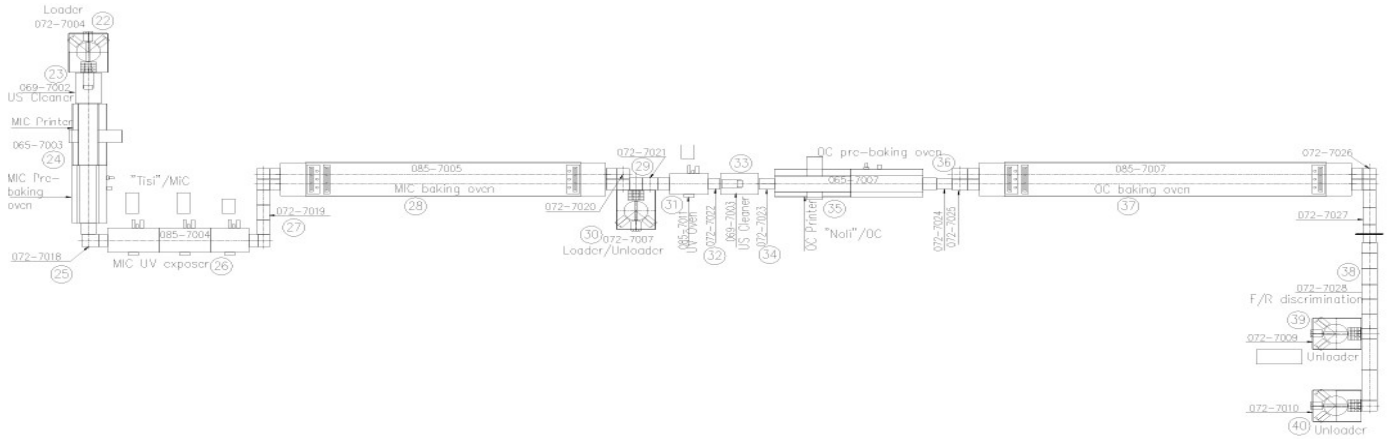
- Glass loader and unloader robots, Kataoka (JPN), 1999
- Inline glass cleaning equipment, Evatech (JPN), 1999
- Inline IRUV drying kiln, Clean Techno (JPN), 1999

- Conveyors, Amagasaki Factory (JPN), 1999
- Inline laser picosecond patterning machine, Gen 2.5 size, made by M-Solv (UK) in 2012
- Inline glass cleaning equipment, Micro Engineering (JPN), 1999

* The price of the washing line equipment, including laser machine is **260 000 EUR**

COATING LINE

TECHNOLOGICAL SCHEME (illustrative)







GENERAL INFORMATION:

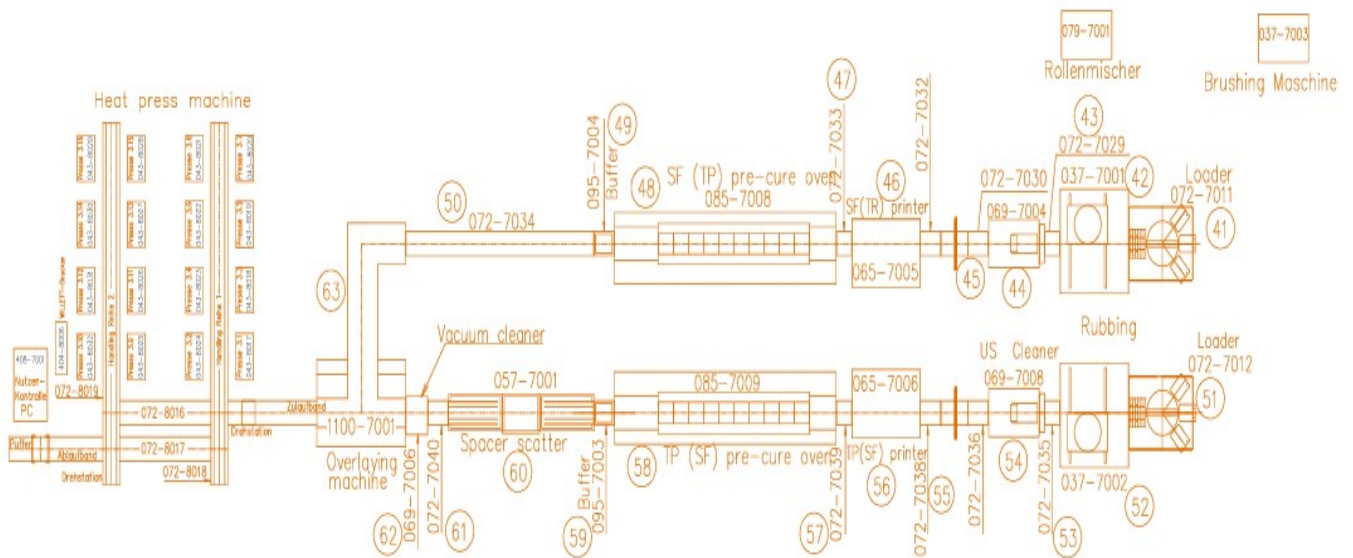
The line equipment was manufactured in 1999, installed in the factory in 2013. The line consists of 24 sections. The line has 2 flexo printers for coating, however, only one is in working order, which requires replacement of rollers and gears, and the other one needs a major overhaul. The working size of the line is GEN 1 (300x400 mm). Key equipment:

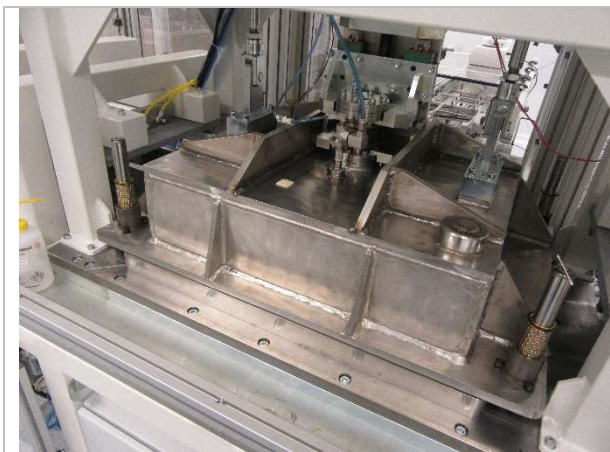
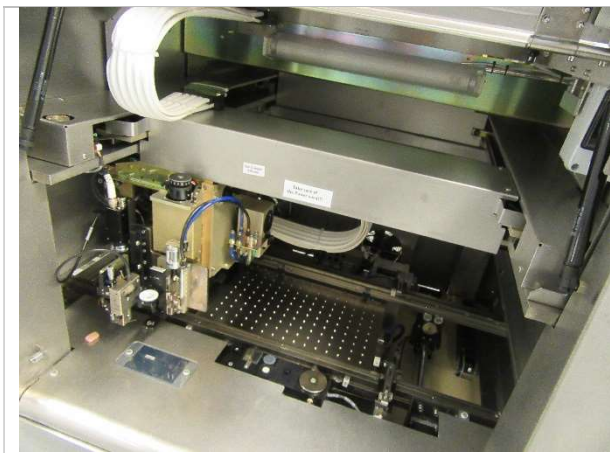
- Glass loader and unloader robots, Kataoka (JPN), 1999
- Dry ultrasonic cleaners, MT System (JPN), 1999
- Hardcoat and polyimide flexo printers with prebake ovens, Nakan Techno (JPN), 1999
- UV Ovens, Clean Techno (JPN), 1999
- High temperature walking beam ovens, Denko (JPN) 1999
- Conveyors, Amagasaki Factory (JPN), 1999

* The price of the coating line equipment is **25 400 EUR**

ASSEMBLY LINE

TECHNOLOGICAL SCHEME (illustrative)









GENERAL INFORMATION:

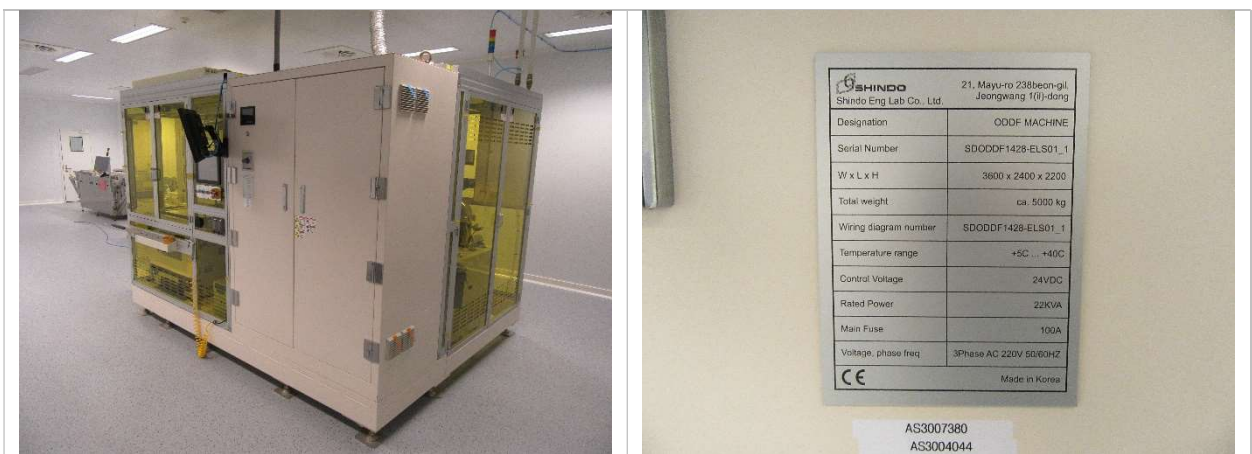
The equipment of the line was mainly manufactured in 1999, installed in the factory in 2013. The line consists of 32 sections. The line is used in the production of passive displays - smart windows, solar panels, e-ink displays. The non-vacuum aligner has been removed from the original line and placed separately and replaced in the line with more modern ODF technology, which was developed by Asymtek and the ODF equipment. The working size of the line is GEN 1 (300x400 mm). Key equipment:

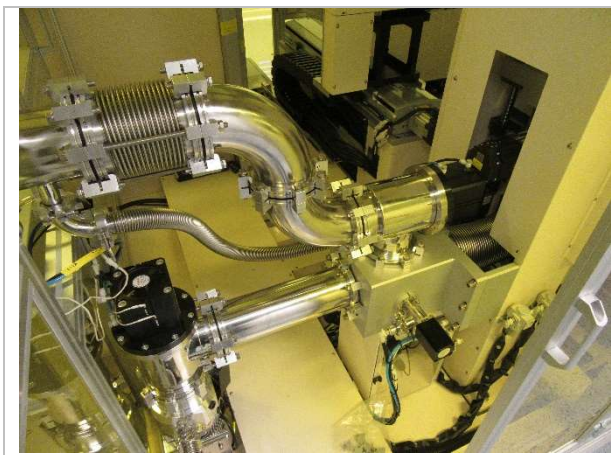
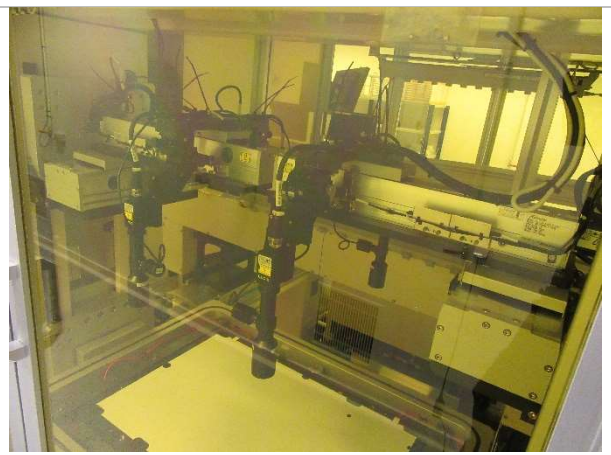
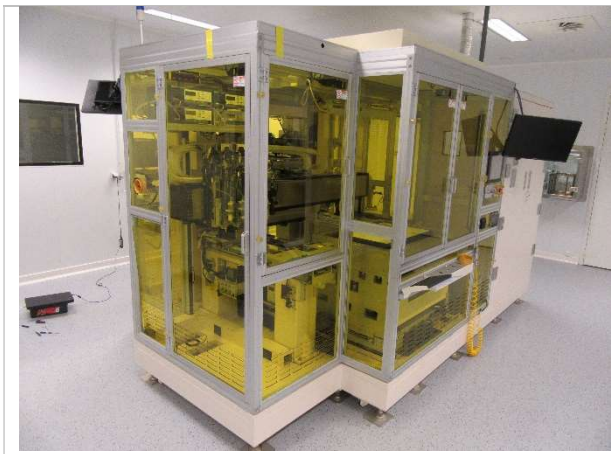
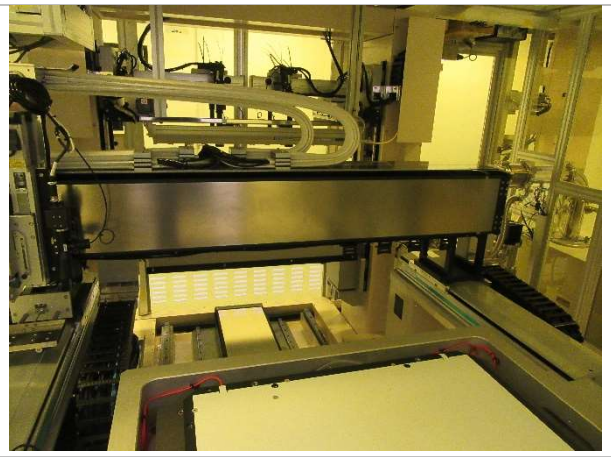
- Glass loader and unloader robots, Kataoka (JPN), 1999
- Dry ultrasonic cleaners, MT System (JPN), 1999
- Rubbing machines, Newton Cataoka (JPN), 1999
- Screenprinters, Newlong Seimitsu Kogyo (JPN), 1999
- Wet spacer scattering machine, Vuteq Industry, 1999
- Curing kilns, Yamato Works (JPN), 1999
- Overlay and alignment station machine, Newton Cooperation (JPN), 1999
- Dispensing station, Asymtek (USA), 2012
- ODF (vacuum) assembly machine, EuroLCDs, 2015
- UV exposer (mask aligner), Japan Science Engineering, 1999
- Conveyors, Amagasaki Factory (JPN), 1999

* The price of the assembly line equipment is **16 900 EUR**

OTHER EQUIPMENT:

SHINDU ODDF MACHINE





GENERAL INFORMATION:

ODDF (vacuum) assembly machine with dispensers for 400x600mm, Shindo (KOR), 2021 in progress. The machine handles both seal dispensing, ink dispensing and coupling. UV is only applied on 4 dots to ensure to keep alignment level. Extra UV curing or thermal curing of the seal needs to be done with other equipment. The UV exposure is done with a big UV lamp handled manually over the displays. Optimization of the process is not in place, also ink dosage adjustment not done and the engineers can only operate 1up per glass at this stage, so this equipment requires support of Shindo engineers to prepare recipes for multiple ups. Shindo provides a +/-5um accuracy, but at the moment accuracy is specified at +/-6um.

* Price for SHINDO ODDF assembly machine is **645 900 EUR**

SPUTTER MACHINE FHR LINE 2500 H



FHR	FHR Anlagenbau GmbH Kasselerstr. 68 D-01458 Cleeve/dorf Cirkolla
Designation:	Inline sputtering system
Type:	FHR-Line 2500 H
Serial number:	8000179
Year of manufacture:	10/2015
Plant length:	10100 x 3700 x 2100
Weight (approx. max. net):	ca. 34000 kg
Weight (approx. max. gross):	60026-000-90000
Temperature range:	+20°C +30°C
Control voltage:	24 V DC
Rated power:	195 kW
Rated current:	100 A
Energy class:	100-2 (medium)
CE	1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 4.0, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 5.0, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 6.0, 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 7.0, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 8.0, 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 9.0, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8, 9.9, 10.0
Made in:	Germany





GENERAL INFORMATION:

PVD coating machine for ITO, SiO₂ and Nb₂O₅ coatings, manufacturer FHR Anlagebau (DE), 2019. PVD Machine made for reactive DC and RF sputtering, with one side load&lock chamber, maximum substrate size 1000x1500mm, for metallic, inorganic and AR coatings.

* Price for SPUTTER MACHINE FHR LINE 2500 H is **466 400 EUR**

NOTE:

* - All equipment prices listed in this document are based on a valuation report made by certified property appraiser.