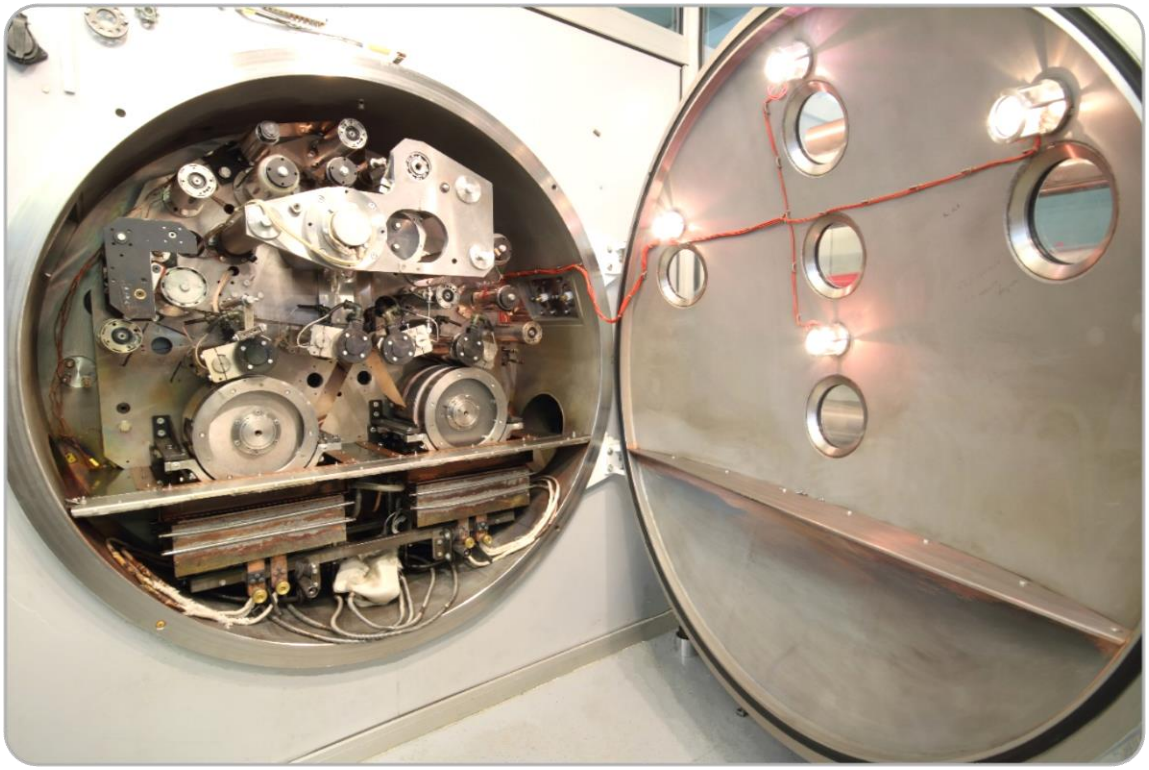
Pilot PVD Li Roll-to-Roll Vacuum Coater

Overview



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1. APPLICATION & DEVELOPMENT

1.1 R&D roll-to-roll vacuum coater Z2P150H (hereinafter – "the coater") is a complete system designed to deposit metallic lithium coatings by means of thermal evaporation.

1.3 The coater can produce either a single-sided coating in one or two deposition zones, or a double-sided coating without breaking the vacuum.

1.4 The design of this coater is based on Sidrabe's practical experience in vacuum web coaters and processes development as well as R&D results, obtained in Sidrabe's Research Department.

1.5 The coater operates in laboratory of Sidrabe's R&D department. It is used for Li deposition technology scaling and manufacturing of trial batches of Li coated material.

2. MAIN FEATURES OF THE COATER

2.1. The coater is a batch-operating plant with web roll loading before cycle and product roll unloading after the cycle.

2.2. The coater consists of 1 chamber, incorporating winding device, 2 process drums, pre-treatment sources, 2 thermal evaporation zones, pumping station and control desk.

2.3. Thermal evaporation zones are equipped with a closed-loop controlled electrically heated crucibles and shutters.

2.4. Process drums incorporate cooling channels and argon-venting for heat contact between substrate and drum surface.

2.5. The coater is designed to run in either single-sided or dual-sided deposition modes.

2.6. A blind flange and mounting area is foreseen for future upgrades, for example a planar magnetron.

2.7. The web winding system is capable of handling thin metallic foils and provides tension separation between the unwinder and rewinder zones.

2.8. Interleaf pre-treatment is performed by glow-discharge.

2.9. The pumping station is based on the usage of turbo-molecular pumps and combination of Roots and rotary vane pumps.

2.10. Operator interface uses a PC-based HMI.

2.11. Coater control is accomplished by a system of PLCs.

3. SCOPE OF DELIVERY FOR THE COATER

3.1. Vacuum chamber
- 3.1.1. Chamber supports.
- 3.1.2. Chamber doors.

3.2. Winding system
- 3.2.1. Web unwinding and rewinding shafts.
- 3.2.2. Interleaf unwinder shaft.
- 3.2.3. Cooled, vented process drums.
- 3.2.4. Idle rollers.
- 3.2.5. Idlers with load cells.
- 3.2.6. Winding device drive, motors and clutches.
- 3.2.7. Tools for roll loading.

3.3. Glow-discharge pre-treatment
- 3.3.1. Pre-treatment sources.
- 3.3.2. HV power supply.

3.4. Evaporation sources
- 3.4.1. Heated jackets.
- 3.4.2. Removable and fixed shields.
- 3.4.3. Shutters and pneumatic actuators.
- 3.4.4. Heating and cooling lines.
- 3.4.5. Heating power supplies.

3.5. Gas inlet system
- 3.5.1. Mass flow controllers.
- 3.5.2. Gas admission control units.
- 3.5.3. Manual needle valve.

3.6. Pumping system
- 3.6.1. Turbo-pumps.
- 3.6.2. Roots blowers and backing pumps.
- 3.6.3. Vacuum gauges.
- 3.4.4. Electrically operated valves.

3.7. Control system
- 3.7.1. Operator PC with HMI interface.
- 3.7.2. PLCs.

3.7. Control system

3.8. Electrical cabinets for coater controls, drives and power distribution

3.9. Primary cooling water system

3.10. Process drum cooling system

3.11. Pneumatic system

4. TECHNICAL PARAMETERS

4.1. Substrate and interleaf

4.1.1.	Substrate material	polymer films or metal foils
4.1.2.	Substrate width	150 ± 5 mm
4.1.3.	Substrate thickness	6 – 40 µm
4.1.4.	Interleaf material	polypropylene
4.1.5.	Interleaf thickness	12 – 30 µm
4.1.6.	Core ID (all rolls)	76.2 ± 0.4 mm
4.1.7.	Core material	metal or plastic
4.1.8.	Maximum interleaved product roll OD	140 mm

4.2. Coating

4.2.1.	Coating material	metallic lithium
4.2.2.	Coating deposition	single or double-sided
4.2.3.	Coating thickness	1 – 30 µm
4.2.4.	Coated width	106 mm
4.2.5.	Uniform coating width	100 mm
4.2.6.	Coating thickness uniformity	± 10%

4.3. Winding system

4.3.1.	Type	non-reversible
4.3.2.	Web speed range	0.2 – 2 m/min
4.3.3.	Tension force range at unwinder and around the process drum	20 – 120 N
4.3.4.	Tension force range at the rewinder	20 – 200 N

4.4. Process drum

4.4.1.	Drum type	water-glycol-cooled, backside ventilated with grooved surface
4.4.2.	Drum diameter	300 mm
4.4.3.	Drum operational temperature	-20 – +15 °C

4.5. Pre-treatment units

4.5.1.	Type	magnetically-assisted, directed glow disharge
4.5.2.	Power supply	DC, ~1kV, ~200 W
4.5.3.	Working pressure	~$7*10^{-3}$ Torr

4.6. Evaporators

4.6.1.	Type	indirectly heated, stainless-steel vessels
4.6.2.	Temperature range at sides of evaporator	450 – 600 °C
4.6.3.	Temperature range at bottom of evaporator	100 – 700 °C
4.6.4.	Heater power	5 + 3 kW each source

4.6.5.	Power supplies	thyristor-controlled AC
4.6.6.	Working pressure	$8*10^{-5}$ – $3*10^{-4}$ Torr
4.6.7.	Dynamic deposition rate	~6 µm*m/min

4.7. Gas inlet system

4.7.1.	Supply line pressure	1.5 – 2.5 bar
4.7.2.	Purity of process gasses	Ar: 6N CO_2: 6N
4.7.3.	Highest gas flows of argon for each process drum	70 sccm

4.8. Pumping system performance

4.8.1.	Ultimate pressure in the deposition compartment (after cleaning of shields, >20 h non-continuous pumping, with substrate)	$6x10^{-6}$ Torr
4.8.2.	Base pressure in the deposition compartment (within 180 minutes, with substrate)	$2x10^{-5}$ Torr
4.8.3.	Venting time	5 minutes

4.9. Requirements for Customer-provided utilities and operating conditions

4.9.1. Cooling water system

4.9.1.1.	Supply line temperature	15 – 25 °C
4.9.1.2.	Supply line pressure	2.5 – 3.0 bar
4.9.1.3.	Return line pressure	≤ 0.5 bar
4.9.1.4.	Estimated flowrate	up to 2.5 m^3/h
4.9.1.5.	Water quality	particle size ≤ 150 µm; hardness ≤ 20 °dH; conductivity 50 – 600 µS/cm; PH value 7 – 8.5.

4.9.2. Cooling/heating system of process drums

4.9.2.1.	Heat-transfer agent	mixture of ethylene glycol and water (50:50 by vol.)
4.9.2.2.	Supply line temperature range	-20 – +40 °C
4.9.2.3.	Pressure in the system	up to 4 bar
4.9.2.4.	Min. differential pressure	2 bar
4.9.2.5.	Estimated flowrate	up to 16 l/h
4.9.2.6.	Cooling capacity	≥ 2 kW at -5 °C
4.9.2.7.	Particle filtration size	≤ 150 µm

4.9.3. Electric power

4.9.3.1.	Type of connection	3-phase, TN-S earthing
4.9.3.2.	Frequency	50 Hz ± 2%
4.9.3.3.	Voltage	3 ph. 400 V +6/-10%
4.9.3.4.	Estimated installed power	~45 kVA
4.9.3.5.	Actual power consumption	16 kW

4.9.4. Compressed air

4.9.4.1.	Supply line pressure	4.5 – 7.0 bar
4.9.4.2.	Estimated consumption	up to 120 l/min during cooling
4.9.4.3.	Particle size	< 5 µm
4.9.4.4.	Dew-point	< 1.7 °C
4.9.4.5.	Oil contamination	< 2 ppm

4.9.5. Requirements to operation area

The room, to which the vacuum side of this coater is exposed to whilst open, has to meet the requirements as follows:

4.9.5.1. Room temperature: 22 ±3 °C.

4.9.5.2. Relative humidity: ≤ 2%.

4.9.5.3. Air circulation rate: < 0.4 m/s.

4.9.5.4. Room maintenance to be in conformity with ISO 14644-5.

4.9.5.5. The room to be in conformity with fire safety requirements of ISO 16730.

4.9.5.6. Cleaning of detachable parts of the coater shall be carried out in a separate room.

5. DIMENSIONS OF THE COATER

5.1. Size of the coater

5.1.1.	Depth	1.9 m
5.1.2.	Width	3.4 m
5.1.3.	Height	2.2 m

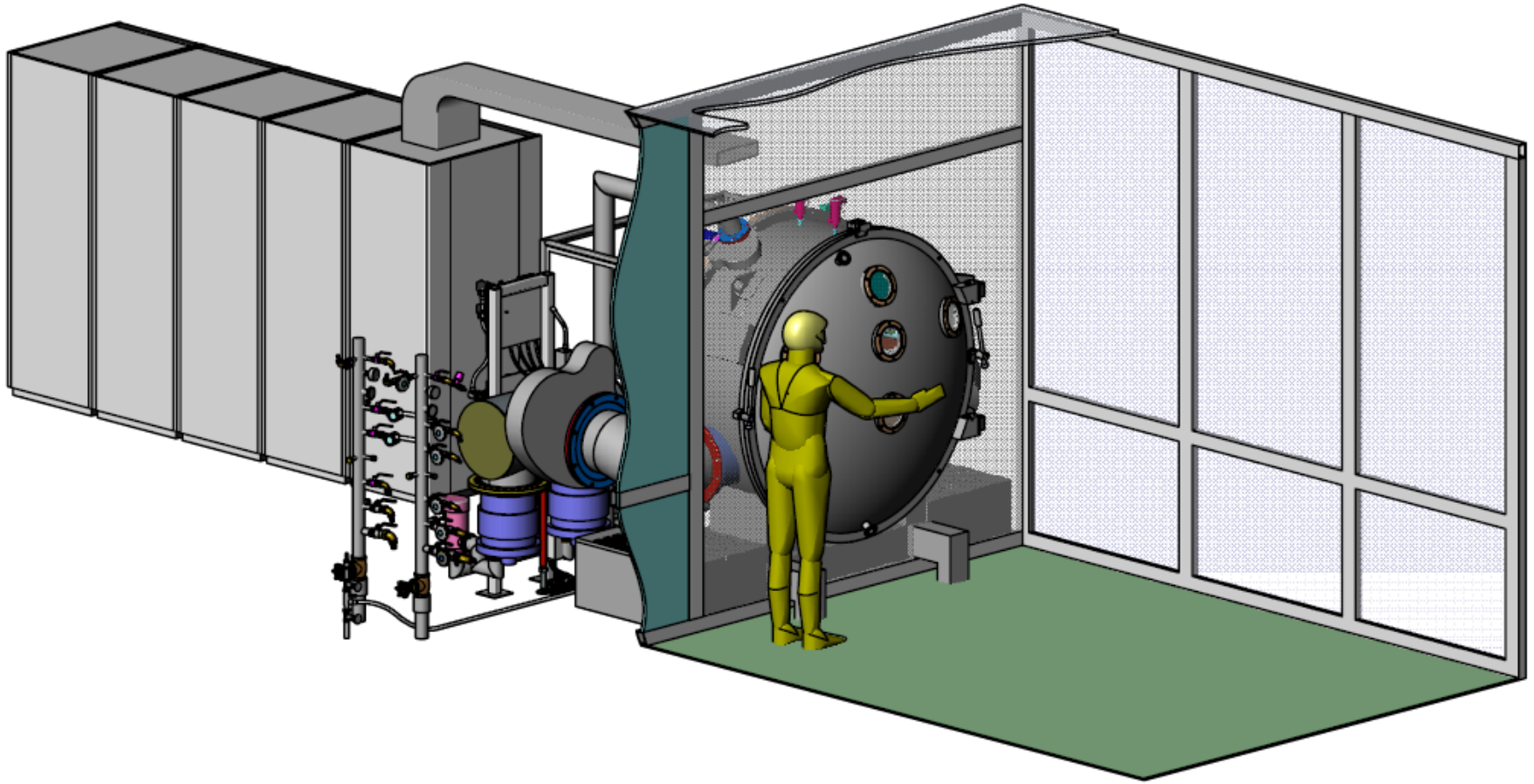
5.2. Minimum installation area

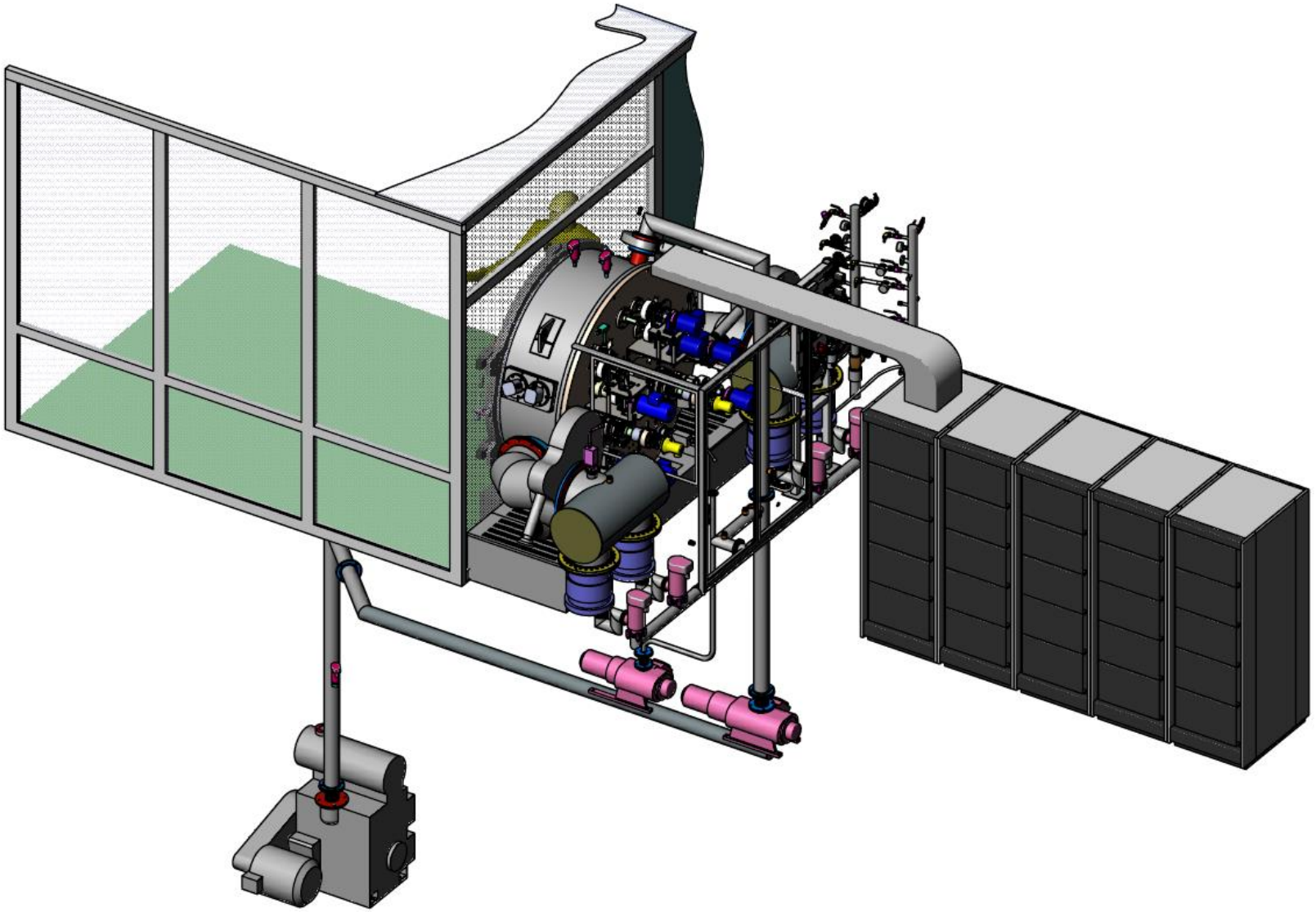
5.2.1.	Length	6.0 m
5.2.2.	Width	5.0 m
5.2.3.	Height	2.5 m

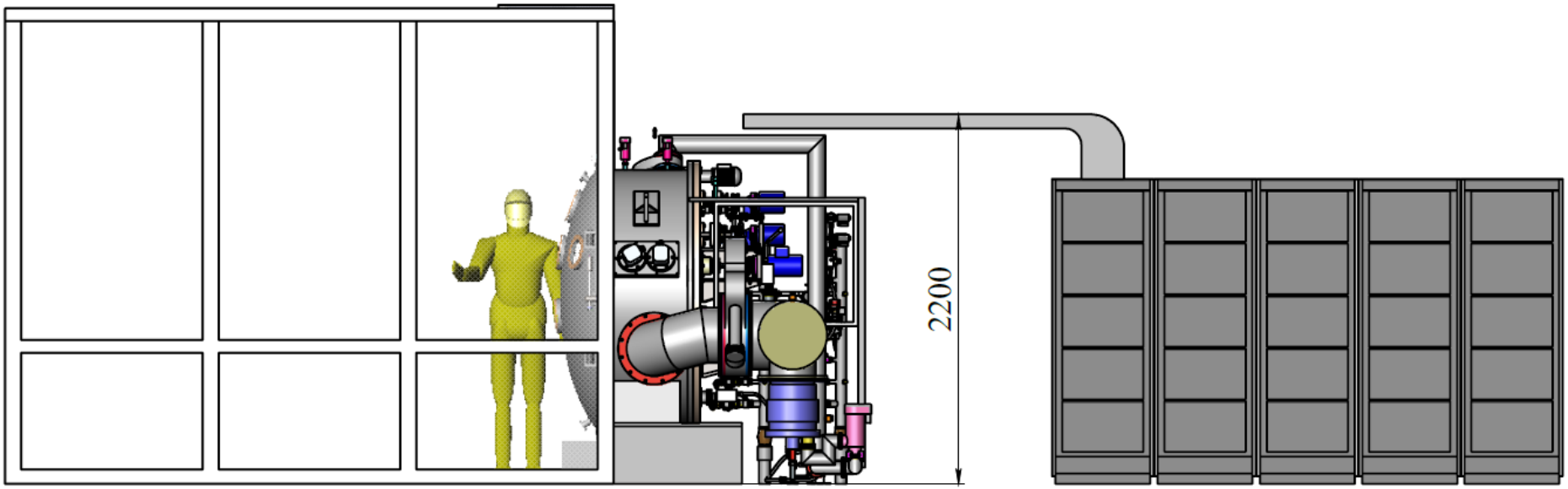
5.3. Weight of the coater

Estimated weight	8100 kg

6. IMAGES



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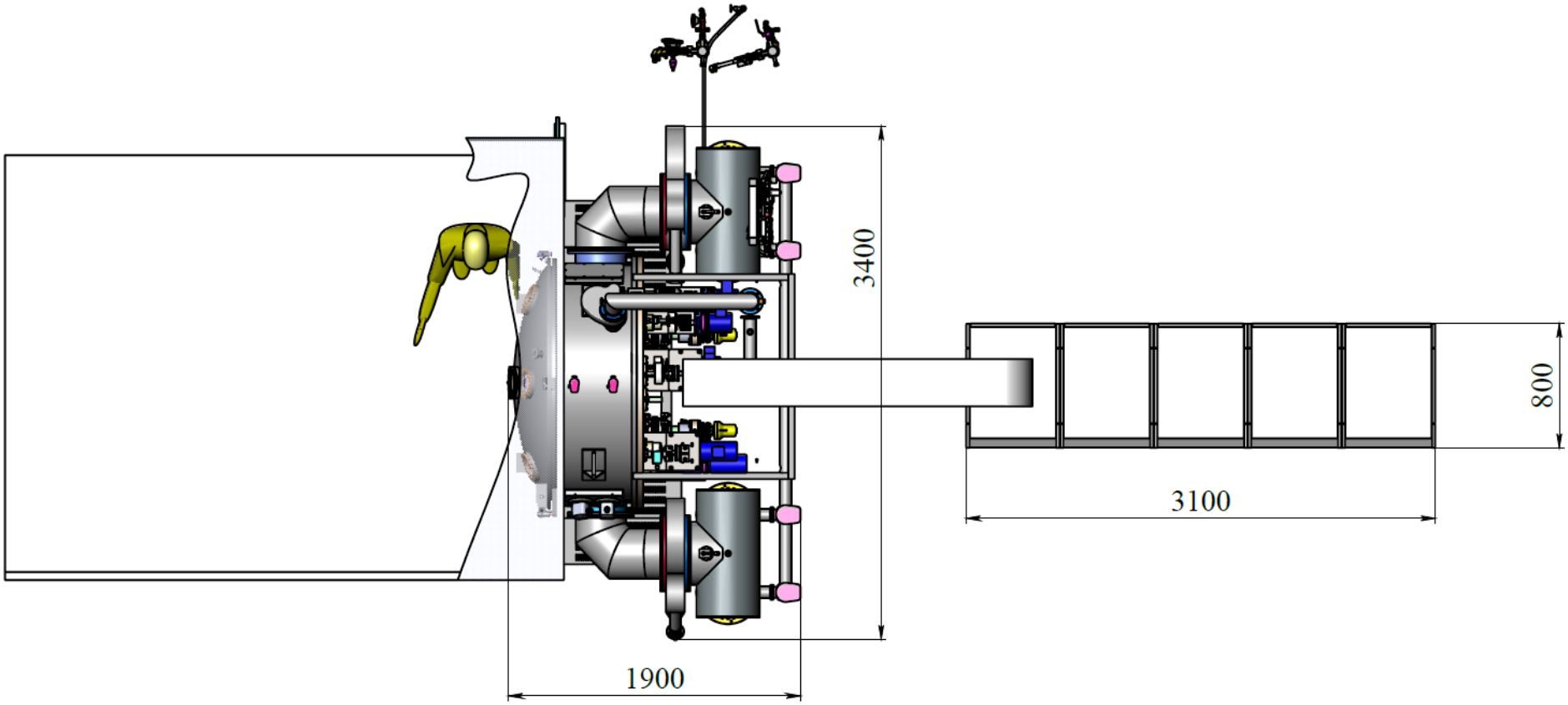
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