

Référence (n° chrono) : **DTNM/SCEF/2026/021**

Version A

Date of Issue: 14/04/2026

EQUIPMENT SPECIFICATIONS

R&D Screen Printer with high precision alignment

EOTP :	A-PROH2-G0-5F-DD
OS :	LOC5NGENCELL
Plateforme :	Surfaces Fonctionnelles

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1. PURPOSE

The specifications set out the supply, on behalf of CEA, of a screen printer for the account of the CEA. The evaluation of the proposal will be done on the technical level, safety level, the EU and French regulation compliances and the tool ergonomic.

If the supplier is unable to draw up the required technical specifications or documents, this shall be clearly specified in its commercial bid by filling in at least the “Supplier’s Comments” area of these specifications.

2. DEFINITION

In this document, the contractor is referred to as “the supplier”.

The instructing party is referred to as “CEA”.

3. GLOSSARY

- LITEN : Laboratoire d’Innovation pour les Technologies des Energies Nouvelles et les nanomatériaux - Laboratory of innovation for new energy technologies and nanomaterials
- PMAD : Prise en Main A Distance (Remote control access)
- MTBF : Mean Time Between Failure (Temps moyen entre deux pannes)
- MTTR: Mean Time To Repair (Temps moyen pour réparer)
- MTBI : Mean Time Between Interrupts (Temps moyen entre interruptions)
- FAT : Factory Acceptance Tests, tests de réception chez le fournisseur
- SAT : Site Acceptances Tests, tests de réception sur site du CEA
- DOE Dossier des Ouvrages Exécutés (As built file)

4. APPLICABLE DOCUMENTS

The supplier shall comply with the documents and all procedures in force at CEA/GRENOBLE. Below is a non-exhaustive list:

EQ/CS23-10: Règles applicables aux entreprises extérieures (French version)
EQ/CS23-11: Applicable rules for outside companies (English version)

These documents shall be available for consultation upon request by the supplier.

5. CUSTOMER – SERVICE PROVIDER CONTACT

The technical contacts for the basic and additional services are:

Mr Didier GALLAIRE

Tel.: +33 4 38 78 02 36

Email: didier.gallaire@cea.fr

6. CONFIDENTIALITY

The supplier undertakes to keep confidential and shall refrain from disclosing to any third party, without written approval from CEA, the whole or part of information and/or knowledge belonging to CEA or any third party, that it may obtain or may have obtained during the service performed on behalf of CEA.

7. TECHNICAL SPECIFICATIONS

7.1. Main function description

The equipment is a screenprinter for laboratory prototypes used to fabricate multilayer components, made of a succession of layers on various substrates (from plastic to glass).

The equipment will have the specificity to have a high precision of positioning of printed patterns over the substrate whose maximum size will be 380mm x 320mm and over the patterns from the previous printed layers (from both side of the substrate).

The equipment will be installed in a clean room.

The equipment will be used 5 days a week, 50 weeks per year by trained operators, in clean room outfit.

7.2. Equipment overview

The equipment must be composed of:

- A loading and unloading zone with an automatic conveyor; on the same side.
- An automatic printing section with control and accuracy of alignment of screens and of the substrate to be printed. As a R&D equipment, the automatic mode must be possible to be disabled to have a manual control over the alignment.
- An automatic and manual mode, which can be switch easily, and this, even during the process.
- It has to have a coating and a printing mode.
- The small maintenance must be easily done by the user of the equipment: This include cleaning, changing small spare parts of the equipment with one or two tools maximum; those must be removed and replaced easily and in safety. The maintenance mode has to be intuitive.
- Small wheels must be mounted on the equipment to make its transfer easy in case of change of the floorplan in the cleanroom. However these wheels will have to be disabled as soon as the equipment will be hooked up.

Important note: this machine must be used in a R&D context. This means that either formats or formulations could vary; an operator must have the freedom to use the machine for various trials, manually. The machine will contribute to the quality and monitoring needs and for improvement of the products in terms of repeatability.

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Overall specifications:

Parameter description	Minimum	Maximum
<i>Substrates size (L*w)</i>	<i>50*50mm</i>	<i>380*320mm</i>
<i>Substrates thickness</i>	<i>0.020mm</i>	<i>15mm</i>
<i>Screen frame size</i>	<i>560*560mm</i>	<i>736*736mm</i>
<i>Ink viscosity</i>	<i>10 mPa.s</i>	<i>125 Pa.s</i>
<i>Printing and coating speed</i>	<i>5mm/s</i>	<i>500mm/s</i>
<i>Blade or squeegee pressure</i>	<i>0.05MPa</i>	<i>1MPa</i>
<i>Snap off</i>	<i>0mm</i>	<i>10mm</i>
<i>Mechanical accuracy of the alignement (final accuracy after the print with all the process) – Total system repeatability</i>	<i>/</i>	<i>10µm</i>

Ink to be printed

The type of ink that we used are mostly conductive metal-based inks (such as copper- or silver-based inks), conductive fully organic inks (such as PEDOT-PSS or carbon), dielectric inks or resins.

7.3. Sub-functions description

In order to satisfy the main function, the equipment will have the following sub-functions:

- Protecting the substrate to be printed from the UV
- Saving different recipes
- Manually loading a substrate of various format (no marks on the chuck) and pre-positionning the substrate on the chuck
- Ensuring the flatness of the total surface of the substrate from the middle to the exterior and especially the corners with an uniform vacuum on the whole surface
- Preventing the static discharge from the substrate
- Manually installing the squeegee and the blade
- Transporting automatically substrate from loading zone to printing zone
- Manually loading a screen of various format
- Pre-positionning the screen centered to print on the center of the substrate format (whatever the substrate format)
- Possibility of making optical inspection of the screen (as a facultative option)
- Possibility of making and saving pictures and measures of the screen (as a facultative option)
- Aligning the screens and the substrate to be printed
- Setting the parameters
- Manually dispensing the ink
- Printing a substrate
 - o Having an independent printing and flooding mode
 - o Having the possibility to flood the screen prior to print
 - o Having different mode to tilt the screen after printing/during printing (as a facultative option)

- Possibility of making optical inspection of the printed substrate (as a facultative option)
- Possibility of making and saving pictures and measures of the printed substrates (as a facultative option)
- Automatically transporting substrate from printing zone to unloading zone
- Manually unloading the printed substrate
- Manually desinstalling the screen
- Manually desinstalling the squeegee and the blade
- Recording the process parameters of the printed substrates
- Cleaning automatically the screens inside the tool between two printing sequence (as a facultative option)
- Connecting the tool to the internal network

These sub functions are detailed in the next sections of this document.

7.4. Description of performances

7.4.1. Protecting the substrate to be printed of the UV

All the lighting within the enclosure of the machine will be UV free (yellow light).

7.4.2. Saving different recipes

All the process parameters shall be controlled, saved and recalled under an identified recipe. Data during the process can be stored and can be saved through network under a format that can be transfer into a database.

Ideally, an integrated historic as a table or chart will allow CEA equipment engineer to visualize the total or partial operation durations maintenance.

In each recipe, we can find each layer of the finally print. For exemple :

- Recipe X
 - o Layer 1 (parameters A)
 - o Layer 2 (parameters B)
 - o ...
 - o Layer n (parameters N)

The number of possible main recipe will be at least 150.

7.4.3. Loading a substrate of various format

The substrate will be loaded manually on an automatic conveyer. It can be plastic foils or rigid materials such as glass or composite.

The table that will support the substrate has to be washable.

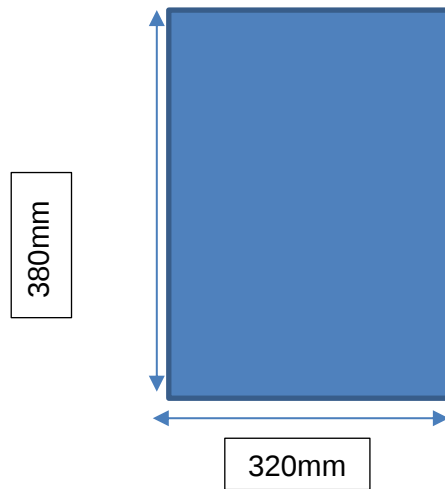
The material of the table must be hard enough to support squeegee and coater blade pressure. It must have a plan level to check the flatness on the total surface of the table.

The format of the main substrate will be 380*320mm:

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The format will not exceed the main format as shown previously but it can be shorter. So the supplier must propose different kind of an adaptable table or system that will contain/support the different dimensions of the substrate.

Here under are the specifications of the maximum and minimum dimensions of the substrate :

	Length	Width	Thickness
Minimum	50mm	50mm	0.020mm
Maximum	380mm	320mm	15mm

A system will be proposed by the supplier to pre-position the substrate 380mm x 320mm at the center position of the table.

Whatever its format the substrate must stay **on position during all the process**, even with the constraints of the ink viscosity, squeegee pressure and the different speed between the coating and printing mode.

If a vacuum system with dots through the table is used, the dots must be drilled as following:

1. to be fitted with the smaller size of sample (50mm x 50mm)
2. the spacing of the dots must be regular with each of them.

The table will be able to carry the substrate for a **print direction along the length or along the width of the substrate what means that the vacuum area of the table must be at least 380mm x 380mm.**

7.4.4. Ensuring the flatness of the total surface of the substrate from the middle to the exterior and especially the corners

The substrate can easily wrap, the supplier must propose solutions to keep flat the total surface of the substrate from the middle to the exterior and especially the corners.

The flatness must be lower than 10µm as TTV.

The supplier will have to measure and communicate the value of the flatness of the chuck

7.4.5. Preventing the static discharge from the substrate

The equipment must have ionizing nozzles to prevent the static discharge from the substrate. During the process, it should be done before the printing section and also after the printing (before the unloading substrate).

Important note: The pressure of the ionizing nozzles must not damage the printed layers. It must be have the possibility to be set.

7.4.6. Ensuring no particles or dusts in the printing area

To avoid dust particles, HEPA Filters will be installed on the top of the enclosure. However, during screen printer maintenance, it will be possible to turn off the HEPA filter with a single switch and to send this information (hard contact) to clean room facility so the extraction may locally be increased.

7.4.7. Installing the squeegee and the blade

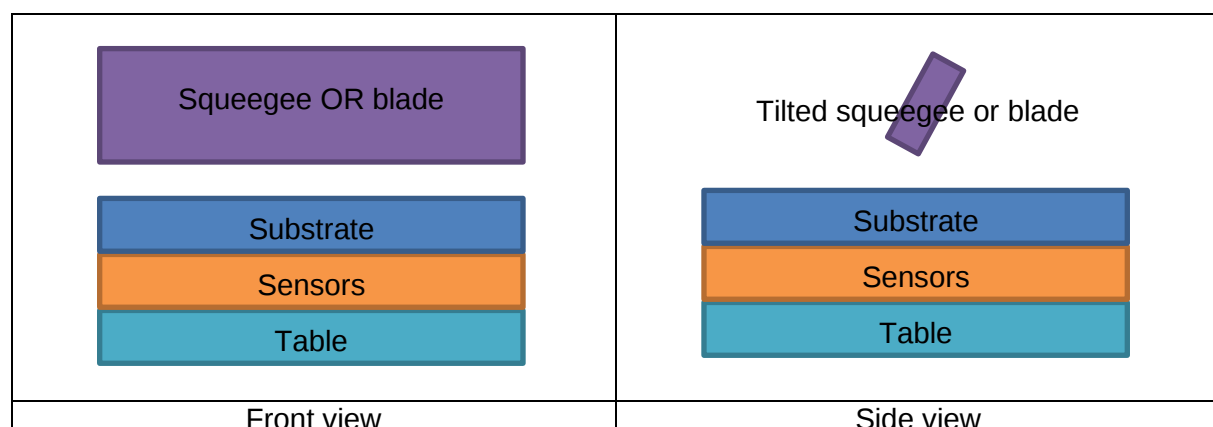
It will be possible to install a squeegee (for the printing) and a blade (for the flooding) inside the tool. Note: The tool can work without any blade whereas the squeegee is mandatory for the printing process.

The holding and clamping system of the squeegee and blade will be easy to use and prevent from any dismantling during printing process.

As the printing must be possible along the length or the width of the maximum size of the substrate, the system will be able to manage squeegee and blade up to 400mm.

The squeegee and blade parallelism adjustment must be performed automatically and this in less than 1 minute. It must work properly with flexible blades or squeegees, with hard blades or squeegees and with tilted blades or squeegees.

The pressure must be fully monitor on all the length of the blade or squeegee.



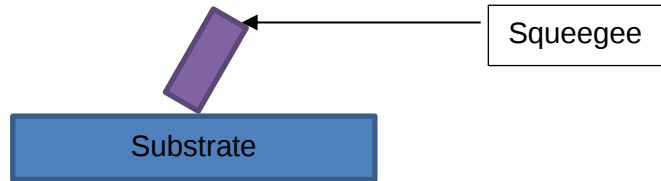
The system for handling the squeegees will be able to adjust

- the squeegee tilt (Theta) from 0° to 60° :

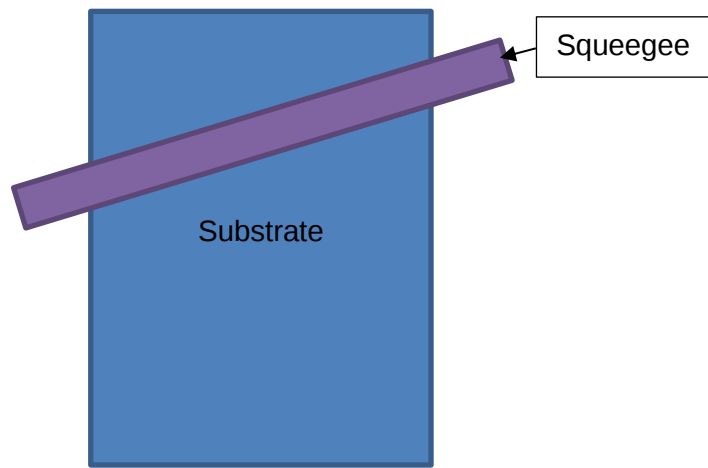
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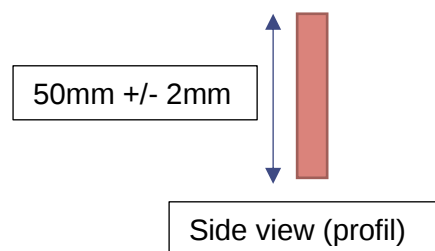


- the squeegee angle (Phi) from 0° to 10°:



The system to hold the squeegee and blade must be standard and universal to be clamped in the tool. Its building will ensure the operator to easily check that it is properly position and tighten to avoid any release during process.

Height of a standard squeegee is 50mm +/- 2mm



7.4.8. Transporting the substrate from loading zone to printing zone

The substrate has to be conveyed automatically from the loading zone to the printing section. The conveyor must be smooth and with no shacking and shocking during its travel.

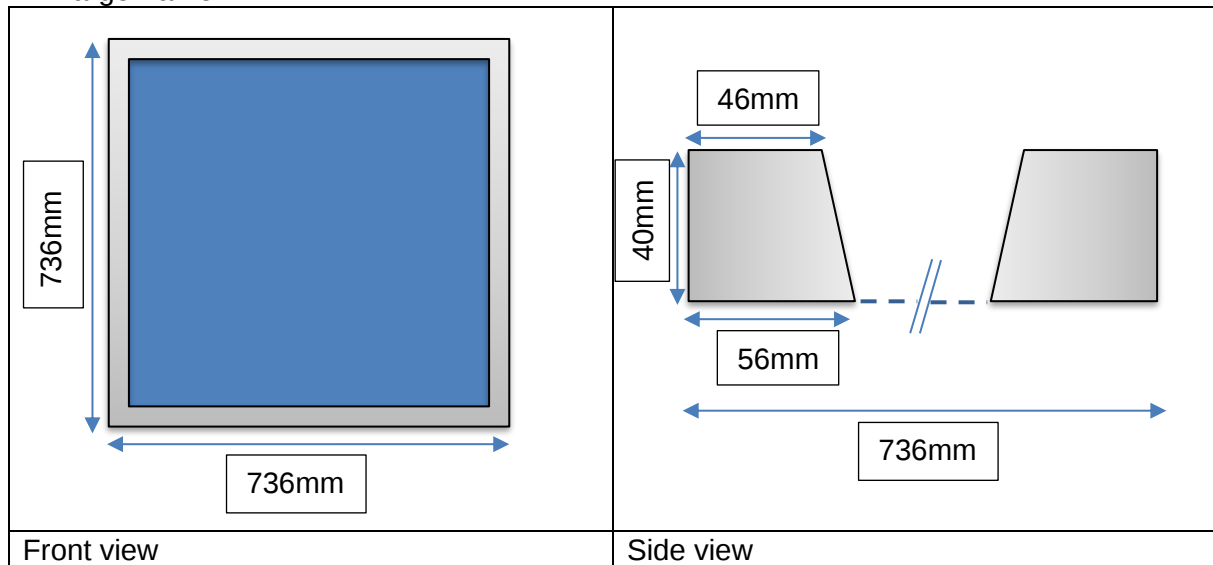
The table has to move with a step by step engine with high accuracy of positioning of less than 20µm.

In case of mechanical initialization of the motor positions, a software option must enable the conveyor to stay at its current position independently from the overall initialization process.

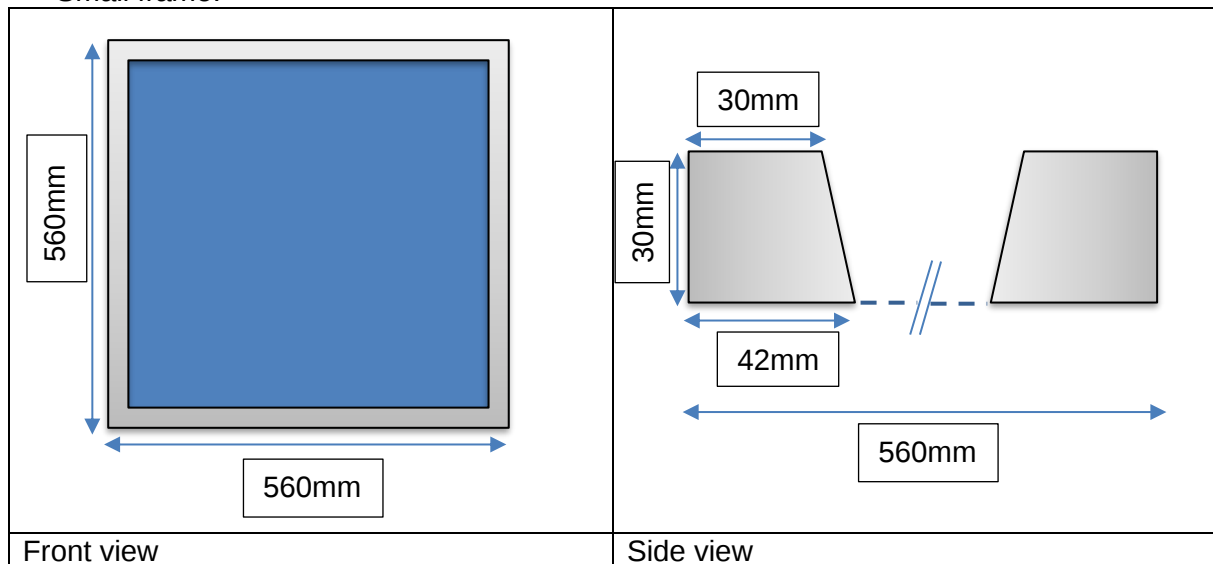
7.4.9. Loading a screen of various format

The equipment will be able to accommodate screen with size from 400*400mm up to 736*736mm. Our main supplier of screen frames is KOENEN or equivalent. The specifications of the frame are of two types :

- Large frame:



- Small frame:



In addition, some specific frames from specific suppliers can be used:

	Area (mm ²)	Frame (mm)	thickness	Frame width (mm)
Maximum frame	736*736	40		56
Minimum frame	400*400	20		30

7.4.10. Pre-positioning the screen centered to print on the center of the substrate format

The screen carrier inside the tool will enable the operator to easily pre-position the screen with its center aligned in respect to the center of the table supporting the substrates.

7.4.11. Possibility of making optical inspection of the screen (as a facultative option)

A camera or a set of cameras will be installed inside the tool in order to take some pictures of the screen with a length scale and a zoom. This system will enable to check the size of the patterns onto the screens with a resolution of $10\mu\text{m}$.

The system must also be able to rapidly measure some dimensions on the screens. It will be linked to data storing system so that the pictures of the screens will be recorded.

The vision system has to record pictures in 5 seconds.

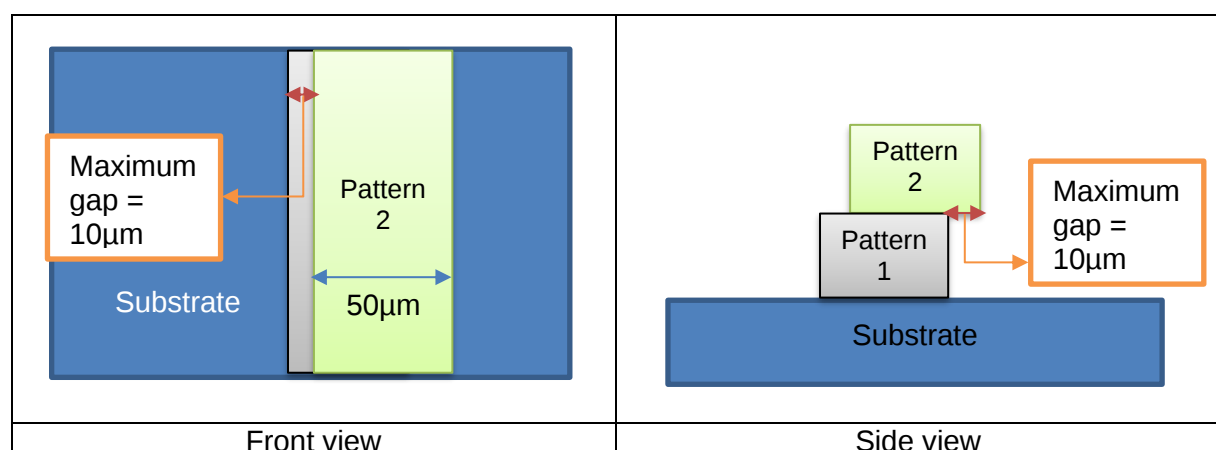
7.4.12. Aligning the screens and the substrate to be printed

The alignment of screen with respect of the tool must be performed with contactless tool. Since different size of screen and different fiducials position will be used, the contactless tool setup and positions should be fully adjustable.

The pattern alignment must allow a precision of less than $10\mu\text{m}$, pattern to pattern.

The design of the pattern are lines or dots of typical dimensions of $50\mu\text{m}$ (width or diameter). Several patterns must be printed one over the others and on both side of the substrate.

In case of 2 layers, the pattern 2 must be printed on the pattern 1, with a layering dimensional tolerance of less than $10\mu\text{m}$.

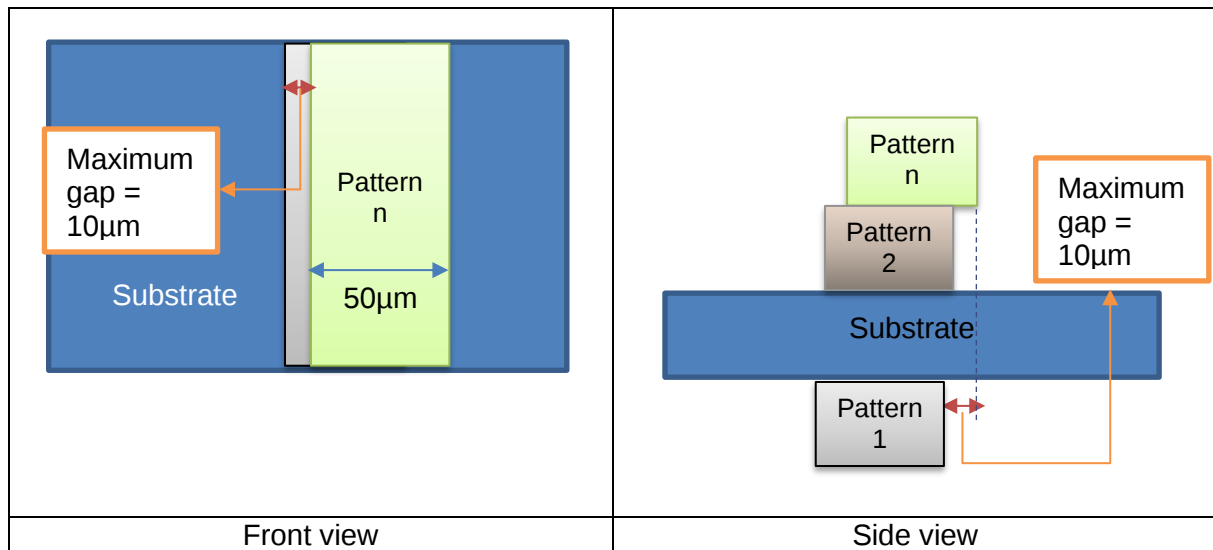


In case of n layers printed one over each other or on both side of the substrate, the pattern number n must be printed with the same layering dimensional tolerance of less than $10\mu\text{m}$ compared to the pattern 1.

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The alignment must **be direct** (meaning no dummy printing), frame with substrate, layers with screen (not with two different cameras to be changed).

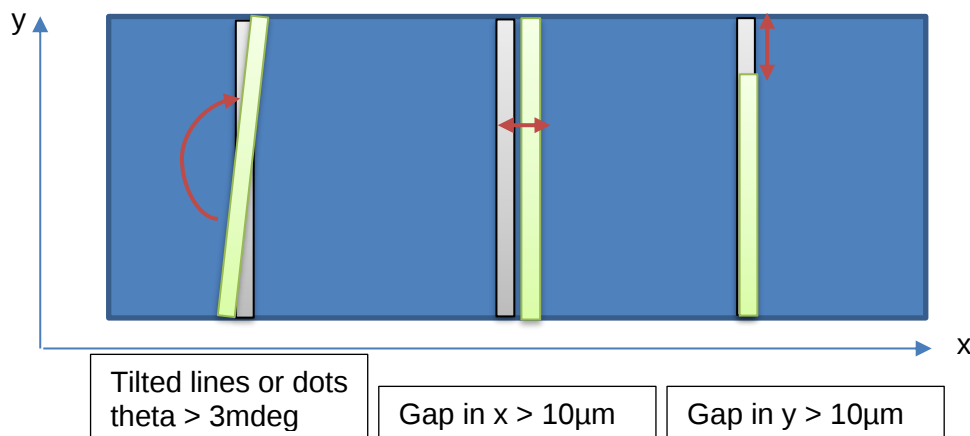
Cameras must be mobile thanks to an automatic command in the software, to check any fiducials wherever in the printing area.

The camera(s) must have the capability to identify screen printed fiducials using metal and colored inks on both top side and back side (if transparent) of the substrate.

The teaching of the fiducial must be performed on real images.

In case of non-automatic recognition of one or several fiducials (especially with bare substrate which doesn't have fiducials), it will be possible to override the fiducials by the user and even in automatic mode.

What is not acceptable for your application :



The layer to layer alignment will be performed based on 2 or 4 marks analysis localized generally close to the four corners of the substrate. The alignment procedure must minimize and balance, on

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the analysed points, the distances between fiducials of the first printed level with a following printed level.

The teaching of the fiducial must be performed on real images and **in direct**.

The system/software will allow to manually enter an X/Y/theta offset to compensate for any misalignment between printed levels.

7.4.13. Setting the parameters

The operator will be able to monitor the equipment during all steps thanks to an interface: at least a control panel and if necessary keyboard, trackpad.

Whatever the system proposed by the manufacturer it will have to be ergonomic:

- in terms of software management,
- its positioning outside the equipment will not disturb any task of the operator: door opening, screen or substrates loading.

The interface will gather all the functionalities to run the tool:

- All hardware positioning
- During printing process, all the parameters of the recipe such as printing sequence, squeegee speed, squeegee and blade pressure, gap... will be managed through this interface. These parameters will be automatically stored inside the used recipes.

<i>Parameter to be stored</i>	<i>Minimum</i>	<i>Maximum</i>
<i>Printing and coating speed</i>	<i>5mm/s</i>	<i>500mm/s</i>
<i>Blade pressure</i>	<i>0.05MPa</i>	<i>1MPa</i>
<i>Squeegee pressure</i>	<i>0.05MPa</i>	<i>1MPa</i>
<i>Snap off</i>	<i>0mm</i>	<i>10mm</i>

7.4.14. Dispensing the ink (automatic dispense as a facultative option)

As an R&D equipment, the tool enables the use of different inks. Indeed, inks are potentially changed for every step of printing. offering different densities and viscosities.

	Minimum (mPa.s)	Maximum (Pa.s)
Viscosity	10	125

If an automatic dispenser is proposed by the supplier, this additional option must be really easy to purge, clean and fill up by the operator on the equipment. The dispensing will be rated and monitored. The dispenser must not induce bubbles or modification of the ink.

The start point and end point of the dispensing must be adjustable by recipe.

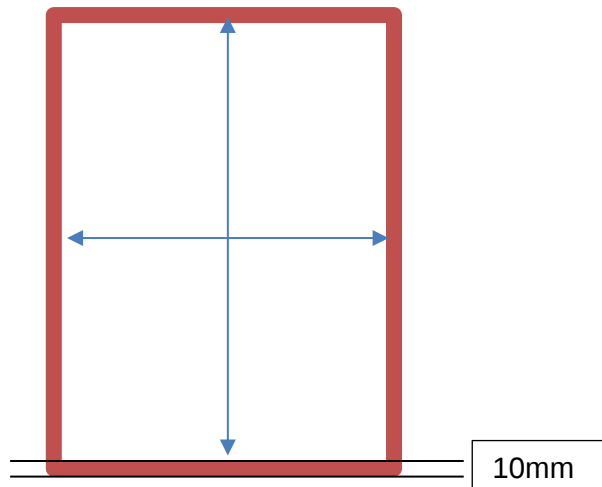
7.4.15. Printing a substrate

The printing area is maximum 360*300mm centered on the substrate. It can be less, especially with shorter substrates, but on all the perimeter, an exclusion area of 10mm on the border of the substrate (as described in figure below) is created in order to forbid printing in this zone. The exclusion area is needed to handle properly the substrate during the different step of handling.

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The system will be designed to enable:

- a printing in both direction in X (from the left to the right of the equipment or from the right to the left of the equipment) or Y (from the front to the rear of the equipment or from the rear to the front of the equipment).
- a printing with one squeegee and one coater blade
- a printing with two squeegees
- a printing mode and flooding mode which can be used in automatic and in manual mode.
- the flooding of the screen independently from the printing process which allow to start or to end the process sequence by a flooding step of the screen.

Printing and coating speed and pressure

The printing and coating speed must be adjustable by software from 5mm/s to 500mm/s. It must have a step by step mode.

The pressure of the blade or squeegee must be adjustable from 0.05 to 1MPa.

Snap-off

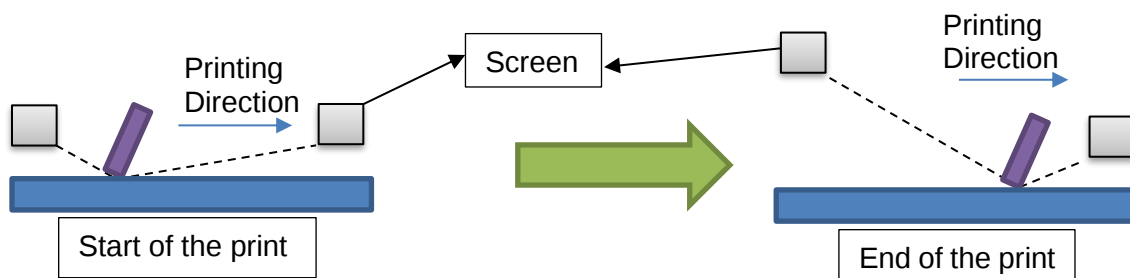
The snap-off must be adjustable from 0 to 10mm.

Peel-off

Different kind of peel-off (as a facultative option) :

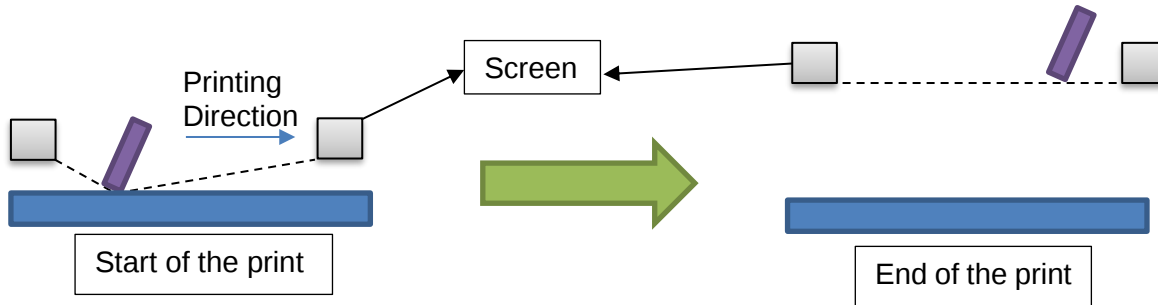
- One side peel-off :

The angle of the screen with respect to the substrate changes during printing or at the end of the print. Two modes must exist : either synchronized with the print or at the end of the print



- Both side peel-off :

At the end of the print, the screen is slowly removed at the same level on both side.



7.4.16. Possibility of making optical inspection of the printed substrate (as a facultative option)

A camera or a set of cameras will be installed after printing in order to take a picture of the printed substrate with a length scale and a zoom. This system will enable to check the size of the printed patterns onto the substrates with a resolution of 10µm.

The system must also rapidly measure the dimension of the substrate and the dimensions of the printing area. It will be linked to data storing system so that the pictures of the substrates with their printing will be recorded.

An HMI must be installed on the equipment so that the operator can observe in real time any printing defects.

The substrate area to be pictured is of 380 * 380mm maximum and 50*50mm minimum.

The vision system has to record pictures in 5 seconds

Important note: The surface of the substrate can be smooth and reflect the light.

7.4.17. Automatically transporting substrate from printing zone to unloading zone

The substrate has to be conveyed automatically from the printing section to the unloading zone. The conveyer must be smooth and with no shacking and shocking during its travel.

The table has to move with a step-by-step engine with high accuracy of positioning of less than 20µm.

7.4.18. Unloading the printed substrate

The operator must have the possibility to unload the printed substrate without damaging it.

7.4.19. Manually desintalling the screen

The operator must have the possibility to unload the screen without damaging it.

7.4.20. Desintalling the squeegee and the blade

The holding and clamping system of the squeegee and the blade will allow an easy remove by the operator after the printing process sequence.

7.4.21. Recording the process parameters of the printed substrates

All the process parameters shall be controlled, saved and recalled under an identified recipe. Data during the process can be stored and can be saved on USB key or network

7.4.22. Cleaning automatically the screens inside the tool between two printing sequence (as a facultative option)

A system will be installed inside the tool to enable an automatical cleaning of the bottomside of the screen between two printing sequences, without removing the screen from the tool.

This system will allow to use different kind of organic solvents such as DI water, IPA or cyclopentanone.

The cleaning step will be triggered either by a request by the operator or by a program schedule through the interface each x printing sequence.

7.4.23. Connecting the tool to the internal network

If the equipment is delivered with a computer, it shall be set up with a Windows 11 Entreprise Operating System and shall be compatible with the SYMANTEC Endpoint Protection 12.1 RU6 MP6 at least (12.1 RU6 MP9 preferred) antivirus.

The hardware shall enable networking and shall feature at least wired (Ethernet) network.

CEA's facilities management shall be called on to configure the PC to the CEA standard before its networking.

It must be possible to save the configuration and acquisition data in a repository of a network server. Therefore, the acquisition data shall be supplied as result files that can be transferred onto the network.

The system must have a remote supervisory system. This supervisory system shall feature a read only profile of the parameters. It shall not be possible to perform any action on the operation of the equipment.

Additional profiles will allow to make the following functions:

- User for the piloting of the equipment
- Maintenance technician for the configuration of the equipment
- Administrator (only for the system administrator staff)

Remote control access of the computer equipment from the Internet shall not be authorised for the maintenance or commissioning phases. Should, for technical reasons, remote control access from an Intranet be required, the supplier shall specify such requirement in its bid. It shall provide the list of all the remote actions that may occur on the equipment using the remote control access. CEA will then carry out an analysis to determine whether or not CEA grants an exception, without this being constituted as a commitment. In any case, the implementation of remote control access shall give rise to a reduction by the supplier which shall be specified in the bid. By default, the remote control access shall then be implemented via RDP (Remote Desktop Protocol) software.

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In case parameters of the system can be modified, the supplier will have to indicate in the offer the elements of **analysis of security of this system of supervision allowing to demonstrate that the security of the equipment remains mastered by technical means independent from the system of supervision**. If these elements are not briefly known at the time of the offer, the supply of these elements will constitute a deliverable in the putting into service.

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7.5. Specifications

7.5.1. Tool specifications

Table 1 - Specifications and test conditions for the equipment

	Acceptance criteria	Target	Tolerance	Test conditions	Samples type or format	Number of sample for test	When	Criteria
E-1	UV free lamp	Yes	No	Inspection, description of the feature by the supplier	NC	1	FAT	Visual
E-2	The table is made of easily washable material	Yes	No	Washing a zone polluted with ink	NC	1	FAT	Ethanol, cleaning paper or tissue
E-3	Flatness of the table	TTV of maximum 10 μ m		Checking the total thickness variation of the chuck + table	Table	1	FAT	Comparator supplied by CEA
E-4	Proposed solutions to keep flat the total surface of the substrate	Yes	No	Evaluating if the substrate is properly maintained on the table and measuring the vacuum depression			FAT	
E-5	Presence of ionizing nozzles	Yes	No				FAT	Visual
E-6	Presence of HEPA filters	Yes	No				FAT	Visual
E-7	Compatibility with maximum squeegee size of	400mm	+/- 1mm	Installing the squeegee	NC	1	FAT	Squeegee supplied by the supplier
E-8	Parallelism of the squeegee must be done automatically	< 1 minute	No	Inspection, description of the feature by the supplier	NC	1	FAT	Squeegee supplied by the supplier
E-9	Parallelism of the blade must be done automatically	< 1 minute	No	Inspection, description of the feature by the supplier	NC	1	FAT	400mmx50mm (height) blade supplied by the supplier

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E-10	Managing the squeegee angle (vertically)	0 to 60°	+/- 0,5°	Installing and tilting the squeegee from 0 to 60° vertically	NC	1	FAT	400mmx 10x50mm (height)squeegee supplied by supplier
E-11	Managing the squeegee angle (horizontally)	0 to 10°	+/- 0,5°	Installing and tilting the squeegee from 0 to 10° horizontally	NC	1	FAT	400mmx 10x50mm (height)squeegee supplied by supplier
E-12	Printing in both directions along one axis	Yes	No	Test without substrate to be printed.	NC	NC	FAT	400mmx 10x50mm (height)squeegee supplied by supplier
E-13	Printing sequence test: flooding first or printing first	Yes	No	Test without substrate to be printed.			FAT	400mmx 10x50mm (height)squeegee supplied by supplier
E-14	Positioning of the frame vs a reference point of the machine	vs a ref point	+/- 5mm	Installing the frame	NC	1	FAT	Screen supplied by CEA
E-15	Precision of the displacement of the table	smooth displacement of the table	+/- 20µm	inspection, description of the feature by the supplier	NC	1	FAT	Visual
E-16	Maximum screen frame size	736*736 x 20mm	+/-5mm	Putting the screen on the machine	NC	NA	FAT	1 screen 736*736 x 20mm supplied by CEA
E-17	Typical screen frame size	560*560 x 30mm	+/-5mm	Putting the screen on the machine	NC	1	FAT	1 screen 560*560 x 30mm supplied by CEA
E-18	HMI is ergonomic. Presence of keyboard and trackpad	Yes	No	Ergonomics will be evaluated, especially no interference with operator task	NC	NC	FAT	Equipment
E-19	Parameters can be controlled saved and recorded in the recipe and traceability system.	Yes	No	Inspection, description of the feature by the supplier	NC	NC	FAT	HMI of the machine
E-20	Adjustable Printing speed	5 to 500mm/S	+/-1 mm/s	Inspection, description of the feature by the supplier	NC	NC	FAT	HMI of the machine
E-21	Adjustable Snap off	0 to 10mm	+/-0,1mm	Inspection, description of the feature by the supplier	NC	NC	FAT	HMI of the machine
E-22	Adjustable Pressure	0,05 to 1MPa	+/- 0,01MPa	Inspection, description of the feature by the supplier	NC	NC	FAT	HMI of the machine

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E-23	Possibility to have two peel off modes	Yes	No	one side peel off: angle of the screen changes during printing. Both side peel off: the screen detaches from the substrate	NC	NC	FAT	1 screen 736*736 x 20mm supplied by CEA
E-24	Teaching of the fiducial	must be performed on real images and in direct.		Verifying how the machine is performing the alignment	NC	NC	FAT	2 screens of 736x736mm with different positioning of the fiducial supplied by CEA

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7.5.2. Process specifications

Process 1

If the test conditions proposed by the CEA are not acceptable or sufficient for the equipment supplier, this one may propose other alternatives to the test conditions.

Table 2 - Specifications and test conditions for screen-printing process of glass

#	Acceptance criteria	Target	Tolerance	Test conditions	Samples type or format provided by CEA	Number of sample for test	When	Criteria
P1-1	Possibility to load substrate of length	380mm	+/-1mm	Positioning a substrate of length 380mm. The substrate must stay on position during all the process,	Glass, dimension 320x380*1,1mm	3	FAT, SAT	Manual loading of the substrate onto the printing table
P1-2	Possibility to load substrate of width	320mm	+/-1mm	Positioning a substrate of width 320mm. The substrate must stay on position during all the process,	Glass, dimension 320x380*1,1mm	3	FAT, SAT	Manual loading of the substrate onto the printing table
P1-3	Possibility to load substrate of thickness	0,02 to 15mm	+/-1mm	Positioning a substrate of thickness 1,1mm	Glass, dimension 320x380*1,1mm	3	FAT, SAT	Manual loading of the substrate onto the printing table
P1-4	Verify that a smaller substrate can stay in position on the table	Yes	No	The substrate must stay on position during all the process,	Glass, dimension 50mmx50mm*1,1mm	3	FAT, SAT	
P1-5	Height of squeegee	50mm	+/- 2mm				FAT, SAT	
P1-6	Top side of the substrate: pattern alignment in X, Y direction	<10µm		Printing a first pattern, drying, then printing another pattern on top; printing area 300x360	Glass, dimension 320x380*1,1mm Silver and dielectric inks	3	FAT, SAT	camera with automatic command (supplier), Silver and dielectric inks of viscosity 3-20Pa.s
P1-7	Back side of the substrate alignment in X, Y direction	<10µm		printing a first pattern on top, flip the substrate then printing another pattern on backside. Printing area 300x360	Glass, dimension 320x380*1,1mm Silver and dielectric inks	3	FAT, SAT	camera with automatic command (supplier), Silver and dielectric inks of viscosity 3-20Pa.s

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P1-8	Angle Alignment theta	<3mdeg		checking the parallelism of patterning from pattern to pattern	Glass, dimension 320x380*1,1mm	3	FAT, SAT	camera with automatic command (supplier), Silver and dielectric inks of viscosity 3-20Pa.s
P1-9	Direct alignment	direct, in real time	No	No dummy printing	Glass, dimension 320x380*1,1mm	3	FAT, SAT	Silver and dielectric inks of viscosity 3-20Pa.s
P1-10	Controlling the size of the printed pattern	the size can be controlled	No	Printing lines of 200µm width, +/- 10µm	Glass, dimension 320x380*1,1mm Silver ink	3	FAT, SAT	Silver and dielectric inks of viscosity 3-20Pa.s
P1-11	offset can be manually set	Yes	No	setting a offset of 2mm	Glass, dimension 320x380*1,1mm	3	FAT, SAT	ink type Silver and dielectric inks of viscosity 3-20Pa.s

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Process 2

Table 3 - Specifications and test conditions for screen-printing process of PET foil

	Acceptance criteria	Target	Tolerance	Test conditions	Samples type or format provided by CEA	Number of sample for test	When	Criteria
P2-1	Possibility to load substrate of length	380mm	+/-1mm	Positioning a substrate of length 380mm. The substrate must stay on position during all the process,	PET foil, dimension 320x380*125µm	3	FAT, SAT	Manual loading of the substrate onto the printing table
P2-2	Possibility to load substrate of width	320mm	+/-1mm	Positioning a substrate of width 320mm. The substrate must stay on position during all the process,	PET foil, dimension 320x380*125µm	3	FAT, SAT	Manual loading of the substrate onto the printing table
P2-3	Possibility to load substrate of thickness	0,02 to 15mm	+/-1mm	Positioning a substrate of thickness 125µm	PET foil, dimension 320x380*125µm	3	FAT, SAT	Manual loading of the substrate onto the printing table
P2-4	Verify that a smaller substrate can stay in position on the table	Yes	No	The substrate must stay on position during all the process,	PET, dimension 50mmx50mm*125µm	3	FAT, SAT	
P2-5	Top side of the substrate: pattern alignment in X, Y direction	<10µm		Printing a first pattern, drying, then printing another pattern on top; printing area 300x360	PET foil, dimension 320x380*125µm Silver and dielectric inks	3	FAT, SAT	Camera with automatic command (supplier), Silver and dielectric inks of viscosity 3-20Pa.s
P2-6	Back side of the substrate alignment in X, Y direction	<10µm		Printing a first pattern on top, flip the substrate then printing another pattern on backside. printing area 300x360	PET foil, dimension 320x380*125µm Silver and dielectric inks	3	FAT, SAT	Camera with automatic command (supplier), Silver and dielectric inks of viscosity 3-20Pa.s
P2-7	Angle Alignment theta	<3mdeg		Checking the parallelism of patterning from pattern to pattern	PET foil, dimension 320x380*125µm	3	FAT, SAT	Camera with automatic command (supplier), Silver and dielectric inks of viscosity 3-20Pa.s
P2-8	Controlling the size of the printed pattern	the size can be controlled	No	Printing lines of 200µm width, +/- 10µm	PET foil, dimension 320x380*125µm Silver ink	3	FAT, SAT	Silver and dielectric inks of viscosity 3-20Pa.s



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7.6. Computer Specifications

7.6.1. Computer Control

The equipment is controlled from a computer workstation, preferably running the Windows operating system.

7.6.2. Network Connection

The equipment is connected to the CEA network through this PC via a dedicated Ethernet connection. The equipment supplier must ensure that an additional network card is installed in the workstation in case the equipment is connected to the sole available network port..

7.6.3. Instrumentation network cloud

The equipment is connected to a dedicated instrumentation IP network cloud. It follows the principle showed in the following figure :

Main Characteristics of the instrumentation network cloud :

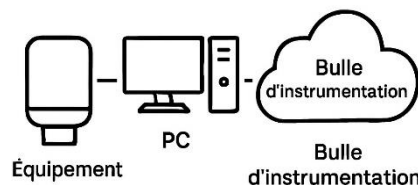


Figure 1 – CEA network connection diagram

- For IT security reasons, there is no internet access or email functionality.
- User session authentication is handled through a CEA Active Directory domain controller.
- Data is uploaded to a shared network storage system.
- Remote access is restricted to CEA's internal IT management service only.

7.6.4. Connection prerequisites

Prior to network connection, CEA requests that the equipment supplier evaluate the feasibility of:

- Installing CEA's specified antivirus software on the PC (reference available upon request).
- Implementing a process for regular Windows updates with two options:
 - Complete system updates (including all updates).
 - Security-only updates (critical security patches only).

7.6.5. Documentation and procedure

The equipment supplier must document the IT configuration of the equipment for its connection to the CEA network (network interface configuration, protocols to be implemented, ports to be opened, data types, architecture diagram, etc.). The supplier will provide a network connection procedure.

7.6.6. Equipment Supplier IT Contact Availability

Availability of an IT contact from the equipment supplier is requested both prior to and during the network connection process.

7.6.7. Data Export

During operation, if the equipment serves as a data source, data should preferably be exported in flat file formats (TXT, CSV) or office document formats (XLSX, PDF) for deposit in the designated network storage (CEA infrastructure).

7.6.8. User Session Management

- Nominal phase:
 - The user session is either individual (named) or generic and authenticated through the CEA Active Directory domain controller.
- Maintenance phase:
 - The user session is local, has administrative privileges, and is named with the Equipment manager ID.

7.6.9. Hard Disk Drive Image

Subject to technical feasibility, CEA will create a disk image of the PC and store it on a network resource. In all cases, the equipment supplier must provide a complete system reinstallation procedure and all necessary source files or binary files (removable media, official download links, software licenses, etc.).

7.6.10. Administrator password

If the PC is running Windows, CEA requests that the equipment supplier provide the password for the ADMINISTRATOR account. This password will subsequently be managed by the IT service provider under CEA's outsourcing contract.

7.6.11. Remote maintenance

If requested by the equipment supplier and subject to technical feasibility, an external remote maintenance solution may be implemented based on CEA's service offering. For IT security reasons, consumer-grade remote maintenance software is not permitted. Remote maintenance sessions are scheduled and conducted under continuous supervision by CEA personnel. During these sessions, the equipment is physically disconnected from the instrumentation network cloud.

8. WORK ENVIRONMENT, PLACE OF INSTALLATION, SUPPLY LIMITS

8.1. Supply limits

The supply limits between CEA and the supplier are as follows:

Elements	Incumbent upon CEA	Incumbent upon the supplier
Transportation from supplier to CEA building entrance		X
Hook up and equipment installation into the room		X
Extraction from the room to the exterior of the building	X	
Fluids, electrical power supply	X	
Prevention plans	X	

8.2. Facilities

The equipment will be installed in a clean room (class 10000) Temp 21°C, Hr 50%.

The equipment must fulfill criteria for being installed in this room.

The supplier shall include in its bid the fluid requirements, electrical power supply and any other required interfaces.

The supplier will submit with their offer the requirements for fluids, electrical power, and all other necessary interfaces, and will complete Appendix 2 provided with this specification document. If these elements are not known at the time of offer submission as they require further study, the supplier commits to providing this information no later than To + 8 weeks (in accordance with Section 9. Timelines), as To refers to the date of order notification by CEA.

The **neutral grounding system** of the installation (e.g., TT, TN-S, IT) must be explicitly stated in this document. This information must be clearly and unambiguously presented to ensure equipment compatibility and compliance with electrical safety regulations. The neutral grounding system typically used at CEA Grenoble is TN-S.

Important note:

Completing Annex 2 will enable CEA to create Piping and Instrumentation Diagrams (PIDs) for fluids as well as the PID for electrical power supply. These PIDs will then be validated by the equipment supplier before hook-up preparation work begins. For simpler equipment, PIDs may not necessarily be required.

Communication Between Equipment and Facilities :

When the equipment relies on certain facilities (such as cooling water, ventilation, compressed air, etc.) for safe operation, the supplier must provide CEA with the following during the design phase:

- The conditions required for proper equipment functioning.

- An analysis of criticality in case of parameter deviations.

This analysis may take the form of an FMECA (Failure Modes, Effects, and Criticality Analysis) or an equivalent method.

Loose of Facility Failure Analysis:

Every potential facility failure—whether isolated or combined with others—must be studied. If a risk is identified, a dedicated section must be included in the documentation.

Safety Signal Integration :

If certain facility parameters could impact:

- The safety of the equipment's process,
- Safe operational mode,
- Overall installation safety,

The supplier must integrate the necessary signals into the safety loop or automation system to enable emergency shutdown or controlled shutdown based on criticality level.

Communication Protocol:

Finally, if the equipment's operation could significantly disrupt the installation's facilities, the supplier must propose to CEA a communication protocol to anticipate and manage these impacts.

8.3. Delivery

The equipment and peripherals shall be delivered in a clean condition and packaged in a proper manner before shipment and be delivered in packaging and crating compatible with this room.

Transport trays, pallets and packaging crates shall be suited to the weights and volumes of the items so as to ensure safe transport and to subsequently prevent any dispute related to defective packaging.

All transport trays, pallets and packaging crates shall be removed by the supplier as the processing of packaging waste is not managed by CEA.

To prepare the installation at CEA, and 1 month before delivery, the supplier must indicate in its offer :

- The number of packages to transport the equipment
- The weight, volume, length, width, height of each package
- The weight of the machine
- The number of legs and weight per leg
- The need for special tools or forklift

Any item of equipment delivered shall bear the order number as well as the recipient's name. The supplier shall plan all measures for unloading and installing the equipment.

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Delivery shall be performed between 8 a.m. and 4:30 p.m. from Monday to Friday.

The equipment shall be installed no later than the 31st March 2027 on site in the D3 building.

The supplier must be there at the delivery of the equipment, from the unloading to the installation at its place.

8.4. Conditions for performing work on the CEA sites

In cooperation with the supplier and its subcontractors (if any), CEA shall draw up the overall prevention plan for the equipment installation and commissioning services.

As equipment lending, including safety equipment, is prohibited by CEA, the supplier and its subcontractors (if any) shall provide the required safety equipment for preventing the specific risks caused by its work (PPE, CPE, etc.). It shall be responsible for replacement and repair of said equipment and, as applicable (without compensation from CEA), it shall train and acquaint its staff with the use thereof in keeping with regulations. Said equipment shall comply with the regulations in force and the supplier shall possess a certificate of conformity.

The supplier and its subcontractors (if any) shall provide collective safety equipment designed to prevent accidents stemming from the work (marking out of the work areas, marking out of the traffic areas; marking out of the handling areas, marking out and implementation of barriers around pits, height differences, etc.). It shall perform and ensure their removal insofar as the service no longer requires the presence of marking systems.

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9. LEAD TIMES

The equipment will be installed on site and received within a desired timeframe of 9 months after the To approval date of the order by the CEA and the supplier.

All the deadlines mentioned below are indicative.

Step	Deadline
Factory Acceptance Test (FAT)	$T_0^* + 34$ weeks
Equipment delivery at CEA site	$T_0 + 35$ weeks
Hook-up and fit up of the equipment	$T_0 + 35$ weeks
Training	$T_0 + 36$ weeks
Site Acceptance Test (SAT)	$T_0 + 36$ weeks

* T_0 refers to the date of order notification by CEA.

To facilitate compliance with delivery and acceptance deadlines, the supplier must promptly transmit all appendix required for equipment installation (fluid requirements, electrical power supply, and any other necessary interfaces (Appendix 2), hazard identification sheet (Appendix 3), equipment consumption data, etc.) or any other necessary elements.

10. QUALITY

The supplier shall apply a quality management system that is of the same level as ISO 9001 for all its activities.

Any significant and/or repeated failures to comply with the specifications shall be notified to the supplier (anomaly email or improvement sheet) in order to perform corrective actions within a stipulated timeframe. In the event of failures or should said corrective actions not be performed, penalty shall be applied to the service provider in reference to the contract.

CEA Grenoble reserves the rights to inspect the effective operation of the system at any time, via quality audits which may be performed at the service provider's premises and on the CEA Grenoble site.

Any measurements taken by the supplier for acceptance tests shall comply with the requirements of paragraph 7.6 of ISO 9001 (control of monitoring and measuring devices). Should the supplier subcontract these measurements, they shall be supplied with a certificate of conformity.

11. SAFETY AND COMPLIANCE

Two supporting documents are available to assist you in drafting the specifications:

CEA Guide RSSN-PRP-02-06

[ED 6231](#) – Successfully Acquiring a Machine or Work Equipment

Use these guides to enhance your specifications, particularly regarding safety and environmental considerations.

As required in CEA's general purchasing conditions, the supplier commits to treating safety as an absolute priority in the design, preparation, and execution of the services covered by the contract.

The supplier acknowledges and applies the "rules applicable to external companies at the Grenoble center" provided with the tender dossier.

The supplier, as well as any subcontractors at any level, must comply with all applicable legislative and regulatory provisions regarding safety and environmental protection.

The equipment must comply with current regulations.

The equipment will be CE certified, bear the "CE marking," and be accompanied by a CE Declaration of Conformity (see § Documentation).

If the equipment is not a "catalog" item, presents particular risks, or has significant value or criticality, include the following sentence:

The supplier is requested to seek assistance from a French certification body to verify regulatory compliance from the equipment's design phase.

11.1. Hazard Identification

CEA may request the supplier to provide a description of the equipment's residual hazards, including the following information:

- Details about residual hazards for operators.
- Interactions between the equipment and its environment (gas or chemical emissions, electromagnetic fields, noise, etc.)

If hazard identification is required, CEA will make this request no later than during the market launch meeting. The supplier will base this analysis on Annex 3 of the Technical Specification Document: Identification of Residual Hazards.

The supplier must submit this analysis to CEA during the design phase (cf. § Documentation).

The author may require the supplier to draft Annex 3 regarding known hazards associated with the type of equipment.

11.2. Risks associated to facilities

Please specify risks associated to facilities if any

11.3. Power supply disconnection and separation device

A power supply disconnection and separation device shall be provided on the equipment, for each source of energy of the machine.

11.4. Power supply lockout / tagout device

A power supply lockout / tagout device with dissipation of the residual energy shall be provided on the equipment, for each source of energy of the machine.

11.5. Emergency stop

Emergency stop buttons shall feature protection against unintentional operation. See the example on the side picture.



11.6. "Service" nitrogen or compressed air connection

When the equipment uses compressed air or nitrogen for controlling valves, actuators, and other systems, the machine must be equipped with a general shut-off valve.

This valve may be locked in the closed position using a padlock to allow for equipment isolation (maintenance).

There must be one or more purge devices to dissipate residual pneumatic energy stored in the machine after the main valve is closed. This dissipation must be performed without risk to exposed personnel.

11.7. Risks related to electricity

Generalities

The equipment shall comply with the regulations in force, in particular the following Directives:

- "Electrical Equipment" 2017/35/EU;
- "Electromagnetic compatibility" 2014/30/EU;
- "Restriction of the use of certain hazardous substances in electrical and electronic equipment" (2011/65/EU).

If the equipment is composed of electrical measurement, control and laboratory devices, it shall comply with Standard NF EN 61010-1.

11.8. Presence of an uninterruptible power supply (UPS)

If the whole equipment must be supplied by an uninterruptible power supply (UPS), then this power supply shall be provided by CEA.

The supplier shall give all the required information for product definition (voltage, power, battery life). The supplier shall provide connection terminals on the equipment to connect the uninterruptible power supply.

In the event that only a portion of the equipment is powered by an internal UPS integrated by the manufacturer, the following rules shall be observed:

- An all-pole isolating device shall be installed downstream of the UPS in order to enable maintenance operations.

- If voltage still remains after the master switch of the machine has been turned off, such presence shall be indicated close to the switch.
- All circuits that remain live after switch off shall be marked in orange colour in accordance with standard 60-204.

11.9. Risks related to fire

The detectors integrated into the equipment will not be connected to the building's fire protection system by default, and will only act on the affected equipment and its associated peripherals, if applicable.

If the supplier deems it necessary to connect their fire protection system with the building's fire safety system, they must first consult with CEA to ensure the compatibility of the entire system.

11.10. Risks related to explosion

The equipment shall comply with the regulations in force, especially the "ATEX" Directive 2014/34/EU.

Whenever the equipment is likely to generate an explosive atmosphere, the supplier shall perform an ATEX risk assessment and substantiate the choice of the selected ATEX equipment. The ATEX zoning plan as well as the certificates of conformity of the ATEX items of equipment shall be supplied to CEA.

11.11. Risks related to Chemicals

When the equipment uses chemical products that pose health and safety risks to operators, the supplier must detail in the risk analysis the protective measures implemented during normal, degraded, or maintenance work phases.

- When chemical products (solid, gaseous, or liquid) are supplied by the supplier, they must provide the complete list of products, along with Material Safety Data Sheets in French (MSDS) for each product. CEA will be particularly vigilant about the content, pictograms, and classification used, as well as the provision of a version written in French.
- All equipment containing liquid chemicals must be organized to form a retention system to prevent the spread of these products outside the equipment without intentional action. These retention systems will be equipped with leak detectors reporting information to the equipment's control panel. The activation of a detector will interrupt the automatic power supply to the machine and the circulation of chemical fluids. The detectors will be tested before the equipment is put into operation.
- The operation of the equipment must be controlled by the proper functioning of the extraction system. The extraction level will be continuously monitored by one or more extraction controllers, which will trigger a visual alarm at the workstation (on the equipment, and if necessary on the affected peripherals).
- Note: For automated equipment, this "extraction" alarm may be combined with other types of alarms on the equipment's control panels. The following must be placed under

EQUIPMENT SPECIFICATIONS

R&D Screen Printer with high precision alignment

Référence (n° chrono) : DTNM/SCEF/2026/021 Version A

extraction: trays, work surfaces, and generally any location where a leak could occur: presence of fittings, valves, pumps, storage capacities (even closed), canisters, etc.

- The chemical product trays on the benches must be equipped with an automatic drain system with adjustable timing, so that solutions can be automatically directed to the drains in case of prolonged extraction failure.
- For certain process requirements, chemical products may need to be heated. At the end of the operation, these baths are drained to dedicated drains. For temperatures above 60°C and for discharges into the "solvents" drain, a study must be conducted to define the best solution: PVDF material, dilution module, heat exchanger, etc.
- If the solution chosen by the supplier involves the installation of a buffer tank to allow cooling of these effluents, it must be under retention and equipped with an adjustable timing drain system, as mentioned above.
- For equipment with process chambers, the supplier must provide the list of expected by-products in case of chamber opening, to facilitate maintenance operations.
- The supplier will provide CEA with the technical data sheets and SDS for the thermal insulators used, prioritizing the least hazardous thermal insulating products (non-CMR). The use of CMR Category 1a and 1b is PROHIBITED. The use of thermal insulating products classified as CMR Category 2 must be justified by the supplier and validated by CEA in advance.
- The supplier will provide CEA with the list of refrigerants used in the equipment and the associated SDS.
- If the equipment is likely to contain materials subject to regulations related to perfluoroalkyl and polyfluoroalkyl substances (Decree of June 20, 2023) and "Substances of Very High Concern" (SVHC) (under Regulation (EC) No 1907/2006), the supplier will inform CEA during the design phase.

11.12. Risks related to handling

For those parts of the equipment requiring handling (pumping units, chamber lids, covers, etc.), in particular during maintenance or installation operations, suitable lifting means shall be provided and described in the safety instructions of the equipment.

Systems integrated into the equipment shall be given preference over removable systems.

11.13. Risks related to pressure vessels

The equipment must comply with current regulations, including:

- Pressure Equipment Directive 2014/68/EU.
- The contract holder will provide the following elements with the supplied pressure equipment, at a minimum:
- The pressure equipment conformity declaration;

- The presence of a CE conformity plate on the affected equipment;
- The service instruction manual;
- The maximum allowable pressure (PS) value;
- The maximum allowable temperature (TS) value;
- The useful volume for tanks;
- The diameters of the sections for pipelines, if applicable;
- The calibration certificates and safety accessories certificates.

11.14. Risks related to work at height

In the event that use, maintenance or installation operation of the equipment require access at height, the supplier shall give priority to the installation of collective protective equipment (e.g.: built-in work platform with handrail complying with the standards in force) or, failing that, provide personal protective equipment (e.g.: anchoring points or lifelines complying with the standards in force). In the latter case, the technical documents shall very clearly refer thereto, so that the associated regulatory checks can be implemented.

Where necessary, the associated personal protections may be required.

These shall have been validated by CEA..

11.15. Risks related to artificial optical radiation

These include visible, infrared, and ultraviolet radiation, whether coherent (such as lasers) or incoherent.

The design, implementation, and labeling of the affected equipment must comply with current regulations and standards.

The supplier must provide CEA with information about the artificial optical radiation used in the equipment during the design phase, particularly regarding the risks to users.

11.16. Risks related to noise

If the equipment falls under the definition of a machine, it must comply with current regulations, including Regulation EU 2023/1230.

11.17. Risks related to temperatures

If the equipment falls under the definition of a machine, it must comply with current regulations, including Regulation EU 2023/1230.

11.18. Signaling

If the equipment falls under the definition of a machine, it must comply with current regulations, including Regulation EU 2023/1230.

Residual risks shall be indicated on the machine by means of regulatory hazard pictograms (triangles with yellow background), accompanied by additional text when applicable. In this case, this text shall be written in French.

11.19. Regulatory inspections

CEA shall have the necessary regulatory inspections carried out by an authorized organization of its choice, in order to verify that the supplied equipment complies with the regulations.

The Supplier shall remedy any non-conformity in the shortest time possible without being able to claim any compensation. Depending on the severity of the detected anomalies, CEA may decide to suspend the commissioning operations until the problems have been solved (refer to Article 30 of chapter 11 of the General Purchasing Conditions).

11.20. Inspection of the work equipment

The equipment must comply with current regulations, particularly Regulation EU 2023/1230. It must be accompanied by:

- The CE marking of the machine;
- The Declaration of Conformity;
- The instruction manual **in French**, including all necessary plans, diagrams, and documents for installation, commissioning, operation, adjustment, assembly, and disassembly.

CEA may arrange for a machine control inspection at the manufacturing site by a certification body of its choice. The report from this manufacturing site inspection must be free of any non-conformities. All remarks made by the certification body must be addressed by the contract holder, who will implement the necessary modifications without requesting any financial contribution from CEA.

In all cases, a second inspection must be conducted after the equipment is installed on-site.

If the equipment meets the definition of a machine, the design of the safety-related control systems must be carried out in accordance with the EN ISO 13849-1 standard. The contract holder must provide CEA with:

- The list of safety-related control systems (SRP/CS);
- The reasoning followed during the design (e.g., the faults considered, the faults excluded);
- The result of the required performance level (PLr);
- The achieved performance level (PL);
- The calculation tool used (e.g., SiStema)

11.21. Regulatory electrical inspection

CEA is attentive to the proper sizing of electrical supplies for equipment connected to its electrical network.

To facilitate proper sizing of the power supply, the supplier must provide CEA with all electrical information for the equipment, including cumulative power ratings determined by calculation (e.g., using the ELIE BT tool).

Once the equipment is installed on-site, CEA will arrange for a regulatory electrical inspection before first commissioning by an accredited certification body of its choice.

12. ENVIRONMENTAL CLAUSES

12.1. Energy Performance/Standby Mode

The Contract Holder commits to implementing all the provisions described in their environmental proposal, which is an integral part of the contract.

In this context, and in accordance with these commitments, the Contract Holder implements all or part of the following environmental measures during the contract execution:

- To communicate data related to the energy performance of the equipment under normal operating conditions (electricity consumption, water consumption, etc.);
- To propose equipment with a standby mode or equivalent device to limit energy consumption when the equipment is not in use or turned off;
- To propose equipment with an alert system to signal excessive energy consumption;
- To provide recommendations for the least energy-consuming modes of operation;
- To propose training on the use of the Equipment in line with the implementation of the clause.

The Contract Holder remains free to submit any alternative solution within the scope of this clause.

The Contract Holder must transmit recommendations to promote more sustainable use of the Equipment based on the usage data communicated during the contract execution by CEA.

12.2. Material Durability/Facilitating Equipment Maintainability

The Contract Holder commits to implementing all the provisions described in their environmental proposal, which is an integral part of the contract.

In this context, and in accordance with these commitments, the Contract Holder implements all or part of the following environmental measures during the contract execution:

- To design equipment with robust materials and extended lifespan;
- To propose equipment offering scalability or adaptability (e.g., by adding frames);
- To ensure that the components of the equipment are easily disassembled and repairable;
- To propose training on the use of the Equipment in line with the implementation of the clause.

The Contract Holder remains free to submit any alternative solution within the scope of this clause.

The Contract Holder commits to providing recommendations to extend the lifespan of the Equipment during the contract execution.

13. EQUIPMENT DOCUMENTATION

The equipment supplier commits to providing, no later than before the Site Acceptance Test (SAT), all technical and administrative documentation related to the equipment (non-exhaustive list).

This documentation will include at least:

- The instruction manual written in French including the CE Declaration of Conformity (in accordance with Regulation EU 2023/1230).
- Identification of hazard sources (see Annex 3) and safety instructions. These documents will enable the development of a risk analysis for the equipment, co-constructed between CEA and the equipment supplier (no later than before the SAT).
- If applicable, technical and installation manuals for all commercial devices, accompanied by their calibration certificates, particularly for measurement sensors.
- The list of spare parts and consumables for routine maintenance, with costs and procurement lead times.

If applicable to the type of machine considered (prototype or custom-built with more or less CEA Intellectual Property), the supplier must provide:

- Process plans and diagrams (assembly, piping, and instrumentation).
- The final design file of the equipment.
- Sources of automation and supervision programs, documented and unprotected.
- The diagram of the IT architecture.
- The nomenclature of inputs/outputs (with tag numbers reported on electrical diagrams).
- The manufacturer's file, TQC (Piping, Quality, Control) plans, as well as the electrical and control-command file (including functional analysis and plans).

14. ACCEPTANCE CONDITIONS

Acceptance is given after complete delivery of the equipment and at the end of the installation and commissioning operations, and after satisfactory tests by the supplier. If there were any remarks during the FAT, it will be necessary to check that the solutions provided comply with the safety requirements (for example, refer to to form FOR259).

Criteria for granting acceptance:

- Supply of the documents stipulated in the "Documentation" § 13.

The acceptance test is organized with 2 steps

A procedure for checking and testing the equipment must be proposed by the supplier. This procedure shall include the controls and tests required by the CEA as described in paragraph 7.5.

14.1. FAT: Factory Acceptance Test

At the factory: Factory Acceptance Test: FAT shall be performed at the Contractor's site based on the procedure defined beforehand and submitted for CEA approval. If there were any remarks during the pre-acceptance

The Factory acceptance is pronounced in the factory of the supplier in the presence of the technical representatives of the CEA, and with CE advisor.

Criteria of the Factory acceptance pronouncement

- Analysis review of the CE compliancy of the line and associate items in operator, engineering and maintenance modes. Requirement: No mismatch with the CE regulation is authorized
- Tool Ergonomic will be reviewed.
- Noise level measurement and compliancy with specifications.
- Tests as described in paragraph 7.5 are successful according to test criteria.

At the issue of the Factory Acceptance, a report will be signed by the CEA and the supplier.

14.2. SAT: Site Acceptance Test

On the Site: Site Acceptance Test: SAT

Acceptance shall take place after full delivery of the equipment, upon completion of the installation and commissioning operations and further to satisfactory tests. The Customer Acceptance will be pronounced within the CEA facilities in the presence of the supplier staff, technical representatives of CEA, and CE advisor.

In accordance with the specifications and expected values described in the section 7:

- Pre-shipment receipt at the supplier's factory
- Full delivery of the equipment
- The end of the installation and commissioning operations, with suppliance of the hardware report
- The qualification checks and tests as described in paragraph 7.5 successfully passed
- Supply of the documents stipulated in the "Documentation" on section 13
- Supply of CE marking on the equipment and CE documentation; EC conformity approval given by the body accredited by CEA.
- Analysis review of the CE compliance of the line and associate items in operator, engineering and maintenance modes. Requirement: No mismatch with the CE regulations is authorized
- Tool Ergonomic will be reviewed with a special focus in the maintenance mode

- Noise level measurement and compliance with specifications.

At the issue of the Customer Acceptance, a report will be signed by the CEA and the supplier.

For control on the CEA site: any tests must be defined by the CEA and validated by the supplier (number of samples, sizes, shapes), number of tests).

14.3. Acceptance Criteria

Acceptance will be granted if:

- The equipment complies with regulatory requirements (see § 11).
- The equipment meets all contractual technical requirements (see § 7).

When verification of an acceptance criterion requires measurement, the means used must be control, measurement, and test equipment (ECME), as defined by ISO 9001

If CEA provides the measurement equipment: Verify the availability of suitable ECME with sufficient precision.

If the supplier provides the measurement equipment:

- Measurements must be performed using compliant ECME.
- The supplier must provide calibration certificates with COFRAC accreditation or equivalent.

14.4. Final Acceptance Pronouncement on Site

Final acceptance is pronounced when:

- The equipment has been delivered in full.
- Installation, commissioning and start-up are completed.
- Qualification controls and tests have been successfully passed.
- Regulatory compliance has been approved. If applicable, machine compliance according to EU 2023/1230, as per a report issued by a CEA-accredited body, with no non-conformities.
- If applicable, compliance with specific risks (ATEX, pressure equipment, etc.) validated by an accredited body.
- The complete equipment documentation has been delivered (see chapter 13).

A proceedings record following CEA's formalism is then drawn up and signed by both parties. This proceedings record allows the acceptance of the control file and, if necessary, the listing of reservations.

15. TRAINING

The supplier undertakes to provide the following training:

15.1. Training on the use of the equipment

The supplier undertakes to conduct training on first level maintenance for 3 people. The supplier shall specify the duration of the required training in its bid.

15.2. Training on first level maintenance

The supplier undertakes to conduct training on first level maintenance for 3 people. The supplier shall specify the duration of the required training in its bid.

15.3. Training on advanced maintenance

The supplier undertakes to conduct training on advanced level maintenance for 3 people. The supplier shall specify the duration of the required training in its bid.

16. WARRANTY

The equipment is contractually guaranteed for 2 year(s) from the date of acceptance against any defects in material, manufacturing, assembly, and operation, in compliance with the technical specifications of the tender document.

This warranty covers parts (excluding consumables), labor, transportation, and travel.

During the warranty period, the supplier commits to intervening for repairs within 10 days following receipt of an email request for intervention from CEA. These services are performed every day from Monday to Friday, 8 AM to 5 PM.

In case of unavailability, the warranty period is extended by an equivalent duration to the equipment's downtime.

17. MAINTENANCE

The small maintenance must be easily done by the user of the equipment.

However, during screen printer maintenance, it will be possible to turn off the HEPA filter with a single switch and to send this information (hard contact) to clean room facility so that extraction may locally be increased

At the end of the warranty, CEA shall be given the possibility to purchase a maintenance contract.

The supplier shall include in its price base, a cost estimate, of the maintenance services by taking into account the following levels of requirement:

- MT1: Annual preventive maintenance (parts and manpower) mode only;
- MT 2 Corrective maintenance on the request of CEA based on an hourly rate including compliance with service and repair lead times.
- MT 3: Regarding the preventive maintenance the supplier will list the points during this operation especially including:

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-
- Misalignment check
 - Table displacement check
 - Check of the vacuum level and precisising the vacumm initial setpoint
 - Horizontality of the machine
 - Squeegee and blade pressure verification check
 - Calibration of the inspection vision system if included in the quotation

Following adjustment of CEA's maintenance requirements, the maintenance contract may be put in place after the warranty period, further to negotiations.

18. ELEMENTS TO BE PROVIDED IN THE BID

- Comments from the Equipment Supplier on the Equipment Specification Document.
- Completed characteristics of fluid requirements, electrical power supply, and all other necessary interfaces (see Appendix 2).
- Hazard identification sheet (see § 11.1 and Appendix 3).
- The cost of preventive maintenance service must be specified
- Duration and descriptions of planned training sessions.
- Separated Mandatory and non Mandatory Option quotes

NB : Mandatory and non Mandatory Options:

- **Mandatory Option:** The supplier must obligatorily include an offer with the option, otherwise the offer will be considered irregular. CEA reserves the right to decide whether to exercise this option or not, but the price of the option must be clearly stated in the offer.
- **Non mandatory type Option:** The supplier has the choice to propose or not propose the option. If the option is not proposed, the supplier will not necessarily be disqualified. CEA reserves the right to decide whether to exercise the option or not.