

Document Reference: DTNM/SCEF/2026/033

EQUIPMENT SPECIFICATIONS DOCUMENT

Vacuum thermal coevaporation system

EOTP	AELOGGG05FDD
OS	LOC7N5TG2LCT
Platform	Surface fonctionnelle

	Name	Function	Signature / Date
Written by	L. Grenet	Research Engineer	
Checked by security	B. Belleville	Safety Engineer	
Checked by Facilities	F. Emieux	Facility Manager	
Checked by Plateform	D. Gallaire	Platform Manager	
Checked by Quality	H. Dufour	Quality Engineer	
Checked by Installation	P. Mora	Installation Manager	
Checked by Management	M. Roumanie	Head Of Laboratory	
Issued by	R. Laucournet	Head of Department	

PUBLIC**Document Revision Table**

Version	Date	Evolution description
A	04/06/2026	Creation

Purchasing Department - SMA Manager Anne MANGIN et Thomas ZEMMERLY 1 copy (email)

Department - Head of Department +Deputy : 1 copy (email)
 Deputy LAUCOURNET Richard / 1 copy (email)
 THERY Jessica 1 copy (email)
 - Safety Engineer BELLEVILLE 1 copy (email)
 Benoit 1 copy (email)
 - Quality Engineer : DUFOUR Hélène
 - Facility Manager : ENTZMANN Vincent

Division - Head of Division : MORA Pascal 1 copy (email)
 - Installation Manager(s) : MORA Pascal 1 copy (email)

Laboratory and platforms - Head of Laboratory : ROUMANIE Marilyne 1 copy (email)
 1 copy (email)
 - Equipment Project Manager: GRENET Louis
 - Platform Manager : GALLAIRE Didier 1 copy (email)
 - Writers: GRENET L. /EMIEUX F. 1 copy (email)

CSOP - Equipment purchasing coordinator M. BOHNKE 1 copy (email)

PUBLIC

PUBLIC**TABLE OF CONTENT**

1.	PURPOSE	6
2.	DEFINITION	6
3.	GLOSSARY	6
4.	APPLICABLE DOCUMENTS	6
5.	INTERFACE CLIENT – PRESTATAIRE.....	6
6.	CONFIDENTIALITY.....	7
7.	TECHNICAL SPECIFICATIONS	7
	7.1. DESCRIPTION OF THE MAIN FUNCTION	7
	7.2. SUB-FUNCTIONS OF THE EQUIPMENT.....	7
	7.3. EXPECTED PERFORMANCES	12
	7.4. SPECIFICATIONS	13
	7.5. COMPUTER SPECIFICATIONS.....	21
8.	WORK ENVIRONMENT, INSTALLATION LOCATION, LIMITS OF SERVICE	23
	8.1. LIMITS OF SERVICES.....	23
	8.2. ENVIRONMENT, FACILITIES	23
	8.3. CEA ON-SITE INTERVENTION RULES.....	24
	8.4. DELIVERY.....	25
9.	TIMELINE.....	26
10.	QUALITY	27
11.	SAFETY AND COMPLIANCE	27
	11.1. HAZARD IDENTIFICATION	27
	11.2. HAZARDS RELATED TO FACILITIES	28
	11.3. POWER SUPPLY DISCONNECTION AND SEPARATION DEVICE.....	28
	11.4. POWER SUPPLY LOCKOUT / TAGOUT DEVICE.....	28
	11.5. EMERGENCY STOP	28
	11.6. "SERVICE" NITROGEN OR COMPRESSED AIR CONNECTION.....	28
	11.7. RISKS RELATED TO ELECTRICITY	28
	11.8. PRESENCE OF AN UNINTERRUPTIBLE POWER SUPPLY (UPS)	29
	11.9. RISKS RELATED TO FIRE.....	29
	11.10. RISKS RELATED TO EXPLOSION.....	29
	11.11. RISKS RELATED TO CHEMICALS.....	29

PUBLIC

11.12. RISKS RELATED TO HANDLING	30
11.13. RISKS RELATED TO PRESSURE VESSELS	30
11.14. RISKS RELATED TO WORK AT HEIGHT	31
11.15. RISKS RELATED TO ARTIFICIAL OPTICAL RADIATION	31
11.16. RISKS RELATED TO NOISE	31
11.17. RISKS RELATED TO TEMPERATURES	31
11.18. SIGNALLING	31
11.19. REGULATORY INSPECTION	32
11.20. INSPECTION OF THE WORK EQUIPMENT.....	32
11.21. REGULATORY ELECTRICAL INSPECTION	32
12. ENVIRONMENTAL CLAUSES.....	33
MATERIAL DURABILITY/FACILITATING EQUIPMENT MAINTAINABILITY.....	33
13. EQUIPMENT DOCUMENTATION.....	33
14. ACCEPTANCE CONDITIONS.....	34
14.1. ACCEPTANCE BREAKDOWN	34
14.2. ACCEPTANCE CRITERIA.....	34
14.3. FINAL ACCEPTANCE PRONOUNCEMENT ON SITE.....	34
15. TRAINING	35
15.1. EQUIPMENT OPERATION TRAINING	35
15.2. FIRST-LEVEL MAINTENANCE TRAINING	35
15.3. ADVANCED MAINTENANCE TRAINING	35
16. WARRANTY.....	35
17. MAINTENANCE	36
18. ELEMENTS TO PROVIDE IN RESPONSE TO THE CONSULTATION	36

PUBLIC**1. PURPOSE**

This specification document defines the supply, on behalf of the CEA, of an equipment designated as "Vacuum thermal coevaporation system." The equipment must be installed at the site of GRENOBLE in the building C4.

The installation work for the equipment will be subject to analysis following the selection of the equipment.

If the technical specifications or requested documents cannot be met, the supplier must clearly specify this in their commercial offer by at least filling out the comment section of Appendix 1 of this specification document.

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
- PMAD : Prise en Main A Distance (Remote control access)
- MTBF : Mean Time Between Failure
- MTTR: Mean Time To Repair
- MTBI : Mean Time Between Interrupts
- FAT : Factory Acceptance Tests
- SAT : Site Acceptances Tests

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. INTERFACE CLIENT – PRESTATAIRE

The technical contacts for the basic and additional services are:

Mr GRENET Louis

Tel : +33 (0)4 38 78 15 62

Email : grenet.louis@cea.fr

PUBLIC

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. Description of the main function

Specifications for a co-deposition thermal evaporation system dedicated to combinatorial research on inorganic materials.

The offer must describe a co-evaporation system, which is a chamber

- comprising 4 thermal evaporation sources to be used simultaneously or sequentially
- working under secondary vacuum
- with a 300 mm diameter rotating and cooled substrate holder
- with a flange ready to plug a mass spectrometer
- with a human machine interface comprising a manual mode and an automatic mode to run pre-defined recipes.

This equipment will be installed in a clean room at CEA Grenoble. The maximum acceptable dimension are Width = 3000 mm, Depth = 2000 mm, Height = 3200 mm (including additional mass spectrometer, see 7.2). It will be used daily (5 days a week, 45 weeks per year) for R&D purposes by technicians, engineers and students. At least one complete shutdown of the equipment will be done each year.

Deposition will be made on Si and glass substrates of dimensions ranging from 25x25 mm² to 200x200 mm²

7.2. Sub-functions of the equipment

a) Deposition system (sources)

- Volume of each source = 10 cm³
- The 4 thermal evaporation sources must be able to work in the range 200°C – 1500°C. Materials to be deposited by the sources may be metals, halogens compounds (PbI₂, CsBr, other), chalcogens (ZnS, NaS, other) or oxide.
- Each source must be equipped with its own quartz balance to monitor or control the evaporation flux from the source.
- Design of the chamber must be optimized to minimize crosstalk between sources (flux measurement from a source to the quartz of another source).
- Each source must be able to work in power mode (source setting is specified as a percentage of the maximum power), in temperature mode (source setting is specified as a fixed temperature) or in flux mode (source setting is specified as a flux target given by its attached quartz balance).

PUBLIC

- The different sources must be able to work sequentially or simultaneously (1, 2, 3 or 4 sources evaporating together). During a process, it must be possible to make sequential steps with variation of number of sources running
- During a process, it must be possible to run sources in power mode / temperature mode and flux mode simultaneously for the different sources

Example of process with 4 steps:

- Step 1: source 1, power mode
- Step 2: source 2, power mode / source 4, temperature mode
- Step 3: source 2, flux mode / source 3, flux mode / source 4, temperature mode
- Step 4: source 3, flux mode
- Step 5: source 1, flux mode / source 2, flux mode / source 3, flux mode / source 4, flux mode
- Each source must have its own shutter to stop evaporation flux. Flux monitoring with quartz balance must be possible even without deposition on the substrate: it should be possible either using the source shutter (flux monitored with source shutter closed) or using the substrate shutter (source shutter open and substrate shutter closed). *Facultative option: the addition of individual shutters for the quartz balance to improve their lifetime could be quoted in option.*

b) Pumping system

During evaporation, the equipment must be under secondary vacuum ($P < 10^{-5}$ mbar). It must be equipped with a primary pump and a turbo-molecular pump able to maintain a low pressure during the process. Specifications for pumping speed, limit vacuum and leakage rate are given in section 7.3.

The turbomolecular pump has to be protected from vapours by a cooled baffle.

An automatic by-pass system must be installed between primary and turbo-molecular pumps to permit a rapid venting of the deposition chamber.

The chamber must be equipped with gauges able to monitor the pressure from limit vacuum to atmospheric pressure.

c) Cooled and rotating substrate holder

- Size, temperature, rotation

The equipment must be equipped with a **300 mm diameter rotating substrate holder** (possibility of using 20x20 cm² squared substrate) with a temperature monitoring and controlling system available.

The temperature control system must be able to maintain the substrate holder at a temperature in the range 10°C – 80°C during process and while rotating. The temperature of the substrate holder needs to be continuously monitored and saved during an automatic process. If the temperature control system is based on heat transfer fluid circulation connected to a chiller, flow and temperature measurement of the fluid has to be monitored and saved all along the processes.

Facultative option: a system to monitor the real temperature at substrate surface (pyrometer, other) would be considered.

The substrate holder must be able to sweep, rotate continuously during process or to stay at fixed defined angle and to switch from continuous rotation to fixed position within one process. Substrate holder position has to be monitored and saved all along the processes.

PUBLIC

Example of process with 3 steps:

- Step 1: Fixed substrate holder at 15°
- Step 2: Continuous rotation at 7 rpm
- Step 3: Fixed substrate holder at 270°
- Loading and unloading

Substrate holder must be easy to remove in order so that samples can be loaded. System can be proposed to fix/clamp a maximum number of samples from 2.5x2.5 cm² to 5x5 cm².

- Quartz balance

Facultative option: a quartz balance has to be attached to the substrate holder to monitor and save the total flux coming from the 4 sources. The quotation must state clearly if such an option is possible to implement.

- Shutter

A shutter must be attached to the substrate holder. Position of the shutter must be monitored and saved all along the processes. Shutter should not mask the quartz balance attached to the substrate holder if present. Facultative option: the shutter can mask only partly (1/4, 1/2, ...) the substrate holder. This could be achieved using different removable parts for the shutter (full, 1/4 or 1/2 shutter screen).

d) Human machine interface

The equipment must be provided with a human-machine interface based on visual flowcharts that is intuitive for users to use. This interface must contain:

- A manual mode (or equivalent name) in which all functionalities of the equipment can be tested separately or together. It includes: the pumping system (pumps on/off, opening and closing of valves), the substrate holder (rotation, cooling), the shutters and the sources (temperature setting, power setting, flux setting).
A PID autotune system for the sources (in power, temperature and flux modes) must be implemented in manual mode
- An automatic mode (or equivalent name) in which deposition recipes can be loaded and executed, including pumping (eventually with purges included), substrate positioning/rotating, substrate cooling and deposition. The recipe must allow to wait for a defined vacuum or time before to start heating. A recipe can contain several deposition steps (at least 10). In each step,
 - substrate can be either fixed at a given angular position or rotating with defined rotating speed
 - from 0 to 4 source(s) can be used simultaneously. Sources can be run either in temperature, power or flux mode. Different modes could be accessible for the different sources (see example below).
 - temperature can be set automatically and varied during the steps.

Example of process with 4 steps:

Step	Substrate position	Substrate temperature	Sources
1	fixed substrate holder at 15°	80°C	• source 1, power mode

PUBLIC

2	<i>Continuous rotation at 2 rpm</i>	<i>10°C</i>	• <i>source 2, power mode</i> • <i>source 4, temperature mode</i>
3	<i>Fixed substrate holder at 270°</i>	<i>From 10°C to 60°C</i>	• <i>source 3, flux mode</i>
4	<i>Continuous rotation at 10 rpm</i>	<i>20°C</i>	• <i>source 1, flux mode</i> • <i>source 2, flux mode</i> • <i>source 3, flux mode</i> • <i>source 4, flux mode</i>

- A process editor must be present to define the processes from chamber pumping to the end of the process.

e) Available flange for additional In-situ characterization

The equipment must include the possibility of adding a mass-spectrometer to monitor in-situ the gas phase during deposition. The mass spectrometer itself should not be included in the offer, but the equipment must have an available DN40 flange to plug the mass spectrometer. Dimension of the mass spectrometer are given in Figure 2.

The exact position of the mass spectrometer (and thus the position of the DN40 flange) is not required in these specifications. However, the mass spectrometer must be aligned with the flux of at least one of the sources, and ideally most of them.

Different options can be envisaged and are left to the discretion of the supplier. Some possibilities are indicated on figure 1. Mass spectrometer can notably be mounted:

- On a removable top part of the chamber, behind a substrate holder with a hole in the middle (in this case, the removable top part of the chamber must be equipped with another substrate holder, but without rotation not cooling). Figure 1(b).
- On a lateral wall of the chamber. In this case, it is necessary that sources can be tilted toward this direction in order for the fluxes to be measured in the mass spectrometer (Figure 1c)
- Other implementation options can be proposed by the supplier and will be considered.

PUBLIC

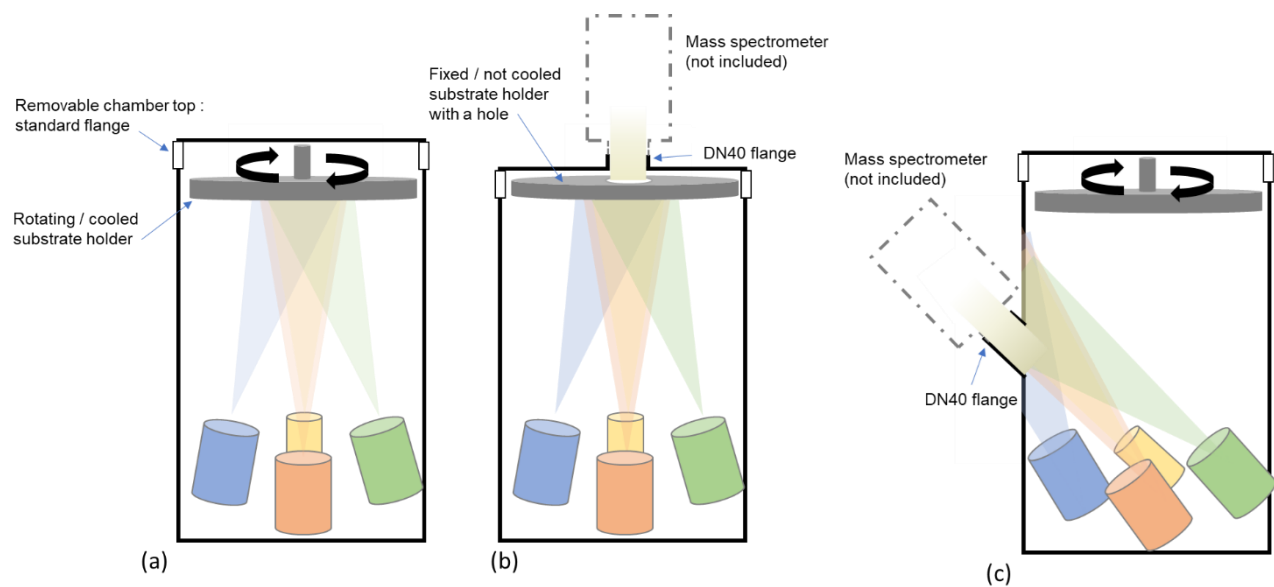


Figure 2 : Schematic of the co-evaporation chamber (a) without the implementation of the mass spectrometer, (b) with the mass spectrometer behind the substrate holder and (c) with the mass spectrometer fixed on a lateral wall.

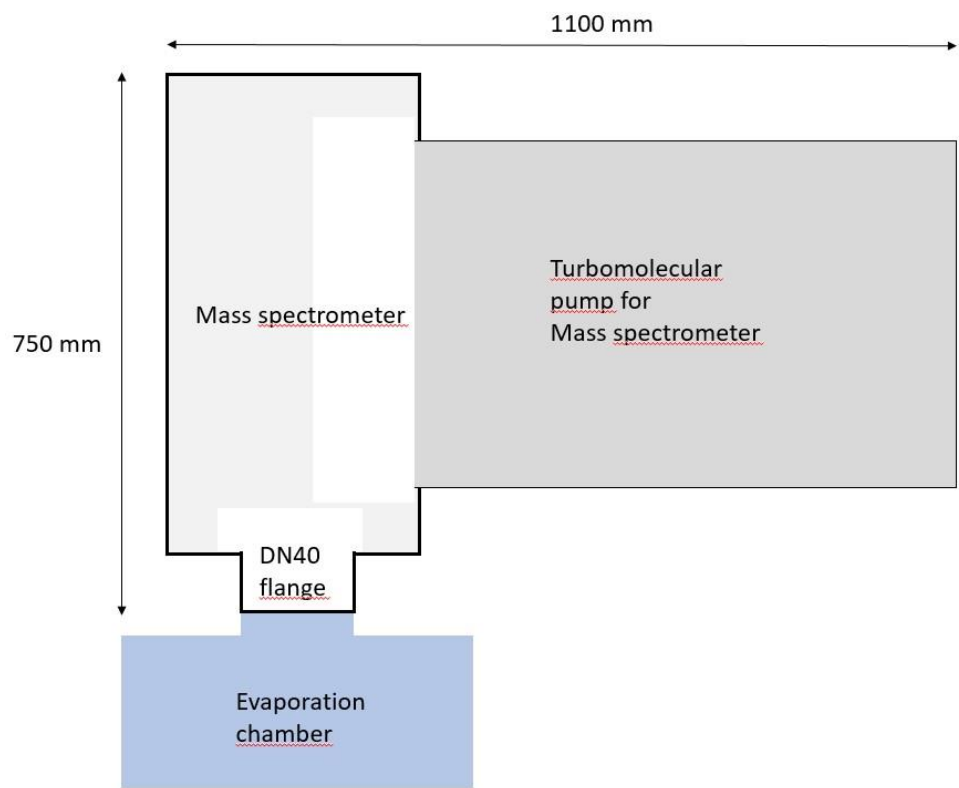


Figure 1 : Approximate dimensions of the mass spectrometer to be plugged on the equipment. A smaller turbomolecular pump can replace the current one if necessary

PUBLIC**7.3. Expected performances****a) Deposition system (sources)**

- Source stabilization
 - For each source, during a 15 min operation in power mode, power P variation $(P_{\max} - P_{\min})/P_{\text{mean}} < 1\%$
 - For each source, during a 15 min operation in temperature mode, temperature T variation $(T_{\max} - T_{\min})/T_{\text{mean}} < 1\%$
 - For each source, during a 15 min operation in flux mode after stabilization, flux variation $(F_{\max} - F_{\min})/F_{\text{mean}} < 5\%$
- Deposition homogeneity: Deposition thickness Th inhomogeneity (defined as $Th_{\max} - Th_{\min}/Th_{\text{mean}}$) from each source on the whole substrate must be lower than 5%.
- Deposition speed: For a standard material (PbI_2), a stable deposition speed S of the flux must be controllable from 0.001 nm/s to 10 nm/s for all sources. The deposition speed variation $(S_{\max} - S_{\min})/S_{\text{mean}}$ must be lower than 1% during a 15 min process.
- Crosstalk (%): Crosstalk between sources is defined as the flux ratio F_j/F_i , where F_i and F_j are the fluxes measured by the quartz balances of the source i and j respectively.
 - For each source i in operation and all other sources j switched off, $F_j/F_i < 10\%$.

b) Pumping system

- The attended limit vacuum of the system is better than $1 \cdot 10^{-6}$ mbar.
- The pumping speed must permit to reach $P < 5 \cdot 10^{-2}$ mbar within 5 minutes, and 10^{-5} mbar within 30 minutes after the system has been vented.
- The leak rate of the system has to be less than $1 \cdot 10^{-3}$ mbar.l/s.
- The by-pass system for pumping has to be automatized. Venting of the equipment must be possible in < 5 min (from secondary vacuum with sources and substrate holder at room temperature).

c) Cooled and rotating substrate holder

- Dimension: diameter 300 mm
- Rotation: from 1 rpm to 10 rpm
- Positioning: 1° precision
- Temperature
 - controllable from 10°C to 80°C
 - temperature uniformity of $\pm 2.5^\circ\text{C}$ over the whole surface under process condition (stabilised co-deposition for 15 min with 2 active sources).
 - Temperature stability: absolute temperature variation in the middle of the substrate holder $< 1^\circ\text{C}$ during a 15 min process (stabilised co-deposition for 15 min with 2 active sources).

d) Human machine interface

- Manual mode: all functionalities (deposition, substrate holder, pumping) available
- Automatic mode: monitoring and save of all parameters (deposition, substrate holder, pumping and metadata) during a process with data saved in a .csv format.

PUBLIC**e) Available flange for additional In-situ characterization**

- One flange DN40 + cork available to plug a mass spectrometer at the position defined by the supplier.
- If the solution with top chamber exchange is selected (Figure 1 b), a system must be proposed to handle the chamber top when shifting from standard stage to Mass spectrometer stage.

7.4. Specifications

The acceptance of the equipment will be done in 2 steps, with a factory acceptance testing (FAT) at the supplier's facility and a final site acceptance testing (SAT) at the CEA site. During the FAT, hardware and equipment specifications will be tested (as detailed in 7.4.1) while process performances will be tested during SAT.

7.4.1. Hardware and equipment specifications

PUBLIC

Tableau 1 - Specifications and tests conditions for the equipment

	SPECIFICATIONS			PROPOSED TEST CONDITIONS				
TEST #	Acceptance Criteria	Equipment Expected Target	Equipment Target Tolerance	Test Condition	Sample Type/Format (Specify who provide them)	Number of Test Samples	FAT ou SAT	Test medium (specify who provides it)
E-1	Limit vacuum	1×10^{-6} mbar	NA	- Performance test 2h of pumping from open chamber - Uncalibrated gauges	NA	NA	FAT and SAT	NA
E-2	Pumping speed	$P < 5 \times 10^{-2}$ mbar in 5' $P < 10^{-5}$ mbar in 30'	NA	- Performance test - from open chamber - Uncalibrated gauges	NA	NA	FAT and SAT	NA
E-3	Venting speed	From 10^{-5} mbar to PA in 5'	NA	Performance test	NA	NA	FAT and SAT	NA
E-4	Leak rate	1.10^{-3} mbar.l/s.	NA	Performance test – chamber insulated at 10^{-5} mbar for 15' Uncalibrated gauges	NA	NA	FAT and SAT	NA
E-5	Substrate holder dimension	300 mm diameter	2 mm	Dimension measurement	NA	NA	FAT	NA
E-6	Substrate holder temperature stability	$(T_{\max} - T_{\min}) < 1^{\circ}\text{C}$ during a 15' process with a source in operation	NA	Performance test with a TC fixed (with kapton) at the surface of the substrate holder center. 2 sources at 400°C and 800°C respectively	NA	NA	FAT and SAT	Device for temperature measurement provided by CEA

PUBLIC

E-7	Substrate holder temperature homogeneity	$(T_{\max} - T_{\min}) < 2^{\circ}\text{C}$ on the substrate holder with a source in operation	NA	Performance test with 3 TC fixed (with kapton) at the surface of the substrate holder center and border 2 sources at 400°C and 800°C respectively	NA	NA	FAT and SAT	Device for temperature measurement provided by CEA
E-8	Substrate holder positionning	1° precision	1°	Measurement of mechanical alignment	NA	NA	FAT	NA
E-9	Source volume	10 cm^3	0.1 cm^3		NA	NA	FAT	NA
E-10	Flange for mass spectrometer	1 flange DN40 available in a position OK for evaporation flux interception	NA	Presence of the flange + visual inspection for the alignment.	NA	NA	FAT	NA
E-11	Top chamber with flange (if selected)	system to handle the chamber top when shifting from standard stage to Mass spectrometer stage	NA	Test of top chamber change.	NA	NA	FAT	NA

PUBLIC**7.4.2. Process specifications**

Process specifications will be tested during FAT at CEA. For the SAT, 2 sources will be loaded with CsBr and PbI_2 respectively. Deposition tests will be made either on ITO-coated soda lime glass substrate or on silicon substrate. Materials for source loading and substrates will be provided by CEA.

PUBLIC**Process 1**

If the test conditions proposed by the CEA are not acceptable or sufficient for the equipment manufacturer, the manufacturer may propose alternative test conditions. These alternatives must be clearly documented and agreed upon by both parties to ensure a comprehensive and fair evaluation of the equipment.

Table 2 - Specifications and test conditions for process 1

	SPECIFICATIONS			PROPOSED TEST CONDITIONS				
TEST #	Acceptance Criteria	Equipment Expected Target	Equipment Target Tolerance	Test Condition	Sample Type/Format (Specify who provide them)	Number of Test Samples	FAT ou SAT	Test medium (specify who provides it)
P1-1	PID tuning for the sources	Autotune available	NA	Manual mode, autotune for Pbl ₂ and CsBr in flux mode.	NA	NA	SAT	CEA
P1-2	Source stability (Power)	$(P_{\max}-P_{\min})/P_{\text{mean}} < 1\%$ during 15'	NA	Manual mode, source Pbl ₂ in power mode, set to a deposition speed ~0.1 nm/s. Stability test for 15'	NA	NA	SAT	CEA
P1-3	Source stability (Temperature)	$(T_{\max}-T_{\min})/T_{\text{mean}} < 1\%$ during 15'	NA	Manual mode, source Pbl ₂ in temperature mode set to a deposition speed ~0.1 nm/s. Stability test for 15'	NA	NA	SAT	CEA
P1-4	Source stability (flux)	$(F_{\max}-F_{\min})/F_{\text{mean}} < 5\%$ during 15'	NA	Manual mode, source Pbl ₂ in flux mode, set to a deposition speed ~0.001 nm/s. Stability test for 15'	NA	NA	SAT	CEA
P1-5	Source stability (flux)	$(F_{\max}-F_{\min})/F_{\text{mean}} < 5\%$ during 15'	NA	Manual mode, source Pbl ₂ in flux mode, set to a deposition speed ~0.1 nm/s. Stability test for 15'	NA	NA	SAT	CEA

PUBLIC

P1-6	Source stability (flux)	$(F_{\max}-F_{\min})/F_{\text{mean}} < 5\%$ during 15'	NA	Manual mode, source PbI_2 in flux mode, set to a deposition speed ~ 1 nm/s. Stability test for 5'	NA	NA	SAT	CEA
P1-7	Source stability (flux)	$(F_{\max}-F_{\min})/F_{\text{mean}} < 5\%$ during 15'	NA	Manual mode, source PbI_2 in flux mode, set to a deposition speed ~ 10 nm/s. Stability test for 2'	NA	NA	SAT	CEA
P1-8	Crosstalk	$< 10\%$	NA	Manual mode. Source PbI_2 set at deposition speed = 1 nm/s Measurement of the flux on the 3 other quartz balances	NA	NA	SAT	CEA
P1-9	Deposition speed	controllable from 0.01 nm/s to 10 nm/s, speed variation $< 1\%$ during 15'	NA	Automatic mode. Process with sequential steps: CsBr set at 0.01 nm/s for 15' CsBr set at 1 nm/s for 5' CsBr set at 10 nm/s for 1' PbI_2 set at 0.01 nm/s for 15' PbI_2 set at 1 nm/s for 5' PbI_2 set at 10 nm/s for 1' Analysis of the recorded data of the quartz balance	NA	NA	SAT	CEA
P1-10	Deposition homogeneity	$< 2\%$ on the whole substrate	NA	Automatic mode. 3 deposition process PbI_2 at 1 nm/s for 10 min - CsBr at 1 nm/s for 10 min - Coevaporation PbI_2 at 0.1 nm/s, CsBr at 0.02 nm/s for 30 min For each process, substrates are fixed in the middle and at the side of substrate holder. A step is made with Kapton on all substrate and deposition thickness is measured with a profilometer.	ITO coated glass substrates 25x25 mm ² provided by CEA	3 processes 4 substrates / process	SAT	Profilometer CEA
P1-11	Process testing	Automatic process + data save	NA	Process defined in automatic mode comprising - Pumping from atm pressure to 1×10^{-5} mbar 4 deposition steps:	ITO coated glass substrates 25x25 mm ² provided by CEA	1 process 1 substrates	SAT	Profilometer CEA

PUBLIC

				○ Pbl₂ at XX W (to be defined), substrate holder at 50°C, positioned at 270°, 1' with shutter closed and 4' shutter open ○ CsBr at YY °C, substrate holder at 10°C, rotation at 5 rpm, 1' with shutter closed and 4' shutter open ○ Coevaporation Pbl₂ at ZZ°C, CsBr at 0.02 nm/s, substrate holder at 80°C positioned at 0°, 1' with shutter closed (Pbl₂ and CsBr) and 1' shutter CsBr open, shutter Pbl₂ closed ○ Coevaporation Pbl₂ at 0.1 nm/s, CsBr at 0.02 nm/s, substrate holder at 10°C rotation at 10 rpm, 2' with shutter closed (both) and 8' shutter open (both) ○ All sources off ▪ Venting of the equipment Control of the saved data.				
--	--	--	--	--	--	--	--	--

A certificate of conformity for the measurement equipment is required for the acceptance of the equipment. This certificate must specify the traceability to standards accredited by the COFRAC (French Accreditation Committee).

PUBLIC**7.4.3. Maintenance specifications**

The components of the equipment required to meet the needs for each function and sub-function are listed to establish any potential conditions expected by the CEA regarding maintenance.

Examples include:

- Provision of a list of spare parts.
- Provision of the modalities of the annual preventive maintenance plan.
- Internal training of the maintenance team.

Table 6 provides an overview of the equipment components and maintenance-related specifications, ensuring that all maintenance requirements are clearly defined and understood by all parties involved.

Table 6: *Components and maintenance related specifications*

Component	Maintenance Specifications
Whole Equipment	Provide an annual maintenance Plan
	Provide lead time and associated cost to establish maintenance training course for 2 people
	Provide a list of spare parts
Sources	Provide a detailed procedure for: - Loading the sources - Cleaning the source shutters - Replacing a crucible - Replacing a thermocouple
Quartz	Provide a procedure for changing the quartz crystals
Chamber	Provide a procedure for unassembling and re-assembling the casing sheets and substrate shutter Provide a procedure for the substrate holder's surface cleaning Provide a list of chamber gaskets
Pumping system	Provide a detailed maintenance plan for primary and turbo pump

PUBLIC

7.5. Computer specifications

7.5.1. Computer Control

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

7.5.2. 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.

7.5.3. 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:

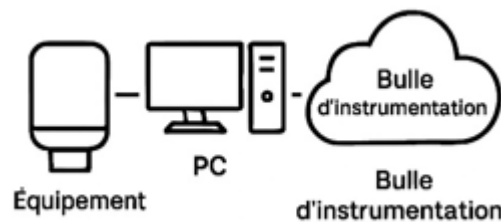


Figure 3 – CEA network connection diagram

- 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.

7.5.4. 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).

7.5.5. 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.

PUBLIC**7.5.6. 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.

7.5.7. 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).

7.5.8. 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.

7.5.9. 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.).

7.5.10. 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.

7.5.11. 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.

PUBLIC**8. WORK ENVIRONMENT, INSTALLATION LOCATION, LIMITS OF SERVICE****8.1. Limits of services**

The limits of Services between CEA and the supplier are the followings:

ITEM	CEA is responsible	Supplier is responsible
Metrology Equipments used for the SAT	X	
Installation and assembly of all materials on site		X
Electrical cabinet hook-up to the CEA power lines	X	

8.2. Environment, Facilities

Tableau 3 – Specifications linked to facilities

Main fluids distribution	Specification for Building D3	Note
Cooling water	Piping material: SS	Recycled cooling water in closed loop
	Inlet Pressure : 5 bar	
	Outlet Pressure : 1,3 bar	
	Inlet Temperature : 18 to 20°C	
	Conductivity : 10 microS/cm	
	pH : 7	
	Point of use Filtration grade : 20 microns	

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 T0 + 8 weeks (in accordance with “Section 9 Timeline”).

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 Appendix 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

PUBLIC

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. CEA on-site intervention rules

Access to the CEA site is strictly regulated. The applicable conditions are described in documents EQ/CS23-10 (Rules applicable for outside companies) and EQ/CS23-11 (Applicable rules for outside companies), provided with the bid documents. These terms also apply to the subcontractor of the supplier that will deliver the equipment.

Prevention plan:

CEA will establish, in collaboration with the supplier and any subcontractors, a comprehensive prevention plan for the installation and commissioning of the equipment.

PUBLIC**Safety Equipment:**

As CEA prohibits the lending of equipment, including safety equipment, the supplier and any subcontractors must provide all necessary safety materials to prevent risks specific to their intervention (PPE, collective protective equipment, etc.). They will ensure the replacement and repair of this equipment and, if applicable, will ensure their personnel are properly trained and aware of its use in accordance with regulations. This equipment must comply with current regulations and have a certificate of conformity.

Collective Safety Equipment:

The supplier and any subcontractors must provide all collective safety equipment aimed at preventing accidents related to the work, such as:

- Marking of work areas.
- Marking of circulation areas.
- Marking of handling areas.
- Marking and installation of barriers around pits and level differences.

They will ensure the installation and removal of this equipment as soon as the service no longer requires the presence of markings.

Specific Access for Deliveries:

Given the access constraints to the CEA site, the supplier must provide a restricted list of individuals authorized to access the CEA:

For EU residents, 10 calendar days before delivery.

For non-EU residents, 25 calendar days before delivery.

8.4. Delivery**Delivery and Installation Organization**

For the proper organization of delivery and installation at CEA, a packing list must be communicated to CEA at the kick-off meeting or at least 2 months before delivery. This list should include the following information:

- The total net weight of the shipment.
- The number of packages for transporting the equipment.
- The weight and dimensions (length × width × height) of each package.
- The number of support points (legs) and the weight supported by each.
- Any need for specific tools or a forklift for installation.
- The unloading plans.

Whenever unloading requires lifting equipment (forklifts, cranes, etc.), a safety protocol supplementing the prevention plan must be established before the unloading operation.

PUBLIC

All delivered materials must bear the order reference and the recipient's name on each item in the packing list.

Supplier Presence

The supplier must arrange for all necessary measures to unload and install the equipment (unloading plan and installation plan). **The supplier must be present during the unloading of any equipment requiring special monitoring due to its size, value, or complexity.**

Installation Location

The equipment must be installed at the Grenoble site in the D3 building.

Logistical Constraints

The supplier must consider logistical constraints related to equipment placement (maximum space, weight, access through doors, ramps, stairs, elevators, maximum height, etc.). These details are specified in Section 7.4 and in Appendix 1.

Dimensional and Load Constraints:

The equipment will be installed a room and will be brought into through a 1400 (L) x 2200 (H) mm² door. The row accessibility implies that the maximum length of the tool must not exceed 1600 mm.

As consequence the maximum dimensions of the equipment parts that have been disassembled for transport are:

- Length 1600 mm
- Width: 1200 mm
- Height: 2200 mm

If these requirements cannot be met, it must be clearly specified in the offer.

Packaging and Waste Disposal

The equipment and all its peripherals must be delivered clean and properly packaged. Transport platforms, pallets, and packaging crates must be suitable for the weight and volume of the items to ensure safe transport and avoid any disputes related to improper packaging.

All transport platforms, pallets, and packaging crates must be removed by the supplier (waste disposal from packaging is not handled by CEA).

Delivery Hours

Deliveries will be made between 8:00 AM and 12:00 AM from Monday to Friday.

9. TIMELINE

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

PUBLIC

Training	$T_0 + 36$ weeks
Site Acceptance Test (SAT)	$T_0 + 36$ weeks

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

o facilitate compliance with delivery and acceptance deadlines, the supplier must promptly transmit all Appendixes 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

For all its activities, the supplier must comply with the requirements of the ISO 9001 standard.

Significant and/or repeated deviations from this specification will be notified to the supplier (via email-anomaly or Improvement Sheet) for corrective action within a specified timeframe. In case of deviations or unperformed corrective actions, penalties will be applied to the supplier in accordance with the contract.

CEA Grenoble reserves the right to verify the effective operation of the system at any time through quality audits, which may be conducted at the supplier's premises and on the CEA Grenoble site.

Any measurements performed by the supplier for acceptance testing must comply with the requirements of Section 7.1.5 of ISO 9001 (Resources for Monitoring and Measurement). If the supplier subcontracts these measurements, they must be accompanied by a certificate of conformity.

11. SAFETY AND COMPLIANCE

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 § 13 Documentation).

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....).

PUBLIC

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 Appendix 3 of the Technical Specification Document: Identification of Residual Hazards.

The supplier must submit this analysis to CEA during the design phase (cf. § 0 Documentation).

11.2. Hazards related to facilities

No specific risks are associated to facilities.

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).
- Standard NF EN 61010-1.
- Standard NF EN 50191.
- Standard NF EN 61558-2-6.
- Standard NF EN 50549-1.

PUBLIC**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.

PUBLIC

- 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 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:

PUBLIC

- 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. Signalling

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

PUBLIC

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 Inspection

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).

PUBLIC

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***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 Appendix 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) (see § 11.1).
- 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).

PUBLIC

- 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

14.1. Acceptance breakdown

14.1.1. FAT Phase - Factory Control and Testing

The supplier must propose a procedure for controlling and testing the equipment. This procedure must include the controls and tests requested by CEA (cf. § 7.4). The controls carried out at the supplier's site will follow this procedure, which must be submitted to CEA for approval beforehand. After approval of the procedure, CEA will indicate the tests it wishes to attend.

At the end of the FAT, a pre-acceptance proceedings record following CEA's formalism is drawn up and signed by both parties. This pre-acceptance proceedings record allows the acceptance of the factory control file and the listing of reservations.

14.1.2. SAT Phase - Controls and Testing on CEA Site

The tests to be carried out on the CEA site must be defined by CEA and validated by the supplier.

If remarks were made during the factory reception (FAT), it will be necessary to verify that the corrective actions implemented meet the safety requirements.

The acceptance tests must cover all the specifications of paragraph § 7.4.

Each requirement must be evaluated (compliant/non-compliant/partially compliant), and the results must be recorded.

Before pronouncing the reception, the supplier must submit all the test and control reports carried out during the SAT.

14.2. Acceptance criteria

Acceptance will be granted if:

- The equipment complies with regulatory requirements (see § 11.19).
- 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 §7.4.3

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.

14.3. Final Acceptance Pronouncement on Site

Final acceptance is pronounced when:

PUBLIC

- 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 (see § 11.10).
- The complete equipment documentation has been delivered (see §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 commits to provide the following training sessions. A training certificate will be issued by the supplier, listing the trained personnel and their level of intervention.

15.1. Equipment Operation Training

The supplier commits to provide training on the use of the Equipment for 4 people. The supplier will indicate in their offer the number of training days required.

This training will cover, among other topics, equipment operation, automation, and control system handling.

15.2. First-Level Maintenance Training

The supplier commits to providing first-level maintenance training for 4 people. The supplier will indicate in their offer the number of training days required.

15.3. Advanced Maintenance Training

The supplier commits to providing first-level maintenance training for 2 people. The supplier will indicate in their offer the number of training days required.

16. WARRANTY

The equipment is contractually guaranteed for 1 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 48 hours 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.

PUBLIC

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

17. MAINTENANCE

At the end of the warranty period, CEA will have the option to subscribe to a maintenance contract.

In their pricing offer, for informational purposes, the supplier will provide as a Non Mandatory type of Option a preventive maintenance service quote which includes:

- Parts and labor for preventive maintenance,
- Corrective maintenance on demand (at hourly rates) with adherence to intervention and repair deadlines.

Following adjustments to CEA's maintenance needs, the maintenance contract may be established after the warranty period through negotiations.

18. ELEMENTS TO PROVIDE IN RESPONSE TO THE CONSULTATION

- Comments from the Equipment Supplier on the Equipment Specification Document (named Appendix 1: "FOR_533_Annexe_1.xlsx").
- Completed characteristics of fluid requirements, electrical power supply, and all other necessary interfaces (named Appendix 2: "FOR_534_Annexe2.xlsx").
- Hazard identification sheet (see § 11.1 and Appendix 3: "FOR_535_Annexe_3.xlsx").
- The cost of preventive maintenance service must be specified
- Duration and descriptions of planned training sessions.
- Separated Mandatory and non Mandatory Option quotes

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.

PUBLIC

APPENDIXES

FOR 533_Annexe_1.xlsx : Supplier's feedback on specifications document

FOR534_Annexe_2.xlsx : Specification Datasheet (GB spreadsheet) for tool installation

FOR535_Annexe_3.xlsx : Hazard Identification Sheet (GB Spreadsheet)