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Document Reference: DES/LITEN/DTS/CDC/2026/010

EQUIPMENT SPECIFICATIONS DOCUMENT

Stringer Shingle

EOTP	A-MSYPV-G0-6B-DD
OS	
Platform	Module
Ref Invest Plan	

	Name	Function	Signature / Date
Written by	V. Barth	Research Engineer	BARTH, Vincent Signé numériquement Le 28/09/2026
Checked by security	V. Poinsot	Safety Engineer	POINSOT, Vincent Signé numériquement Le 28/09/2026
Checked by Facilities	M. Fernandes	Facility Manager	FERNANDES, Marc Signé numériquement Le 28/09/2026
Checked by Plateform	M. Czajka	Platform Manager	CZAJKA, Marlène Signé numériquement Le 29/09/2026
Checked by Quality	N. Baillet	Quality Engineer	BAILLET, Nathalie Signé numériquement Le 29/09/2026
Checked by Installation	E. Voroshazi	Installation Manager	VOROSHAZI, Eszter Signé numériquement Le 29/09/2026
Checked by Management	R. Feilleux	Head Of Laboratory	FEILLEUX-ANGINIEUR, Romain Signé numériquement Le 29/09/2026
Issued by	D. Duca	Head of Department	DUCA, David Signé numériquement Le 29/09/2026

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Document Revision Table

Version	Date	Evolution description
A	17/07/2026	Creation

Purchasing Department	- SMA Manager	1 copy (email)
Department	- Head of Department +Deputy	1 copy (email)
	- Safety Engineer	1 copy (email)
	- Quality Engineer	1 copy (email)
	- Facility Manager	1 copy (email)
Division	- Head of Division	1 copy (email)
	- Installation Manager(s)	1 copy (email)
Laboratory and platforms	- Head of Laboratory	1 copy (email)
	- Equipment Project Manager	1 copy (email)
	- Platform Manager	1 copy (email)
	- Writer(s)	1 copy (email)
CSOP	- Equipment purchasing coordinator	1 copy (email)

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TABLE OF CONTENT

1. PURPOSE 5
2. DEFINITION 5
3. GLOSSARY 5
4. APPLICABLE DOCUMENTS 5
5. INTERFACE CLIENT – PRESTATAIRE 5
6. CONFIDENTIALITY 6
7. TECHNICAL SPECIFICATIONS 6
7.1. DESCRIPTION OF THE MAIN FUNCTION 6
7.2. SUB-FUNCTIONS OF THE EQUIPMENT 7
7.3. EXPECTED PERFORMANCES 7
7.4. SPECIFICATIONS 10
7.5. IT SPECIFICATIONS 15
8. WORK ENVIRONMENT, INSTALLATION LOCATION, LIMITS OF SERVICE 17
8.1. LIMITS OF SERVICES 17
8.2. ENVIRONMENT, FACILITIES 17
8.3. CEA ON-SITE INTERVENTION RULES 18
8.4. DELIVERY 19
9. TIMELINE 20
10. QUALITY 20
11. SAFETY AND COMPLIANCE 21
11.1. HAZARD IDENTIFICATION 21
11.2. HAZARDS RELATED TO FACILITIES 21
11.3. POWER SUPPLY DISCONNECTION AND SEPARATION DEVICE 21
11.4. POWER SUPPLY LOCKOUT / TAGOUT DEVICE 21
11.5. EMERGENCY STOP 21
11.6. "SERVICE" COMPRESSED AIR CONNECTION 22
11.7. RISKS RELATED TO ELECTRICITY 22
11.8. PRESENCE OF AN UNINTERRUPTIBLE POWER SUPPLY (UPS) 22
11.9. RISKS RELATED TO FIRE 23
11.10. RISKS RELATED TO HANDLING 23
11.11. RISKS RELATED TO WORK AT HEIGHT 23

PUBLIC

11.12. RISKS RELATED TO NOISE 23
11.13. RISKS RELATED TO TEMPERATURES 24
11.14. SIGNALLING 24
11.15. REGULATORY INSPECTION 24
11.16. INSPECTION OF THE WORK EQUIPMENT 24
11.17. REGULATORY ELECTRICAL INSPECTION 24
12. ENVIRONMENTAL CLAUSES 25
13. EQUIPMENT DOCUMENTATION 25
14. ACCEPTANCE CONDITIONS 26
14.1. ACCEPTANCE BREAKDOWN 26
14.2. ACCEPTANCE CRITERIA 26
14.3. FINAL ACCEPTANCE PRONOUNCEMENT ON SITE 26
15. TRAINING 27
15.1. EQUIPMENT OPERATION TRAINING 27
15.2. FIRST-LEVEL MAINTENANCE TRAINING 27
15.3. ADVANCED MAINTENANCE TRAINING 27
16. WARRANTY 27
16.1. WARRANTY COVERAGE AND SERVICE COMMITMENTS" 27
17. MAINTENANCE 27
18. ELEMENTS TO PROVIDE IN RESPONSE TO THE CONSULTATION 28

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1. PURPOSE

This specification document defines the supply, on behalf of the CEA, of an equipment designated as **Shingle Stringer**. The equipment must be installed at the site CEA-INES.

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

- CEA : Commissariat à l’Energie Atomique et aux Energies Alternatives
- LITEN : Laboratoire d’Innovation pour les Technologies des Energies Nouvelles et les nanomatériaux
- RAC : Remote Access Control
- INES : Institut National de l’Energie Solaire (Bourget du Lac site)
- MTBF : Mean Time Between Failure
- MTTR: Mean Time To Repair
- MTBI : Mean Time Between Interrupts
- FAT : Factory Acceptance Tests
- SAT : Site Acceptances Tests
- ECA : Electrically Conductive Adhesive

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:

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Mr Vincent BARTH

Tel : +33 (0)4 79 79 22 13

Email : vincent.barth@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

The Shingle stringing machine specification must cover several key aspects related to the handling, assembly, and processing of photovoltaic tiles using Electrically Conductive Adhesive (ECA). The machine must be able from tiles as input to manufacture shingle strings.
The machine must be available for use in both research and development (R&D) activities and production processes. This flexibility ensures that the machine can be utilized for experimental and developmental purposes without being restricted to exclusive production use. It aims to prevent any potential exclusivity issues, allowing for a versatile and adaptable application of the machine in various operational contexts.

7.1. Description of the main function

The shingle stringing machine is designed to fabricate both linear shingle strings and matrix shingle matrices. The machine must perform the attachment of tiles using Electrically Conductive Adhesive (ECA) and ensure the curing of the polymer to achieve proper adhesion.

Key Features and Specifications:

- Fabrication Capabilities: The machine must be capable of producing continuous linear strings of shingles and support the creation of matrix configurations of shingles, allowing for versatile production setups.
- Tile Attachment and Adhesion: The machine must apply ECA to attach the tiles. The ECA must be deposited in the form of pads to ensure uniform and precise application. The machine must include a curing station to ensure the polymer in the ECA achieves the necessary adhesion properties.
- Overlap Control: The machine must enable the precise overlap of tiles, with an adjustable range from 1mm to 3mm. This feature ensures flexibility in the production process to meet specific design requirements.

Usage Conditions:

- Environmental Conditions: The machine is intended for installation in an air-conditioned laboratory environment. Note that this laboratory does not have particulate pollution control.
- Operational Conditions: The machine is designed for use by multiple trained operators and is expected to operate 5 days per week, for approximately 50 weeks per year.
- Production Capacity: The machine must support a production capacity of 5-10MW (megawatts) per year, ensuring efficient and high-volume output to meet industrial demands as well as prototype development.

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7.2. Sub-functions of the equipment

The shingle stringing machine must be able to do the following functions

- Loading of tiles
  The tiles will be stacked in a loader. They must be efficiently separated to be loaded individually in the stringer line. A specific focus must be done on a gentle handling of the pieces to avoid unnecessary mechanical stress.

- Check of tiles integrity (cracks, defects)
  Once in the stringer line, a first step must be a system able to detect any deterioration on the cells. The deteriorations are either mechanical (breakage, cracks), either physical (tile passivation defects, tiles resistivity defect).

- Deposition of ECA
  ECA must be deposited on the tile in a reproducible and precise methods. A specific attention must be done on the possibility to deposit precise pads of ECA and on the stress applied to the tiles during the deposition.

- Shingle assembly
  The shingles must be assembled according to a first configuration in line. The range of the overlap is indicated in the specification in the 7.3.

- Curing
  The curing must allow to cure the ECA and to ensure shingle adhesion in a time compatible with the expected throughput

- Unloading of shingle strings
  The unloading must be able to discharge shingle (or matrix shingle) without damaging the layup.

7.3. Expected performances

The expected performances are classed in 4 categories:

- F0 = mandatory minimum requirement, must be quoted in the main offer, not negotiable;
- F0* = mandatory, must be quoted in the main offer, can be negotiated during the negotiation phase;
- F1 = Mandatory type of Option: The supplier must obligatorily include an offer with the specified option, otherwise the offer will be considered irregular and eliminated. The 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. The price of mandatory options will be included in the overall budget for the comparison of offers.
- F2 = Non Mandatory type of Option: The supplier has the discretion to propose or not propose the specified option. If the option is not proposed, the supplier will not necessarily be disqualified. The CEA reserves the right to decide whether to exercise the option or not.

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7.3.1. Tiles dimensions

Specification	Description	Category
Tiles width	[25.00 – 0.15 mm ; 27.00 + 0.15mm]	F0
	[20 mm – 0.15mm ; 25 mm]	F0*
	[27 mm ; 35 mm + 0.15mm]	F0*
Tiles length	[105 mm - 0.15 mm ; 210.10 mm + 0.15mm]	F0
	[70 mm ; 156.75 mm]	F0*
	[50 mm ; 156.75 mm]	F1
Tiles thickness (wafer)	[90 µm ; 120 µm]	F0
	[60 µm ; 90 µm]	F0*
	< 60 µm	F1
Tiles inspection	Luminescence-based quality inspection system for tiles, integrated with automated defect detection software (breakage, cracks, surface degradation)	F0

7.3.2. ECA deposition

Specification	Description	Category
ECA temperature	Temperature control on ECA deposition system	F0*
ECA deposition	To be applied in the form of pads* or dots	F0*
ECA deposition	Must enable an inter-pad distance of 500µm	F0*
ECA deposition	Must reduce mechanical stress to low thickness tiles	F0*
ECA thickness, without tiles pressed on it, but with curing	≤ 60 µm	F0
ECA thickness, without tiles pressed on it, but with curing	≤ 50 µm	F0*
ECA curing	Must allow complete curing of the ECA on the strings accordingly with the desired throughput	F0

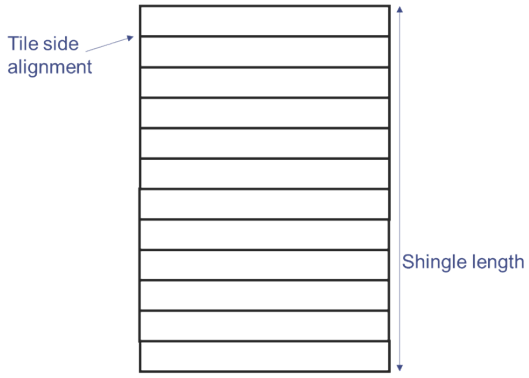
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Specification	Description	Category
ECA cleaning	System to clean the system between production	F2

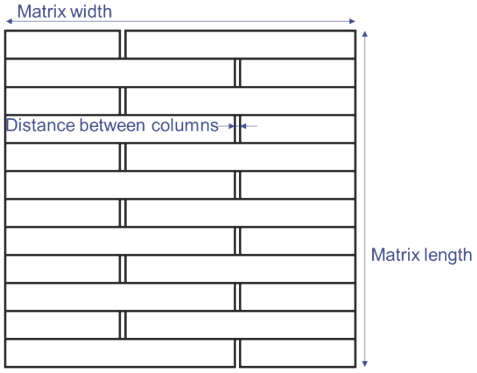
* a pad/dots is a discrete, localized deposition (rectangular/circular) area designed to provide a specific electrical or mechanical connection point, as opposed to a continuous in-line deposition, which forms an uninterrupted conductive path along a surface

7.3.3. Output String Configuration

The two configurations expected are the following:



Baseline configuration



Variant

Specification	Description	Category
Tile overlap	[1 mm ; 3 mm]	F0
	[0.5 mm ; 1 mm]	F0*
	[3 mm ; 5 mm]	F0*
Shingle/matrix length	[41 mm ; 1200 mm]	F0*
Matrix case: number of columns in a matrix	2 – 4 The column width is defined by the maximum tile length within the matrix. To maintain a running bond (staggered) pattern, a row with N full tiles	F0

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Specification	Description	Category
	alternates with a row containing (N – 1) full tiles flanked by two half tiles	
Matrix width	Maximum 850mm	F0*
Interconnector integration	System to add interconnector at the beginning and the end of the shingle strings/matrix based on ECA	F1
Unloading	System to automatically control the output quality associated with a software to sort the strings/matrix	F0*
Unloading	System to manually unload any matrix or shingles produced	F0
Unloading	System to automatically unload any matrix or shingles produced	F1
Throughput	1000 tiles per hour	F0
Throughput	2500 tiles per hour	F0*
Uptime	>90%	F0
Strings/matrix inspection	Luminescence system to check strings/matrix quality	F0*

7.4. Specifications

Specification	Description	Category
ECA deposition precision	50µm (length and width)	F0
ECA deposition precision	10µm (thickness)	F0
Tile overlap precision	100µm	F0
Tile side alignment	200µm	F0
Tile side alignment	<100µm	F0*
Tide angle alignment	<0.1° per tiles	F0
Strings geometry	Precision on strings length < 0.2%	F0
Strings geometry	Precision on strings length < 0.1%	F0*

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Specification	Description	Category
String geometry	Precision on cumulative side error alignment <500µm	F0
String geometry	Precision on cumulative angle error alignment <0.5°	F0
Precision on temperature (ECA curing)	[100°C to 180°C] with a precision of ±10°C	F0
Precision on temperature (ECA curing)	[100°C to 180°C] with a precision of ±5°C	F0*
Homogeneity on temperature for ECA curing	The temperature must remain homogenous on the whole width of the tiles or the matrix ±10°C	F0
Homogeneity on temperature for ECA curing	The temperature must remain homogenous on the whole width of the tiles or the matrix ±5°C	F0*

7.4.1. Hardware and equipment specifications

The throughput of the machine should be 1000 tiles per hour with an uptime of 90%.

The equipment must allow the unloading of the shingle tiles or matrix produced on the stringer.

An HMI must be implemented on the stringer to work on the machine and to manage the process during production. For shingle matrix case, the stringer shall be able to handle 2 different tiles format as described in 7.3.3.

Equipment performance indicators are defined as follow:

A) The definition of the down-time calculation used by the CEA-LETI is set out in Appendix C.

Up-time (%) = 100 – Down-time (%)

B) During the warranty period:

Uptime > 90% MTBF1 > 1000h MTTR2 < 4h.

C) Penalties during the warranty period

The up-time (see Appendix C "up-time definition") shall be assessed on a three-monthly basis.

Should one of the 2 parameters (Uptime or MTBF), recorded during the warranty period, not comply with specifications: the warranty period shall be automatically extended by a period of 3 MONTHS.

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During this extension, the Contractor shall perform all the corrective actions necessary to meet the specifications.

If, at the end of this warranty extension period, the specifications are still not met: the warranty shall be further extended by periods of 3 MONTHS until the specifications are met »

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Tableau 1 - Specifications and tests conditions for the equipment

	SPECIFICATIONS			PROPOSED TEST CONDITIONS				
TEST #	**Acceptance Criteria**	**Equipement 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	Possibility to load the different cell format	Loading of the specified tiles	-	-	Tiles (supplier)			
E-2	Rejection of tiles with defect	Broken tiles Tiles with cracks Tiles with defect size >10% of the surface	-	Loading of tiles with known defects	Tiles with defects (CEA)	30	FAT	
E-3	Temperature of ECA	Validate control of temperature of ECA system deposition	Set the ECA environment temperature	-	ECA (supplier)	1	FAT	
E-4	ECA deposition	Pads	50µm x 50µm x 10µm	On a tile	Tiles (Supplier provides tiles)	5	FAT/SAT	Microscope CEA
E-5	Temperature	150°C	10°C	On a typical run	Shingle dummies with thermocouples	1	FAT/SAT	Thermocouple CEA
E-6	Strings dimensions	1mm overlap Alignment on edge Angle deviation	100µm per tile 200µm per tile 0.1° per tile	Five runs	12 tiles shingles (Supplier provides tiles)	5 per runs	FAT/SAT	Microscope CEA
E-7	Strings dimensions (cumulative error)	Cumulative error on complete shingle	<0.2% length <500µm lateral < 0.5° in angle	Five runs	12 tiles shingles (Supplier provides tiles)	5 per runs	FAT/SAT	Microscope CEA + ruler

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	SPECIFICATIONS			PROPOSED TEST CONDITIONS				
TEST #	**Acceptance Criteria**	**Equipement 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-8	Handling	Production test	Uptime 0.98	Run during 20mn	Production of 12 tiles shingles	30 strings	FAT/SAT	observation
E-9	Mini-marathon test	Continuous productions of string for 1 h. 980 tiles minimum. No bug or stops longer than 1.2 min. Production must meet string quality and string geometry	Uptime 0.98 Yield 0.98 according to string quality* and string geometry	Supplier tool development recipe and material	Production of 12 tiles shingles (Supplier provides tiles)	1 run, 980 pieces	FAT/SAT	

*No cracks or breakage in the shingle strings, EL must not show defects > 10% of the surface of one tile. No more than 2 tiles must be degraded in the whole strings

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7.5. IT 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:

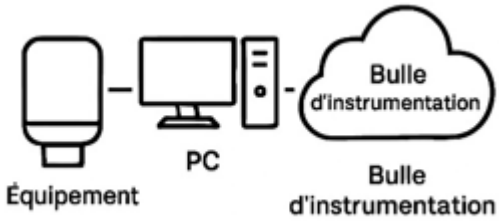


Figure 1 – CEA network connection diagram

- 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.

7.5.4. 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).

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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.

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 Access Control for 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.

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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 FAT/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

No specific risk identified associated to facilities.

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.

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 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.

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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 (temperature).

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.

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.

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 CEA-INES site.

Dimensional and Load Constraints:

The maximum transport dimensions of the equipment (or its largest transportable module) shall allow passage through a doorway measuring 8m (L) x 2.9 m (W) × 3.00 m (H) ground floor.

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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* + 32 weeks
Equipment delivery at CEA site	T_0 + 40 weeks
Training	T_0 + 42 weeks
Site Acceptance Test (SAT)	T_0 + 44 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.

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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).

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 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 associated with facilities in INES have been identified.

No specific facility requirements have been identified for this type of equipment. However, the equipment supplier shall specify the required utilities for each process fluid, together with the overall environmental operating conditions, including the acceptable temperature and relative humidity ranges.

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 picture.



11.6. "Service" 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).

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.

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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 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.

11.10. 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.

11.11. 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.

11.12. 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.

11.13. 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.

11.14. Signalling

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.

11.15. 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).

11.16. 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 will 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.

11.17. 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.

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12. ENVIRONMENTAL CLAUSES

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).
- The manufacturer's file, TQC (Piping, Quality, Control) plans, as well as the electrical and control-command file (including functional analysis and plans).
- Any other documents required by applicable regulations.

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14. ACCEPTANCE CONDITIONS

14.1. Acceptance breakdown

Reception may consist of two phases (see Tableau 1):

- Factory Acceptance Test (FAT)
- Site Acceptance Test (SAT)

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 (see Tableau 1).

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 (see Tableau 1).

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 § 11.15).
- The equipment meets all contractual technical requirements (see § 7, see Tableau 1)

14.3. 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.
- 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 6 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

16.1. Warranty Coverage and Service Commitments"

The equipment is contractually guaranteed for 2 years 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 7 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

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

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

- 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.xslx”).
- The cost of preventive maintenance service must be specified
- Duration and descriptions of planned training sessions.
- Separated Mandatory and non Mandatory Option quotes

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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)