EQUIPMENT SPECIFICATIONS

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Laser Induced Firing Tool

FREE DISTRIBUTION

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Platform Cellules

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Table of changes

Version	Writer	Date	Subject of the change
A	Thibaut Desrues	04/07/2025	
B	Thibaut Desrues	07/07/2025	Specs modification
C	Thibaut Desrues	05/12/2025	New tender
D	Thibaut Desrues	11/09/2026	Options modifications + New tender

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1. PURPOSE

The specifications set out the supply, on behalf of CEA, of a tool permitting to apply a “laser induced firing” (also called “laser enhanced contact”) process, on large surface both sides contacted c-Si solar cells (formats M10, G12, full or half cells) with no limitations in terms of metallization grid design (number of busbars).

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

2. DEFINITION

In this document, the contractor is referred to as “the supplier”.
The instructing party is referred to as “CEA”.

3. GLOSSARY

LITEN: Laboratoire d’Innovation pour les Technologies des Energies Nouvelles et les nanomatériaux - Laboratory of innovation for new energy technologies and nanomaterials
INES: Institut National of l’Energie Solaire (Site du Bourget du Lac) – National solar energy institute (Bourget du Lac site)
DOE: Dossier des Ouvrages Exécutés (As built file)

4. APPLICABLE DOCUMENTS

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

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

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

5. CUSTOMER – SERVICE PROVIDER CONTACT

The technical contacts for the basic and additional services are:

Mr DESRUES Thibaut
Tel.: +33 (0)4 79 79 28 77
Email: thibaut.desrues@cea.fr

Mr CRAYES Pierre
Tel.: +33 (0)4 79 79 27 40
Email: pierre.crayes@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.

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7. TECHNICAL SPECIFICATIONS

The equipment shall fulfil the requirements listed in Section 7, with the indicated flexibility degree:
- F0: mandatory
- F1: preferable

The following specifications will be verified during acceptance and warranty period at INES. Any specification verified during tests must be stable and available all over the warranty period and might be checked at any time during the period of validity.

7.1 General requirements

- Equipement characteristics:

The tool must preferably not exceed

- 500kg weight
- L=200cm; W= 100cm; H=200cm

- Cell format and technology versatility:

- Both sides contacted cells compatible
- IBC compatible
- Full & half cell compatible
- No limitation regarding solar cell front and rear side metallization grid (BB number)
- Cell thickness ≥110 µm

- Loading and unloading

- Manual loading and unloading
- Automatic transport belt to the process chamber

- Electrical contacting and polarization

- Pneumatic cell contacting unit in the process chamber
- Polarization of the device (up to +/-25V)

- Laser source

The laser must be able to generate a high charge carriers density in the polarized device inducing a localized heating process at metallized areas.

- Main source: IR beam
- Class 1 laser products

- Process recipe

The laser must be delivered with a “best known” process recipe for improving the contact resistance of industrial TOPCon solar cells. This recipe must be free of use at CEA.

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The characteristics of the system are listed in Table 1. The optional specifications are listed in the **Erreur ! Source du renvoi introuvable.**.

Table 1: Specifications of the system

Criteria	Level	Flexibility
Equipement characteristics		
Weight	< 500kg	F1
Height	< 200cm	F1
Width	< 100cm	F1
Length	< 200cm	F1
Cell format and technology versatility		
Both sides contacted (busbars)		F0
Both sides contacted (busbarless)		F0
Interdigitated Back Contact	Compatible providing specific contacting chuck	F0
G12 size		F0
M10 size		F0
G12R size		F0
Half G12 size		F0
Half M10 size		F0
Laser source		
Class	1	F0
Main source	IR	F0
Loading and unloading		
Automatic cell transport belt		F0
Electrical contacting and polarization		
Pneumatic cell contacting		F0
Polarization unit	Up to +/- 25V	F0

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Control		
Software management	Possibility to specify each step regading the laser power, processing time and the polarization characteristics	F0

7.2 Maintenance of the equipment

The main information regarding the consumables and maintenance costs will be specified, particularly regading the following aspects:

- Expected lifetime of the laser source (if different types of components are included in the “laser source”, please specify the lifetime of each component)
- Expected lifetime of the polarization system
- The sensitivity of each component of the system regarding process cycles
- Information about maintenance frequency
- Information about feasability of component replacement
- The cost of the replacement of the laser source, or of some of its components, have to be provided on the basis of the cost in 2025.
- The cost of a 1 years maintenance contract

The mandatory characteristics regarding maintenance information are listed in table

Table 2: Mandatory information regarding maintenance

Criteria	Level	Flexibility
Information about laser source lifetime	Expected lifetime of each component of the laser source and impact of process cycles	F0
Information about consummables costs	Cost of the replacement of each component	F0
Polarization system	Information about maintenance and cost of replacement	F0
Information about maintenance	Access, operating time.	F0
1 year maintenance contract		F1

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7.3 IT equipment

If the equipment is delivered with a computer, it shall be set up with a Windows 11 Enterprise Operating System and shall be compatible with the SYMANTEC Endpoint Protection 14.3 at least antivirus.

All computers on the equipment must be equipped with RAID hard drive redundancy.

The hardware shall enable networking and shall feature at least wired (Ethernet) network. All computers will be connected to tool internal network, therefore, CEA will be able to save any files from the tool to CEA server through Ethernet connection.

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

Remote control access of the computer equipment from the Internet is available using SOPHOS interface. Wired Ethernet connection should be available as well as internet access software (Edge, Chrome, Firefox…, IE not supported).
Should supplier, for technical reasons, remote control access by another software interface be required, CEA will carry out an analysis to determine whether or not CEA grants an exception, without this being constituted as a commitment.

Supplier will provide:
- All necessary software installation files and license keys, needed to be able to reinstall all the system after hard disk drive change
- Hard disk drive ghost of all computers at the end of tool warranty period

8. WORK ENVIRONMENT, PLACE OF INSTALLATION, SUPPLY LIMITS

8.1 Supply limits

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

Elements	Incumbent upon CEA	Incumbent upon the supplier
Transport		x
Delivery of the equipment	x	
Handling and setting up the equipment	x	
Starting up the tool		x
Declaration of conformity		x
Complete Layout of the tool		x
Complete technical datasheet and drawings		x
Operating instructions in English (French if possible)		x
Pneumatic and electrical diagrams		x
List of specific parts needed for maintenance operations (references and quantity)		x

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Detail of preventive maintenance operations (frequency and operating mode)		x
Facilities Utility List (FUL)		x
Installation of gas detector linked to the distribution system	x	
Connecting the tool to the facilities	x	
Equipments used to perform the measurement during acceptance	x	

8.2 Environment, Facilities

The equipment will be installed IN clean room environment

The supplier shall include in its bid the fluid requirements, electrical power supply and any other required interfaces (FUM=Facilities Utilities Matrix).

The planning of installation shall be given by the supplier at least 1 month before the day of installation (unloading of the tool, moving to the cleanroom, connection to the facilities…).

A list of facilities and specifications related to the facilities available in CEA's buildings is available in the tables below.

1/ Specifications in regards to effluent collection:

	Cleanroom specifications	**Specific comments**
Acid-base rinsing effluent network	Material: HDPE	Reprocessed locally: Recycling of effluents into ultrapure water - mandatory limitation of the discharge temperature at the machine outlet → below 60 ° C
Ammonia effluent network	Material: HDPE	Storage (15 m^3) – external reprocessing – mandatory limitation of the rejection temperature at the machine outlet → below 60°C
Concentrated acid-base effluent network	Material: HDPE	Reprocessed locally in the Ecureuil station: Recycling of effluents into ultrapure water - mandatory limitation of the discharge temperature at the machine outlet → below 60 ° C
Organic effluent network (IPA, ALKATEX etc.)	Material: HDPE	Storage (15 m^3) – outdoor reprocessing
Solvent effluent network	Material: galvanized steel	Collected in tanks 30 liters for off-site reprocessing
Wastewater network	Material: PVC	
General extractions	Material: PVC (locally stainless steel or galvanized)	Separate networks for solvent, acid and heat discharges.
	Pressure: from -250 to -600 Pa. depending on the location	"Booster" fans can be implanted locally to increase flow and depression

2/ Specifications in regard to general fluid distribution:

	Cleanroom specifications	**Specific comments**
Cooling water	Material: Stainless steel One-way pressure: 5 bar	Closed loop water circuits

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	Return pressure: 1.3 bar One-way temperature: 18 to 20°C Conductivity: less than 200 µS/cm pH: 7 Point-of-use filtration: 20 microns	
Deionized water	Material: PVC or PVDF Pressure: 3 bar Temperature: ~18°C Resistivity: ~ 18 Mohm pH: 7 Point-of-use filtration: 0.1 or 0.2 microns	No EDI recycling at machine outputs CHU is in the scope of CEA INES.
Tap water	Material: PVC or galvanized steel Pressure: 6 bar Temperature: 16°C Conductivity: 450 µS/cm pH: 7.7 Hardness: Hard: 15°f<TH<30°f Point-of-use filtration: 20 microns	CEA INES accepts, that tap water does not comply with contractor requirements.
Process vacuum	Material: galvanized steel or stainless steel Relative pressure: ~ -700 mbar	
Nitrogen "process" gas	Material: stainless steel 316L Ra 0,4	
N2 Liquid	Relative pressure: 7.5 bar Quality: N5.0 O2 < 1 ppm CO + CO2 + CnHm < 2 PPM H2O < 1 ppm H2 < 1 ppm	
Nitrogen "Service" gas	Same network than "process" nitrogen	"Service" nitrogen is used for everything related to the sweeping of gas pumps and burners
Compressed air "clean"	Material: stainless steel 316L Ra 0.8 Relative pressure: ~ 7 bar	
Argon	Material: stainless steel 316L Ra 0,4 Relative pressure: ~ 6 bar Quality: N5.0 O_2 < 1 ppm H_2O < 2 ppm H_2 < 1 ppm CO_2 < 0.5 ppm CnHm < 0.5 ppm N_2 < 1 ppm	
Oxygen	Material: stainless steel 316L Ra 0,4	
Liquid O_2	Relative pressure: ~ 8 bar Quality: N4.5 H_2O < 5 ppm N_2 < 10 ppm CO_2 < 0.5 ppm CO < 0.5 ppm	
Helium network	nonexistent	
Hydrogen	Material: stainless steel 316L Ra 0,25 Relative pressure: ~ 4 bar Source quality: N5.0 H_2O < 2 ppm O_2 < 0.5 ppm CO < 0.05 ppm CO_2 < 0.05 ppm CH_4 < 0.1 ppm	

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	N_2 < 2 ppm	

8.3 Delivery

Any item of equipment delivered shall bear the order number as well as the recipient's name.
The supplier shall plan all measures for unloading and installing the equipment.
Delivery shall be performed between 8am. and 12am. from Monday to Friday.

The equipment shall be installed on the INES site at the Bourget-du-lac in the ECUREUIL building, in the Back End Zone (inside the cleanroom facility)

Commissariat à l'Energie Atomique et aux énergies alternatives
50 avenue du Lac Léman
F-73375 LE BOURGET-DU-LAC (Chambéry), France

The equipment and peripherals shall be delivered in a clean condition and packaged in a proper manner.

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

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

8.4 Conditions for performing work on the CEA site

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

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

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

9. LEAD TIMES

The equipment will be installed on site and received within a desired timeframe of 18 weeks from the date T_0 of notification of the order by the CEA.

The inspection on the manufacturing site must be carried out within a desired timeframe of following the T_0.

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10. QUALITY

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

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

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

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

11. SAFETY AND CONFORMITY

As set forth in CEA's general purchasing conditions, the contractor undertakes to consider safety as an absolute priority in the design, preparation and performance of the services subject of the Contract.

The contractor shall read and apply the "Rules applicable to outside companies working at the Grenoble centre" (refer to chapter 4, "Applicable documents").

The contractor and its subcontractors (if any), irrespective of their rank, shall apply the legal and regulatory provisions pertaining to safety and environmental protection.

The equipment shall comply with the regulations in force.

The equipment shall be CE certified, feature a "CE marking" and shall be accompanied by a CE declaration of conformity (refer to chapter 13 "Documentation").

The contractor shall obtain assistance from a French inspection organisation in order to verify the conformity of the equipment with the applicable regulations as from the design phase.

11.1 Risk analysis

The contractor shall provide a risk analysis for the equipment and include all the associated items of safety equipment, their actions and servo-controls.

Said analysis shall highlight the specific risks related to the equipment and provide substantiation for the associated protection measures.

The supplier shall transmit this analysis to CEA right from the design phase (refer to chapter 13 "Documentation").

11.2 Risks related to facilities and machines

11.2.1 Power supply disconnection and separation device

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

11.2.2 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.

11.2.3 Emergency stop



Emergency stop buttons shall feature protection against unintentional operation. See the example on the photo opposite.

11.2.4 "Service" nitrogen or compressed air connection

Whenever the equipment uses compressed air or nitrogen to control valves, actuators and other systems, the machine shall be equipped with a general shut-off valve.
This valve may be secured in closed position by means of a padlock in order to allow lockout / tagout of the facility (maintenance).

One or more bleeding devices shall also be provided to allow the residual pneumatic energy stored within the machine to be dissipated after closing the general shut-off valve. This dissipation shall be carried out without any risk for the exposed personnel.

11.3 Risks related to electricity

11.3.1 Generalities

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

- « Matériel électrique destiné à être employé dans certaines limites de tension » (2014/35/EU) ;
- « Limitation de substances dangereuses dans les équipements électriques et électroniques » (2011/65/UE).

11.4 Risks related to fire

By default, the detectors integrated into the equipment shall not be connected to the fire safety system of the building and shall act only on the equipment concerned and its associated peripherals, if any.

If the contractor considers that it is necessary to connect its fire safety system to the fire safety system of the building, it shall previously contact CEA to verify the compatibility of the entire system.

11.5 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.

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11.6 Risks related to work at height

If the maintenance or the installation of the tool requires height-acces systems, the contractor shall provide the equipment for collective protection (work platform with railing), or individual protection (anchor points or lifelines that comply with current standards) if collective protection is not possible. In the latter case, the technical documentation must clearly refer to them, so that the associated regulatory controls can be implemented.The instruction handbook shall provide the necessary information to ensure the security of the user. In the case of the use of personal protective equipment, the instruction manual must clearly describe the safety instructions for carrying out operations requiring the wearing of personal protective equipment.

11.7 Risks related to artificial optical radiation

This includes visible, infrared and ultraviolet radiation, whether coherent (laser-type) or incoherent.

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

As early as the design phase, the supplier must provide the CEA with information on the artificial optical radiation used on the equipment, and in particular the risks for users.

11.8 Risks related to noise

If the equipment falls within the definition of machine, it must comply with the regulations in force, in particular European regulation EU 2023/1230

11.9 Risks related to temperatures

If the equipment falls within the definition of machine, it must comply with the regulations in force, in particular European regulation EU 2023/1230

11.10 Signalling

If the equipment falls within the definition of machine, it must comply with the regulations in force, in particular European regulation EU 2023/1230. Residual risks will be indicated on the machine by standardized hazard pictograms (triangles with a yellow background), possibly accompanied by additional text. In this case, the text will be in French.

11.11 Regulatory inspections

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

The contractor 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).

11.11.1 Inspection of the work equipment

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

- The CE marking of the machine;
- The declaration of conformity;

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- The instruction manual in French, including the various plans, diagrams, and documents required for its installation, commissioning, operation, adjustment, assembly, and disassembly.

The CEA may have a machine inspection carried out at the manufacturing site by an inspection body of its choice. The report resulting from this inspection at the manufacturing site must be free of any non-compliance. All comments made by the inspection body must be taken into account by the contractor, who will make the necessary modifications, without the CEA being required to provide any assistance. In all cases, a second inspection must be carried out after the equipment has been 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 EN ISO 13849-1. The contract holder must provide the CEA with:

- a list of safety-related control systems (SRP/CS),
- the reasoning followed during the design (e.g., faults taken into account, faults excluded),
- the result of the required performance level (PLr),
- the achieved performance level (PL),
- the calculation tool used (e.g., SIStema)

11.11.2 Regulatory electrical inspection

To ensure safe and properly installed electrical alimentation of the tool, the contractor shall provide to CEA the necessary electrical information of the equipment, such as the cumulative capacity determined by ELIE BT.

Once the equipment is installed on the site and prior to commissioning, CEA shall have a regulatory electrical inspection carried out by an inspection body of its choosing.

12. ENVIRONMENTAL CLAUSES

As part of the "Sustainable Development" approach, CEA Grenoble works to improve its environmental performance, and wishes to be supported in this process by its Service Providers and Suppliers.

The equipment manufacturer could present in its offer the actions it has already implemented in its activity in favor of sustainable development and its proposals for improvements specific to this service. It could detail for example:

- In particular the efforts made to reduce:
  - Consumption of electrical and thermal energy and fluids
  - Cooling water flow rates by an optimized calculation of the heat exchangers.
- The recycling of potential fluids proposed.

The equipment must be designed in such a way as to limit polluting emissions into the environment, in particular by the implementation of clean technologies, the segregation and treatment of effluents and waste according to their characteristics, and the reduction of the quantities released.

13. EQUIPMENT DOCUMENTATION

The equipment supplier undertakes to provide (non-exhaustive list):

- The user manual written in French (in accordance with European Regulation EU 2023/1230 where applicable)

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- The maintenance and servicing instructions (in accordance with European Regulation EU 2023/1230 where applicable);
- The CE declaration (in accordance with European Regulation EU 2023/1230 where applicable);
- Equipment risk analysis (see § 1.1), safety instructions and risk identification.
- Any other documents required by applicable regulations.

14. ACCEPTANCE CONDITIONS

Acceptance is given after complete delivery of the equipment and at the end of the installation and commissioning operations, and after satisfactory tests. If there were any remarks during the pre-acceptance (if it was carried out in the factory, see 11.11.1 Checking work equipment), it will be necessary to check that the solutions provided comply with the safety requirements.

Criteria for granting acceptance:

- Supply of the documents stipulated in the “Documentation” paragraph 13.
- Tests described in **Table 3** shall be fulfilled.

Table 3

Acceptance tests

	Test	***Method of measurement***	***Criteria***
Loading/unloading	Wafer handling	Different wafer sizes	No breakage
Wafers contacting	Wafer handling	Different wafer sizes	No breakage
Polarization	Electrical contact	Different wafer sizes	Effective electrical contact
Process	Variation of process parameters	I-V measurements of (at least 10) TOPCon solar cells before and after Laser Induced Firing	Efficiency variation after LIF treatment
Contact	Confirmation of contact enhancement	I-V measurements of (at least 10) TOPCon solar cells before and after Laser Induced Firing with optimal parameters	Efficiency gain after LIF treatment

15. TRAINING

The supplier undertakes to provide the following training:

15.1 Training on the use of the equipment

The supplier undertakes to conduct training on the use of the equipment for 3 to 5 people.

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The supplier shall specify the duration of the required training courses in its bid.
This training shall include will include awareness on how to get started with the equipment as well as the software interface.

This training shall include:
- System overview (system components, options…)
- Safety (interlocks, safety hazard, EMO, robot stops...)
- Equipment start/stop procedure
- Basic software operations and advanced operations including recipe modification database or log file analyses, and different level access
- Process procedures (including loading, wafer handling, wafer format change...)
- Required calibration procedures
- Functional analysis

15.2 Training on first level maintenance

The supplier undertakes to conduct training on first level maintenance for 5 people. The supplier shall specify the duration of the required training in its bid.

This training shall include both maintenance and equipment safety awareness for basic non dangerous activities, as follow :
- System overview (system components, options…)
- Safety (interlocks, safety hazard, EMO, robot stops)
- Installation and facilities
- Advanced software operations including recipe modification, database or log file analyses, and different level access
- Functional analysis (tanks, components, etc…)

15.3 Training on advanced maintenance

The supplier undertakes to conduct training of advanced maintenance for 5 people. The supplier shall specify the duration of the required training in its bid.

This training shall include procedures and training on material loading and unloading on the equipement and all maintenance procedures that might present risk for the operator as follow :
- Advanced safety (MSDS, EMO loop, energy isolation lockout/tagout, etc…)
- Equipment start/stop procedure
- Required calibration procedures (flow, weight, inspection camera, etc…)
- Preventive maintenance procedures (incl. parts to be changed)

16. WARRANTY

Notwithstanding the legal warranty, the equipment shall be guaranteed 2 years as from acceptance against any material, manufacturing, installation and operating defect, in compliance with the technical requirements of the specifications.

Said warranty shall cover the parts (excluding consumables), workmanship, transportation and travel.

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Throughout the warranty period, the supplier undertakes to carry out repair work at the latest within 48 hours following receipt of a fax or an email form CEA requesting a service call. These services shall be carried out every day from Monday to Friday, from 8 a.m. to 4.30 p.m.

In the event of equipment unavailability, the warranty period shall be extended by a period of time equal to the equipment downtime.

17. MAINTENANCE

17.1 Spare parts

In its bid, the supplier will provide:

- Complete spare parts list, including datasheets.
- Complete list of recommended spare parts to have on-site (consumable and non-consumable) with part number and price, based on pareto list of replacement parts requests by other customers for same system
- A separate spares list for all safety devices components (leak detection, interlocks, safety relays…

17.2 Swap kit

If necessary, the supplier will provide a swap kit with all parts for which he recommends an external cleaning.

17.3 Manuals and procedures

The Supplier will provide:

- Operation & Maintenance manual.
- Schematics of the entire tool (electrical schematics, diagrams of pneumatics and hydraulic circuits, interconnection schematics between sub-assemblies).
- Mechanical construction drawings i.e. exploded view with description and part number.
- For sub-assembly components, OEM operation & maintenance manual will be provided as well as software needed for maintenance purposes.
- Interlocks matrix.
- SECS/GEM PV2 implementation Manual.
- Procedure to control all safety equipment items including:
  - The list of items to be tested regularly (detailed subassembly list must be provided).
  - The details of the test and control (as well as the expected result).
  - The control tools.
  - The control frequency.
- Procedure to calibrate all metrology inspection categories including calibration tools/instruments required and their calibration certificates
- Necessary number of technician, duration, and recommended equipment requalification for each procedure.
- Cleaning recommendation (*in situ* clean, external cleaning) with best-known method.

17.4 Special tool

The supplier will provide:

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- Every specific jigs or tools needed for maintenance purposes (main equipment, sub-assemblies…)
- Every calibration features, instruments, wafers… needed

17.5 Maintenance contract

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

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

- Full service (commitments on the availability time of the equipment including the preventive maintenance services, unlimited corrective maintenance and supply of spare parts). By default, the performance expected in the Full Service contract is that stipulated herein;

- Preventive maintenance (parts and manpower) + corrective maintenance on demand (hourly rate) including compliance with service and repair lead times.

Following adjustment of CEA's maintenance requirements, the maintenance contract may be put in place after the warranty period, further to negotiations.
The maintenance cost will be taken into account when selecting the supplier.

18. ELEMENTS TO BE PROVIDED IN THE BID

- Comments from the Equipment Manufacturer on the Equipment Specifications (refer to § Annex 1).
- The description of required utilities. Completed characteristics of fluid requirements, power supply and all other necessary interfaces (refer to § Appendix 2).
- Maintenances costs
- The duration and description of the planned training
- Safety analysis of the equipment (refer to § 11.1)

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Appendix 1. **Equipment Specifications compliance - to be provided by the equipment manufacturer**

Supplier name	
Offer reference	

C = Compliant
NC = Non Compliant adaptations are necessary
NA = Non Applicable

Spécification Topics	Compliant?			Supplier Comments	Supplier Alternative proposal	Final decision
1.Purpose	C ☐	NC ☐	NA ☐			
7.1 Expected Spécifications	C ☐	NC ☐	NA ☐			
7.3 IT equipment	C ☐	NC ☐	NA ☐			
8.1 Supply limits	C ☐	NC ☐	NA ☐			
8.2 Environnement facilities	C ☐	NC ☐	NA ☐			
8.3 Delivery	C ☐	NC ☐	NA ☐			

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Spécification Topics	Compliant?			Supplier Comments	Supplier Alternative proposal	Final decision
8.4. Conditions for performing work on the CEA site	C ☐	NC ☐	NA ☐			
9-Lead Times	C ☐	NC ☐	NA ☐			
10 Quality	C ☐	NC ☐	NA ☐			
11 1.Risk analysis	C ☐	NC ☐	NA ☐			
11.2.1- Power supply disconnection and separation device	C ☐	NC ☐	NA ☐			
11.2.2 Power supply lockout/tagout device	C ☐	NC ☐	NA ☐			
11.2.3- Emergency stop	C ☐	NC ☐	NA ☐			
11.2.4-“Service” nitrogen or compressed air connection	C ☐	NC ☐	NA ☐			
11.3.1 Risks related to electricity - Generalities	C ☐	NC ☐	NA ☐			

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Spécification Topics	Compliant?			Supplier Comments	Supplier Alternative proposal	Final decision
11.3.2 Presence of an uninterruptible power supply (UPS)	C ☐	NC ☐	NA ☐			
11.4- Risk related to fire	C ☐	NC ☐	NA ☐			
11.5 Risks related to explosion	C ☐	NC ☐	NA ☐			
11.6 Risks related to chemicals	C ☐	NC ☐	NA ☐			
11.7 Risks related to handling	C ☐	NC ☐	NA ☐			
11.8 Risks related to pressure vessels	C ☐	NC ☐	NA ☐			
11.9 Risks related to work at height	C ☐	NC ☐	NA ☐			
11.10 Risks related to artificial optical radiation	C ☐	NC ☐	NA ☐			
11.11 Risks related to noise	C ☐	NC ☐	NA ☐			
11.12 Risks related to temperatures	C ☐	NC ☐	NA ☐			

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Spécification Topics	Compliant?			Supplier Comments	Supplier Alternative proposal	Final decision
11.13 Signalling	C ☐	NC ☐	NA ☐			
11.14.1 Work equipment inspections	C ☐	NC ☐	NA ☐			
11.14.2 Regulatory electrical inspections	C ☐	NC ☐	NA ☐			
12. Environmental Clauses	C ☐	NC ☐	NA ☐			
13. Equipment documentation	C ☐	NC ☐	NA ☐			
14 Acceptance Conditions	C ☐	NC ☐	NA ☐			
15.1 Training on the use of the equipment	C ☐	NC ☐	NA ☐			
15.2 Training on first level maintenance	C ☐	NC ☐	NA ☐			
15.3 Training on advanced maintenance	C ☐	NC ☐	NA ☐			
16 Warranty	C ☐	NC ☐	NA ☐			

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Spécification Topics	Compliant?			Supplier Comments	Supplier Alternative proposal	Final decision
17 Maintenance	C ☐	NC ☐	NA ☐			
18 Elements to be provided in the BID	C ☐	NC ☐	NA ☐			

Validation summary of the points to be clarified			
	Name	***Date***	***Signature***
SUPPLIER			
CDPE			
Division Manager			

Dispatch: Head of the Department- CDPE (Chef de Projet Equipement) - Service Achats - Chef d'installation - Responsable plateforme

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Appendix 2. Specifications for installing equipment - to be provided by the equipment manufacturer

Features completed with fluid requirements, power supply and any other interfaces he deems necessary for a good estimate of the cost of installing the equipment.

1) This appendix will allow the CEA to produce the fluids PID and electrical PID.
2) These PIDs will then be sent for verification to the equipment supplier for approval.
3) The Hook Up and Fit Up will begin after the official validation of the PIDs by the supplier.



Annexe2_Datasheet_for_Tool_Installatio

This file can be sent at a companie.
The file content is put here as an illustration of the requested content.

Modèle de l'équipement :

Liste des Equipments & sous-equipments

Nom	Location (Fab or sub-fab)	Type (Chiller, pump…)	Model	Dimensions (L x w x h) in mm	Weight (Kg)	Supplied by

Dimensionnement nécessaire des facilities pour le bon fonctionnement de l'équipement				Connection		Consumption (e) = "Consomation"				Pressure (bar) at the connection on the tool		Temp (° C)		Purity		
Fluid (a)	From	To	Description (b)	ID (c.)	Size (d)	Type	Min	Max	Average	Min	Max	Min	Max		Supplied by	Comments (ex: max length..) (f)

Comments

(a): Voir feuille "Fluids" pour quelques exemples

(b): Pour décrire le but et les caractéréistiques de connexion

(c): Nom de la connexion identifiée sur l'équipement

(d): Taille de la connexion, l'unité doit être précisée

(e): Flows (débit entrant et sortant) et consommations qui doivent être converti comme décrit ci-dessous :

Exhaust : m3/h

ERP (PCW), EDI (DIW), VP, drain : l/min

Gaz : Slm (Standard liter per minute)

(f): Mettre les remarques et contraintes à connaître pour l'installation de l'équipement : par exemple longueur maximale, ...

Exigences Electriques

From	To	Type (power, signal..)	Voltage	Phases	Breaker Amp = limite en ampères de sécurité	FLA (Full Load Amperage)	Average Amp	Supplied by	Installed by

Nuisances

From	To	Type (power, signal..)	Voltage	Phases	Breaker Amp = limite en ampères de sécurité	FLA (Full Load Amperage)	Average Amp	Supplied by	Installed by

Nuisances		unity	level
Security description must be attached	Noise	dB	
	Vibrations		
	X rays		
	Magnetic		
	Dust		
	"Nano" particles		

Fluids	Descriptions
ACS / CDA	Air Comprimé Sec / Compressed Dry Air
N2S	Nitrogen Service
N2P	Nitrogen Process
Ar	Argon Process
He	Helium Process
Exhaust	Exhaust
Acid Drain	Acid Drain
HF Drain	HF Drain (if [HF] > 1%)
Solvent Drain	Solvent Drain
ERP / PCW	Eau de Refroidissement Process / Process Cooling Water
EDI / DIW	Eau Dé-Ionisée / Deionised Water
VP	Vide Process / Vacuum (P=-880mbar) (expect pump)
Process Gas	Example : H2, SiH4, CH4…
Process Fluid	Example : IPA, HF, H3PO4…

Appendix 3. **CEA INES – PUMA 2 FLUIDES GENERAUX**

A. Fluides

a. Eau de ville
b. Eau adoucie
c. Eau chaude secondaire
d. Eau glacée
e. Eau de refroidissement B1
f. Eau de refroidissement B2
g. Eau de refroidissement B3
h. Eau déionisée B1/2/3
i. Eaux usées
j. Vide process

B. Gaz

a. Azote process
b. Azote service
c. Air comprimé
d. Argon
e. Oxygène
f. Hydrogène
g. Hélium
h. 10% PH3/H2
i. 10% B2/H6/H2
j. NH3
k. SiH4
l. CH4
m. CO2
n. 10% He/Ar
o. 5% He/Ar
p. 4% H2/N2
q. 5% H2/N2
r. C2F6
s. N2O
t. NF3
u. 1% PH3/H2
v. 0.5% B2H6/H2
w. BCL3
x. TransLC
y. POCl3

C. Chimie

a. Ethanol ABS DENAT
b. Acétone 100%
c. Acide Acétique 99.9ù
d. HCL 37%
e. HF 50%
f. HNO3 69.5%
g. H2SO4 69.5%
h. Ammoniaque 29%
i. H2O2 30%
j. IPA 100%
k. KOH 44%
l. Ethylène Glycol

D. Extractions

m. Extraction chaleur
n. Extraction solvant
o. Extraction acide

E. Effluents

p. Effluents acido-basiques de rinçage
q. Effluents fluorés concentrés
r. Effluents acido-basiques concentrés
s. Effluents solvants

18.1 F. Alimentation électrique

a. Monophasé
b. Triphasé

18.2 G. Bâtiment

a. Surcharge admissible
b. Plans d’infrastructures

A. Fluides

	Caractéristiques	Remarques particulières
Eau de ville site	Matériau : PVC ou acier galvanisé Pression : 6 bar Température : 16°C Conductivité : 450 µS/cm pH : 7,7 Calcium : 70 mg/l Filtration point d'utilisation : 20 microns	
Eau adoucie	Matériau :	Utilisée pour le remplissage des réseaux
	Pression :	
	Température :	
	Conductivité :	
	pH :	
	Calcium :	
	Filtration point d'utilisation :	
Eau chaude (secondaire)	Température aller : 45/38°C Conductivité : 2158 µS/cm pH : 9,3	Chaudières P_{totale}=800kW Utilisation pour les batteries chaudes (SB, LT, bureaux…)
Eau glacée	Température : 7/12°C Conductivité : 2171 µS/cm pH : 9,4	Groupe-froid P_{totale}=1600kW Utilisation pour les batteries froides (SB, LT, bureaux…) et eau de refroidissement
Eau de refroidissement	Matériau : Inox Température aller : >18°C Conductivité : 799 µS/cm pH : 8,2 Filtration point d'utilisation : 25 microns	Circuit d'eau recyclée en boucle fermée : $P_{échangeur}$=290kW Utilisation principalement au Frontend
Eau de refroidissement Boucle 2	Matériau : Inox Pression aller : 6 bar Température aller : >18°C Conductivité : 832 µS/cm pH : 8,2 Filtration point d'utilisation : 25 microns	Circuit d'eau recyclée en boucle fermée : $P_{échangeur}$=290kW Utilisation principalement au Frontend
Eau de refroidissement Boucle 3	Matériau : PVC Pression aller : 4 bar Température aller : >18°C Conductivité : 770 µS/cm pH : 8,5 Filtration point d'utilisation : 10 microns	Circuit d'eau recyclée en boucle ouverte : $P_{échangeur}$=290kW Utilisation principalement au Backend et sérigraphie
Eau déionisée 1/2/3	Matériau : PVC ou PVDF Pression : 3 bar Température : ~18°C Résisitivité : ~ 18 Mohm pH : 7 Filtration point d'utilisation : 0,1 ou 0,2 microns	Pas de recyclage d'EDI en sorties des machines

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Réseau eaux usées	Matériau : PVC	
Vide process	Pression relative : ~ -700 mbar	

B. Gaz

Azote gaz "process" **N2 Liquide**	Matériau : inox 316L Ra 0,4	
	Pression relative : 7,5 bar	
	Qualité : N5.0	
	O2 < 1 ppm	
	CO + CO2 + CnHm < 2 PPM	
	H2O < 1 ppm	
	H2 < 1 ppm	
Azote gaz "Service"	Réseau non différencié de l'azote "process"	Au bâtiment Puma2, l'azote "Service" est utilisé pour tout ce qui concerne les balayages de pompes et bruleurs a gaz
Air comprimé "propre"	Matériau : inox 316L Ra 0,8	
	Pression relative : ~ 7 bar	
Argon	Matériau : inox 316L Ra 0,4	
	Pression relative : ~ 6 bar	
	Qualité : N5.0	
	O2 < 1 ppm	
	H2O < 2 ppm	
	H2 < 1 ppm	
	CO2 < 0,5 ppm	
	CnHm < 0,5 ppm	
	N2 < 1 ppm	
Oxygène	Matériau : inox 316L Ra 0,4	
	Pression relative : ~ 8 bar	
	Qualité : N4.5	
	H2O < 5 ppm	
	N2 < 10 ppm	
	CO2 < 0,5 ppm	
	CO < 0.5 ppm	
Hydrogène	Matériau : inox 316L Ra 0,25	
	Pression relative : ~ 4 bar	
	Qualité source : N5.0	
	H2O < 2 ppm	
	02 < 0,5 ppm	
	CO < 0,05 ppm	
	CO2 < 0,05 ppm	
	Ch4 < 0,1 ppm	
	N2 < 2 ppm	
Hélium		
10% PH3/H2		
10% B2/H6/H2		
NH3		
SiH4		
CH4		
CO2		
10% He/Ar		

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5% He/Ar		
4% H2/N2		
5%H2/N2		
C2F6		
N2O		
NF3		
1% PH3/H2		
0,5% B2H6/H2		
BCL3		
TransLC		
POCl3		

C. Chimie

Ethanol ABS DENAT	Volume : 5L	
Acétone 100%	Volume : 5L	
Acide Acétique 99.9%	Volume : 2.5L	
HCL 37%	Volume : 30L / 2.5L	
HF 50%	Volume : 56L / 2.5L	
HNO3 69.5%	Volume : 2.5L	
H2SO4 69.5%	Volume : 2.5L	
Ammoniaque 29%	Volume : 30L / 5L	
H2O2 30%	Volume : 58L / 2.5L	
IPA 100%	Volume : 2.5L	
KOH 44%	Volume : 60L / 2.5L	
Ethylène Glycol	Volume : 5L	

D. Extractions

Extraction chaleur	Matériau : Acier galvanisé Pression : -740Pa	Rejet commun avec extraction solvant Variateurs à 74.6% au 01/2023
Extraction solvant	Matériau : Acier galvanisé Pression : -650Pa	Rejet commun avec extraction chaleur Variateurs à 82.5% au 01/2023
Extraction acide	Matériau : PVC Pression : -1150Pa	Rejet indépendant à Puma 2A Variateurs à 59.3% au 01/2023

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E. Effluents

Réseau effluents acido-basique de rincage	Matériau : PEHD	Retraité en local dans une central neutralisation - limitation impér de la température de rejet en s machine --> inférieure à 60°C
Réseau effluents fluorés concentrés	Matériau : PEHD	Collecté en cuve pour retraiter hors site - limitation impérative c température de rejet en s machine --> inférieure à 60°C -->nge gravitaire.
Réseau effluents acido-basique concentrés	Matériau : PEHD	Collecté en cuve pour retraiter hors site - limitation impérative c température de rejet en s machine --> inférieure à 60°C -->nge gravitaire.
Réseau effluents solvants	Matériau : acier galvanisé	Collecté en cuve 30 litres pour retraitement hors site

F. Alimentation électrique

Transformateur	2 transformateurs 1600 kVA	
Monophasé/Triphasé	3 phases + neutre + terre Phase/Phase tension: 400 V +/- 10 % Phase/Neutre tension: 220 V + / - 10 %	Fréquence: 50 Hz Régime neutre TNS

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