

Document title	Cryogenic Platform for Superconducting Qubit Characterization
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1 PURPOSE

CEA-LETI is seeking to acquire a cryogenic platform for superconducting qubit characterization featuring two high-performance dilution refrigerators. This acquisition is central to our mission of advancing quantum computing, providing the ultra-low temperature environment (typically below 10 mK) necessary for the precise electrical and microwave characterization of superconducting circuits. By utilizing two refrigerators, this platform will enable high-throughput testing and the validation of qubit coherence and gate fidelities, significantly accelerating our development of scalable quantum processors.

This document provides the detailed technical specifications and outlines the procurement process for this equipment. It is designed to give potential suppliers a comprehensive understanding of our requirements regarding cooling power and signal wiring. Our objective is to secure a robust system that meets the rigorous stability and operational standards essential for next-generation quantum hardware research.

We are considering the purchase of two high-performance and closed-loop dilution refrigerator systems. System A will be primarily configured for high-throughput and high-capacity characterization, while System B is oriented toward more complex, versatile, and long-integration-time investigations. Crucially, both systems must share sufficient design commonality to ensure System B can serve as a temporary backup for System A if required.

Documents to be provided by the Contractor during the tender process

- ✓ The Contractor must complete and deliver to CEA-LETI **Appendix A: Summary of Contractor's comments** and put any comments in this section (the Contractor must not add any comments in the main text).
- ✓ The Contractor must deliver to CEA-LETI **Appendix H: Datasheet for Tool Installation.**
- ✓ The Contractor must deliver to CEA-LETI the system footprint and dimension of all systems or sub systems
- ✓ The Contractor must deliver to CEA-LETI pre installation manual
- ✓ The Contractor must complete and deliver to CEA-LETI **Appendix I: Risk Identification Sheet**
- ✓ The Contractor must complete and deliver to CEA-LETI **Appendix K: pedestal specification**

2 EQUIPMENT TECHNICAL SPECIFICATIONS

This specification outlines the requirements for the procurement of two high-performance, cryogen-free dilution refrigerator systems.

The required equipment consists of two identical dilution cryostats designed to cool superconducting qubits and diverse samples to temperatures below 15 mK. High-fidelity quantum experiments demand an environment essentially free of thermal and electronic interference; therefore, the refrigerators must be rigorously isolated from both electrical and mechanical noise originating from the gas handling system and the pulse tube cryocooler.

To ensure full compatibility and maintenance uniformity, both units shall utilize identical cryogenic cores and gas-handling systems. However, to meet diverse research needs, their internal architectures and wiring are tailored to lean toward different applications.

System A is primarily configured to favor high-throughput characterization. The integration of 14 RF input lines and 2 output lines enables the sequential characterization of multiple qubit devices, maximizing experimental throughput within a single cooling cycle.

System B is oriented toward experimental versatility and the study of complex superconducting circuits, providing a highly adaptable platform. In particular, system B will be occasionally tasked with experimental runs regarding other research requiring a controllable magnetic field. To maintain this flexibility without compromise, we require a modular magnet system that can be easily installed or removed. Crucially, the system must achieve the same cryogenic performances that a "bare" cryostat when the magnet is absent, ensuring the mixing chamber stage remains in a pristine state for the most sensitive superconducting experiments.

We describe first the common specifications of both cryostats (cryocooler, frame, gas-handling system, ...) and then the specific requirements of system A and B.

2.1 Common specifications

Each system is a fully automated, cryogen-free dilution refrigerator including a gas handling system, temperature measurements, and a control suite. The systems must support continuous operation without warmup for at least one year while maintaining all technical specifications. We require both systems to differ only from wiring and magnet aspects described in the next parts.

To demonstrate technical compliance, the proposal must include a comprehensive technical documentation comprising a detailed description of the system architecture, performance specifications, and engineering drawings for both the refrigerator and the gas handling system (GHS). These documents must explicitly map the proposed hardware to the stated requirements, demonstrating how the design fulfills all thermal, mechanical, and spatial constraints.

Furthermore, the submission must provide clear evidence of the system's ability to meet specified base temperatures and cooling powers under the required experimental heat loads. This documentation will serve for the technical evaluation of the bid.

2.1.1 Cryocooler

The pre-cooling (4K) shall utilize a high-capacity pulse tube cryocooler, specifically chosen to minimize mechanical vibration and electromagnetic interference. The unit must deliver a nominal cooling capacity of at least 1.3 W at 4.2 K. This cooling capacity is indispensable for managing the active heat dissipation from the microwave wiring and the power consumption of cryogenic Low-Noise Amplifiers (LNAs), ensuring that the 4 K stage remains a stable thermal anchor without risking thermal runaway that could compromise the sub-10 mK base temperature of the mixing chamber.

The compressors are expected to be water-cooled. They must be designed for remote installation in a separate utility room located 3 to 5 meters away from the cryostat, connected via flexible, armored helium lines of sufficient length to maintain laboratory serenity. For installation logistics, the compressor must pass through a doorway of 1.22 m width and 2.10 m height without requiring structural modifications to the facility.

The supplier must include in its offer the cryocooler's power consumption (50 Hz) and cooling water requirements.

2.1.2 Cryostat core

The cryostat core architecture is engineered for large volume experiments, utilizing a series of distinct cooling stages with plate diameters exceeding 250 mm. The plates typically correspond to 50 K, 4 K, 1K (still), 100mK (cold-plate), and 10mK (mixing chamber). The design ensures a base temperature below 15 mK is fully maintained even with the specified experimental wiring installed. The mixing chamber (MXC) flange provides a substantial experimental footprint of at least 250 mm in diameter, with a dedicated vertical clearance of at least 150 mm above the flange and 250 mm below it.

The system is designed for year-long operational cycles at a 15 mK base temperature without requiring a warm-up. As a "dry" system, it operates without external liquid helium vessels, though it must incorporate a liquid nitrogen LN2 cold trap (manually refilled) to prevent capillary blockages during extended runs. While this manual trap is standard, a long-life automated version is detailed as an option later in this text. The configuration ensures rapid thermal cycling, achieving cooldown to below 15 mK in under 30 hours.

The necessary $^3\text{He}/^4\text{He}$ mixture must be included in the supply, typically comprising 18 L of ^3He at >99.9% isotopic enrichment to guarantee a cooling power of at least 10 μW at 20 mK and 250 μW at 100 mK.

To ensure reliability, the design must eliminate all internal vacuum seals within the cryostat. Every connection on the dilution unit, still pumping line, and return line inside the cryostat must feature metal-to-metal seals or laser-welded joints; the use of soft solder or O-rings is prohibited. The entire dilution circuit, encompassing pumps and room-temperature lines, must maintain a leak rate of less than $10\text{e-}10$ mbar.L/s.

High-efficiency radiation shields must be installed at different stages. The vacuum enclosure and the different radiation shields should be sufficiently lightweight to be handled by two people without lifting tools. The cryostat must be electrically isolated from the gas handling system, pumps, and pulse tube components to maintain an ultra-low electronic noise floor essential for quantum measurements.

The cryostat must feature a minimum of five KF40 and two KF63 ports (or their technical equivalents), providing ample access for wiring, line-of-sight ports, or experimental feedthroughs. This layout ensures the system remains highly adaptable, allowing for the integration of additional wiring or specialized components without requiring custom structural modifications to the vacuum enclosure.

2.1.3 Cryostat frame

The refrigerator is supported by a high-stiffness aluminum frame engineered to shift structural resonances away from the pulse tube's operating frequencies, effectively damping mechanical vibrations that would otherwise translate into heat at the mixing chamber stage.

The assembly is strictly constrained by laboratory dimensions, requiring a design that fits within a 3.65 m ceiling height while leaving sufficient overhead clearance to hoist and remove the nested radiation shields and vacuum cans. For installation logistics, the frame and all sub-components must be modular enough to pass through a standard doorway of 1.53 m width and 2.10 m height without requiring structural modifications to the facility.

2.1.4 Thermometry

The thermometry and thermal control system must provide high-precision monitoring and active regulation across the entire temperature range of the cryostat. The system must include a multi-channel temperature controller equipped with a suite of calibrated thermometers (typically ruthenium oxide RuO_2 for the millikelvin stages and Cernox or silicon diodes for the higher temperature plates). This instrumentation must be capable of stable temperature regulation, specifically allowing MXC plate to be maintained at any setpoint up to 900 mK ensuring flexibility for characterizing devices at various thermal equilibrium points.

To facilitate efficient experimental turnover, the system must include a dedicated heater to reduce the time required for system warm-up. This hardware must be fully integrated into the system's control software, allowing for automated, safe warm-up sequences that monitor the temperature gradient to prevent thermal stress. The kit must include all necessary cryogenic-grade cabling and heat-sinking to ensure that the heater does not introduce parasitic heat loads during normal base-temperature operation.

2.1.5 Gas-handling system

The gas-handling system must be a standalone, modular unit designed for installation in a separate utility room located 1.2-1.6 meters from the cryostat. To navigate facility constraints, the unit must not exceed a height of 2.85 m, ensuring compatibility with the laboratory's structural overhead beams. The system must be deliverable through a laboratory doorway of 1.22 m width and 2.10 m height without requiring structural modifications. To eliminate high-frequency mechanical vibrations and acoustic noise, the turbomolecular pumps used for mixture circulation must be integrated within the GHS cabinet rather than mounted directly on the cryostat.

The quotation must include all pumps required for the full operation of the system, including the mixture circulation pumps, the pulse tube compressor, and the dedicated vacuum pumps for the cryostat's primary insulation vacuum. To ensure the highest purity of the $^3\text{He}/^4\text{He}$ mixture and prevent long-term degradation, all pumps and the mixture compressor within the GHS must be oil-free.

The system must support fully remote operation via a network connection while retaining the capability for complete manual control directly from the hardware interface, independent of a computer connection. The software suite must feature fully automated "one-button" cooldown and warm-up protocols to streamline experimental turnover. Critically, the system must include robust automatic modes that transitions and recovers the cryostat to/from a safe state following any shortage in power, pneumatic pressure, or water-cooling supply. The safety protocol must be hardware to function reliably even in the event of a control computer failure.

2.2 System A: High-throughput

System A is optimized for high-volume characterization of superconducting qubits, featuring wiring to maximize data output. It is delivered with 14 RF input and 2 RF output lines, supporting a DC to 18 GHz bandwidth while maintaining a sub-15 mK base temperature. The design prioritizes signal integrity and thermal anchoring for routine, sequential device testing. We describe here its RF and DC wiring.

2.2.1 RF lines

The system must be delivered with 14 RF input lines and 2 RF output lines pre-installed, spanning from the room-temperature (300 K) flange to the mixing chamber plate. All feedthroughs at the 300 K stage must guarantee high hermeticity with a leak rate better than $10\text{e-}8$ mbar.L/s.

While the initial configuration consists of 16 RF lines, the cryostat must be pre-configured with sufficient flange and feedthrough ports to support a total of 24 RF lines. This headroom is required to facilitate a seamless future expansion, potentially performed in-house, allowing for increased characterization throughput by simply installing additional wiring into the pre-existing ports. To optimize space, the RF wiring must be bundled to minimize the number of vacuum ports and flanges consumed, leaving ample room for these future upgrades. We expect the RF wiring to fit within the two required KF63 ports.

Each RF cable must be terminated with high-quality SMA connectors designed for high reliability over repeated cryogenic transitions. These connectors must be robust enough to maintain mechanical and electrical integrity through numerous cooldown and warm-up cycles without degradation. This ensures both robust thermalization and a modular architecture that can withstand long-term experimental use.

The 14 RF input lines must support a broad bandwidth from DC to 18 GHz. The coaxial cabling must exhibit an attenuation profile of less than 2 dB/m at 1 GHz and 5 dB/m at 10 GHz when operational below 4 K. The material selection for the coaxial cabling must prioritize low thermal conductivity to minimize heat load, targeting a value below $5\text{e-}5$ W.cm/K at 4 K. This is typically achieved using semi-rigid coaxial lines with a diameter of less than 1 mm, featuring a silver-plated CuNi (SCuNi) inner conductor and a CuNi outer conductor.

For effective thermalization of the center conductor, cryogenic SMA attenuators must be installed at each plate. The design must utilize standard, discrete SMA attenuators rather than integrated bulkhead-style units to provide maximum maintenance flexibility and cost optimization. Final attenuation values for each stage will be specified at the time of order.

The 2 RF output lines are optimized for high-sensitivity readout across a DC to 18 GHz bandwidth. To minimize the heat load on the sample, the segments from 4 K to the MXC must employ superconducting NbTi coaxial lines, while

the segments from 300 K to 4 K shall utilize lines similar to what is being used for the RF input lines described previously.

The 4 K stage must be equipped with a comprehensive mounting kit to support up to four cryogenic LNAs (e.g., Low Noise Factory models). This modular kit shall feature universal gold-plated mounting brackets to ensure optimal thermal anchoring, a suite of flexible RF interconnects designed to bridge the amplifiers between the MXC input lines and the 4 K output lines, and the DC wiring required to power the amplifiers. The amplifiers will be sourced through another procurement. The complete assembly must provide a seamless, high-gain signal path, enabling the end-to-end amplification of microwave signals from the mixing chamber plate to the room-temperature acquisition electronics. To support this, the configuration must include twelve dedicated DC bias lines (up to three per LNA) that originate at the 4 K stage. Detailed specifications for the DC bias lines spanning from room temperature to the 4 K stage are provided in the next section.

2.2.2 DC wiring

The DC wiring consists of (i) low impedance copper wiring to supply the LNAs at the 4K stage, and (ii) low thermal conductivity wiring down to the MXC stage to bias superconducting circuits.

To power the four LNAs at the 4 K stage, the system requires at least twelve low-impedance copper wires (up to three per LNA). These lines must be engineered to provide a total line resistance of less than 1 Ohm at 4 K to prevent voltage drops and localized heating. Given that high-conductivity copper lines introduce a significant thermal bridge from room temperature, the vendor must demonstrate a robust thermalization strategy, utilizing heat sinks at intermediate stages to ensure these power lines do not parasitically elevate the temperature of the surrounding cryogenic environment.

For the control and flux biasing of superconducting devices, the system must include 72 DC lines extending from three 24-pins fisher connectors at room temperature down to the MXC plate. To minimize the conductive heat load, these lines must utilize low-thermal-conductivity materials. Specifically, each line shall consist of phosphor-bronze (PhBr) wiring from room temperature to the 4 K stage, with a maximum resistance of 15 Ohms, transitioning to superconducting NbTi/CuNi clad wire from the 4 K stage to the MXC. This transition ensures that the final segments contribute zero Joule heating and negligible thermal conduction to the sample stage. The wirings use hermetic 24-pin Fischer connectors with a leak rate better than 10e-8 mbar.L/s at room temperature and 25-pin micro-D connectors within the cryostat.

2.2.3 Additional wiring

As an option, the following enhancements to the signal infrastructure shall be quoted:

2.2.3.1 [Option] Six additional RF input lines

Six additional RF input lines, identical in specification to the 14 lines previously described, bringing the total to 20 input lines.

2.2.3.2 [Option] Two additional RF output lines

Two additional RF output lines, identical in specification to the 2 lines previously described, bringing the total to 4 output lines.

2.2.3.3 [Option] Additional RF flange ports

Enhanced scalability, providing pre-configured flanges and feedthrough ports to support a total capacity of at least 32 RF lines instead of the base 24.

2.2.3.4 [Option] DC breakout at 4 K

The 72 PhBr DC lines must include a breakout at 4 K to accommodate the installation of custom filters and components.

These optional configurations must maintain the same requirements for modularity, thermalization at each stage, and high-quality connectors as specified in the base configuration.

2.2.4 Additional cryogenic components

As an option, the following enhancements to the cryostat infrastructure shall be quoted:

2.2.4.1 [Option] Long-life cold trap

The system shall be equipped with an integrated, cryogen-free 'Long-Life' cold trap designed to ensure high-purity circulation of the helium mixture. This component must enable continuous, uninterrupted cryogenic operation for a period of up to three years by effectively removing impurities without the need for an external liquid nitrogen cold trap or manual refills. The trap should be fully integrated into the cryostat's internal vacuum and thermal stages, utilizing available cooling power at the 4 K flange (typically consuming no more than 150 mW). Furthermore, the system must feature an automated regeneration process that occurs during the standard system warm-up cycle, eliminating the need for manual intervention or separate maintenance procedures during long-term experimental runs.

2.2.4.2 [Option] Auxiliary vacuum turbomolecular pump

The gas handling system shall include an integrated secondary turbomolecular pump to facilitate independent vacuum operations. This module must utilize a service manifold that is isolated from the main helium-3/helium-4 circulation circuit to ensure that evacuation, maintenance, and auxiliary pumping tasks can be performed without risking the purity or volume of the helium gas mixture. The system shall support concurrent operation of the auxiliary pump and the primary circulation circuit. This architecture must provide a robust safeguard against operational errors, ensuring the cryostat vacuum chamber can be evacuated independently without compromising the integrity or pressure of the helium mixture circuit. The integration should be fully supported by the gas handling control software to provide automated protection and status monitoring of the vacuum levels.

2.3 System B: Long run

System B is engineered for long-duration measurements and is designed for experimental versatility across diverse research fields. It utilizes a leaner RF configuration (6 input / 2 output lines). A key requirement is its "magnet-ready" modularity, allowing for the easy installation or complete removal of a superconducting magnet without compromising base cryogenic performance.

2.3.1 RF lines

The system must be delivered with 6 RF input lines and 2 RF output lines pre-installed, spanning from the room-temperature (300 K) flange to the mixing chamber plate. All feedthroughs at the 300 K stage must guarantee high hermeticity with a leak rate better than 10^{-8} mbar.L/s.

While the initial configuration consists of 8 RF lines, the cryostat must be pre-configured with sufficient flange and feedthrough ports to support a total of 12 RF lines. This headroom is required to facilitate a seamless future expansion, potentially performed in-house, allowing for increased characterization throughput by simply installing additional wiring into the pre-existing ports. To optimize space, the RF wiring must be bundled to minimize the number of vacuum ports and flanges consumed, leaving ample room for these future upgrades. We expect the RF wiring to fit within the two required KF63 ports.

Each RF cable must be terminated with high-quality SMA connectors designed for high reliability over repeated cryogenic transitions. These connectors must be robust enough to maintain mechanical and electrical integrity through numerous cooldown and warm-up cycles without degradation. This ensures both robust thermalization and a modular architecture that can withstand long-term experimental use.

The 6 RF input lines must support a broad bandwidth from DC to 18 GHz. The coaxial cabling must exhibit an attenuation profile of less than 2 dB/m at 1 GHz and 5 dB/m at 10 GHz when operational below 4 K. The material selection for the coaxial cabling must prioritize low thermal conductivity to minimize heat load, targeting a value below 5×10^{-5} W.cm/K at 4 K. This is typically achieved using semi-rigid coaxial lines with a diameter of less than 1 mm, featuring a silver-plated CuNi (SCuNi) inner conductor and a CuNi outer conductor.

For effective thermalization of the center conductor, cryogenic SMA attenuators must be installed at each plate. The design must utilize standard, discrete SMA attenuators rather than integrated bulkhead-style units to provide maximum maintenance flexibility and cost optimization. Final attenuation values for each stage will be specified at the time of order.

The 2 RF output lines are optimized for high-sensitivity readout across a DC to 18 GHz bandwidth. To minimize the heat load on the sample, the segments from 4 K to the MXC must employ superconducting NbTi coaxial lines, while the segments from 300 K to 4 K shall utilize lines similar to what is being used for the RF input lines described previously.

The 4 K stage must be equipped with a comprehensive mounting kit to support up to four cryogenic LNAs (e.g., Low Noise Factory models). This modular kit shall feature universal gold-plated mounting brackets to ensure optimal thermal anchoring, a suite of flexible RF interconnects designed to bridge the amplifiers between the MXC input lines and the 4 K output lines, and the DC wiring required to power the amplifiers. The amplifiers will be sourced through another procurement. The complete assembly must provide a seamless, high-gain signal path, enabling the end-to-end amplification of microwave signals from the mixing chamber plate to the room-temperature acquisition electronics. To support this, the configuration must include twelve dedicated DC bias lines (up to three per LNA) that originate at the 4 K stage. Detailed specifications for the DC bias lines spanning from room temperature to the 4 K stage are provided in the next section.

2.3.2 DC wiring

The DC wiring consists of (i) low impedance copper wiring to supply the LNAs at the 4K stage, and (ii) low thermal conductivity wiring down to the MXC stage to bias superconducting circuits. All the DC wirings use hermetic 24-pin Fischer connectors with a leak rate better than 10e-8 mbar.L/s at room temperature and 25-pin micro-D connectors within the cryostat.

To power the four LNAs at the 4 K stage, the system requires at least twelve low-impedance copper wires (up to three per LNA). These lines must be engineered to provide a total line resistance of less than 1 Ohm at 4 K to prevent voltage drops and localized heating. Given that high-conductivity copper lines introduce a significant thermal bridge from room temperature, the vendor must demonstrate a robust thermalization strategy, utilizing heat sinks at intermediate stages to ensure these power lines do not parasitically elevate the temperature of the surrounding cryogenic environment.

For the control and flux biasing of superconducting devices, the system must include 72 DC lines extending from three 24-pins fisher connectors at room temperature down to the MXC plate. To minimize the conductive heat load, these lines must utilize low-thermal-conductivity materials. Specifically, each line shall consist of phosphor-bronze wiring from room temperature to the 4 K stage, with a maximum resistance of 15 Ohms, transitioning to superconducting NbTi/CuNi clad wire from the 4 K stage to the MXC. This transition ensures that the final segments contribute zero Joule heating and negligible thermal conduction to the sample stage. The wirings use hermetic 24-pin Fischer connectors with a leak rate better than 10e-8 mbar.L/s at room temperature and 25-pin micro-D connectors within the cryostat.

2.3.3 Magnet specifications

While the primary application of this system is superconducting qubit research, it is designed to occasionally accommodate various quantum technologies that may require magnetic fields during dedicated experimental runs. To account for potential budgetary constraints, the procurement is split into two distinct options: a magnet-ready base system and a field-upgradable magnet package. This modular structure ensures that the system is 'future-proofed'. Should the magnet package not be acquired in the initial tender, it can be integrated later without requiring structural modifications or the costly replacement of existing cryostat components.

2.3.3.1 [Option] Magnet-ready base system

The vendor must provide a "magnet-ready" cryostat which do not include field-upgradable components including the 3D vector magnet, its power supply, and dedicated controller. This magnet-ready base configuration must include all structural and thermal components that cannot be easily retrofitted or that would require the costly replacement of already-purchased parts.

Specifically, the radiation shields, vacuum enclosures, internal flanges, and wiring must be engineered to accommodate a future magnet installation without further mechanical modification. For example, if the intended magnet requires a three-piece vacuum can architecture, the base offer must include this exact design, supplied with a magnet-free lower section for standard operation to ensure perfect compatibility for future upgrades. The magnet-specific shield section should then be included within the field-upgradable magnet package. All components that are not considered user-installable field upgrades must be included in the magnet-ready base price to prevent any future structural rework or part replacement.

Furthermore, the permanent components installed within the base system to support the magnet, such as high-current leads and support brackets, must be engineered for minimal thermal impact. These elements must have a negligible effect on the cryostat's base temperature and must not degrade the coherence or performance of superconducting qubits when the magnet is not in use.

2.3.3.2 [Option] Field-upgradable magnet package

The magnet package requires a 3D vector magnet providing a minimum magnetic field of 1 T along all three axes, with a clear bore diameter of at least 70 mm for sample space. The package must include a dedicated power supply with remote control, comprehensive quench protection, a persistent mode system, and a magnet temperature monitoring system.

We require a modular magnet system that can be easily installed or removed by the user without any soldering. Being able to remove the magnet is mandatory to minimize stray magnetic fields, maximize available volume at the MXC plate, and reduce cooldown time. This flexibility allows for magnetic field characterization when needed, while permitting the complete removal of the coil for superconducting qubit experiments.

2.3.4 Additional wiring

As an option, the following enhancements to the wiring infrastructure shall be quoted:

2.3.4.1 [Option] Six additional RF input lines

Six additional RF input lines, identical in specification to the 6 lines previously described, bringing the total to 12 input lines.

2.3.4.2 [Option] Two additional RF output lines

Two additional RF output lines, identical in specification to the 2 lines previously described, bringing the total to 4 output lines.

2.3.4.3 [Option] Additional RF flange ports

Enhanced scalability, providing pre-configured flanges and feedthrough ports to support a total capacity of 16 RF lines instead of the base 12.

2.3.4.4 [Option] DC breakout at 4 K

The 72 PhBr DC lines must include a breakout at 4 K to accommodate the installation of custom filters and components.

2.3.4.5 [Option] Additional copper DC loom

One additional 24-way DC loom, featuring a total resistance of $<1\ \Omega$ from the room-temperature feedthrough to the mixing chamber stage. The loom must utilize high-conductivity materials, typically employing copper wiring from room temperature to the 4 K stage and superconducting NbTi wires from 4 K to the MXC to eliminate resistive heating at the coldest stages.

These optional configurations must maintain the same requirements for modularity, thermalization at each stage, and high-quality connectors as specified in the base configuration.

2.3.5 Additional cryogenic components

As an option, the following enhancements to the cryostat infrastructure shall be quoted:

2.3.5.1 [Option] Long-life cold trap

The system shall be equipped with an integrated, cryogen-free 'Long-Life' cold trap designed to ensure high-purity circulation of the helium mixture. This component must enable continuous, uninterrupted cryogenic operation for a period of up to three years by effectively removing impurities without the need for an external liquid nitrogen cold trap or manual refills. The trap should be fully integrated into the cryostat's internal vacuum and thermal stages, utilizing available cooling power at the 4 K flange (typically consuming no more

than 150 mW). Furthermore, the system must feature an automated regeneration process that occurs during the standard system warm-up cycle, eliminating the need for manual intervention or separate maintenance procedures during long-term experimental runs.

2.3.5.2 [Option] Auxiliary vacuum turbomolecular pump

The gas handling system shall include an integrated secondary turbomolecular pump to facilitate independent vacuum operations. This module must utilize a service manifold that is isolated from the main helium-3/helium-4 circulation circuit to ensure that evacuation, maintenance, and auxiliary pumping tasks can be performed without risking the purity or volume of the helium gas mixture. The system shall support concurrent operation of the auxiliary pump and the primary circulation circuit. This architecture must provide a robust safeguard against operational errors, ensuring the cryostat vacuum chamber can be evacuated independently without compromising the integrity or pressure of the helium mixture circuit. The integration should be fully supported by the gas handling control software to provide automated protection and status monitoring of the vacuum levels.

3 GENERAL BUILDING, FLUIDS, ELECTRICITY, ENVIRONMENT SPECIFICATIONS

3.1 Environment of the equipment

3.1.1 Building specifications

Features of the location of the equipment:

- Environment: laboratory.
- Environmental Conditions and tolerances (temperature and humidity)
22 +/- 1°C or 23 +/- 5°C depending on the location in the building.

3.1.2 Building fluids

See **Appendix B**: General fluids building 10.05.

3.1.3 Building power network specifications

CAUTION:

The equipment covered by these specifications must be connected to an electrical distribution mains with earthed neutral system (TN –S diagram).

If necessary, refer to CEI 60364 standard

Electrical features

Power supply voltages available on main:

- Single-phase: 1 phase + neutral + earth
Phase/Neutral voltage: 230 V +/- 10 %
 - Three-phase: 3 phases + neutral + earth
Phase/Phase voltage = 400 V +/- 10 %;
Phase/Neutral voltage = 230 V +/- 10 %
- Main frequency: 50 Hz

3.1.4 Adaptation of the machine to the power network

CAUTION:

When the neutral lead is distributed in the machine, a cut-off device must be placed on the neutral lead, at the equipment item's general switch.

Neutral lead colour in machine:

Inside the equipment, the neutral lead shall be of light blue colour (EN 60204 standard) or clearly identified otherwise (colour ring, marker).

Protection lead colour in machine:

Inside the equipment, the protection lead (earth) shall be of green and yellow colour.

Power supply transformer (general machine)

Should a transformer be necessary:

- Contractor shall estimate this supply as an option, indicating all electrical features (power, primary and secondary voltages, etc.).
- A dry transformer (without liquid dielectric medium) is preferable;
For transformers or other devices, containing a liquid dielectric medium:
 - Pyralene is prohibited;
 - Installation conditions in machine shall meet Decree of January 17, 1989 establishing prevention steps against fire hazard introduced by dispersion and ignition of flammable liquid dielectric media. In this case, mandatorily consult us.
- Characteristics of the transformer:
 - It shall be compliant with the "low voltage" directive **2014/35/EC** and affixed with the CE marking for this purpose,
 - case of a three-phase transformer:
Secondary windings must be bridge connection so that there is a neutral point
This provision applies even if the neutral is not used by the machine in order to enable protection against indirect contacts (ground connection if necessary)
- For "dry" transformers, the applicable construction standards are:
 - **NF EN 61558** standard, for powers of less than 25 KVA single-phase, or 40 KVA three-phase
 - **NF EN 60076** standard, for powers in excess of 25 KVA single-phase and 40 KVA three-phase

3.1.5 Uninterruptible power supply (UPS)

Should all the equipment be powered by an emergency power supply (UPS), this power supply shall be provided by CEA.

Contractor shall provide all the necessary information for defining the product (voltage, power, autonomy).

Contractor shall provide lock terminals on the equipment to connect the emergency power supply.

If only a section of the equipment is powered by an internal UPS incorporated by the manufacturer (IT section for example), the following rules shall be complied with:

- An omnipolar separation mechanism shall be installed downstream of the UPS in order to allow maintenance operations.
- The presence of voltage after shutoff of the machine master switch shall be signalled on same.

- The circuits still powered after cut-off must be identified in orange inside the equipment as per standard **NF EN 60204**.

3.2 Management of the environment

In reference to its “Sustainable Development” initiative, CEA-LETI is working on improving its environmental performance and would like understand what its service providers and Contractors’ contributions are to this regard.

Contractor shall therefore list in its offer all the initiatives that it has undertaken and / or is planning to undertake to make its business more sustainable from an environmental and social perspective. It will provide details about:

- its efforts regarding reduction in:
 - consumption of electrical and heat energy, and fluids;
 - exhaust flows through careful design of covers and exhaust points;
 - cooling water flow rates using an optimized calculation for heat exchangers.
- proposed fluid recycling.

The equipment must be designed so as to limit polluting emissions in the environment in particular by implementing clean technologies, segregation and treatment of effluents and waste depending on their characteristics, and reduction of the discharged quantities.

3.2.1 Process Cooling Water

Contractor will provide design calculations for heat exchangers to be connected to the buildings process cooling water supply system (allow for delta T of at least 5°C). If necessary, it will also justify pressure relief valves on the valve console. In the event flexible pipes are used in the equipment or for links with auxiliary modules, connections using a single Swagelock rubber series PB from-end or the equivalent with a central tube in Buna N, braided-fiber reinforcement and covered with abrasion-resistant, nonflammable Buta N. End-pieces will be the push-on type and/or double-ring in 316 stainless steel adapted for the required pressure (Serflex or similar collars are prohibited). Color of flexible piping: blue for “inlet” into the equipment and red for “outlet”.

3.2.2 Exhaust and other internal equipment air systems

The Contractor will provide design reports or tests used to define air flow rate required to comply with current regulations. It will select the sections of adapted systems in order to limit resistance (air speed < 8m/s for exhaust and < 6m/s for supply). It will study optimal routing inside the equipment, particularly by limiting the number of specific head losses. If flexible piping is used, they shall be classified M1 for fire and be of the smooth interior type adapted to the fluid being carried.

Drawings will be provided before construction to indicate routing of air systems (exhaust and supply), design inside the equipment and its auxiliary modules.

4 SAFETY

4.1 EC conformity

The supplied equipment or service shall meet the regulations in force in France. Said regulations include the European directives transposed into French Law.

European Directives:

Compliance with the European directives applicable to the equipment is mandatory.

In particular (if applicable) :

- “Machinery” directive **2006/42/EC**
See **Appendix D**: Specifications for delivering work equipment (Compliance with European machinery directive **2006/42/EC**).
- “Electromagnetic compatibility EMC” directive **2014/30/EU**
- “Low voltage” directive **2014/35/EU**
- “ATEX” directive **2014/34/EU**

- “Pressure” directive **2014/68/EU**

The equipment shall be EC certified, a “CE marking” shall be affixed thereon and it shall be accompanied by an EC/EU declaration of conformity.

Construction standards

Compliance with harmonized European Standards (NF EN or NF EN ISO) will be favored, the application of these standards giving a presumption of conformity on the subjects concerned.

- **Risk analysis**

The various risks (mechanical, electrical, thermal, gas, chemical, radiation) shall be clearly mentioned by Contractor in its proposal.

The risk analysis will be made according to the applicable reference standard: **NF EN ISO 12100: "Safety of machinery - General principles of design - Risk assessment and risk reduction"**

These risks shall be handled:

- in accordance with the instructions of the applicable directives:
- in accordance with the recommendations of Paragraphs 5.2 to 5.12

- **Design of safety related parts:**

The safety functions will be designed in accordance with standard NF EN ISO 13849-1 "**Safety of machinery - Safety-related parts of control systems - Part 1: general principles of design**" for each type of hazard (mechanical / gas / thermal...)

- **Electrical equipment of machines**

The electrical equipment of machines will be designed in accordance with standard **NF EN 60204**

Reminder of technical points in relation with the regulations:

Warning :

This paragraph is aimed at attracting the manufacturers' attention to a few specific technical points which may lead to non compliance if they're not completed.

- **Energy separation device**

The equipment will be fitted with an isolation device on each energy source (electricity, pneumatic, nitrogen, etc.) that can be locked in the off position.

- **Electrical cabinets**

Electrical cabinets will have an IP2X protection index and it will only be possible to open them with a tool or a key; the inside of the cabinet will also have an IP2X protection rating so as to avoid any risk of direct contact during maintenance operations (components / wiring)

- **Guards design**

- Protection panels:

Protection panels (guards) will be strictly designed in compliance with Machinery Directive **2006/42/EC** (See appendix F: 1.3.8 to 1.4.3)

Moreover, the following conditions shall be complied with for selecting guards:

Fixed guards:

The installation of fixed guards by manufacturer will be accepted if:

- Frequent disassembly for maintenance is not necessary

- Removal of guard is exclusively reserved to maintenance personnel by following a written instruction drawn up by manufacturer (lock out tag out of affected moving elements for example).

Moving guards:

Moving guards will be considered as all types of guards installed on hinges (doors) or not complying with the criteria of fixed guards.

- The opening of the movable protectors will have to stop the risks present behind these protectors, by means of a safety system designed in accordance with the applicable European standards.
- The opening detectors installed on movable guards will be safety components in accordance with **NF EN ISO14119**

- **Maintenance modes**

If the machinery is equipped with "maintenance" or "service" mode in which the safety systems are neutralised, these modes will be strictly designed in compliance with Directive 2006/42/EC "Selection of control or operating modes"

(See: appendix F point 1.2.5)

Consequently:

- The maintenance of the equipment should not require the direct neutralization of the detection components (interlock doors). If this neutralization is necessary, it should be done via a maintenance mode accessible via a code or a key and simultaneously cause the reduction of risks (reduction of speeds, permanent control of the movements ...)
- The maintained action required to validate the movements will be of the pedal type or "dead man" safety handle.

In particular, this system will be present on the control modules ("teach pendant ") for teaching robots.

- **Fume cupboards**

In case of fume cupboards, the applicable standards are:

NF EN 14175-1, NF EN 14175-2, NF EN 14175-3, NF EN 14175-4, NF EN 14175-6, NF EN 14175-7.

Factory and onsite "type tests" shall be subject to a conformance certificate or Contractor declaration. The Contractor shall anticipate all exhaust surveillance devices, associated servomechanisms and operator information devices on equipment operating state.

4.2 Risks connected with facilities

Power supply sectioning:

A power supply-sectioning device must be designed on the equipment for each energy source of the machine

Electrical supply cut-off device:

The accessories enabling the electrical supply of all or part of the machine to be immobilised shall be supplied with the equipment (locking circuit breakers in off position).

Compressed air connection or "service" nitrogen:

When the equipment uses compressed air or nitrogen for valve, actuator and other system control, the machine must be equipped with a general shut-off valve.

This valve must include a locking system, by means of a padlock, in order to make the facilities safe for maintenance. One or more drain/purge systems must be available to dissipate the residual pneumatic energy stored in the machine after general valve shutting-off. Energy dissipation must be harmless to any exposed personnel or operators.

Presence of an uninterruptible power supply (UPS):

The instructions of Paragraph 4.1.5 shall be complied with.

The cut-off component at UPS output may be locked in "off" position.

4.3 Risks connected with fire

Automatic fire extinction system for equipment using solvents:

Equipment implementing solvents in open tray (pans, most often) must have an automatic CO2 extinction system. This system will be connected to the operation of detectors (smoke, flame, temperature, etc.) installed above open trays, but also at equipment retention trays.

DESAUTEL (or equivalent) type automatic extinction systems certified and validated by qualified authorities shall be installed with approval of the facilities department. Dry contacts shall be supplied in the building in order to report each of the following elements of information:

- System disturbance
- Fire detection (1 detector giving alarm)
- Confirmed fire detection (2 detectors giving alarm, extinction triggered)

Intrinsic equipment fire detection system:

When fire detectors are supplied with the equipment, they must be accompanied by the risk analysis leading to their installation, in such a way that the LETI is able to make decisions on the grounds for doubling said detection using existing systems in the building which are compatible with the fire systems in place. Detectors integrated into equipment shall not be connected with the fire system of the building and shall only have an action on the equipment in question and its related peripheral devices, if required.

The Contractor will specify and provide the necessary documentation relating to:

- Periodic calibration of sensors: frequency, operating mode, calibration gas used, parts to change in preventive and corrective maintenance, and any information necessary to maintain the detectors in good working order.
- Connections required on the equipment, in case of:
 - Detection alarms for different thresholds
 - Malfunctions

A list of these interlocks with the corresponding wiring diagrams will be provided.

4.4 Risks connected with chemical products

Not applicable.

4.5 Risks connected with handling

For the parts of equipment requiring handling: pumping units, chamber lids, covers, etc., notably during maintenance or installation operations, lifting means must be foreseen and described in the equipment safety notice.

Systems integrated into the equipment will be favoured over mobile systems.

In the case of a mobile system, it must be marked "CE", be the subject of an EC declaration of conformity and an instruction manual in French.

4.6 Risks connected with automatic loading of Fouds onto LoadPorts

Not applicable.

4.7 Risks connected with pressurised equipment

For equipment subject to "Pressure" directive 2014/68/EU, Contractor shall:

- Provide a complete file of the equipment in order to enable the commissioning inspection operations
- Update the roll where all the interventions will be recorded (inspections, requalification, and maintenance).

Contractor shall submit the periodicity of visit and controlled equipment requalification.

4.8 Risks connected with work at height

Not applicable.

4.9 Risks connected with laser radiation

Not applicable.

4.10 Risks related to sources of ionizing radiation (radioactive sources / electric generators of ionizing radiation, etc.)

Not applicable.

4.11 Risks connected with noise

In reference to machinery directive **2006/42**:

"Machinery must be so designed and constructed that risks resulting from the emission of airborne noise are reduced to the lowest level taking account of technical progress and the availability of means of reducing noise in particular at source.

The level of noise emission may be assessed with reference to comparative emission data for similar machinery."

The noise level measurements will be performed and mentioned in the instruction manual in compliance 2006/42

The noise level generated by the equipment in its installation environment should be less than 70 dB (A).

If noise level is likely to exceed 70 dB (A), the Contractor will suggest quoted technical solutions of reduction: silent hardware, soundproof materials, soundproof covers on noise sources...

4.12 Risks connected with temperature

Hot surfaces: the temperatures of directly accessible hot surfaces must comply with standard requirements **NF EN ISO 13732-1**

Cold surfaces: The temperatures of cold surfaces directly accessible shall comply with the requirements of standard **NF EN ISO 13732-3** of 2008

WARNING: In the case of heating systems embedded in the machine

- The manufacturer must foresee the consequences of a malfunction of the control unit by installing a completely independent overheating safety device (sensor / regulator ...). This safety system will shut down the power and will require manual reset for restart (after fault clearing). The reliability of the cut-off system will be defined according to **EN 13849-1**
- The manufacturer must be able to define the consequences of a sudden and simultaneous complete interruption of the machine's "facilities": water / electricity / extraction hot air / nitrogen service ... when the system is at nominal temperature.

The equipment will have to support this scenario without generating a fire risk internal to the machine, nor any other risk (explosion ...)

In this scenario, if the temperature of the external enclosure of the equipment exceeds that of the equipment in normal mode, the Contractor will give the estimated temperature values and will consider them in the installation instructions (safety distances from the walls and other equipment).

4.13 Signaling

Signalling: risks shall be indicated on the machine using danger pictograms such as described in European regulations, accompanied as the case may be by an additional text;

In this case, the text must be labelled in French.

4.14 Intervention conditions on the CEA-LETI site

In collaboration with the Contractor and its possible sub-contractors, the CEA-LETI shall draft an overall prevention plan for installation, start-up and possibly development (JDP) services on equipment.

As loaning material is prohibited at the CEA, the Contractor and any subcontractors must provide safety materials needed to prevent specific risks generated by its intervention: PPE, CPE, breathing apparatuses, etc. It shall be responsible for replacement and repairs and, if required (without compensation on the part of CEA), it shall

promote awareness and train its staff for use of equipment as per regulations. This material shall comply with regulations in force and shall be accompanied by a certificate of conformity.

The Contractor and its possible sub-contractors must provide all collective safety equipment used to prevent accidents due to works (marking work areas, marking traffic areas, marking handling and flyby areas, marking and installation of barriers around pits, level differences, etc.). It shall carry out and ensure removal of them as soon as the service no longer requires the presence of marking.

5 SUSTAINABLE DEVELOPMENT

5.1 Corporate Social Responsibility (CSR)

With an amount representing nearly 2.7 billion euros, CEA purchases are an integral part of societal and environmental issues.

The CEA monitors the quality and diversity of relations with its suppliers. It conducts a responsible purchasing policy based on three priority commitments:

- Create and maintain confidence-inspiring relations with its suppliers,
- Take into account the responsible dimension of its purchases,
- Contribute to the development of Small and Medium Enterprises (SMEs) and innovation.

Since 2004, it has been a signatory of the “responsible supplier relationship” charter and adheres to the SME Pact, a national support scheme for innovative SMEs.

The CEA's commitment to developing responsible purchasing cannot be made without taking this dimension into account by its suppliers.

The CEA is therefore counting on your proposals within the framework of this consultation to optimize the environmental impact of your services and develop the integration of people who are excluded from employment and the protected sector.

5.2 Sustainable development and development of the local economic fabric

As part of the “Sustainable Development” approach, CEA Grenoble is striving to improve its environmental performance and requires the cooperation of its suppliers in this respect.



In its proposal, the service provider shall present its corporate strategy as regards sustainable development and its specific improvement proposals concerning the work that covered by these Specifications.

Furthermore, as part of its “Plan Déplacement Entreprise” (“Corporate travel plan”), CEA Grenoble undertakes to reduce its environmental footprint.

The service provider shall cooperate with CEA Grenoble and undertakes to use zero emission vehicles as much as possible to meet the requirements mentioned in these Specifications.

Furthermore, LETI MINATEC is a pedestrian area, with regulated vehicular access.

Vehicles identified by the company's name may access the pedestrian area subject to CEA Grenoble's approval. All other vehicles shall be parked in the dedicated car park.

The recovery or disposal of waste created during the performance of the services is the responsibility of the supplier during the duration of the contract.

The supplier shall ensure that any operations, collection, transport, storage, sorting and disposal of waste created by the services subject to the contract are carried out to the sites likely to receive them, in accordance with the regulations in force.

5.3 Energy performance

As part of its ISO50001 "energy management" initiative, CEA Grenoble is working to improve its energy performance, and would like to be supported in this by its suppliers.



In its offer, the service provider presents its proposals for improvement specific to the services detailed in the present specifications.

CEA Leti asks the service provider to propose all equipment and solutions enabling to optimize and reduce as much as possible the energy consumption of the entire project, and to propose in its offer the energy saving certificates related to the project. »

6 EQUIPMENT DELIVERY CONDITIONS

The equipment and all the peripherals will be delivered clean and packaged in a serious and appropriate way. The transport platforms, pallets and packaging cases must be adapted to the weight and volumes of the elements in order to ensure safe a transport and avoid any dispute connected with improper packaging.

7 CONDITIONS FOR INSTALLING EQUIPMENT

Contractor shall enclose with its technical proposal the pre-installation document defined in **Appendix E**, then an installation file at the time of the installation.

It shall include all the installation conditions in particular the elements required in Paragraph 2: "instruction manual /installation" of Appendix E: Specifications pertaining to documents and manual to be provided with the equipment.

8 TRAINING & LEARNING

The Contractor undertakes to provide at no additional cost training covering the use of the equipment (operation and process development), and safety. Trainings for maintenance (hardware and software) will have to be proposed and quoted as an option.

- Training for use of the equipment

After commissioning of the equipment, user training shall be provided on site for 3 people. This training shall cover at least cooldown, warm up, recovery from a simulated power outage of 5 min, and cooling power measurements. The supplier shall specify the duration of the required training courses in its bid.

- Safety training

Contractor shall provide a complete safety training of the staff which will be appointed to operate the equipment.

In particular, this training must include:

- ✓ Training on the use conditions and contraindications of use,
- ✓ Information on the prevention devices implemented and residual risks,
- ✓ Training on the specific precautions and procedures to be complied with during adjustment and maintenance interventions,
- ✓ Training on the periodic functional check operations of the safety systems.

- Level 1 maintenance training to be quoted as an option

First level maintenance training will be provided for 2 people at CEA-LETI or on the Contractor's premises for maintenance and/or process staff upon acceptance. The Contractor will provide a list and description of first level maintenance operations to be carried out on the equipment.

9 DOCUMENTATION

See **Appendix E**: "Specifications relating to the documents and manuals to be supplied jointly with the equipment".

Each manual must be available in two paper version plus digital and possible CD-ROM version. Two sets of each manual shall be provided.

10 WARRANTY

10.1 Warranty conditions

Warranty shall start at the date of equipment acceptance for a duration of one year.

Warranty shall include corrective maintenance operations and cover all related costs: labour, spare parts, travels, shipments etc...

10.2 Support during warranty

During the warranty period, the Contractor agrees to provide support within a maximum timeframe of 5 business days after receiving an e-mail or a call from CEA-LETI. Support shall be available for on-site intervention from 8am-6pm on weekdays.

11 MAINTENANCE

11.1 Spare parts

11.1.1 List of spare parts

In its bid, the Contractor shall include:

- A comprehensive list of spare parts;
- A comprehensive list of consumables needed to operate the equipment, with the functions, reference and price for each component.

These lists may be used as a basis for drawing up an agreement for the supply of spare parts and consumables. The Contractor shall specify the standard delivery timeframe as well as the timeframe for an emergency situation.

11.1.2 Process-kit

Not applicable.

11.1.3 Storage area

Not applicable.

11.2 Maintenance contract

At the end of the warranty period, the CEA-LETI shall have the possibility of subscribing a maintenance contract. The Contractor shall commit to be able to perform preventive and corrective maintenance for each piece of Equipment after the warranty period has expired and for a minimum period of 10 years.

In the commercial proposal, the Contractor shall calculate the price of optional maintenance services, taking the following requirement levels into account:

- Full service including preventative maintenance, unlimited corrective maintenance, and all required spare parts. The Contractor should also commit to a defined up-time of the tool during this period. Unless otherwise stated, the performance of the tool during the Full Service contract will be that defined in the current « EQUIPMENT SPECIFICATIONS FORM ».
- Preventive maintenance plus corrective maintenance on request (hourly rates) complying with intervention and repair deadlines.

Further to the adjustment of CEA's needs with respect to maintenance, the maintenance contract may be implemented after the warranty period has expired further to negotiations.

11.3 Cost of ownership (COO)

Not applicable.

12 CHECKS & TESTS

The tests and checks of conformity for equipment subject of these specifications are broken down into six groups:

- ✓ At the factory
- ✓ Delivery
- ✓ Installation and commissioning
- ✓ Qualification
- ✓ Acceptance
- ✓ End of warranty

12.1 Checks and tests at the factory (Factory acceptance tests)

Not applicable

12.2 Check upon delivery & at unpacking

Contractor shall submit the packing procedure for CEA-LETI acceptance. It shall at least specify breakdown of the packages, space requirement and associated instrumentation (example: accelerometer indicator).

The Contractor will ensure proper following of this procedure. If the delivery occurs in the presence of the Contractor (or his representative), the Contractor will check the integrity of the various packages, analyse the associated instrumentation and draft a "delivery" report (using their own documentation). Otherwise, the delivery countersigned by CEA-LETI shall be considered as the delivery report.

The Contractor shall ensure that the equipment is correctly unpacked.

13 – Installation

The following chapters describes the main steps for installation preparation

13.1 Preparation

Contractor should be available at all time to assist CEA LETI in the preparation of the system installation

Part 1:

No later than 1 week after PO notification, Contractor must provide:

- Appendix H v0 - if not provided during the tender process
- System footprint - Dimension of all systems or sub systems
- Pre installation Manual

2 months after Po notification:

- Contractor must assist CEA LETI teams in order to validate definitive Appendix H v1 and Footprint/layout.

Part 2:

2 months after PO notification:

- Contractor must validate Appendix I with the CEA LETI safety officer be compliant with CEA risk management policy (Appendix I, Fire suppression analysis, extra safety detections common validation)
- Consolidate the need of sub assembly which might be supplied by CEA LETI

Part3:

6 months before system delivery Contractor must assist CEA LETI:

- for chassis conception (formal Contractor dimension and cut off validation is requested)
- for PIDs (fluids & electric) conception (same)
- commissioning planning

14.2 Installation

Basic Rules:

During the installation and as soon as possible, the Contractor will remove all waste and parts from the installation which are no longer required

All along the installation, Contractor must follow CEA LETI teams safety policy and must not open or start any fluid or source of energy without specific approval.

The following chapter describe the main steps for the installation & commissioning

14.2.0 System delivery & move in to final location:

After system delivery, system will be uncrated and moved in to its final location by CEA-LETI or its subcontractor. Contractor must be present during this phase at the same time.

14.2.1 Tiers 0 - System mechanical assembly, system start Up

Basic Rules:

The Contractor shall use its own tools to perform equipment assembly, including handling and lifting tools that may be necessary.

During this phase, the Contractor will perform the equipment assembly, levelling.
Interconnections will be managed according to contract specification specified in the Appendix H.

No energy will be present during this phase.

At the end of the Tier0:

- The machine and sub system will be energized.
- The Contractor must be present to acknowledge the power supply is meeting its specification

14.2.2 Tiers 1 - Final Hook Up and system start Up after power up

Basic Rules:

The Contractor must:

- Attend all the operations to install and connect the equipment to the facilities (fluids, extractions, etc.) and shall make sure that the latter are compliant with the Contractor's specifications. The contractor has the responsibility of the final connection from facilities to its equipment's
- Contractor must follow CEA safety policy and must not open or start any fluid or source of energy without specific approval.
- Make sure that the connections are compliant with the Contractor's specifications.
- For all the fluid connections (including effluents) or gas inter equipment or modules provided by the Contractor, the latter will carry out the marking and direction of these networks in accordance with European standard NF X 08-100 including pictograms SGH informing of the danger by printed solvent resistant laminated polyester adhesive stickers.
The valves will be equipped with color labels engraved out of PVC 8/10e fixed by adapted collars indicating their function.
- At the end of the installation, the Contractor will remove all waste and parts from the installation which are no longer required.

At the beginning of this phase, the system will be able to be powered Up.

The connection to Gas, Fluid, air extraction and Drain will be performed during this phase

The final gas connection to the system will be supervised by the contractor

The contractor will then:

- Perform the required hardware adjustment and calibration (robotics etc.) according to its system specification.
- Carry out checks on facilities which includes checking the various safety controls.
- Provide an "hardware report" commissioning which summarizes the progress of the above step and the result of the various controls. This report will confirm that the connection by the Contractor and standard safety tests are completed. The main safety elements concerned are: emergency stops, the extraction detection, leakage or gas detection, door contacts ... (Operation and connections)

Note:

The fluid connections to the equipment (process or chemical gases) will be made by CEA-LETI after receiving the "hardware report" described above from the Contractor and after the safety compliance inspection (described bellow) has been successfully completed.

At the end of the Tiers 1:

CEA-LETI will perform a safety compliance inspection (EC requirements).

The Contractor must be present during this inspection and will make all necessary documents available for the assessment of the equipment.

Depending on the anomalies, CEA-LETI may decide to suspend the commissioning operations pending remediation of the problems. Non-conformities noted correspond to non-compliance with the regulatory points. Any non-compliance must be resolved before the acceptance report can be signed.

All Anomalies and malfunctions will be promptly corrected by the Contractor no additional costs.

14.2.3 Tiers 2 - Contractor Equipment qualification & Handling test

This qualification procedure shall be performed in the presence of CEA-LETI authorised representatives.

The summary of these tests shall be countersigned by CEA-LETI (qualification summary report).

During this step,

- The contractor will make the handling test according to specification
- CEA LETI will test exhaust efficiency and air flow (FFUs)
- The contractor will make its own system qualification according to system specification. A summary report might be provided and countersigned by CEA Leti at the end of the contractor test

In the case it is not under specification, the contractor will take the proper actions to get the systems under CEA LETI specification.

At the end of the Tiers 2:

The equipment is meeting the contractor specification test and the equipment is available for the CEA LETI process qualification.

The Contractor will remove all waste and parts from the installation which are no longer required.

14.2.4 Tiers 3 - CEA Process Qualification

During this phase, CEA-LETI ensures that the expected specifications for each process are met.

If these specifications are not met, even after the equipment supplier's intervention, it may result in the CEA-LETI refusing to accept the equipment or recording reservations in the CEA Equipment Acceptance Report.

Note: the contractor must be present during the test of the equipment

13.3 Acceptance

This acceptance recognises conformity of the equipment and transfer of ownership. The equipment warranty period shall start once the acceptance has been confirmed.

Acceptance shall be pronounced after:

- ✓ **Full delivery of the equipment**
- ✓ **The end of the installation and commissioning operations**
- ✓ **The qualification checks and tests successfully passed**
- ✓ **Authorisation from the installation manager at the home site**
- ✓ **Delivery of the documentation (see make up in APPENDIX E: Specifications pertaining to documents and manuals to be supplied with the equipment)**

A reception document without qualifications (*) will be signed between CEA-LETI and Contractor.

(*) A concession may possibly be granted for a reserve forming the subject of a detailed action plan for restoring compliance to the specifications subject of this document. If so, acceptance will be pronounced "with reservations"

Note: Only the report in CEA-LETI format, shall prevail to assert the associated payments with this stage and launch the warranty period.

13.4 End of warranty

The completion of the guarantee is pronounced at the end of the guarantee period under the following conditions:

- ✓ **Total removal of all qualifications noted during the acceptance**
- ✓ **No abnormalities detected**
- ✓ **Compliance of the equipment with the specifications during this period.**

In case of any abnormality, the Contractor will perform any work required to ensure the compliance of the equipment. If the functioning of the equipment is not satisfactory, the warranty period is automatically extended by a period described in the contract.

14 APPENDICES

APPENDIX A: Summary of Contractor's comments

Please ensure you complete the provided template file, "Appendix_A.xlsx", with all required information and return it as a mandatory part of your final offer submission.

APPENDIX A : contractor feedback to specifications									
			Specifications title		Cryogenic Platform for Superconducting Qubit Characterization				
			Specifications reference		DRT-LETI-DCOS-SCCS-LCEF-26-02-000409				
			Contractor company name						
			Quotation reference						
			Contractor reply Please add "X" in relevant column			If Contractor reply involves change to specification -> Specification discussion			
Item number	Item title	LETI owner	Fully accepted	Accepted with modification	Not applicable	Contractor comment #1 + date	CEA-Leti comment #1 + date	Contractor comment #2 + date	CEA-Leti comment #2 + date
1	PURPOSE	RE							
	Appendix A								
	Appendix J								
	Appendix K								
	Footprint and dimension of all systems								
	Pre-installation manual								
2.1	Common specifications	RE							
2.1.1	Cryocooler								
2.1.2	Cryostat core								
2.1.3	Cryostat frame								
2.1.4	Thermometry								
2.1.5	Gas-handling system								
2.2	System A: High-throughput	RE							
2.2.1	RF lines								
2.2.2	DC wiring								
2.2.3	Additional wiring								
2.2.3.1	(Option) Six additional RF input lines								
2.2.3.2	(Option) Two additional RF output lines								
2.2.3.3	(Option) Additional RF flange ports								
2.2.3.4	(Option) DC ground at 4 K								
2.2.4	Additional cryogenic components								
2.2.4.1	(Option) Long-life cold trap								
2.2.4.2	(Option) Auxiliary vacuum turbomolecular pump								
2.3	System B: Long Run	RE							

APPENDIX B: general fluids in building 10.05

General fluid distribution	Building 41 characteristics	Specific observations
Cooling water <i>(Recommended dimensioning velocity: 1.5 m/s)</i>	Material : heat-insulated PVC / INOX	Closed loop recycled water systems → waste water consumption prohibited
	Outgoing pressure: 6 bar	
	Return pressure: < 1 bar	
	Outgoing temperature: 19 °C	
	Conductivity: 200 microS/cm	
	pH: 7	
	Operating point filtration: 20 microns	
	Processing products: pH control, corrosion inhibitor, biocide	
Compressed Dry Air	Material: stainless steel 304L	/
	Relative pressure: 7 +/-0.3 bar	
	H2O < 2 ppm	
	Temperature: 20°C +/-5°C	
	Particles 0.2 microns< 2 /cubic ft	
	Relative pressure: 7 +/-0.3 bar	

APPENDIX C: Definition of Availability

1. Planned time

The total planned time corresponds to the total hours of use for a reference period: 5 shifts - 7 days (168h/week).

2. Up-time definition

The basic formula for calculating the up-time is:

- Up-time (%) = 100 - Equipment down-time (%)

3. Down-time definition

The equipment down-time is the time during which the machine cannot be used for production according to the process specifications.

The equipment down-time is divided into:

- Scheduled down-time
- Unscheduled down-time

A) SCHEDULED DOWN-TIME

The scheduled down-time is the equipment shut-down time scheduled by the maintenance and production for preventive maintenance, for operations involving cleaning, modification, improvement, changing location, etc...

B) UNSCHEDULED DOWN-TIME

The unscheduled down-time is an unscheduled period during which the machine can not be used for production. Down-time must result from a failure proper to the equipment and not result from external elements (fluids, building, etc...).

This time does not take the user's imperfections into account :

- malfunctioning after incorrect use of the equipment (non-compliance with operating procedures),
- malfunctions resulting from the user's installations or structural or social problems.

4. Measuring up-time

Due to the up-time definition given above, measuring the up-time simply involves measuring the down-time.

5. Measuring down-time

A) START

Down-time starts from stoppage of production due to stopping of the machine, either deliberate or not, and from the agreement between the production and maintenance teams that production can no longer be performed with the specifications.

This moment is recorded on a document or in a file and is immediately notified to the Contractor (in case of failure) by telephone with confirmation by MAIL within 24h.

B) DURATION

Down-time covers:

- The initial period during which the operator performs troubleshooting to locate the cause of error, plus the waiting time of a maintenance person after a call to the Contractor's departments (in the case of a failure).
- The duration of the maintenance operation (repair / improvement / modification).
- The repair time resulting from waiting for spare parts.
- The time, after repair, to burn-in and check the equipment.
- The maintenance and process qualification time.

These different times must be noted and recorded accurately.

C) END

The end of equipment down-time takes place after the process has been qualified again. At this moment the machine is again in compliance with the specifications and can be used for production in agreement with the maintenance and process teams.

The different down-time states and times are consultable and can be supplied to the equipment Contractor on request from him.

MTBF definition

The MTBF is the mean up-time value in hours between two failure (the interrupt can be scheduled or unscheduled down-time). This mean value is calculated over 13 weeks and is the number of hours of up-time divided by the number of interrupts.

$MTBF = \text{Up-time (in hours)} / \text{number of interrupts}$.

MTTR definition

Mean time to recover: mean time to put the machine back into a state of compliance, this state takes account of scheduled and unscheduled down-time and is averaged over 13 weeks.

$MTTR = \text{number of hours of down-time} / \text{number of interrupts}$

APPENDIX D: Specification for delivery of equipment subject to the European “machinery” Directive 2006/42/CE

Purpose: The aim of this document is to recall the application conditions of this directive as well as certain important technical points

1/ Reminder of the applicable regulation

The “machinery” directive is a European text transposed into the French law.

2/ Definition of a machine

A machine is “an assembly fitted with or intended to be fitted with a drive system other than directly applied human or animal effort consisting of linked parts or components, at least one of which move and which are joined together for a specific application...”

Consequently:

Any equipment complying with the definition will be designed and built in application with the “machinery” directive 2006/42

A machine is considered as “placed on the market for the first time”, “new” or “in the new condition” if it has not been used in a member state of the European Economic Community (EEC).

Consequently:

A second-hand machine from a non-EC country will be considered as new upon its entry into the EC.

The applicable regulation will be that in force at its date of entry.

3/ Reference standards

The presumption of conformity with regulatory requirements is provided by compliance with the provisions described in the harmonised standards mentioned above and circulated by AFNOR Tour de l'Europe 92049 Paris Cedex 7, France:

- specific standards to machinery
- general safety standards,
- standards pertaining to electrical equipment of machinery NF EN 60-204

Note: Compliance with standard 61010-1 does not give a presumption of compliance to the machinery directive

4/ Documents to be provided with the equipment subject to directive 2006/42

➤ EC declaration of conformity

2006/42 annex II:

"EC DECLARATION OF CONFORMITY OF THE MACHINERY

The declaration and translation thereof must be drawn up under the same conditions as the instructions [See Annexe I, Section 1.7.4.1, points a) and b)] and must be typewritten or else handwritten in capitals.

This declaration relates exclusively to the machinery in the state in which it was placed on the market and excludes components which are added and/or operations carried out subsequently by the final user.

The EC declaration of conformity must contain the following particulars:

- 1) business name and full address of the manufacturer and, where appropriate, its authorised representative;
- 2) the name and address of the person authorised to compile the technical file, who must be established in the community;
- 3) description and identification of the machinery, including generic denomination, function, model, type, serial number and commercial name;
- 4) a sentence expressly declaring that the machinery fulfilled all the relevant provisions of this directive and where appropriate a similar sentence declaring the conformity with other directives and/or relevant provisions with which the machinery complies. These references must be those of the text published in the official journal of the European Union;
- 5) where appropriate, the name, address and identification number of the notified body which carried out the EC type-examination referred to in Annexe IX and the number of the EC type-examination certificate;
- 6) where appropriate, the name, address and identification number of the notified body which approved the full quality assurance system referred to in Annexe X;
- 7) where appropriate, a reference to the harmonised standard used as referred to in Article 7, Paragraph 2;
- 8) where appropriate, the reference to other technical standards and specifications used;
- 9) the place and date of the declaration;
- 10) identification and signature of the person empowered to draw up the declaration on behalf of the manufacturer or his authorised representative."

➤ An instruction manual

An instruction manual shall be drawn up in compliance with Paragraph 1.7.4 of Directive 2006/42; see our Appendix E

5/ Marking on the equipment (2006/42 – 1.7.3)

"I. – Each machinery must be marked visibly, legibly and indelibly with the following minimum particulars:

- a) The business and full address of the manufacturer;
- b) Designation of the machinery;
- c) The CE marking;
- d) The designation of series or type;
- e) The serial number if any;
- f) The year of construction, that is, the year in which the manufacturing process is completed. It is prohibited to predate or postdate the machinery when affixing the CE marking.

Furthermore, machinery designed and constructed for use in a potentially explosive atmosphere must be marked accordingly.

II. – Machinery must bear full information relevant to its type and essential for safe use. Such information is subject to the requirement set out in Section 1.7.1.

III. – Where a machine part must be handled during use with lifting equipment, it must be indicated legibly, indelibly and unambiguously."

APPENDIX E: Specification relating to documents and manuals to be provided with the equipment

1. Purpose

This appendix is intended to define the documentation to be delivered by the Contractor with the equipment (content, language, delivery schedule).

The documentation to be delivered by the equipment must meet current regulations.

The CEA-LETI / LETI specifications include the statutory requirements.

These obligations depend on whether the equipment is subject to the machine directive 2006/42 / EC.

2. Supply of an equipment item subject to machinery directive 2006/42/EC (e.g. 98/37/EC)

2.1. Regulatory obligations

2.1.1. Instruction manuals

The regulations describe all the elements relating to the instructions that must be supplied with the equipment (content, language etc.).

This information is included in Annex I to Directive 2006/42 transposed into French law (Annex I of Book II of the Labour Code)

Content

The instruction manual will be drafted in compliance with Paragraph 1.7.4. of this appendix and where applicable Paragraphs 3.6.3 (moving machines) and 4.4 (lifting systems).

2006/42 - 1.7.4 .2: Content of the instruction manual:

"Each instruction manual must contain, where applicable at least the following information:

- a) The business name and full addresses of the manufacturer;
- b) The designation of the machinery as marked on the machinery itself except for the serial number in compliance with Paragraph 1.7.3;
- c) The EC declaration of conformity or a document setting out the contents of the EC declaration of conformity, showing the particulars of the machinery, not necessarily including the serial number and the signature;
- d) General description of the machinery;
- e) The drawings, diagrams, descriptions and explanations necessary for the use, maintenance and repair of the machinery and for checking its correct functioning;
- f) A description of the workstation(s) likely to be occupied by operator;
- g) A description of the intended use of the machinery;
- h) Warnings concerning ways in which machinery must not be used that experience has shown might occur;
- i) Assembly, installation and connection instructions, including drawings, diagrams and the means of attachment and the designation of the chassis or installation on which the machinery is to be mounted;
- j) The instructions relating to installation and assembly for reducing noise or vibration;
- k) The instructions for putting into service and use of the machinery and, if necessary instructions for the training of operator;

- l) The information about the residual risks that remain despite the inherent safe design measures, safe-guarding and complementary protective measures adopted;
- m) Instructions on the protective measures to be taken by the users, including, where appropriate, the personal protective equipment to be provided;
- n) The essential characteristics of tools which may be fitted to the machinery;
- o) The conditions in which the machinery meets the requirement of stability during use, transportation, assembly, dismantling when out of service, testing or foreseeable breakdown;
- p) Instructions with a view to ensuring that transport, handling and storage operations can be made safely, giving the mass of the machinery and of its various parts where these are regularly to be transported separately;
- q) The operating method to be followed in the event of accident or breakdown; if a blockage is likely to occur, the operating method to be followed so as to enable the equipment to be safely unblocked;
- r) The description of the adjustment and maintenance operations that should be carried out by the user and the preventive maintenance measures that should be observed;
- s) Instructions designed to enable adjustment and maintenance to be carried out safely, including the protective measures that should be taken during these operations;
- t) The specifications of the spare parts to be used, when these affect the health and safety of operators;
- u) The following information on airborne noise emissions:
- the A – weighted emission sound pressure level at workstations, where this exceeds 70 dB (A); if this level is less than or equal to 70 dB (A), this fact must be indicated;
 - the peak C - weighted instantaneous sound pressure value at workstations where this exceeds 63 Pa (130 dB in relation to 20 μ Pa);
 - the A – weighted sound power level emitted by the machinery, where the A – weighted emission sound pressure level at workstations exceeds 80 dB (A)."

Language

"All machinery must be accompanied by instructions in French.

The instructions manual accompanying the machinery must be either an original instruction manual or a translation of the original manual in which case, the translation must be accompanied by the original instruction manual."
(Transposition of 2006/42 1.7.4)

"The instruction manual is drafted in French and may be in one or more official Community languages. The word original instruction manual must appear on the language version(s) verified by the manufacturer. Where no original instruction manual exists in French, a translation into this language must be provided by the manufacturer or by the person bringing the machinery into France. This translation must bear the words translation of the original instruction manual." **(Transposition of 2006/42 1.7.4.1)**

Consequently, the following will be provided:

- The instruction manual in its original version drafted in one of the EC languages, in any case
- The instruction manual translated in French (if the original version was drafted in another language than French) in the case where this obligation is incumbent upon the Contractor.

2.1.2. Maintenance manual

"By way of exception, the maintenance instructions intended for use by specialised personnel mandated by the manufacturer may be supplied in only one community language which the specialised personnel understand."
(2006/42- 1.7.4)

2.2. **Specific specifications at CEA/LETI**

Contractor shall mandatorily provide:

- The instruction manual as described in 2.1.1 and specified in 2.2.1.
- The maintenance manual as described in 2.2.2.
- A file of all elements that were tested and validated during startup and adjustments made in connection with facilities for each fluid. This file will also include factory tests and calculation sheet for parts of the facility used for their selection during design (heat exchangers, flow rates, sections of pipes that are inside equipment).
- These instructions should be delivered with the equipment except the installation section of the instructions which should be received by CEA-LETI / LETI, together with the Contractor's offer.

2.2.1. Instruction manual

The instruction manual shall correspond to the machine delivered and contain in particular the following chapters:

- Handling
- Assembly – Disassembly
- Installation
- Commissioning
- Adjustment
- Use
- Maintenance (1st level)

Handling

This chapter shall deal with the conditions for handling the equipment: lifting or bearing points, miscellaneous precautions to be taken during handling. It shall give indispensable information such as the weight in kilograms. It shall highlight the counter-indications such as for example shocks, tilting etc...

If the equipment is comprised of different parts, the same information shall be given for handling each part.

Assembly - Disassembly

This chapter shall specify if applicable the order of the operations, the precautions to be taken, and the tooling required.

Installation

This part shall contain all the specifications necessary for installation and connection of the machine on the CEA-LETI premises. A copy of this part shall be sent to the CEA/LETI/Department concerned, before the equipment is delivered. This chapter shall contain in particular the following information :

- For the equipment and its sub-assemblies: dimensions in mm, weight (in kg), dimensional drawing mentioning the connection points to the different networks.
- Environment required: dust content, hygrometry, vibrations, sensitivity to vibrations and electromagnetic radiation, extractions to be provided etc...
- Nature of the floor: resistance required with respect to the weight of the machine, flatness.
- Electricity: Voltage, Power, features of the power supply transformer if applicable.
- Pneumatics (compressed air): pressure, quality.
- Fluids: Type, pressure, flowrate, temperature, characteristics.
- Gas: Type, pressure, quality.
- Counter-indications for installation, nuisances introduced by the equipment.

All these parameters shall be accompanied by a tolerance.

Commissioning

Even if commissioning is performed by the Contractor, this chapter shall set out the procedure to be followed for commissioning of the equipment (prior checks, start-up procedure etc.).

Adjustments

A procedure shall be provided to perform tuning/adjustments within the scope of normal everyday use of the machine.

Use

This chapter shall contain:

- The conditions of use scheduled by the manufacturer.
- The definition of the workstation(s) occupied by the operator(s).
- A presentation of the equipment enabling identification of the different parts (photos, diagrams) explaining the function of each part, particularly of the control and safety means.
- A description of the running sequence of the operations performed by the equipment. All the processes available on the equipment shall be described along with the nature and influence of each "process" parameter.
- An operating mode describing the details of the operations to be performed to process a sample, a batch (for example). It shall contain the learning instructions.

CAUTION

In the case of an automatic machine, the operation mode shall not be limited to necessarily succinct description of loading/unloading of a sample or a batch (for example) but shall enable the parameters of the standard functions to be adjusted and the alarm messages to be understood.

In the case where man/machine dialogue takes place via keyboard + monitor or touch-sensitive screen, the following information provided by the manual shall enable :

- the general software architecture (maintenance part / engineering part / operator part for example) to be understood,
- navigation between the different parts,
- the parameters of a task performed by the machine and influencing the "process" (for example: speed, time, pressure, power etc.) to be adjusted, these operations falling within the scope of normal use of the machine in a research environment,
- the results or "process" running monitoring tables to be accessed,
- the alarm messages to be understood and interpreted.

To achieve this result, the manual shall reproduce the main tables displayed on the monitor. Each table shall be accompanied by comments on the actions to be performed, on the nature of the information given.

Maintenance

The object of this chapter is to enable troubleshooting to be performed and certain problems of low complexity to be resolved. It involves 1st level maintenance.

CAUTION

All the chapters of this manual shall be drafted integrating the safety warnings so that the operations described can be carried out without any risks.

This appendix is fully applicable even if supply of the equipment is accompanied by personnel training.

The potential users of this manual are technicians or engineers in charge of tuning the "processes". This shall be taken into account in the choice of the information supplied.

The equipment shall only be accepted after a detailed examination of the documents provided.

2.2.2. Maintenance manual

It shall contain :

- a presentation of the machine enabling the component parts to be located (photos),

- the interconnection diagrams between the different sub-assemblies,
- the electrical power diagrams, control diagrams, and interconnection diagrams between the different parts, the printed circuit board diagrams,
- the diagrams of the pneumatic and hydraulic circuits,
- the mechanical construction drawings (exploded views),
- the spare parts list,
- the specific documentation of apparatuses integrated in the machine such as automatic controllers, regulators, RF and micro-wave generators.
- the programs and programming tools associated to automatic controllers,
- the list of periodic checks to be performed,
- the list of preventive maintenance operations to be performed with the list of consumables associated with the operation,
- a troubleshooting guide,
- the access modes to the software maintenance parts, if applicable, and the back-up procedures.

3. Supply of equipment not subject to the machinery directive: Specifications of CEA/LETI

The special specifications of CEA/LETI [(§ 2.2)] of this document apply.

APPENDIX H: Datasheet for tool installation

The supplier must furnish a detailed Site Preparation Document summarizing all necessary requirements for the equipment's installation. This document must explicitly specify the demands for utilities, including, but not limited to, electrical power supply (voltage, phase, current, and required connectors), compressed air/nitrogen (pressure, flow rate, and connection fittings), and any other necessary supplies (water cooling).

APPENDIX I: Risk Identification Sheet

Please ensure you complete the provided template file, "Appendix_I.xlsx", with all required information and return it as a mandatory part of your final offer submission.

				DPFT			
APPENDIX I : Risk Identification Sheet							
EQUIPEMENT REFERENCE & NAME :							
REFERENCE OF SAFETY DOCUMENTS PROVIDED							
EC Compliance certificate		☐		Safety information and requirements in French ☐			
RISK IDENTIFICATION							
Chemical risk : ☐							
Product name	Physical state (solid, liquid, gas)	DANGEROUSNESS				Usage concentration	Usage temperature
		Flammable	Combustive	Irritant / Harmful	Sensitizer / Toxic / CMR		
Explosion risk : ☐							
Under-pressure elements (bulb, pressure tank, ...) :				Pressure :		Volume :	
Thermal risk : ☐							
Heating elements :				Temperature :			
Electrical risk : ☐							
Maximum voltage :				AC :		DC:	
Risk from ionising radiations : ☐							
Sealed radioactive material ☐		Presence of X-rays ☐		Open source radioactive material ☐			
Risk from non-ionising radiations : ☐							
UV ☐		Infrared ☐		High frequency ☐		Electromagnetic ☐	
Microwaves ☐		Permanent magnet ☐		Laser ☐ Category (1-2-3-4) :			
Risk from handling during maintenance: ☐							
Manual handling ☐		Mechanical handling ☐		Handling device :			
Other risks :							
Equipment internal detections :							
Fire detection ☐				Leak detection ☐			
Gas detection ☐				Extraction control ☐			
Comments :							

APPENDIX K: Pedestal specification

Please ensure you complete the provided template file, "Appendix_K.xlsx", with all required information and return it as a mandatory part of your final offer submission along the different requested documents.

 		
APPENDIX K : Template and Footprint		
EQUIPEMENT REFERENCE & NAME :		
Tool characteristics		
Dimensions (mm)		
Weight (Kg)		
Footprint/drawings file name Has to be provided at T0 including subeq		
Chassis specifications		
Template file name (.DWG) Has to be provided at T1-6 months (with weight repartition and all cut-off locations)		
Seismic brackets installation requested	Yes ☐	No ☐
Vibrations specifications		
Specific request		
Comments :		