SPECIFICATION SHEET

SUPPLY, INSTALLATION AND COMMISSIONING OF A COMPLETE HELIUM LIQUEFACTION SYSTEM, RANGING FROM RECOVERY, PURIFICATION, GAS STORAGE, LIQUEFACTION AND A COLLECTION NETWORK FOR THE LABORATORY OF THE INSTITUT DE CIÈNCIES PHOTONIQUES, THROUGH AN OPEN PROCEDURE SUBJECT TO HARMONIZED REGULATION

FILE NUMBER: 2025.SU.007

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CLAUSE 1. Object of the contract

The purpose of this contract is the supply, installation and commissioning of a "COMPLETE HELIUM LIQUEFACTION SYSTEM, RANGING FROM RECOVERY, PURIFICATION, GAS STORAGE, LIQUEFACTION AND A COLLECTION NETWORK" for ICFO's laboratory.

The types of items supplied are linked to the CPV (Common Public Procurement Vocabulary), **38000000-5** Laboratory, optical and precision equipment (except glasses).

CLAUSE 2. Needs to satisfy

Scanning Tunneling Microscopy (STM) is an important microscopy technique for physics, chemistry and general materials science. In an STM, a tunnelling current is measured between an atomically sharp tip and a sample. Through the scanning of the surface, information about the topography and the local density of states is obtained with atomic resolution. It enables understanding of the electronic properties of a material with atomic resolution. Logically, the STM is a common tool present in many national physical and chemical laboratories.

The STM installed in Icfo operate at millikelvin temperatures and under ultra-high-vacuum conditions to conduct research on two-dimensional materials. For this purpose, it is necessary the continuous consumption of helium due its thermodynamics properties, more or less around 10 helium liters/day.

In order to satisfy this requirement thinking in the sustainability and the lack of helium supplies, a complete installation for the recycling and liquefaction of the helium used in the STM is necessary. The system should include:

1.- Low pressure manifold to connect the recovery circuit (from the STM) to the recovery line.
2.- An atmospheric helium recovery gas bag with a volume around 8.5 m3 corresponding to and equivalent of 11 liters of liquid helium.
3.- A medium pressure helium recovery compressor (27.6 bar).
4.- A number of helium storage cylinders corresponding to and equivalent of 65 liters of liquid helium.
5.- An automatic helium purifier to reach at least a 99.995% of purity.
6.- Liquefaction plant to guarantee a production capacity at least of 40 liters/day.
7.- A 350 liters liquid storage dewar.
8.- Accessories for regeneration, and all the connection lines and fittings between the components.

CLAUSE 3. Technical requirements

1.- Low pressure manifold.

The manifold should be equipped with 5 Aeroquips® that will be used to collect helium from different sources and send it to the helium recovery bag: 2 3/4in male, 2 1/2in male and 1/4in male.

2.- Helium recovery gas bag.

The atmospheric recovery gas bag should have around 8.5 m3 of helium gas (equivalent storage of 10 liters of liquid helium). In order to fit in Icfo's installation site the size should be around: 3.5 m diameter and 2.5 m length. The gas bag should be equipped with a cross connector with a 50-mbar safety valve and a level measurement sensor to control the high or low threshold signal to start or turn off the medium pressure helium compressor. Finally, the gas bag should be installed also on an aluminium structure.

3.- Medium Pressure helium Compressor.

The helium compressor used to compress the helium gas from the recovery bag should work at "medium pressure" around 27 bar and be refrigerated by air. It will refill the helium storage cylinders.

4.- Medium pressure storage cylinders.

The supplier should provide the number of storage cylinders suitable according the liquid helium production requirement and the medium pressure compressor working conditions.

The cylinders should be cleaned and degassed, ready to be used for pure helium storage, connected to each other with a stainless-steel pipe and through a pipe with the compressor and the automatic purifier.

The line between the purifier and the storage has to be equipped with a pressure regulator and sensor.

5.- Automatic helium purifier.

The Helium Purifier is used to purify the Helium gas stored Medium Pressure recovery circuit prior to liquefaction. The purity level should be controlled by an internal analyser which authorizes or not the gas supply to the liquefaction plant. The purification rate required should be 0 – 55 liters / min and the output helium purity 99.9995%.

6.- Liquefaction plant.

The liquefaction plant is used to obtain the liquid helium from the gas after its purification. It should guarantee a liquefaction capacity ≥40 liters/day at 4.42K with a standard setting of 3 PSIG (200 mbar) from room temperature Helium vapors. It should be continuous at 3 PSIG and is not limited or stopped during transfers.
The helium liquid should be stored in a 350 liters (at least) dewar.

7.- Recovery Line.

The pipe from the STM lab to the helium liquefaction installation will be supplied by Icfo, but the materials used and properties and requirements should be provided by this tender participant.

CLAUSE 4. Power distributions and safety

- The system should be configured for EU (Spain) power grid (voltage, sockets, etc.) and be CE marked.
- The system will be fully protected against unexpected power cuts and, in that case, will be fully safe for the operators. A quick and easy turning on of the system has to be possible after a power cut.

CLAUSE 5. System layout and services

- The proposal will include a complete set of pictures, drawings and layouts of the system, including dimensions, location and details of the different components.
- The proposal **will include full installation and start-up requirements (Unpack all system components; Assembly; Pump; Run system to helium liquid production ratio; During**

the installation process, instruction should be provided on proper procedures for operation and maintenance of the system), clearly specifying connection type, tubing materials, pressures, flows, etc, for the specific configuration of the offered system.

- A set of documentation should be delivered in English and Spanish including the following topics:
    - Installation and operating instructions for whole installation specially the purifier and the liquefier
    - Performance report for the liquefier
    - CE certificates of conformity
    - Description of the main preventive maintenance tasks
    - Manuals of every component.

CLAUSE 6. Transportation, installation, start-up and training

- The proposal will include transportation to ICFO's facilities including insurance and all export/import and customs duties. **DAP incoterm will apply.**
- The machine will be placed in the selected location by ICFO. Contract winner will cover all costs, organization and coordination of machine placement, including any required specialized equipment or vehicle, and any required component disassembly and reassembly for system unloading and transportation inside the building to the target lab location.
- Onsite system startup included followed by the acceptance tests specified below.

CLAUSE 7. Warranty and Follow-on Support

- **1-year Full Warranty** on all parts and components of the system irrespective of the manufacturer. The warranty will include the replacement of any faulty or damaged part(s) during normal use of the system, no matter the manufacturer of the component(s). It will cover any cost related with the disassembly, transportation, reparation and re-assembly of the damaged component(s), including all travelling and living costs of the required service engineer(s). An on-site repair, or a justified alternative to reduce the system down time to the minimum, will always be the first service option. A team of properly qualified and skilled service engineers will have to be available.

CLAUSE 8. Training

- System training to ICFO personnel included. The number of training days and approximate schedule will be specified in the proposal.

CLAUSE 9. Delivery and Installation Time

The system must be delivered and installed at ICFO within a maximum period of **30 weeks**.

Delivery time is defined as the time elapsed since the PO until the system delivery at ICFO facilities. It includes the manufacture of the system, the transportation, the installation and the acceptance test at ICFO's premises.

CLAUSE 10. Target price

- The target price for the system is 375.600,00 € (VAT excluded).
- Payment terms:
    - Payment on order - 30% total price
    - Payment on delivery - 50% total price
    - Payment on commissioning and training - 20% total price

Castelldefels, on the date of its digital signature

Prof. Dr. Carmen Rubio Verdú
GL STM on 2D quantum materials