

HELIUM PURIFIER AND LIQUEFIER

DAI003.069

UPDATES

DATE	REVIEW	PAGES CHANGED	KEY CHANGES

1 OBJECTIVE

This specification defines the operational parameters for the purchase and installation of a helium liquefier and purifier.

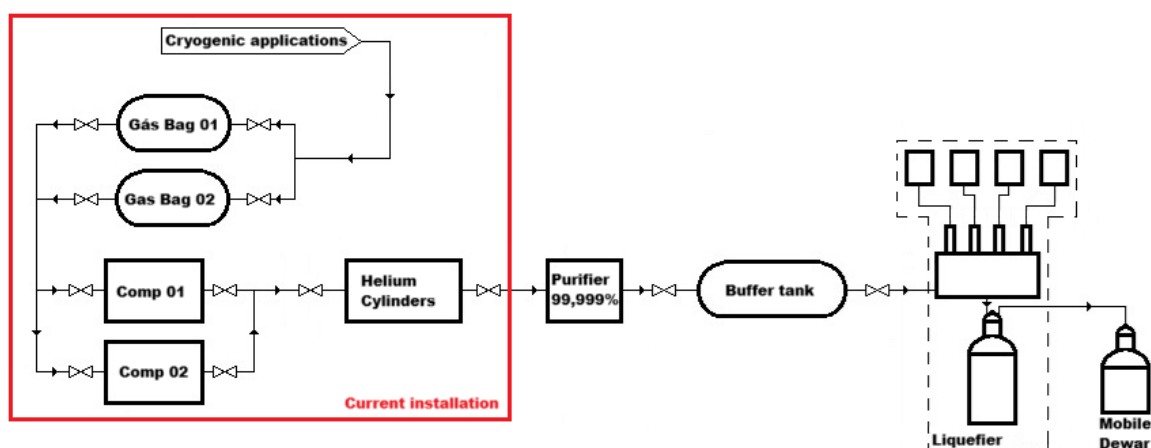
2 OUT OF SCOPE

2.1 CNPEM has in operation a recovery system where all helium boil-off from cryogenic application is recovered and pressurized at 180 bar.g and purified with 98% (see attached 1). The plant detailed in the attached 1 is out of scope of this specification.

3 Scope

3.1 Purifier

3.1.1 The purifier described in this specification will be installed between the helium cylinders and input of liquefier as indicated in picture 1.



Picture 1

3.1.2 The supplier can use liquid nitrogen as a trap for impurities.

3.1.3 The purity of gas output must reach 99,999%. The supplier shall inform, if the gas analyser is included in the proposal.

3.1.4 The helium gas flow rate must be no less than 10 m³/h.

3.1.5 The supplier shall inform if the heater is included on the purifier.

3.1.6 The supplier shall inform us of the time for regeneration.

3.1.7 The supplier shall inform if the vacuum pump is included for regeneration of the purifier.

3.1.8 The supplier shall inform in the proposal if the purifier has only one adsorber and stops the helium gas supply for liquefier, or if the purifier has a double adsorber without interruption of helium gas during the regeneration.

3.1.9 The supplier shall inform all details necessary to integrate the purifier as indicate bellow but not limited to:

- type and size of input connection,
- type and size of output connection,
- operation pressure of input and output,
- any other aspect recommended by supplier.

3.1.10 The purifier shall be able to control all operation parameters. The operator must be able to easily define the operational parameters through an HMI.

3.2 Liquefier

3.2.1 The liquefaction capacity of 80 liters/day.

3.2.2 The liquefier must be expandable, and the supplier shall inform us what the maximum capacity is after reconfiguration.

3.2.3 The liquefier shall be plugged and play type.

3.2.4 The supplier shall consider in the proposal all necessary accessories required for routine operation.

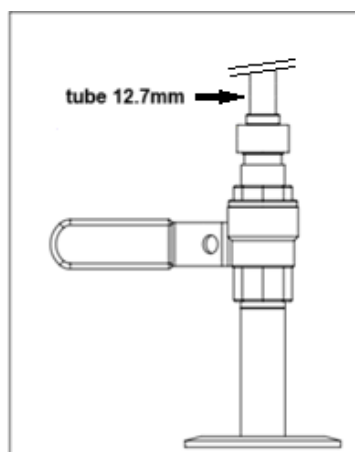
3.2.5 The compressors for the cryocoolers shall be water cooled.

3.2.6 The supplier shall inform in the proposal the cooldown time of the liquefier.

3.2.7 The supplier shall consider in the proposal a fixed dewar coupled to the liquefier with:

- Level sensor,
- Pressure regulator of helium,
- Safety devices,
- Interface to connect it to another mobile dewar. The standard

CNPEM connection is a tube of 12.7mm, as indicated in picture 2.



Picture 2

3.2.8 The liquefier shall be able control pressure autonomously with precision regulators while transferring to another mobile dewar, without the necessity use of helium gas. The operator must be able to easily define the pressure set point through an HMI.

3.2.9 The supplier shall inform all details necessary to integrate the liquefier as indicate bellow but not limited to:

- type and size of input connection,
- type and size of output connection,
- operation pressure of input and output,
- any other aspect recommended by supplier.

3.2.10 The supplier shall inform us of all connections necessary to integrate the current installation (picture 1 and attached 1) and liquefier.

2.2.11 The supplier shall inform us of all operational and maintenance procedures. The parameters defined by operator and visualization of the instrumentation must be available in the HMI.

3.3 Control System

3.3.1 The control system should be fully automated using an industrial PLC, and the manufacturer of the PLC must be validated by CNPEM.

3.3.2 The program shall be done by IEC 61131-30, and CNPEM must have full access to the commented program and automation logic with no restrictions.

3.3.3 Communication between automation modules should preferably be done using the PROFINET protocol.

3.3.4 The automation of the liquefier/purifier must consider interface signals with the helium recovery system made by CNPEM. Input and output signals, digital and analog.

3.3.5 All variables relevant to automation and others requested by CNPEM must be available through an OPC UA server embedded in the control PLC.

3.3.6 It is recommended that the layout adhere to ANSI/ISA 101 standards. The HMI must have user-level authorizations and restrictions.

3.3.7 The purifier and liquefier (CLP and IHM) must have remote access.

3.3.8 In case of power shutdown, the liquefier should be prepared to smoothly go to a stand-by mode. The start-up must be carried out by the operator.

3.4 Deliverables

3.4.1 The supplier can start manufacturing when CNPEM confirms receipt the following documentation:

- Diagram P&ID of purifier and liquefier integrated with the current installation,
- The fixed dewar data sheet,
- Operation manual of purifier and liquefier,
- Maintenance procedures of purifier and liquefier.

Remark: CNPEM will consider as a differential supplier, that provide all maintenance that permit CNPEM operates autonomously.

3.5 Factory Acceptance test

3.5.1 CNPEM will approve the FAT since receiving the documentation with the results of the tests:

- the cooldown of liquefier,
- liquefaction capability,
- pressure regulation of fixed dewar to a mobile dewar,
- HMI functionality with instrumentation measurement of purifier and liquefier,
- the flow and purity of helium from purifier.

Remark: the instruments used during the tests of liquefier and purifier, shall be certificated.

3.6 Site Acceptance test

3.6.1 CNPEM will approve the SAT since receiving the documentation with the results of the tests:

- Integration of purifier e liquefier receiving helium with purity of 98% from current installation, and liquefying helium with the data obtained in the FAT.
- Verification of purifier and liquefier operation with remote visualization.

3.7 Warranty

3.7.1 The supplier shall inform the terms of warranty in the proposal.