

## Project Overview

As part of the UK's in-kind contribution to the European Spallation Source (ESS) project, STFC Daresbury Laboratory are committed to perform qualification tests and delivery of 84 (+ 4) high- $\beta$  dressed cavities by the end of June 2020. The Vertical Test Facility (VTF) in which these cavities will be tested requires a Helium Plant capable of producing superfluid helium at 2K with a warm gas recovery system. The warm gas recovery system will manage the recovery of gas from the return of the Cryostat to either medium or high pressure storage or a combination of both.

This specification details the requirements for the supply of two pressure vessels suitable for storage of helium gas, one for medium pressure use (SOL 16 bar) and one for high pressure use (SOL 42 bar).

**In order to submit an offer for this tender, a prior site visit is essential to fully assess the requirements.**

This document is presented in the following sections:

- Section 1 – Project Overview
- Section 2 – Key Requirements
- Section 3 – Defines the build standards required by Daresbury Laboratory

## Key Requirements

### Pressure Vessel Specification – Medium Pressure (Quantity of 1)

- Pressure vessel must be designed and constructed in compliance with EN 13445 "Unfired pressure vessels"
- Suitable for safe operation at vacuum and positive pressures up to and including 16 Bar (0-17 BarA)
- Suitable for external use in UK (external temperature range -20°C to +40°C)
- Suitable for Class 2 gas usage.
- Volume of 40,000 litres
- Internal protection against corrosion shall include a suitable paint or epoxy finish and must be oil free.
- Externally painted with Epoxy based paint (or equivalent) for UK weather resistance
- Pressure Vessel shall be of vertical construction
- Pressure vessel shall be supplied with suitable pressure relief valve for helium use
- Pressure Vessel shall have flanged fill connection size DN50, set at ~1m height from feet.
- Pressure vessel shall be supplied with suitable pressure relief valve for helium use. Maximum flow rate from compressor to this vessel is 44.3 g/s which is already dealt with by an existing pressure relief valve connected to the helium compressor. Therefore the pressure vessel relief valve should be sized to deal with normal gas expansion due to external temperature variations.
- Pressure vessel shall be supplied with drain connection (bottom of tank).
- Pressure vessel shall be supplied with suitable pressure relief valve for helium use.
- Pressure Vessel shall be supplied with suitable pressure indication gauge for helium use.

## Pressure Vessel Specification – High Pressure (Quantity of 2)

- Pressure vessel must be designed and constructed in compliance with EN 13445 "Unfired pressure vessels"
- Suitable for safe operation at vacuum and positive pressures up to and including 42 Bar (0-43 BarA)
- Suitable for external use in UK (external temperature range -20°C to +30°C)
- Suitable for Class 2 gas usage.
- Volume of 10,000 litres
- Internal protection against corrosion shall include a suitable paint or epoxy finish and must be oil free.
- Externally painted with Epoxy based paint (or equivalent) for UK weather resistance.
- Pressure Vessel shall be of horizontal construction.
- Pressure vessel shall be supplied with suitable pressure relief valve for helium use
- Pressure Vessel shall have flanged fill connection size DN50, set at ~1m height from feet.
- Pressure vessel shall be supplied with suitable pressure relief valve for helium use. Maximum flow rate from compressor to this vessel is 11.2 g/s which is already dealt with by an existing pressure relief valve connected to the helium compressor. Therefore the pressure vessel relief valve should be sized to deal with normal gas expansion due to external temperature variations.
- Pressure vessel shall be supplied with drain connection (bottom of tank).
- Pressure vessel shall be supplied with suitable pressure relief valve for helium use.
- Pressure Vessel shall be supplied with suitable pressure indication gauge for helium use.

## Build Requirements

The following build standards and procedures will be observed:

### Standards and legislation

- Pressure vessel must be designed and constructed in compliance with EN 13445 "Unfired pressure vessels"
- Compliance with Pressure Equipment Directive (PED) 97/23/EC and shall be CE Marked.

### Threaded Joints

- Are only to be used for drain and pressure relief ports.
- Threaded joints are not permitted at sizes larger than DN20.

### Flanged Joints

- Flanged joints are to be sealed with gaskets suitable for use with high purity helium gas
- Flanged joints are only to be used at interface with equipment connections and inspection ports.

DARESBURY LABORATORY

Department ASTeC

Project ESS High Beta Cavity Testing – Pressurised helium gas storage vessels

Description Technical Specification

## Pressure Testing

Storage vessels are to be pressure tested to 1.5 x the stated Safe Working Pressure using nitrogen gas as the test medium. The holding time is to be at least 30 minutes. The manufacturer is to supply test certification.

### Acceptable leak rates:

- Pipelines & welded joints  $< 1 \times 10^{-6}$  mbar l/s – conduction single leak
- Flanged Joints  $< 1 \times 10^{-4}$  mbar l/s – conduction single leak
- Pressure relief valves  $< 1 \times 10^{-4}$  mbar l/s – conduction single leak
- Threaded Joints  $< 10^{-2}$  mbar l/s – conduction single leak

## Vacuum Testing

Pressurised helium gas storage vessels are to be designed to be suitable to be evacuated to a pressure less than 1mb as part of normal system operations.

### Acceptable leak rates:

- Welded joints  $< 1 \times 10^{-6}$  mbar l/s – conduction single leak
- Flanged Joints  $< 1 \times 10^{-4}$  mbar l/s – conduction single leak
- Pressure relief valves  $< 1 \times 10^{-4}$  mbar l/s – conduction single leak
- Threaded Joints  $< 1 \times 10^{-2}$  mbar l/s – conduction single leak