

1. Introduction

The use of pressure vessels at the Australian Centre for Neutron Scattering (ACNS), typically as sample cells charged with gas, is strictly controlled and the vessels used must comply with the requirements of AS1210 or equivalent internationally recognised pressure vessel code.

This document covers pressure cells with volumes of up to 30 cubic centimetres. Larger vessels may require further considerations to be made, please contact the Sample Environment (SE) and Engineering & Capital Programs (E&CP) groups for advice about this.

The process to gain approval may take a considerable amount of time dependant on complexity of proposed equipment and quality of documentation submitted to support design and manufacture compliance to AS1210 or equivalent. Therefore it is in the best interests of users to ensure that the approval of pressure vessels is addressed well in advance of any experiments to be performed, and before scheduling of beam time.

Please contact the following people as early as possible to supply information about the vessel to be used, and the description of the proposed experiment, including details about the sample to be investigated, and the environment (temperature, pressure, type of gas, duration of experiment):

- Sample Environment (SE) group leader Paolo Imperia (Paolo.Imperia@ansto.gov.au)
- SE officers Stan Lee (Stanley.Lee@ansto.gov.au) and Andrew Manning (Andrew.Manning@ansto.gov.au)

The scheduling of neutron experiments may need to be altered to ensure that enough time is available to complete the approvals process, so as much detail about previous testing and approvals of vessels as possible should be provided to ensure that experiments are not delayed.

Section 2 of this document details how new pressure vessels can be designed in conjunction with the ECP team at ANSTO to ensure that the vessel will be approved for use.

Pre-existing vessels may also gain approval from the ECP team, by either providing sufficient documentation to allow the vessel to be certified (see Section 3), or by submitting the vessel for further testing by the ECP team (see Section 4). Finally, several checks must be performed on approved vessels before use, as described in Section 5.

The use of pressure vessels may be subject to the completion of and adherence to a Safe Work Method Statement (SWMS) document – please contact the sample environment group for advice about this.

A decision on approval will typically be provided within 4-6 weeks from receiving a complete application if it is inclusive of all documentation listed in Section 3. It will take longer if documentation or requested information is missing or inadequate. Upon receiving an application users will be notified if further documentation or information is required.

Pressure range over which approval can be sought: If the difference in pressure between the inside and outside of the vessel is no more than 50 kPa, then the vessel is not considered to be a pressure vessel. Otherwise, it will be considered to be a pressure vessel. Note that the outside of the vessel may either be at atmosphere (101.33 kPa absolute) or vacuum (0 kPa absolute). Approval can be sought for gases at pressures of between 0 MPa absolute (vacuum) to 20.1 MPa absolute at room temperature, which for an isothermally compressed ideal gas equates to a stored energy of 3.2 kJ (0.76 g of TNT).

Approval for pressures above 20.1 MPa absolute may be possible upon consultation with the SE and ECP groups, provided that the stored energy of the compressed gas is no greater than 3.2 kJ.

For gases at temperatures above room temperature (at temperature T), the pressure limit must be lowered accordingly, where the stored energy at room temperature (300 K) is no greater than $300 K/T \times 3.2$ kJ. Approval for using pressure vessels at temperatures above ambient is at the discretion of the SE and ECP groups, and is dependent on the material composition of the vessel and the type of gas used.

Gas species: Explosive, corrosive, and toxic gases have special requirements for use which must be discussed with the Sample Environment group prior to the experiment. Note that a SWMS may need to be completed in this case.

2. Fabrication of new pressure vessels

Ideally, new pressure vessels should be designed and fabricated in collaboration with ANSTO to ensure design/manufacture/test requirements are met. Please note that assistance with designing and drafting can be provided by the ECP and SE groups upon request. Fabrication and testing can also be arranged through ANSTO. Please contact the SE group for advice about these processes, including costs and expected completion time.

3. Documentation to be provided which does not lead to further testing being required

Below is a list of documentation that is standard practice for pressure vessel design and manufacture. Providing all the following documents for new or pre-existing pressure vessels will minimise approval time and eliminate the need for additional tests to be performed by ANSTO. These documents, which must be in English or supplied with an accurate translation, include:

- A complete technical drawing of the pressure vessel including cross sections, design code/class, dimensions/thicknesses, materials and their specifications (including any fasteners used), weld details, min/max design pressure and temperature, volume, fluid, test pressure, relief valve specifications.
- Calculations to demonstrate compliance of the vessel design to AS1210 or similar pressure vessel code (eg. ASME, PD5500, AD2000).
- Equivalent of AS 4458 Manufacturers Data Report (a conformity certificate certifying that the manufactured vessel complies to the design drawing and with the design/manufacture/test requirements of the code used).
- Material certificates.
- Weld procedures (if welded).
- Weld inspection reports (if welded) – eg. x-ray radiography.
- Dimensional inspection report.
- Pressure/vacuum and leak test reports.
- Identification engraved on the equipment – drawing number and serial number.
- Relief valve test certificate (unless supplied by SE group).
- Details of proposed operating procedures, and proposed operating conditions including fluids/chemicals used, minimum/maximum pressures and temperatures, number of pressure cycles, experiment duration.
- Plant hazard risk assessment (with assistance from SE group) in addition to a SMWS if deemed necessary after consultation with the SE group.

If the pressure vessel is a commercially proven “off the shelf” item from a reputable manufacturer rather than a custom design, providing the following documents will simplify the approvals process:

- Documentation to demonstrate that the equipment is commercially proven equipment available “off the shelf” (e.g. published catalogues/website, with references to model numbers, engineering drawings, specifications, design/manufacture/test code certification).
- Engineering drawing from the manufacturer stating the recognised code/class of design/manufacture/test that the equipment conforms to, design ratings of the equipment.

Further notes:

- If an existing cell is being reused, provide details of previous operating history including maximum pressure and temperature, fluids used in the cell, number of pressure cycles.
- If there is any doubt with the documentation provided, condition or history of new or previously used cells ANSTO will recommend additional tests or manufacture of new cells.

4. If further testing is required

If sufficient documentation as described in Section 3 cannot be provided for a pre-existing vessel, the vessel must be submitted to the ECP team at ANSTO for examination and testing to confirm that the vessel as completed has been manufactured to suitable standard. The costing and expected completion time should be discussed with the ECP team beforehand. Tests performed may include:

- Dimensional inspection.
- X-ray fluorescence (XRF) testing to confirm materials of manufacture.
- If welded, radiographic assessment to confirm welding quality.
- Pressure test, to >1.5x design pressure, or by agreement if such a test cannot be performed.
- For small cells, multiple cells may be manufactured and a sample burst tested.

5. Required checks to be performed for approved pressure vessels before use

During setup/commissioning on the beamline SE group will carry out the following checks:

- Visual inspection of all parts.
- Check that the serial number of the vessel matches the supplied documents.
- Leak test of final assembly.
- If appropriate, availability of pressure relief valve set at designated pressure.

End of User Instruction