

Approval process for use of pressure vessels at ACNS

The use of gas pressure vessels at the Australian Centre for Neutron Scattering (ACNS) is strictly controlled, and the vessels used must comply with the Australian Standard for Pressure vessels AS1210 (or an equivalent internationally recognised pressure vessel code). This document aims to help visiting scientists gain approval for the use of small pressure vessels containing up to 20.1 MPa absolute.

Which pressure vessel components require approval?

Any components which are used to maintain a pressure differential of at least 50 kPa (including vacuum vessels) must conform to AS1210. Custom-made components must be approved by the Sample Environment group in ACNS and the Pressure Vessel Approvals Officer in the Engineering and Capital Projects (ECP) group. This includes any welded, forged, brazed or cast metal vessels; non-metal vessels; interfaces with external piping such as threaded joints, flanges or other sealing surfaces; non-pressure components critical to the integrity of the vessel such as supports or lifting points; and protection devices such as relief valves or temperature controls.

Off-the-shelf commercially manufactured components may not require such an extensive approval process, and should be discussed with the Sample Environment group (sample_environment@ansto.gov.au).

Please contact the Sample Environment group if clarification of the scope of such approvals is required.

For what conditions can approval be sought via this process?

If the difference in pressure between the inside and outside of the vessel is more than 50 kPa, then the vessel is considered to be a pressure vessel. Note that the inside or outside of the vessel may either be at atmosphere (101.33 kPa absolute) or vacuum (0 kPa absolute).

This document applies for vessels up to 30 cubic centimetres in volume. This approval process may also be possible for larger vessels, at the discretion of the SE and ECP groups.

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 a temperature T above room temperature (300 K), the pressure limit must be lowered accordingly. 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. In this case, the stored energy at room temperature must remain less than $300 \text{ K} / T \times 3.2 \text{ kJ}$.

Explosive, corrosive, and toxic gases have special requirements for use which must be discussed with the Sample Environment group prior to the experiment, and a risk assessment (SWMES) may need to be completed.

What is required to gain approval for a pressure vessel?

The proposed experiment including the use of pressure vessels will be reviewed for safety and regulatory requirements. It is likely that a risk assessment (SWMES) involving your Local Contact or Instrument Scientist and the Sample Environment group will be required in addition to the below documentation.

Documentation required for approval of custom-designed vessels

The approval process for custom-designed pre-existing pressure vessels require the following documents to be provided in English (or supplied with an accurate translation):

- A complete technical drawing of the pressure vessel conforming to a design code including all dimensions, materials, weld details, design pressure and temperature ranges.
- Calculations to demonstrate compliance of the vessel design to AS1210 or equivalent (ASME, PD5500, AD2000).
- Manufacturers Data Report AS4458 or equivalent to certify conformity of manufacture and test requirements.
- Material certificates.

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- Details of welding procedures and a weld inspection report according to AS3992 or equivalent.
- Pressure/vacuum and leak test reports.
- Identification engraved on the equipment (drawing number and serial number).
- Relief valve specifications and test certificate (if applicable).
- Details of proposed operating procedures and conditions including fluids/chemicals used, minimum/maximum pressures and temperatures, number of pressure cycles, and experiment duration.
- 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.

ANSTO will recommend additional tests or manufacture of new cells if there is any doubt with the documentation provided or the condition or history of new or previously used cells. The scheduling of neutron experiments may need to be altered 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.

What if there is not enough documentation to approve the vessel?

If sufficient documentation as listed above 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 has been manufactured to AS1210 or equivalent. The costing and expected completion time should be discussed with the ECP team beforehand. Tests performed may include:

- Dimensional inspection.
- X-ray fluorescence testing to confirm materials of manufacture.
- Radiographic assessment to confirm welding quality (if applicable).
- Pressure test, to >1.5x design pressure, or by agreement if such a test cannot be performed.
- Burst testing if multiple vessels are available

During setup/commissioning on the beamline the sample environment team 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, installation of a pressure relief valve.

I would like to develop a new pressure vessel to use in an upcoming experiment

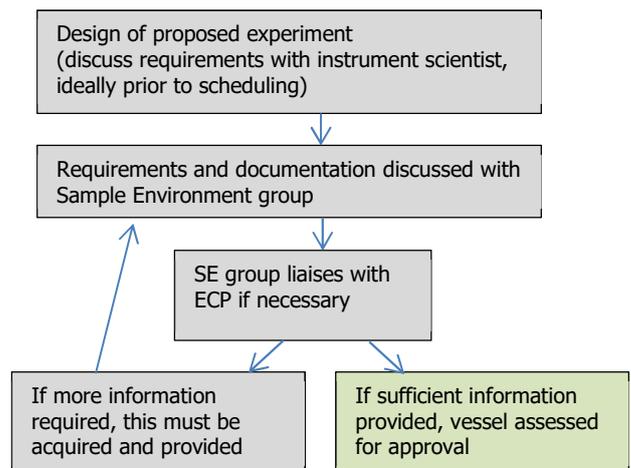
New pressure vessels should ideally be designed and fabricated in collaboration with ANSTO to ensure that the design and manufacture meets pressure vessel requirements. Please note that assistance with designing and drafting can be provided by the ANSTO engineering group and ACNS sample environment group 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.

My pressure vessel is an off-the-shelf item

If the pressure vessel is a commercially proven off-the-shelf item from a reputable manufacturer rather than a custom design, providing the following documentation to demonstrate that the equipment adheres to AS1210 or equivalent will simplify the approvals process:

- Published catalogues/website with references to model numbers
- Engineering drawings
- Specifications
- Design/manufacture/test code certification
- Design ratings of equipment

Process to seek approval



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How long will approval take?

The process to gain approval may take a considerable amount of time dependent 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 researchers to ensure that the approval of pressure vessels is addressed well in advance of any experiments to be performed, and ideally before the scheduling of beam time. Please contact the Sample Environment team as early as possible.

A decision on approval will typically be provided within 6 weeks from receiving a complete application if it is inclusive of all documentation listed above. 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.