



Procedure: Compressed gas cylinder safety

Purpose

The purpose of this procedure is to outline minimum requirements for the safe use and storage of all types of compressed and liquefied gas cylinders, including emergency situations at the Australian National University (ANU) to ensure compliance with the *Work Health and Safety Act 2011 (Cth)*, the *Work Health and Safety Regulations 2011 (Cth)* and the University Work Health & Safety (WHS) Management System. This procedure is linked to the Australian National University's Work health and safety policy and is one of the safe work procedures within the WHS Management System.

Definitions

(Compressed) gas cylinder - is any type of cylinder specifically designed to contain gases under pressure of greater than one atmosphere, and having the capability of dispensing the gas by means of a control valve mechanism.

Procedure

Scope

1. This procedure applies to compressed gas cylinders that are under the control of the University, and are used and operated by staff members and students.
2. This procedure is not applicable to fire extinguishers, portable pressurised cylinders (i.e. aerosol or spray cans) nor any privately owned and operated compressed gas cylinders not under the control of the University.

General requirements

3. Each College, Research School or Service Division will implement the requirements of this procedure to ensure the safe use and storage of gas cylinders under the control of the local area and assign a responsible person for maintaining an up-to-date inventory of all gas cylinders.
4. The inventory will include information on the type, quantity and location. A copy of the inventory will be available on the Electronic Records Management System (ERMS) and/or MAXIMO or equivalent asset management system, and on their respective intranet site. Note: This inventory may also be created in Chemical Management System (CMS) where applicable.

Responsibilities

5. The College Dean, Research Schools or Service Division Director (or nominated person) is responsible for:

- maintaining an inventory of all gas cylinders within the work or building space or those used by the local area;
- ensuring appropriate inspection activities occur for all gas cylinders prior to being accepted from the vendor;
- ensuring gas cylinders are stored in accordance with minimum requirements;
- ensuring gas cylinders are used only for their intended purpose and handled by appropriately trained workers;
- ensuring all gas cylinders are transported in a safe manner;
- developing and implement emergency response procedures that provide appropriate coverage for leaking gas cylinders and other foreseeable emergencies; and
- ensuring the provision of appropriate training for those workers who use or handle gas cylinders.

6. Workers are responsible for:

- using gas cylinders only for their intended purpose; and
- maintaining currency of training required to undertake work with compressed gas cylinders.

Acceptance criteria

7. All gas cylinders will be inspected before being accepted from the approved vendor. Inspection criteria will include as a minimum:

- damaged gas cylinders will not be accepted;
- corroded or leaking cylinders will not be accepted;
- presence of cylinder caps; and
- proper labelling of cylinders and connection points.

Storage

8. As a minimum, the following requirements apply:

- no storage allowed in exit or egress routes, damp areas, within 3m of corrosive chemicals, fumes, heat, or flammable/combustible substances;

- all gas cylinders will be stored in well ventilated areas with an incombustible floor. Storage in basements, wells and within 3m of sewers is not allowed;
- storage areas exposed to vehicle traffic will be protected by barriers;
- all storages areas will be provided with an incombustible roof to protect from heating by sunshine; roofs will be constructed in such a way that gasses cannot accumulate underneath;
- full and empty cylinders will be stored separately where possible;
- cases of different hazard classes will not be stored together - Flammable gases will be separated from oxidizing gases by at least 6m or by a 1.5m high fire wall (at least 30 minutes resistance);
- gas cylinders will be stored in the upright position and secured with a bracket affixed to the wall (or equivalent chain may be used where brackets unavailable) between midpoint and shoulder. Exception of LPG Forklift Cylinders in use;
- gas cylinders will be capped when not in use or attached to a system;
- all storage areas will be periodically inspected at least annually;
- storage areas of gas cylinders and trolleys for gas cylinders will be clearly indicated on the site's emergency plans with details of type and maximum contents;
- trolleys for gas cylinders will always be returned to a safe storage area at a fixed location as indicated on the emergency plan, at the end of the work day or shift;
- cylinders should only be stored in areas where water cannot accumulate as this may cause corrosion to the cylinder base;
- storage areas for flammable/combustible gases are designated and clearly signposted with "no smoking" and free from other ignition sources; and
- cylinders such as those used on BBQs shall not be stored indoors.

Maximum permissible amounts in buildings

9. In terms of storage, the total dangerous goods load will be the combination of all cylinders whether empty, full, or in use (a cylinder is defined as in use if it is connected to a system, including standby cylinders).

10. Storage of gases in cylinders, in quantities not exceeding those in Table 1 below shall be classified as minor storage.

11. It is recommended gas cylinders are stored outside buildings in caged compounds with the gas piped into the building. An exemption may apply where a hazard assessment is completed that lists appropriate control measures.

Table 1: Maximum aggregate water capacity of gas cylinders per 200 m² of floor space.

CLASS OF GAS	MAX, AGGREGATE WATER CAPACITY, LITRES
Flammable	500
Non-flammable, non-toxic, aerosol	2000
With a class 5.1 subsidiary risk, oxidisers	1000
Toxic gases, corrosive, acute	50

12. Where gases of mixed classes are kept in minor storage (noting storage requirements above), the aggregate quantity of all gases shall not exceed 2000 L and the quantity of each gas shall not exceed that given in Table 1 above.

Handling and use

13. As a minimum, the following requirements apply:

- gas cylinders will only be handled by properly trained personnel;
- gas cylinders will be transported secured in an upright position and with secured caps; they will not be rolled, dragged, or physically carried. Hand trolleys will be provided for safe transportation;
- locate cylinders where they will be protected from physical damage by striking or falling objects, corrosion or tampering;
- defective gas cylinders will not be used (e.g. leaking cylinders, corroded valves, stuck caps or valves, etc.); they will be isolated, tagged as damaged and will be returned to the supplier for repair/replacement;
- gas cylinders will be used in well ventilated areas; use in basements is not permitted;
- gas cylinders will not be used inside confined spaces;
- gas cylinders will be secured with a chain (or equivalent) between midpoint and shoulder or their stability otherwise guaranteed (e.g. manpower, design & construction);
- filling of small bottles from bigger cylinders will not be allowed in storage areas;
- engineered boxes/cages/trolleys/carts are mandatory for transport;

- rotate stock on a first in, first out basis as good practice; and
- gas cylinders shall not be lifted by a crane unless secured in a suitably engineered cage designed for cylinder transport.

Leaking gas cylinders and other emergencies

14. Each College, Research School or Service Division will implement emergency response procedures covering leaking gas cylinders and any other foreseeable emergencies. As a minimum, the following requirements apply:

- verification in case of a suspected minor leak; a competent person may attempt to stop the leak, e.g. by tightening valve gland or packing nut;
- moving the leaking gas cylinder to an isolated, well ventilated area – if safe to do so; posting hazard signs and contacting the supplier; and
- in case of a major leak where moving the gas cylinder is not possible: evacuation of the area, securing entrances and contacting emergency services.

15. Potential emergencies may include but are not limited to:

Cylinders on fire

16. In the event a cylinder catching fire, the following requirements are advisable as a minimum:

- if safe and trained to do so, extinguish the flame as quickly as possible;
- keep away, do not approach or attempt to move the cylinder or open the valve;
- evacuate the area (200 meter radius initially);
- contact the fire/rescue services and the supplier explaining compressed gas bottles are involved in fire and approximately how many and type; and
- keep in mind many fire brigades create a 24-hours hazard zone of 200 metres or less and will advise people and businesses to keep the area evacuated.

Fire due to hose piping leak

17. In the event of a fire due to hose piping leak, the following requirements are advisable as a minimum:

- if safe and trained to do so, close the cylinder valve to extinguish the flame as quickly as possible;
- evacuate the area (200 metre radius initially); and
- contact the fire/rescue service and the supplier explaining compressed gas bottles were/are involved in fire.

Cylinders following severe impact

18. In instances where cylinders have been severely impacted the following requirements are advisable as a minimum:

- even if cylinders are not leaking and do not show signs of internal heating (e.g. hot spots), as a precaution, cylinders are not to be used until they have been inspected for damage by the cylinder supplier; and
- if cylinders are leaking: exclude all sources of ignition, stop traffic, evacuate area and contact the fire/rescue services.

Safe use

19. When moving cylinders ensure that the valve is closed and fitted with a protection cap. Always use a cylinder trolley or approved device to move individual cylinders.

20. Any equipment used (torch, hoses, regulator, flashback arrestors, etc.) should be designed and constructed to recognised standards for use with acetylene.

21. Equipment will be kept in good working condition and free from oil or grease.

22. Install flashback arrestors and check (non-return) valves. Use correct flow rates for the acetylene application. Flashback occurs when acetylene flow rate is lower than torch need. A too high flow causes solvent carry over, flame disturbance and reduces the effectiveness of flashback prevention devices.

23. Ensure availability of appropriate fire extinguishers. It is strongly recommended that dry powder type fire extinguishers are available close to or in the work area.

24. Hot work permits must be completed prior to hot work on a gas cylinder. Refer to [permit to work procedure <link to be provided>](#).

25. Compressed gas cylinders are designed to be used in the upright position. This helps to avoid solvent spitting experienced with some types of porous material.

26. Do not “crack” open the cylinder valve to blow out dust from the valve outlet as there is a risk of ignition. If necessary, clean the outlet valve with a lint free cloth before connecting the regulator.

27. When connected, ensure that the regulator pressure is released and faces away from the outlet, before slowly opening the cylinder valve.

28. Ensure that the equipment is leak tested and purged of air before use. Alternatively, equipment can be provided with self-sealing valves/connectors. Incorrectly designed fittings increase the risk of air ingress and could lead to an explosion inside the piping and equipment, arising from the heat of compression. Only use fittings that have been specifically designed for use with acetylene.

29. Only workers trained in the use of compressed gas equipment can use such equipment.

Safe transport

30. Depending on the quantity of product, the transportation of all compressed gas cylinders may be subject to Transport of Dangerous Goods Regulations.

31. Always close cylinder valves during transport – acetylene cylinders are never completely empty because acetylene is dissolved in the solvent and residual acetylene remains, even if there is no more flow/pressure when the valve is open.

32. Ensure that valve protection is in place and that regulators and other equipment are disconnected from the cylinder before transport.

33. Always ensure that gas cylinders are fixed and secured for transport, in an upright position and separated from the driver's compartment. When the destination is reached, remove any cylinder(s) from the vehicle. Do not store cylinder(s) inside any vehicle.

34. Trolleys/carts for oxyacetylene with cylinders for cutting and welding are preferably to be protected by a board with a fire resistance rating of at least 30 minutes. A extinguisher will be available on the trolley/cart.

Acetylene/oxygen cylinders

35. Acetylene is colourless gas with a characteristic smell and is slightly lighter than air and highly flammable. It can generate an explosive atmosphere at airborne concentrations above 2.3%.

36. Acetylene requires very little energy to ignite an air/oxygen mixture that could explode. Under certain conditions acetylene can decompose explosively into carbon and hydrogen. To prevent this happening, acetylene is stabilized by storing in specially designed cylinders, filled with a porous material and containing a solvent (most commonly acetone) into which the acetylene is dissolved.

37. Acetylene cylinders require additional cooling once the fire has been extinguished to fully cool the entire cylinder content. Fires involving acetylene are only to be extinguished by trained emergency services personnel.

38. Always consider alternatives for welding and cutting jobs like arc welding or LPG cylinders which have less risk than acetylene. Alternatively, local areas should hire an expert who regularly and competently uses acetylene, as this also reduces the storage required and risk on campus.

39. Cranes shall not lift portable oxygen acetylene bottles/torches and dolly unless disconnected, secured and in a suitably engineered cage.

Training

40. All areas shall ensure that all staff and students who are required to handle or use gas cylinders as part of their job complete the ANU Compressed Gas and Cryogenic Safety training course presented by the WEG or local area training every three years.

41. A register of University staff who are trained under the requirements of this procedure shall be maintained by the WEG.

Sources

Legal and other requirements
<i>Work Health And Safety Act 2011 (Cth)</i>
<i>Work Health And Safety Regulations 2011 (Cth)</i>
<i>Dangerous Goods (Road Transport) Act 2009 (Cth)</i>
<i>Dangerous Goods (Road Transport) Regulations 2010 (Cth)</i>
AS1216 Class labels for dangerous goods (2006)
AS2030.1 SAA Gas Cylinders Code
AS4332 The Storage And Handling Of Gases In Cylinders
AS4603 Flash Back Arresters-Safety Devices for Use with Fuel gases And Oxygen or Compressed Air
AS1596 LPG Storage and Handling

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