

Australian/New Zealand Standard™

Safety in laboratories

Part 6: Plant and equipment aspects



AS/NZS 2243.6:2010

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Part 6: Plant and equipment aspects

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee, CH-026, Safety in Laboratories, to supersede AS 2243.6—1990, *Safety in laboratories, Part 6: Mechanical aspects*.

The revision was undertaken to update the Standard to reflect risk management principles and current occupational health and safety approaches and terminology. A new section has been added to include information on planning for use of plant and equipment covering risk assessments, procurement, installation and commissioning of plant and equipment, along with training of persons who will use it. A section on maintenance has also been added.

This Standard is intended for use in conjunction with other Standards of the AS/NZS 2243 series and is applicable to all laboratory situations. Other parts of the series are as follows:

- Part 1: Planning and operational aspects
- Part 2: Chemical aspects
- Part 3: Microbiological aspects and containment facilities
- Part 4: Ionizing radiations
- Part 5: Non-ionizing radiations—Electromagnetic, sound and ultrasound
- Part 7: Electrical aspects
- Part 8: Fume cupboards
- Part 9: Recirculating fume cabinets
- Part 10: Storage of chemicals.

The term ‘normative’ has been used in this Standard to define the application of the appendix to which it applies. A ‘normative’ appendix is an integral part of a Standard.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

**Australian/New Zealand Standard
Safety in laboratories****Part 6: Plant and equipment aspects**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard sets out requirements and recommendations designed to promote safe working practice relevant to the operation of plant and equipment in laboratories and describes the nature of the potential hazards. This Standard also covers safe working practices relevant to the use of compressed gas cylinders and cryogenic substances.

1.2 OBJECTIVE

The objective of this Standard is to specify requirements and provide information, recommendations and procedures on the conduct of operations involving plant and equipment in laboratories that will promote safe working practices.

1.3 APPLICATION

This Standard should be used in conjunction with the appropriate part(s) of AS/NZS 2243 that are relevant to the type of work being carried out in the laboratory. If the requirements of any part of this Standard conflict with any National, State or Territory regulations, the appropriate statutory regulations shall apply.

1.4 REFERENCED DOCUMENTS

A list of documents referenced in this Standard is given in Appendix A.

1.5 DEFINITIONS

For the purpose of this Standard, the definitions below apply.

1.5.1 Competent person

A person who has acquired through training, qualifications or experience, or a combination of these, the knowledge and skills enabling that person to perform a specified task.

1.5.2 Hazard

A source or a situation with a potential for harm in terms of human injury or ill-health, damage to property, damage to the environment, or a combination of these. [AS/NZS 4801]

1.5.3 Laboratory

Any building or part of a building used, or intended to be used, for scientific or technical work, including research, quality control, testing, teaching or analysis. Such work may involve the use of chemicals (including dangerous goods and hazardous substances), pathogens and radiation, or processes including electrical or mechanical work. The laboratory includes such support areas as instrument and preparation areas, laboratory stores and any offices attached or adjacent to the laboratory.

NOTES:

- 1 In a multi-occupancy building, the area occupied by the laboratory may be referred to as the laboratory area.
- 2 AS/NZS 2982.1 contains definitions of various types of laboratories.

1.5.4 Liquid**1.5.4.1 Combustible liquid**

A liquid other than a flammable liquid that has a flash point, and that has a fire point less than its boiling point.

For the purposes of this Standard, combustible liquids are divided into two classes as follows:

Class C1—a combustible liquid that has a flash point of 150°C or less.

Class C2—a combustible liquid that has a flash point exceeding 150°C.

NOTE: The boiling point is taken to mean that point at which it is no longer possible to achieve the rate of temperature rise required by ASTM D92 for the fire point test.

1.5.4.2 Flammable liquid

A liquid that has been defined in the ADG Code/NZS 5433 as a Class 3 liquid.

1.5.5 Material safety data sheet (MSDS)

A document that describes the properties and uses of material, that is, identity, chemical and physical properties, health hazard information, precautions for use and safe handling information.

NOTE: MSDSs are also known as safety data sheets (SDSs) in New Zealand.

1.5.6 May

Indicates the existence of an option.

1.5.7 Plant

Any machinery, equipment (including scaffolding), appliance, implement or tool and any component or fitting thereof or accessory thereto.

1.5.8 Residual current device (RCD)

A device intended to isolate supply to protected circuits, socket-outlets or electrical equipment in the event of a current flow to earth that exceeds a predetermined value. [AS/NZS 3000]

1.5.9 Risk

(In relation to any potential injury or harm.) The likelihood and consequence of that injury or harm occurring. [AS/NZS 4801]

1.5.10 Risk assessment

The overall process of estimating the magnitude of risk and deciding what actions will be taken. [AS/NZS 4801]

1.5.11 Shall

Indicates that a statement is mandatory.

1.5.12 Should

Indicates a recommendation.

1.5.13 Working in isolation

Work carried out in an area where normal means of contact (e.g. verbal, sight) with other staff are not available, so that the potential risk of existing hazards is increased to the extent that extra precautions are needed. This includes working in isolated areas on or off-site, either during or outside normal working hours.

SECTION 2 PLANNING FOR USE OF PLANT AND EQUIPMENT

2.1 GENERAL

2.1.1 Planning

The best basis of planning for safety is to consider in advance the consequences of every action. Such considerations should include location, services, scale, compatibility, ergonomics and workflow.

2.1.2 Risk assessment

Risk assessment of all operations in the laboratory involving plant and equipment shall be carried out. For further information on risk identification, control and management see AS/NZS 4801 and AS/NZS 60079.10.

When controlling risks, the most effective control measures available should be chosen in order of effectiveness. The hierarchy of controls is as follows:

- (a) Elimination of hazards from the laboratory.
- (b) Substitution of a substance or process.
- (c) Isolation of the hazard.
- (d) Application of engineering controls, e.g. local exhaust ventilation.
- (e) Adoption of safe work practices, including documented work methods.
- (f) Where other effective means to control the hazard are not practical, use of suitable personal protective equipment.

As part of the risk assessment, the information contained in various regulations and accompanying codes of practice, instruction manuals and the other Parts of this series shall be considered in areas such as chemical safety. Tasks shall be assessed for performance during normal working hours and outside of normal working hours, as the risk is often increased out of hours when the availability of emergency personnel is reduced. Security requirements for the laboratory's activities shall also be considered with respect to access to the laboratory area. This assessment shall also address access to, and operations in, the laboratory pertaining to students, maintenance staff, contractors, visitors (including children), cleaners, security staff and animals (experimental and comparison).

Within particular industries there may be existing methodology together with control levels that apply to the operation of these assessments. In addition, National, State and Territory authorities provide guidance notes on the application of risk assessment procedures to be adopted when implementing and complying with the regulations.

2.1.3 Procurement

Prior to procurement, a risk assessment should be performed in order to identify all potential hazards and ensure that controls are adequate. In addition, the risk assessment carried out in accordance with Clause 2.1.2 should be reviewed to ensure its ongoing validity.

Plant and equipment shall be selected to ensure it is fit for the intended purpose and that design for safe operation has been given adequate attention by the manufacturers. Equipment shall be selected to be suitable for electrical services in Australia or New Zealand, as appropriate, and for the hazardous area zoning of the area in which it is to be installed. Noise requirements should also be specified and either the 'choose-quiet' or 'buy-quiet' process as outlined in AS/NZS 1269.2 should be implemented. Safety requirements for plant and equipment should be included in the purchasing documentation.

NOTE: Safety issues that should be considered at the time of purchase, include the need for—

- (a) special units designed specifically for handling flammable materials (e.g. fitted with flameproof motor) or pathogens;
- (b) adequate shielding against failure of moving parts;
- (c) the purchase of specific safety equipment relating to the safe operation of the equipment being purchased (e.g. oil mist filter for a vacuum pump);
- (d) an interlocking system that prevents starting unless covers and guards are properly closed and locked, and also prevents access to moving parts whilst it is in motion; and
- (e) automatic controls to switch off the equipment when excessive vibration occurs.

2.1.4 Installation and commissioning

The manufacturer's directions for installation shall be followed, or the manufacturer's technical representative shall be requested to install the equipment.

Detailed installation and operating instruction manuals should be obtained from the manufacturer. Instruction manuals should be in clear and concise English and understood before operation of equipment.

Safe operation of equipment is dependent on the correct installation. The following precautions should be observed when installing and commissioning laboratory equipment:

- (a) Ensure that the equipment has adequate safeguards and controls to satisfy a risk assessment and relevant standards (see Clause 3.2.3).
- (b) Select a safe location with adequate space, ventilation and lighting and separation from other equipment and operations.
- (c) Ensure that services are available or provided from appropriate sources after checking the applications for which any existing services have been approved.
- (d) Ensure any noise control measures are in place.
- (e) Ensure appropriate operating and maintenance procedures are developed and specify any personal protective equipment to be worn during its operation.
- (f) Ensure that the equipment is used within the limitations of its design.
- (g) Ensure that the equipment is subjected to a commissioning procedure which tests its design capabilities and safeguards.

NOTE: Audit, inspection and maintenance procedures should be implemented to ensure installation precautions remain effective

The equipment shall be installed in accordance with AS/NZS 3000, with particular attention to hazardous zoning.

2.2 TRAINING

Persons who use plant and equipment shall be competent in its use. Such persons shall be made aware of the operating characteristics, basic safe working practices and emergency procedures relevant to the equipment involved, and in particular the need for wearing appropriate protective equipment where other methods of control are not sufficient. Training records should be kept, especially where a number of persons are using a variety of plant and equipment.

2.3 REQUIREMENT FOR SAFE CONDUCT

Good housekeeping is one of the best aids to safety with mechanical apparatus. This implies the need for tidiness, cleanliness, clear work areas, and proper use and timely maintenance of plant and equipment. The following recommendations apply to good housekeeping practices in the laboratory:

- (a) Keep fire escape routes completely clear at all times.
- (b) Make appropriate personal protective equipment for eyes, ears, face, hands, feet and respiratory system as specified in AS/NZS 2243.1 available to laboratory personnel. The equipment should be comfortable to wear, and should be selected, used and maintained in accordance with HB 9.
- (c) Maintain all safety equipment in the best operating condition, and regularly check and inspect for correct operation in accordance with the manufacturer's instructions.
- (d) Secure items such as loose-fitting clothing, ties, jewellery including rings, and long hair (including beards) to keep them out of moving equipment. Sleeves of overalls or working-shirts should either be rolled up above the elbow, or be buttoned tightly at the wrist.
- (e) Keep benches, shelves and cupboards clean and tidy. Apparatus and reagents should be cleaned, and put away immediately after use.
- (f) Clean up after each stage of an operation. Apparatus that has contained harmful chemicals should be rinsed before being left for final cleaning.
- (g) Return all equipment not in use to its proper place in a clean and working condition.

2.4 STORAGE OF WORK MATERIALS

Work materials should be stored in well constructed racks at an access height suitable for use with the materials handling methods employed.

2.5 EMERGENCY MANAGEMENT

Emergency management procedures shall comply with the requirements in AS/NZS 2243.1.

SECTION 3 EQUIPMENT IN GENERAL USE

3.1 USE OF MACHINES

Mechanical apparatus shall be used only within the range of operating conditions for which it was designed. Machines with rotating components are particularly susceptible to stress because, in such apparatus, the centrifugal stresses increase as the speed of the rotor increases.

Movement of machinery parts consists basically of rotary, sliding or reciprocating motion that, individually or in combination, can produce cutting, shearing and crushing injuries. Rotating parts are also capable of inflicting injury by personal entanglement. Dangers from machinery can be minimized by the operator wearing suitable clothing, and by fitting suitable guards, physical barriers and electrical interlocks to the machine to protect both the operator and passing traffic.

3.2 SAFEGUARDING OF MACHINERY

3.2.1 General

An obvious function of a machine guard is to keep the operator's body, fingers, clothing and arms away from the danger points, without impeding the intended operation of the machine, or obstructing vision. This function can usually be met by intelligent design.

Another function, which may be less obvious, is to keep hazardous objects from striking the operator. A grinding wheel guard is an example of this; a suitable guard should be of an appropriate shape and of adequate strength to contain any potential hazard.

A guard can serve a further function in preventing the fitting of an attachment likely to fail. In the case of the grinder this could be an oversize wheel, which would be more prone to disintegration. This aspect of guard functioning also applies to interlocks, where the machine cannot be started or operated unless the guard is correctly in position. The AS 4024.1 series should be consulted for further information on guarding and interlocks.

3.2.2 Hazards to operators

A person may be injured by machinery as a result of—

- (a) coming into contact with machinery, or being trapped between the machinery and any semi-permanent or fixed structure;
- (b) being struck by, or becoming entangled in or by, any material in motion in the machinery;
- (c) being struck by ejected parts of the machinery; or
- (d) being struck by material ejected from the machinery.

The use of automatic equipment to move components, materials and substances into and out of machine tools and process machinery should be considered, as this may reduce the hazards to operating personnel. Care should be taken to ensure that the use of automatic equipment does not introduce further hazards, e.g. trapping of operators between the automatic equipment and parts of the machine or materials being processed.

3.2.3 Basic principle of safeguarding

A risk assessment of the hazards involved in the use of equipment shall be carried out in accordance with AS 4024.1. Potentially dangerous machinery parts should be eliminated or effectively enclosed at the design and manufacturing stage of the machinery. If this cannot be achieved, suitable safeguards shall be used, or provision made for safeguards to be easily incorporated before use.

All mechanical equipment should be fail-safe and, when power is returned after any interruption, the equipment controls should require manual resetting before the equipment can be restarted.

Unless a machine or area is safe by virtue of its position, the machinery should be provided with an appropriate safeguard that eliminates or reduces danger before access to the danger area can be achieved. The following design considerations relating to safeguarding should be taken into account:

- (a) Provision should be made to facilitate the fitting of alternative types of safeguards on machinery where it is known that the type of work that the machinery will perform will vary.
- (b) Movable machinery guards or covers should be interlocked with the drive to the parts being guarded.
- (c) Lubrication and routine maintenance facilities for machinery should be located outside the machine working area.
- (d) Every mechanism and control forming part of a safeguard should, as far as practicable, be of fail-safe design.

3.2.4 Construction of safeguards

Safeguards should be constructed with observance of the following considerations:

- (a) All safeguards should be of robust design and adequate strength.
- (b) Guards should be made of metal, timber, laminated or toughened glass, suitable plastics or a combination of these, as appropriate.
- (c) Whatever safeguard is selected, it should not be a likely source of injury, such as having trapping or shear points, splinters, or rough or sharp edges.

3.3 FIXED POWER TOOLS

3.3.1 General requirements

The following general requirements apply to the safe use of fixed power tools:

- (a) *Competence* Fixed power tools shall be operated by competent persons only.
- (b) *Eye protectors* Whenever power tools are used, eye protectors complying with AS/NZS 1337 shall be worn by operators and persons in the immediate vicinity.
- (c) *Chuck keys* The chuck key shall be removed from the chuck immediately after the drill bit or workpiece has been fixed-in or removed.

On and off switches for power control should be designed to prevent accidental starting of machinery, and to facilitate instant cut-off of power by one movement. Emergency stop push-buttons should be installed on fixed power tools. The switches should be in a practical location.

3.3.2 Drilling machines

The following requirements apply to the safe use of drilling machines:

- (a) Fixtures, machine vices or workpieces shall be clamped to the table or set against stop bars. Workpieces shall not be drilled while being held with rags or similar materials.
- (b) When the flutes of a drill become choked with swarf, the machine shall be stopped before the swarf is removed.
- (c) Swarf from drills shall be removed only in accordance with established safe practices using a swarf hook, brush or suitable gloves. Compressed air shall not be used as a forced-blast cleaner.