NATSPEC// Construction Information

TECHreport TR 07

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Providing access for maintenance

This TECHreport outlines the basic principles of providing access for maintenance, current requirements in Australian legislation and standards, and good practice. It draws together relevant information from a variety of sources that designers and specifiers can pursue for more detail.

PROVIDING ACCESS FOR MAINTENANCE

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1 INTRODUCTION

1.1 The need for access for maintenance

Good maintenance requires good access. If there is no access to maintain something, it will not be maintained or, if there is inadequate access, it will be inadequately maintained.

Lack of maintenance or inadequate maintenance leads to more breakdowns, premature failure, unnecessary energy use, increased greenhouse gas emissions and poor performance and, in some instances can impair health and safety. Poor access for maintenance increases these effects and results in longer outages for repairs and maintenance. It also increases the cost of achieving the same standard of maintenance. For these reasons, access for maintenance is a fundamental health, safety, sustainability and operating cost concern.

The provision of adequate access for maintenance is both a design and a construction issue.

Some matters relating to access must be accounted for in the design, such as adequate means for safe access to plant rooms for routine maintenance, and removal and replacement of equipment.

Other aspects are normally left to the installing contractor to determine, such as the location of items requiring frequent inspection. The demarcation between design and construction responsibilities is not precise, so in some instances details will be shown on the design drawings while in others the same details will be left to the contractor to decide.

The current situation in Australia is that most requirements, including those in the National Construction Code (NCC), are general in nature.

Even though the NCC does not explicitly mandate the provisions for access for maintenance, a design or installation that is not accessible for maintenance could reasonably be regarded as not being fit for the purpose.

Many Australian Standards and relevant legislation dealing with elements that require maintenance either say nothing about access for maintenance or express the requirement in vague terms like "adequate access" without defining what constitutes adequate. This TECHreport aims to address the issue as part of NATSPEC's mission of improving the quality of construction in Australia.

1.1.1 Summary

This TECHreport does not set out to be a comprehensive manual on design of access. Instead, it is intended to collect information relevant to current Australian practice from a variety of sources that readers can pursue in more detail.

This NATSPEC TECHreport:

- Discusses the principles relating to provision of access for maintenance.
- Summarises coverage of access requirements in legislation and standards.
- Provides general guidance on the provision of access for maintenance in situations not specifically covered in legislation or standards.
- Discusses equipment location and arrangement to provide adequate access for routine operation, maintenance, repair and replacement.

1.1.2 Use of the expression 'access for maintenance' in this TECHreport

For brevity, this TECHreport uses the term 'access for maintenance' to refer to access for a range of purposes including maintenance, inspection, measurement, operation, lubrication, adjustment, repair, replacement and other maintenance related tasks for building services plant. Access required for other purposes such as firefighting and for people with a disability is not included in this term.

1.2 Issues relating to the provision of access for maintenance

1.2.1 Cost

The first and most obvious issue is that the provision of access for maintenance has a capital cost.

Adequate access increases plant room floor areas for example and may require more complex and costly plant and service layouts. These costs need to be balanced against maintenance cost savings and the benefits of improved access. One approach to balancing this is to take into account the required frequency of access so, for example, items requiring weekly maintenance should be located so they can be easily accessed without requiring a portable ladder, while items that require annual or less frequent access might not justify this more costly provision.

Access that depends on temporary facilities such as portable ladders still require adequate space and access provisions so they can be used safely and effectively. See for example AS 1892.5 on the use of portable ladders.

1.2.2 Task type

Tasks requiring only inspection or operation (e.g. of valves) are less demanding than those involving disassembly or removal. Removal requires enough space to remove and replace the item safely and without damage.

1.2.3 Difficulty of task

Difficulty increases when the task involves complex manipulation, force or hammering, use of special tools or lifting. The more difficult the task to be performed, the more space required to perform it effectively and safely.

1.2.4 Frequency and duration of task

More frequently scheduled tasks and items requiring rapid access for operation (e.g. safety switches) need to be more easily accessed than those that require infrequent access.

1.2.5 Maintenance personnel

Over the life of the building and its systems there will inevitably be turnover of personnel and shifts between in-house and contracted personnel. Access for

maintenance must not assume that maintenance personnel are familiar with the building, its plant and systems, or potential hazards and risks.

1.2.6 Hazards

Access for maintenance must minimise hazards to maintenance staff, other persons and to the building and its contents. Issues to consider include:

- Noise separation.
- Protection from health risks such as *Legionella*.
- Containment and management of dangerous chemicals.
- Containment and management of refrigerant leaks.
- The handling of contaminated filters that may need to be double bagged before removal.
- Access for maintenance in sterile areas like operating theatres.
- Prevention of falls from height.
- Restrictive movement. Injury caused by rotating and other moving components.

2 STATUTORY REQUIREMENTS AND GOOD PRACTICE GUIDES

2.1 Introduction

The bulk of state and territory legislation for access for maintenance relates to safe access and maintenance for the protection of health rather than access to maintain items in their original operating condition, prevent breakdowns or preserve energy efficiency.

2.2 State and territory legislation and regulation

2.2.1 NCC

The NCC no longer mandates the provision of access for maintenance. It does however include several State and Territory variations in the schedules, for access for maintenance.

2.3 Australian Standards and handbooks

Section 6 of this TECHreport lists Australian Standards and handbooks dealing with matters relevant to access for maintenance. The following standards are particularly useful, but all standards should be taken into consideration.

2.3.1 AS 1657 *Fixed platforms, walkways, stairways and ladders - Design, construction and installation*

This deals with many issues relating to access for maintenance such as construction, minimum dimensions and slip resistance. Important dimensions are:

- Minimum headroom: 2000 mm (AS 1657 clause 3.1.5).
- Minimum width of stairs: 600 mm (AS 1657 clause 7.2.1).

These are minimums for safety but may not be adequate for effective maintenance. The minimums recommended in *Space requirements for plant access, operation and maintenance* (see clause 2.5.2) are 2100 mm headroom and 750 mm width with an absolute minimum of 550 mm width. As 550 mm is less than that required by AS 1657, this TECHreport and NATSPEC worksection *0171 General requirements* clause **ACCESS FOR MAINTENANCE** use the following:

- Vertical clearance: ≥ 2100 mm, vertically, above horizontal floors, ground and platforms.
- Horizontal clearance: Preferably ≥ 750 mm clear, but in no case less than 600 mm between equipment or between equipment and building features including walls.

2.3.2 AS/NZS 3000 *Electrical installations (known as the Australian/New Zealand Wiring Rules)*

Although primarily oriented to safety, this standard includes many specific requirements for access for maintenance. The following figure is an example:

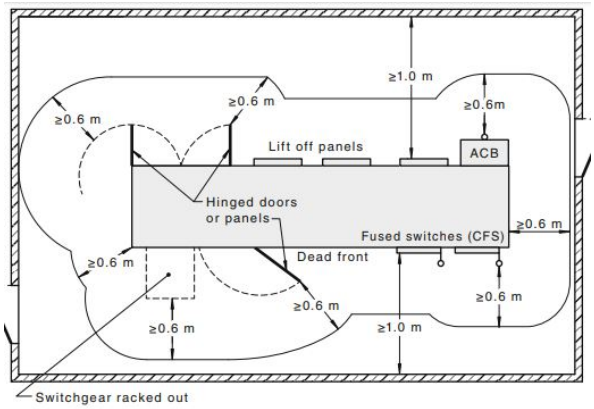


FIGURE 2.19 ACCESS TO SWITCHBOARDS—
FREESTANDING SWITCHBOARD WITH SWITCHGEAR RACKED OUT

2.4 Australian sources of information on good practice

2.4.1 Manufacturers' documents

A primary source of recommendations for access for maintenance is manufacturers' literature. Manufacturers often recommend such things as:

- Maintenance schedules and frequencies. These should be used to make decisions about accessibility and where to locate items.
- Clearances for maintenance and removal of components.
- Position relative to other items.
- Lifting masses and arrangements for heavy items.
- The use of special tools and instruments.

2.4.2 AS/NZS 4024 *Safety of machinery series*

This group of standards covers basic access principles, anthropometric data and specific cases. Although oriented primarily to the safe use of machines in manufacturing, many of the requirements are also applicable to access for maintenance for building services plant.

2.4.3 SAA/SNZ HB 32 *Control of microbial growth in air-handling and water systems in buildings*

Clause 6.2 gives recommendations for cooling tower access for maintenance.

2.4.4 AIRAH DA19 *HVAC&R Maintenance*

AIRAH DA19 covers maintenance for all components of HVAC&R systems. Clause 3.5 of DA19 deals specifically with accessibility and contains material derived from this TECHreport.

AIRAH DA19 includes three maintenance levels, with Maintenance Level A being best practice, Maintenance Level B good practice and Maintenance Level C minimum statutory compliance. Because these involve different frequencies of maintenance the different maintenance levels may result in different provisions for access. NATSPEC default text is for Maintenance Level A. Specifying Maintenance Level B or C may result in reduced access since NATSPEC access for maintenance provisions are dependent on maintenance frequency. See **Frequency of access**.

Although DA19 emphasises the importance of adequate and safe access for maintenance, it does not provide specific guidance on how this should be achieved because of the range of sizes, shapes and configuration of plant. It refers readers to relevant Australian Standards including AS 1470 (now withdrawn), AS 1657, AS 1892.1, AS 2865 and AS/NZS 3666.1.

2.4.5 AIRAH *HVAC Hygiene: Best practice guidelines*

This guideline deals with HVAC hygiene, inspection and maintenance and is aligned to the AS/NZS 3666 series of standards. It deals with access and is concerned with access to interior parts of HVAC systems. It also deals with frequency of inspection and includes recommended inspection intervals but notes that climatic and other circumstances may require more frequent inspection. It recommends monthly inspection of air handling units, air intakes and exhausts, and moisture producing equipment.

2.4.6 Australia Department of Climate Change and Energy Efficiency *Guide to best practice maintenance & operation of HVAC systems for energy efficiency*

Despite its name, this publication does not address the effect of access on the effectiveness of maintenance and so makes no relevant recommendations.

2.5 International sources of information on good practice

2.5.1 General

There is substantial literature dealing with access for maintenance published outside Australia that can help with making adequate provisions. Being from non-Australian jurisdictions, it must be interpreted with reference to Australian Standards and legislation, reducing its usefulness. The following are particularly useful resources.

2.5.2 UK Ministry of Defence *Space requirements for plant access, operation and maintenance*

This document is one of the most comprehensive guides to the provision of access for maintenance for building services. It uses the basic principles of BS 8313 and applies them to many common building services situations.

2.5.3 BS 8313 *Code of practice for accommodation of building services in ducts*

This British Standard contains recommendations for the design, construction, installation and maintenance of fixed ducts. Also covered are suspended flooring, ceiling voids and cavities. It includes relevant anthropometric data.

2.5.4 BSRIA *AG 11/92 Design for maintainability*

This guide covers a wide range of matters relating to maintenance. It includes checklists for designers, owners and contractors to assist in providing

maintainable systems and recommends strategies for reducing maintenance.

3 PRINCIPLES FOR MAINTENANCE ACCESS

3.1 Access

3.1.1 Documentation and identification

Show space allocations for access for maintenance and removal of items on the drawings. It may also be useful to mark these allowances by painting floors or walls so apparently empty space is not used for storage or later installation of items.

3.1.2 Frequency of access

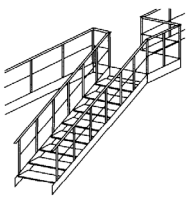
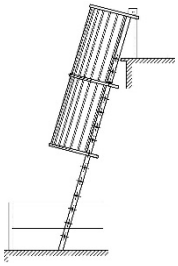
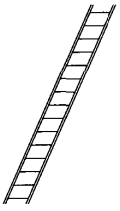
NATSPEC worksection *0171 General requirements* **ACCESS FOR MAINTENANCE** clause classifies the access required by frequency of maintenance in accordance with the recommendations of *Space requirements for plant access, operation and maintenance* and is summarised as follows:

Type of access by frequency

Frequent maintenance	**Occasional maintenance**	**Infrequent maintenance, repairs or replacement**
Readily accessible	Semi-clear access	Limited access
Frequency: items requiring access for maintenance monthly or more often	Frequency: items requiring access for maintenance between monthly and six monthly	Frequency: items requiring access for maintenance less frequently than six monthly
NATSPEC Access class A	NATSPEC Access class A or B	NATSPEC Access class A or B or C

Using these three broad categories, the kind of access is determined by the required **NATSPEC access classes table**.

NATSPEC access classes table

NATSPEC Access class A	**NATSPEC Access class B**	**NATSPEC Access class C**
Clear and immediate access to and around plant items	Platform accessible by non-vertical ladder	Temporary access
If more than 2 m above the ground, floor or platform: Provide a platform with handrails accessible by a stair, all to AS 1657	If more than 2 m above the ground, floor or platform: Provide a platform with handrails accessible by a non-vertical ladder, all to AS 1657	Locate so that temporary means of access conforming to Work Health and Safety regulations can be provided
 Access from floor or ground level or from walkway or platform and stairs to AS 1657.	 Access from walkway or platform and inclined ladder to AS 1657.	 Access using portable ladder or other means conforming to Work health and Safety regulations.

3.2 Plant location and layout

3.2.1 Location

Plant location should consider:

- The mass of items (including concrete plinths and inertia bases) and related structural engineering design issues.
- Size and ease of removal of plant items.
- Ingress to and egress from plant spaces.

3.2.2 Arrangement

The following should be considered (see also *Space requirements for plant access, operation and maintenance*):

- Compliance with mandatory requirements for safe egress.
- Space issues other than access for maintenance, such as space around air cooled equipment for air flow and preventing transmission of noise and vibration.
- Space for future plant. This space should not be used to provide access for original plant.
- Reducing space needed for access by laying out plant so access space is shared. The space should be sized for the larger item. Sometimes this can also be combined with passageways and the like to reduce overall floor area required.
- Sufficient space for hinged components to swing safely out of the way.
- Avoiding trip hazards and obstacles to removing heavy items on wheeled transport by not running services such as drains and conduits across floors.
- Locating large and/or heavy components closer to plant room access so that they are easier to remove and replace. Alternatively, consider a removable wall or removable roof panels for major replacement, provided suitable crane access is also possible.
- Access for maintenance without demolition of building components or disassembly or removal of otherwise unaffected plant items.
- Co-location of similar plant types and separation of plant that may interfere with each other. For example, consider separating electrical and water services, and co-locating noisy items.
- Sufficient space for the lifting equipment. In general, heavy items are usually more easily lifted by mobile equipment rather than lifting eyes or beams.

3.3 Space for personal access

AS/NZS 4024.1702 gives the following guidance relating to the size of openings for the passage of a person:

a) Ease of passage for a person is influenced by:

- The type of clothing, e.g. light or heavy clothing.
- Whether tools are being carried, e.g. for maintenance or repair purposes.
- Whether additional equipment such as personal protective equipment (including protective clothing), or portable lighting, is being carried or worn.
- The demands of the task, e.g. posture, nature and speed of movement, lines of sight, application of force.
- Frequency and duration of task.
- Length of passage, e.g. through a relatively thin wall (e.g. the wall of a vessel) where there is space for movement at the exit or through a channel type passage.
- Amount of space available to allow for the dynamic nature of movement to escape from danger.
- The position and size of supports for the body, e.g. foot support, hand holds.

b) Environmental conditions (e.g. darkness, heat, noise, moisture).

c) Level of risk during the task.

4 NATSPEC PROVISIONS

4.1 What NATSPEC worksections can and cannot cover

As NATSPEC is a master specification system, it can only deal with matters the contractor has control over. Basic design issues such as plant room size and location are up to the design team and cannot be fixed by the specification.

An exception to this is some forms of design and construct contracts in which the contractor is responsible for these design issues. For such contracts, NATSPEC must be amended to specify relevant design parameters. NATSPEC TECHreport *TR 03 Specifying design and construct for mechanical services* deals with the range of design and construct approaches and notes that even in fully designed building projects the contractor has a limited design role. If the contractor has a significant role in designing access for maintenance, relevant design parameters should be included in the relevant worksection.

There can be divided responsibilities for the provision of access for maintenance. Designers are responsible for overall space provisions and the arrangement of major items while the contractor is responsible for detail matters through such things as equipment selection, shop drawings and on-site decisions. For example, the tender drawings may show the location of chillers but the contractor normally selects these through competitive pricing and provides details to suit the selected chillers on the shop drawings. On site, pipe fitters make further decisions about details relating to the chillers such as sensor location. All three of these decision-making processes can affect access for maintenance positively or negatively.

The specification cannot fix fundamental design flaws or remove the designer's liability for them, but it can specify how the contractor's detailed design decisions regarding access for maintenance can support good practice.

4.2 NATSPEC worksections

4.2.1 *0171 General requirements*

Interpretation clause

The **INTERPRETATION** clause in *0171 General requirements* contains several important definitions that apply to all aspects of buildings, although they will most often be relevant to services:

- Access for maintenance: Includes access for maintenance, inspection, measurement, operation, adjustment, repair, replacement and other maintenance related tasks.
- Provide: Provide and similar expressions mean supply and install and include development of the design beyond that documented.

This gives the contactor responsibility for filling in details not included in the contract documents. Provision of access for maintenance comes within this definition:

- Accessible, readily: Readily accessible, easily accessible, easy access and similar terms mean capable of being reached quickly and without the use of a tool, without hazard, climbing over or removing obstructions, or using a movable ladder, and in any case not more than 2.0 m above the ground, floor or platform.

This definition is adapted from the definitions of readily accessible in AS/NZS 3000 and AS/NZS 5601.1. Readily accessible, easily accessible and similar terms appear in numerous technical worksections so this definition affects many aspects of building projects. It is important that the drawings do not conflict with this requirement.

Access for maintenance clause

The **ACCESS FOR MAINTENANCE** clause in *0171 General requirements* sets out general provisions relating to access for maintenance and inspection that apply to all other worksections. The kind of access depends on the frequency of inspection and maintenance.

While this clause is based on good practice, design details should be reviewed in the light of project needs and statutory requirements.

For example, it says that items requiring access monthly or more frequently must be *readily accessible*, i.e. conform to the definition in the **INTERPRETATION** clause. Since AS/NZS 3666.1 and AS/NZS 3666.2 require that coils, trays, sumps, condensate drains, tundishes, and traps be inspected monthly, the NATSPEC requirement effectively precludes locating air handling units in ceilings.

4.2.2 Other technical worksections

Typical access matters covered in other technical worksections include:

- Lifting provisions.
- Access details to be included on shop drawings.
- Safety features relating to access. For example, *0724, 0725, 0726, 0727 Air handling plant* and *0731 Fans* address issues including access doors and panels, internal lighting and the need under certain situations for a fan safety cut off switch for walk-in sections.
- Provisions for removal of components.
- Clearances between items.

5 DESIGN OF ACCESS PROVISIONS

5.1 Recommendations

The following are suggestions for consideration in design and documentation of access provisions:

- Show access for maintenance provisions on the design drawings so it does not appear to be wasted space. Provide hatching indicating areas to be kept clear for maintenance access, storage, and maintenance activities. Also consider signage.
- If possible, locate items requiring frequent access so they are readily accessible to the definition in *0171 General requirements*.
- Show space for withdrawal of plant items e.g. motors, filters, fan shafts.
- If possible, locate items requiring reading of values such as gauges at or near eye height.
- Locate plant and equipment so that nameplates and labels can be read easily.
- Provide sufficient space to allow use of normal tools (e.g. space to turn a spanner to remove bolts, unscrew unions) without the need for alternative, non-standard tools.
- Consider the method of removal and replacement of large or heavy items of plant both from their installed location and from the building.
- For capital cost and efficient maintenance, minimise the need for fixed or portable ladders, access ways, platforms, etc. If provided, they must be designed to comply with respective legislation and standards.
- Avoid roof access via ladder and access hatch. This is particularly so if the plant on the roof requires monthly or more frequent inspection, since this kind of access does not conform to the requirement of being readily accessible. Instead, arrange for conventional stairs and doors onto the roof as they are safer for carrying tools, removing and replacing components, etc.
- If the designed access requires either temporary scaffolding or a cherry picker, it probably indicates poor design and will probably result in poor maintenance.
- Some ceiling types (e.g. linear metal) are difficult to access. Do not locate items requiring access above them.
- Provide access panels in fixed plaster ceilings for access to items requiring inspection and maintenance. This form of access does not conform to the requirement of being readily accessible.
- Avoid locating items requiring frequent access above tiled ceilings, as it inevitably results in damaged tiles and does not conform to being readily accessible.
- Arrange access to plant to minimise inconvenience to building occupants. For example, maintenance of one tenant's plant should not be dependent on access through another tenancy.
- Do not obstruct plant and other items that are likely to require removal when installing later items.
- Reduce the extent of access for maintenance required by appropriate equipment selection. For example, intumescent fire dampers require less inspection and maintenance than mechanical fire dampers (see AS 1851).

6 AUSTRALIAN STANDARDS RELATED TO ACCESS FOR MAINTENANCE

6.1 Australian Standards with specific requirements related to access for maintenance

This table lists services-related and other standards that include specific requirements for access for maintenance, such as definitions, clearances, room dimensions, equipment locations, access openings and covers.

Notes

1. This includes only direct reference. Standards may be referenced by other standards which are themselves referenced in legislation.
2. These are examples only and not necessarily all of the references in the standard. They do not include access required for other purposes, for example, disabled access and firefighter access.
3. These are summary tables and intended for guidance only. Standards and regulations change over time and specific references should be checked. One useful source of information on current and previous references to standards is www.austlii.edu.au.

Designation	Year	Title	Referenced in NCC Volume 1,2,3	Referenced in other legislation (see Note 1)	Referenced in codes of practice	Examples of access for maintenance requirements (clause number and detail) (See Note 2)
AS/CA S009	2020	Installation requirements for customer cabling (Wiring Rules)	No	No	Yes	**Clause 4.2.82 Definitions – Readily accessible** *Readily accessible* defined. NATSPEC has adopted this definition. **Clause 9.2.1 Separation from services other than LV power or HV circuits** *The cables, conductors and terminations of customer cabling shall be separated from non-telecommunications services such as plumbing and ELV power cables so as not to impede access to, or repair of, the other service or the customer cabling.* *Note 1: A minimum clearance of 50 mm is recommended where customer cabling runs alongside other service cables, conduits or pipes.* **Appendix D Recommended access clearances for MDFs and NTDs (Informative)** Clearances provided.
AS 1210	2010	Pressure vessels	No	Yes	Yes	**Clause 3.20 Inspection openings** contain detailed requirements for access openings. **Clause 8.18.1 Protection of valves and fittings – Location for inspection and maintenance** *Pressure-relief devices, other safety devices and important vessel fittings shall be located and installed so that they are readily accessible for operation, inspection, maintenance and removal.*

PROVIDING ACCESS FOR MAINTENANCE

Designation	Year	Title	Referenced in NCC Volume 1,2,3	Referenced in other legislation (see Note 1)	Referenced in codes of practice	Examples of access for maintenance requirements (clause number and detail) (See Note 2)
AS/NZS 1546.1	2008	On-site domestic wastewater treatment units - Septic tanks	3	Yes	Yes	**Clause 2.3.3 Performance requirements – Holding tanks and pump wells** *Holding tanks and pump wells shall be designed and constructed:* *(j) With access for installation and maintenance of the pump.* **Clause 2.4.4 Performance criteria – Outlet filters** *Outlet filters, where fitted, shall be accessible for maintenance through an access or inspection opening sized in accordance with the design requirements for the filter (see Appendix D).* **Clause 2.4.7 Performance criteria – Access and inspection openings and covers** *Access openings shall be located to allow access for desludging of the chamber(s), for maintenance or replacement of any outlet filter where fitted and shall be of sufficient size to allow the desludging mechanism to reach all parts of the chambers and the removal of the outlet filter where fitted.* *Inspection openings shall be located to give access to the inlet and outlet fittings, for maintenance of any outlet filter where fitted, and shall have a cross-sectional area of not less than 7,500 mm^2 (equivalent to 100 mm diameter).* *Access openings and inspection openings shall either be at or above ground level or be able to be extended to the finished ground level if the septic tank is installed underground.* *Covers for access openings and inspection openings shall:* *(a) Provide an effective, durable and watertight seal and be able to be resealed each time the cover is removed;* *(b) Be durable and able to withstand superimposed loads; and* *(c) Be secure and shall be designed to prevent removal by children.* **Clause 3.4.2 Optional devices - Outlet filters** *Where installed, outlet filters shall:* *(c) Be accessible for maintenance through access or inspection openings sized in accordance with the design requirements for the filter; and* *(d) Be accessible for removal and replacement.* **Clause 3.6 Access and inspection openings and covers** *Access and inspection openings and covers shall be located in an easily accessible location for maintenance purposes. They shall be provided with a corrosion-resistant means of lifting, and be designed to prevent removal by children.* ***C3.6** The size and siting of one or more access openings are governed by the size of the desludging equipment and the need to be able to desludge all chambers in a tank and the design requirement of the outlet filter where fitted. Access openings are typically 500 mm x 450 mm rectangular or 500 mm diameter (circular) and located over the tank partition, where fitted.*

PROVIDING ACCESS FOR MAINTENANCE

Designation	Year	Title	Referenced in NCC Volume 1,2,3	Referenced in other legislation (see Note 1)	Referenced in codes of practice	Examples of access for maintenance requirements (clause number and detail) (See Note 2)
AS 1657	2018	Fixed platforms, walkways, stairways and ladders - Design, construction and installation	1	Yes	Yes	A fundamental standard for access for maintenance.
AS 1892.1	2018	Portable ladders - Performance and geometric requirements	No	No	Yes	A fundamental standard for access for maintenance.
AS 1892.5	2020	Portable ladders - Selection, safe use and care	No	No	Yes	A fundamental standard for access for maintenance. Legislation and codes of practice cite AS 1892.5:2000.
AS 2865	2009	Confined spaces	No	Yes	Yes	This is a key standard relating to access for maintenance. **Appendix C2 General design considerations (Informative) – Means of entry and exit** deals with means of entry and exit and references ISO 15534-1, ISO 15534-2 and ISO 15534-3.
AS/NZS 2918	2018	Domestic solid fuel burning appliances - Installation	1,2	Yes	Yes	**Clause 3.2.1 Appliance installation – Clearances and heat shielding – Access clearances** *To provide the user with access to the appliance, the clearance between any part of the appliance and any adjacent fixed surface or object shall be not less than the following:* *(a) For the appliance front surface: 1 m.* *The clearance specified shall apply when any door or drawer is in its closed position with respect to the appliance surface.* *(b) For any appliance surface (other than the appliance front surface) that includes an opening for fuelling or ash removal, or to which regular access by the user is otherwise necessary: 500 mm.* *The clearance specified shall apply when any door or drawer is positioned at its fullest extent of protrusion from the appliance surface.* *(c) For any part of the appliance (other than the surfaces described in Items (a) and (b) above) to which only hand access, occasional user access, or maintenance access is necessary: 100 mm.* *The clearance specified shall apply when any knob or control is positioned at its fullest extent of protrusion from the appliance surface.*

PROVIDING ACCESS FOR MAINTENANCE

Designation	Year	Title	Referenced in NCC Volume 1,2,3	Referenced in other legislation (see Note 1)	Referenced in codes of practice	Examples of access for maintenance requirements (clause number and detail) (See Note 2)
AS/NZS 3000	2018	Electrical installations (known as the Australian/New Zealand Wiring Rules)	No	Yes	Yes	**Clause 1.4.3 Definitions – Accessible, readily** *Capable of being reached quickly and without climbing over or removing obstructions, or using a movable ladder, and in any case not more than 2.0 m above the ground, floor or platform.* NATSPEC has adopted this definition for use in non-electrical situations. Contains many references to access for maintenance, for example: **Clause 2.10.2.2 Switchboards – Location of switchboards – Accessibility and emergency exit facilities** **Figures 2.19 to 2.23 Access to switchboards** deal with accessibility and emergency exit facilities for Switchboards clause.
AS/NZS 3084	2017	Telecommunications installations - Telecommunications pathways and spaces for commercial buildings	No	No	Yes	**Clause 3.1.2 Location** *The telecommunications room should be located as close as practicable to the centre of the area served and preferably in the core area. Horizontal pathways should terminate in the telecommunications room located on the same floor as the area being served.* *In a single tenant building, the telecommunications room should preferably be located in an accessible area on each floor, for example a common hallway. In a multi-tenant building, the telecommunications room for the tenant's communications services shall be within the tenancy.* **Clause 4.2.2 Access** *Accessibility for the delivery of large equipment to the ER should be provided.*
AS/NZS 3500.4	2021	Plumbing and drainage - Heated water services	3	Yes	Yes	**Clause 5.3.2 Accessibility and clearances** *Water heaters shall be located and oriented in accordance with the following:* *(a) The rating plate and instruction notice shall be in a visible position.* *(b) Unobstructed access shall be available to the burner, heating units, controls, cold water storage tanks and other apparatus requiring maintenance.* *(c) All valves and the easing gear on a relief valve shall be readily accessible.* *(d) There shall be 150 mm minimum clearance from the end of the easing gear of temperature/pressure-relief valves to allow for valve removal.* *(e) The heater shall be subsequently removable without major structural alteration to the building or major alteration to the piping.*

PROVIDING ACCESS FOR MAINTENANCE

Designation	Year	Title	Referenced in NCC Volume 1,2,3	Referenced in other legislation (see Note 1)	Referenced in codes of practice	Examples of access for maintenance requirements (clause number and detail) (See Note 2)
AS 3780	2023	The storage and handling of corrosive substances	No	Yes	Yes	**Clause 3.3 Requirements for transit storage** *The following requirements apply to the transit storage of corrosive substances and of other dangerous goods being held in the storage area with them:* *(c) Except when in freight containers, stacks of packages and IBCs in a transit storage area shall –* *(i) each not exceed 25 t;* *(ii) be accessible from all sides; and* *(iii) be segregated from each other by at least 5 m.* **Clause 5.4 General requirements for package stores** *Package stores for corrosive substances, other than indoor storage cabinets, shall meet the following general requirements, as appropriate:* *(a) Stores shall be located on a floor that has immediate access from outside the building.* *(b) At least two means of access shall be provided to stores having a floor area greater than 25 m².*
AS 3961	2017	The storage and handling of liquefied natural gas	No	Yes	Yes	Contains many references to access for maintenance, for example: **Clause 2.6.13 Ventilation and access** contains specific details and dimensions for access to tanks. **Clause 2.9.4 Interconnected tanks** *Where two or more tanks are so piped that liquid or vapour can pass from one to the other, the piping system shall be designed to ensure that no one tank can become liquid-full as the result of filling, operating, or temperature conditions.* **Clause 2.9.9 Cold-contact hazards** *Human contact with cold piping shall be prevented by protective insulation wherever possible, otherwise by limiting access or by providing guards or protective clothing.* **Clause 2.13.2 Security fence** *A security fence shall be at least the equivalent of a chainwire fence 1.8 m high. In addition –* (a) *a fully surrounding fence shall be at least 1.5 m from the tank, and provided with at least two lockable outward-opening, or sliding gates at locations in the perimeter chosen to optimize access or escape from opposite directions.* *(b) a partial fence surrounding only the valves or pumps shall be installed so that access through the fence is not possible, and at least one lockable gate, 1 m wide, that allows easy access to the equipment shall be provided.*
AS 4254.2	2012	Ductwork for air-handling systems in buildings - Rigid duct	1	Yes	Yes	**Clause 2.1.1 General** *All ductwork shall be installed allowing clearances for access when carrying out testing, commissioning and maintenance routines.* **Clause 2.1.3 Kitchen exhaust ductwork** requires access at specific locations in kitchen exhaust ducts. **Figure 2.3 (Q) Cooling and heating coil installation** requires access at cooling and heating coils.

PROVIDING ACCESS FOR MAINTENANCE

Designation	Year	Title	Referenced in NCC Volume 1,2,3	Referenced in other legislation (see Note 1)	Referenced in codes of practice	Examples of access for maintenance requirements (clause number and detail) (See Note 2)
AS 4426	1997	Thermal insulation of pipework, ductwork and equipment – Selection, installation and finish	No	No	Yes	**Clause 1.5.2 Clearance between insulation and the surrounding surfaces** *A minimum clearance of 25 mm beyond the full extent of thermal movement shall be allowed between insulated plant and structural or other insulated surfaces, except where the shielded depth is greater than 300 mm. In such cases, or where pipe banks against walls or ceilings are involved, the designer should envisage the sequence of the fixing of the insulating material and its finish and make all necessary provision.* **Clause 2.2.1 Optimum effectiveness** *Maintenance costs should be minimised by attention to detail in the layout of the system. Particular attention should be given to the accessibility of removable sections, valves, or similar, and the protective systems used in inaccessible locations such as ducts.*
AS/NZS 5139	2019	Electrical installations – Safety of battery systems for use with power conversion equipment	No	Yes	No	**Clause 4.2.5 Pre-assembled integrated BESS room requirements** *The size of the room shall allow for sufficient clearance around the pre-assembled integrated BESS to provide safe handling and access for installation, removal and maintenance.* *The pre-assembled integrated BESS minimum unimpeded access on the working side of a system shall be no less than 600 mm or the clearance specified by the manufacturer, whichever is greater. Where access panels allow access to 230 V a.c. connections, the minimum clearance shall be 900 mm.* **Clause 5.2.5 Pre-assembled battery system room requirements** *The size of the room shall allow for sufficient clearance around the pre-assembled battery systems to provide safe handling and access for installation, removal and maintenance.* *The minimum unimpeded access on any working side of the battery system enclosure shall be either-* *(a) 900 mm with doors open; or* *(b) 600 mm with doors open for battery systems that have* *(i) voltage no greater than DVC-A; and* *(ii) a calculated arc flash energy at the output terminals of the battery system not greater than 4.0 cal/cm^2; or* *(c) the clearance specified by the manufacturer, whichever is greater.*

PROVIDING ACCESS FOR MAINTENANCE

Designation	Year	Title	Referenced in NCC Volume 1,2,3	Referenced in other legislation (see Note 1)	Referenced in codes of practice	Examples of access for maintenance requirements (clause number and detail) (See Note 2)
AS/NZS 5149.3	2016	Refrigerating systems and heat pumps – Safety and environmental requirements – Installation site	No	Yes	Yes	**Clause 5.11 Dimensions and accessibility** *The dimensions of the machinery room shall allow easy installation and sufficient room for service, maintenance, operation, repair and disassembly of the refrigerating equipment. There shall be clear headroom of at least 2 m below equipment situated over gangways and permanent workplaces.* **Clause 6.4.2 Location** *Shut-off valves shall be located outside of the occupied space and shall be positioned to enable access for maintenance by an authorised person.* **Clause 9.5 Installation** *The installation of the detector shall allow for checking, repair, or replacement by an authorised person.*
AS/NZS 14763.2	2020	Information technology – Implementation and operation of customer premises cabling – Planning and installation	No	No	No	**Clause 7.7.1.1.3 Equipment rooms** require equipment rooms to be provided with doors that are at least 1 m wide and at least 2.13 m high. **Clause 7.7.1.1.4 Rooms intended to contain distributors** requires room dimensions to be a 3 x 3 m minimum and access of at least 0.9 m wide and at least 2 m high. To provide additional space and maintenance, the minimum room dimensions for distributors containing up to 500 outlets shall be 3.2 m (length) x 3.0 m (width). **Annex B (Normative) Common infrastructures within multi-tenant premises** supplements or modifies the corresponding clauses in the body of the standard as they apply to the planning and installation of telecommunications cabling in common spaces within multi-tenant premises.

6.2 Australian Standards with non-specific requirements related to access for maintenance

This table lists services-related and other standards that include non-specific requirements for access for maintenance requirements, such as 'easy and safe access', 'so as to be easily accessible', 'not be installed in inaccessible locations'.

Designation	Year	Title	Referenced in NCC Volume 1,2,3	Referenced in other legislation	Referenced in codes of practice	Access for maintenance
AS/NZS 1200	2015	Pressure equipment	No	Yes	Yes	Required
AS 1324.1	2001	Air filters for use in general ventilation and airconditioning - Application, performance and construction	No	No	Yes	Required
AS 1375	2023	Industrial fuel-fired appliances	No	Yes	Yes	Required
AS/NZS 1547	2012	On-site domestic wastewater management	3	No	Yes	Required
AS 1668.1	2015	The use of ventilation and air conditioning in buildings - Fire and smoke control in buildings	1	Yes	No	Required
AS 1668.2	2012	The use of ventilation and airconditioning in buildings - Mechanical ventilation in buildings	1,2	Yes	Yes	Required
AS 1668.2	2024	The use of ventilation and airconditioning in buildings - Mechanical ventilation in buildings	No	Yes	Yes	Required
AS 1670.1	2018	Fire detection, warning, control and intercom systems - System design, installation and commissioning - Fire	1	Yes	Yes	Required
AS 1670.1	2024	Fire detection, warning, control and intercom systems - System design, installation and commissioning - Fire	No	Yes	Yes	Required
AS 1670.4	2018	Fire detection, warning, control and intercom systems - System design, installation and commissioning - Emergency warning and intercom systems	1	No	Yes	Required
AS 1670.4	2024	Fire detection, warning, control and intercom systems - System design, installation and commissioning - Emergency warning and intercom systems	No	No	Yes	Required
AS 1670.6	2023	Fire detection, warning, control and intercom systems - System design, installation and commissioning - Smoke alarm systems	No	No	No	Required
AS 1682.2	2015	Fire, smoke and air dampers - Installation	No	No	No	Required
AS 1768	2021	Lightning protection	No	No	Yes	Required
AS 1851	2012	Routine service of fire protection systems and equipment	No	Yes	Yes	Required
AS/NZS 2032	2006	Installation of PVC pipe systems	No	No	Yes	Required
AS/NZS 2033	2024	Design and installation of polyolefin pipe systems	No	No	Yes	Required
AS 2118.1	2017	Automatic fire sprinkler systems - General systems	1	Yes	Yes	Required
AS 2118.2	2021	Automatic fire sprinkler systems – Wall wetting sprinkler systems	No	Yes	Yes	Required
AS 2118.3	2010	Automatic fire sprinkler systems - Deluge systems	No	Yes	Yes	Required
AS 2118.4	2012	Automatic fire sprinkler systems - Sprinkler protection for accommodation buildings not exceeding four storeys in height	1,3	Yes	Yes	Required
AS 2118.5	2008	Automatic fire sprinkler systems - Home fire sprinkler systems	3	Yes	Yes	Required

PROVIDING ACCESS FOR MAINTENANCE

Designation	Year	Title	Referenced in NCC Volume 1,2,3	Referenced in other legislation	Referenced in codes of practice	Access for maintenance
AS 2118.6	2012	Automatic fire sprinkler systems - Combined sprinkler and hydrant systems in multistorey buildings	1,3	Yes	Yes	Required
AS/NZS 2201.1	2007	Intruder alarm systems - Client's premises - Design, installation, commissioning and maintenance	No	No	Yes	Required
AS 2201.3	1991	Intruder alarm systems - Detection devices for internal use	No	Yes	No	Required
AS 2201.4	1990	Intruder alarm systems - Wire-free systems installed in client's premises	No	No	No	Required
AS/NZS 2293.1	2018	Emergency lighting and exit signs for buildings - System design, installation and operation	1	No	Yes	Required
AS 2419.1	2021	Fire hydrant installations - System design, installation and commissioning	1,3	Yes	Yes	Required
AS 2419.2	2009	Fire hydrant installations - Fire hydrant valves	No	Yes	No	Required
AS 2610.1	2007	Spa pools - Public spas	No	No	Yes	Required
AS 2610.2	2007	Spa pools - Private spas	No	No	No	Required
AS 2676.1	2020	Installation, maintenance, testing and replacement of secondary batteries in buildings - Vented cells	No	Yes	Yes	Required
AS 2896	2021	Medical gas systems - Installation and testing of non-flammable medical gas pipeline systems	No	Yes	Yes	Required
AS 2941	2013	Fixed fire protection installations - Pumpset systems	No	Yes	Yes	Required
AS/NZS 2982	2010	Laboratory design and construction	No	No	Yes	Required
AS/NZS 3003	2018	Electrical installations - Patient areas	No	Yes	Yes	Required
AS/NZS 3009	1998	Electrical installations - Emergency power supplies in hospitals	No	No	No	Required
AS/NZS 3010	2017	Electrical installations - Generating sets	No	No	No	Required
AS 3497	2021	Drinking water treatment system – Design and performance requirements	No	No	No	Required
AS/NZS 3500.1	2021	Plumbing and drainage - Water services	3	Yes	Yes	Required
AS/NZS 3500.2	2021	Plumbing and Drainage - Sanitary plumbing and drainage	3	Yes	Yes	Required
AS/NZS 3500.3	2021	Plumbing and drainage - Stormwater drainage	1,2	Yes	Yes	Required
AS/NZS 3666.1	2011	Air-handling and water systems of buildings - Microbial control - Design, installation and commissioning	1	Yes	Yes	Required
AS/NZS 3666.2	2011	Air-handling and water systems of buildings - Microbial control - Operation and maintenance	No	Yes	Yes	Required
AS/NZS 3666.3	2011	Air-handling and water systems of buildings - Microbial control - Performance-based maintenance of cooling water systems	No	Yes	Yes	Required
AS/NZS 3690	2009	Installation of ABS pipe systems	No	No	No	Required
AS 3788	2024	Pressure equipment - In-service inspection	No	Yes	Yes	Required
AS 3798	2007	Guidelines on earthworks for commercial and residential developments	No	Yes	No	Required
AS 3873	2001	Pressure equipment - Operation and maintenance	No	No	Yes	Required
AS 3892	2001	Pressure equipment - Installation	No	No	Yes	Required
AS/NZS 4024.1201	2014	Safety of machinery - General principles for design - Risk assessment and risk reduction	No	No	No	Required

PROVIDING ACCESS FOR MAINTENANCE

Designation	Year	Title	Referenced in NCC Volume 1,2,3	Referenced in other legislation	Referenced in codes of practice	Access for maintenance
AS/NZS 4024.1401	2014	Safety of machinery - Ergonomic principles - Design principles - Terminology and general principles	No	No	No	Required
AS 4587	2020	Water mist fire protection systems - System design, installation and commissioning	No	No	No	Required
AS/NZS 4645.1	2018	Gas distribution networks - Network management	No	Yes	Yes	Required
AS 4674	2004	Design, construction and fit out of food premises	No	No	Yes	Required
AS 4809	2017	Copper pipe and fittings - Installation and commissioning	No	No	No	Required
AS 11801.1	2019	Information technology - Generic cabling for customer premises - General requirements (ISO/IEC 11801-1:2017, MOD)	No	No	No	Required
AS 11801.2	2019	Information technology - Generic cabling for customer premises - Office premises (ISO/IEC 11801-2:2017, MOD)	No	No	No	Required
AS 11801.3	2019	Information technology - Generic cabling for customer premises - Industrial premises (ISO/IEC 11801-3:2017, MOD)	No	No	No	Required
AS/NZS 62676.4	2020	Video surveillance systems for use in security applications – Application guidelines (IEC 62676-4:2014, MOD)	No	Yes	No	Required
SAA/SNZ HB 32	1995	Control of microbial growth in air-handling and water systems of buildings	No	Yes	Yes	Required
SA HB 230	2008	Rainwater tank design and installation handbook	No	No	No	Required
SA HB 276	2004	A guide to good practice for energy efficient installation of residential heating, cooling & air conditioning plant & equipment	No	No	No	Required

6.3 Australian Standards relating to elements requiring maintenance but without access for maintenance requirements

This table lists services-related standards that do not include access for maintenance requirements, despite the need for maintenance as discussed in this TECHreport.

Designation	Year	Title	Referenced in NCC Volume 1, 2, 3	Referenced in other legislation	Referenced in codes of practice	Access for maintenance
AS CISPR 15	2017	Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment (CISPR 15:2013+AMD1:2015 (ED.8.1) MOD)	No	No	No	No requirement
AS 1417	2023	Receiving antennas for radio and television in the VHF and UHF broadcast bands - Design, manufacture and performance of outdoor terrestrial television antennas	No	No	No	No requirement
AS 1668.4	2012	The use of ventilation and airconditioning in buildings - Natural ventilation of buildings	1	No	Yes	No requirement
AS 1668.4	2024	The use of ventilation and airconditioning in buildings - Natural ventilation of buildings	No	No	Yes	
AS 1670.3	2018	Fire detection, warning, control and intercom systems – System design, installation and commissioning – Fire alarm monitoring	1	No	Yes	No requirement
AS 1670.3	2024	Fire detection, warning, control and intercom systems – System design, installation and commissioning – Fire alarm monitoring	No	No	Yes	No requirement
AS/NZS 2041.2	2011	Buried corrugated metal structures - Installation	No	No	No	No requirement
AS 2118.8	1997	Automatic fire sprinkler systems - Minor modifications	No	No	Yes	No requirement
AS 2118.9	1995	Automatic fire sprinkler systems - Piping support and installation	No	No	Yes	No requirement
AS 2201.2	2022	Alarm and electronic security systems - Monitoring centres	No	No	No	No requirement
AS/NZS 2201.5	2008	Intruder alarm systems - Alarm transmission systems	No	No	No	No requirement
AS 2419.3	2012	Fire hydrant installations - Fire brigade booster connections	No	No	Yes	No requirement
AS 2441	2005	Installation of fire hose reels	1,3	Yes	Yes	No requirement
AS 2467	2008	Maintenance of electrical switchgear	No	Yes	Yes	No requirement
AS/NZS 2566.1	1998	Buried flexible pipelines - Structural design	No	No	Yes	No requirement
AS/NZS 2566.1 Supp 1	1998	Buried flexible pipelines - Structural design – Commentary (Supplement to AS/NZS 2566.1 (1998).	No	No	Yes	No requirement
AS/NZS 2566.2	2002	Buried flexible pipelines - Installation	No	No	Yes	No requirement
AS 2665	2001	Smoke/heat venting systems - Design, installation and commissioning	1	No	Yes	No requirement
AS/NZS 3008.1.1	2017	Electrical installations - Selection of cables - Cables for alternating voltages up to and including 0.6/1 kV - Typical Australian installation conditions	No	Yes	No	No requirement

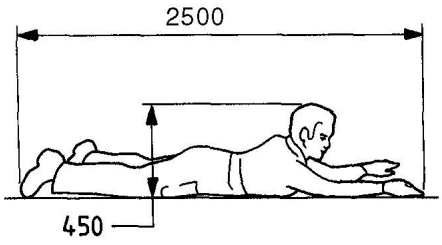
PROVIDING ACCESS FOR MAINTENANCE

Designation	Year	Title	Referenced in NCC Volume 1, 2, 3	Referenced in other legislation	Referenced in codes of practice	Access for maintenance
AS/NZS 3013	2005	Electrical installations - Classification of the fire and mechanical performance of wiring system elements	1	Yes	Yes	No requirement
AS 3085.1	2022	Telecommunications installations - Administration of communications cabling systems - Basic requirements	No	No	No	No requirement
AS 3600	2018	Concrete structures	1,2,3	Yes	Yes	No requirement
AS/NZS 3666.4	2011	Air-handling and water systems of buildings - Microbial control - Performance-based maintenance of air-handling systems (ducts and components)	No	Yes	Yes	No requirement
AS/NZS 3725	2007	Design for installation of buried concrete pipes	No	No	Yes	No requirement
AS 3735	2001	Concrete structures for retaining liquids	No	No	Yes	No requirement
AS/NZS 3760	2022	In-service safety inspection and testing of electrical equipment and RCD's	No	Yes	Yes	No requirement
AS/NZS 4024.1100	2019	Safety of machinery - Application guide	No	No	Yes	No requirement
AS/NZS 4024.1701	2019	Safety of machinery - Human body measurements - Basic human body measurements for technological design	No	No	Yes	No requirement
AS/NZS 4024.1703	2014	Safety of machinery - Human body measurements - Principles for determining the dimensions required for access openings	No	No	Yes	No requirement
AS/NZS 4024.1704	2014	Safety of machinery - Human body measurements - Anthropometric data	No	No	Yes	No requirement
AS 4060	1992	Loads on buried vitrified clay pipes	No	No	Yes	No requirement
AS 4070	1992	Recommended practices for protection of low-voltage electrical installations and equipment in MEN systems from transient overvoltages	No	No	No	No requirement
AS 4072.1	2005	Components for the protection of openings in fire-resistant separating elements - Service penetrations and control joints	1	No	Yes	No requirement
AS 4100	2020	Steel structures	1,2,3	Yes	Yes	No requirement
AS/NZS 4234	2021	Heated water systems - Calculation of energy consumption	1,3	Yes	Yes	No requirement
AS 4254.1	2021	Ductwork for air-handling systems in buildings - Flexible duct	1,2	Yes	Yes	No requirement
AS/NZS 4645.2	2018	Gas distribution networks - Steel pipe systems	No	No	Yes	No requirement
AS/NZS 4777.1	2024	Grid connection of energy systems via inverters - Installation requirements	No	No	Yes	No requirement
AS/NZS 4777.2	2020	Grid connection of energy systems via inverters - Inverter requirements	No	Yes	Yes	No requirement
AS 4897	2008	The design, installation and operation of underground petroleum storage systems	No	Yes	Yes	No requirement
AS/NZS 62676.1.2	2020	Video surveillance systems for use in security applications - System requirements - Performance	No	No	No	No requirement

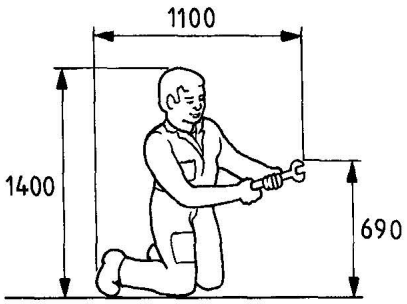
PROVIDING ACCESS FOR MAINTENANCE

Designation	Year	Title	Referenced in NCC Volume 1, 2, 3	Referenced in other legislation	Referenced in codes of practice	Access for maintenance
		requirements for video transmission (IEC 62676-1-2:2013, MOD)				
SA HB 37.1	1993	Handbook of Australian fire standards - Fire - General	No	No	No	No requirement
SA HB 37.2	1993	Handbook of Australian fire standards - Electrical equipment	No	No	No	No requirement
HB 100	2000	Coordination of power and telecommunications - Manual for the establishment of safe work practices and the minimization of operational interference between power systems and paired cable telecommunication systems	No	No	No	No requirement
HB 101	1997	Coordination of power and telecommunications - Low frequency induction (LFI): Code of Practice for the mitigation of hazardous voltages induced into telecommunications lines	No	No	No	No requirement
HB 102	1997	Coordination of power and telecommunications - Low frequency induction (LFI): Application Guide to the LFI Code	No	No	No	No requirement
HB 326	2008	Urban greywater installation handbook for single households	No	No	No	No requirement

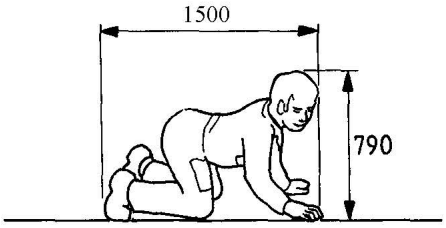
7 SOME TYPICAL ACCESS FOR MAINTENANCE ALLOWANCES



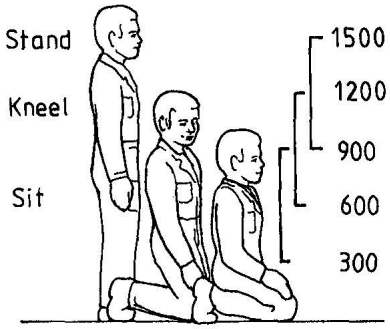
(a) Prone



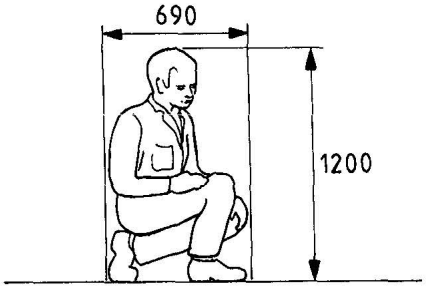
(b) Kneel



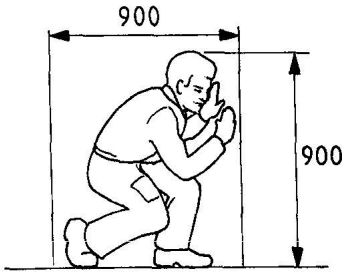
(c) Crawl



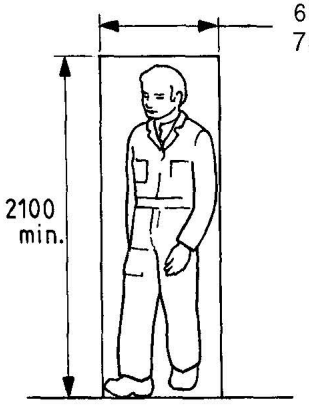
(f) Maintenance reach levels



(d) Squat

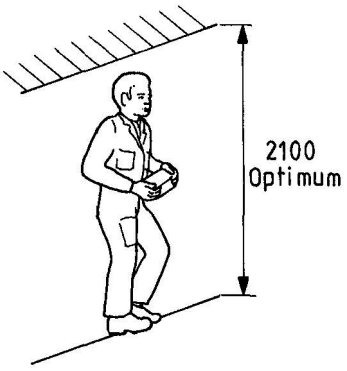


(e) Stoop



600 absolute minimum to AS 1657
750 preferred minimum

(g) Passageway



Incline not to exceed 20°

Width 750 min. to 1100 optimum

(k) Ramp

All dimensions are in millimetres.

Figure 7.1 Plantroom access: Anthropometric data
Source: U.K. Ministry of Defence

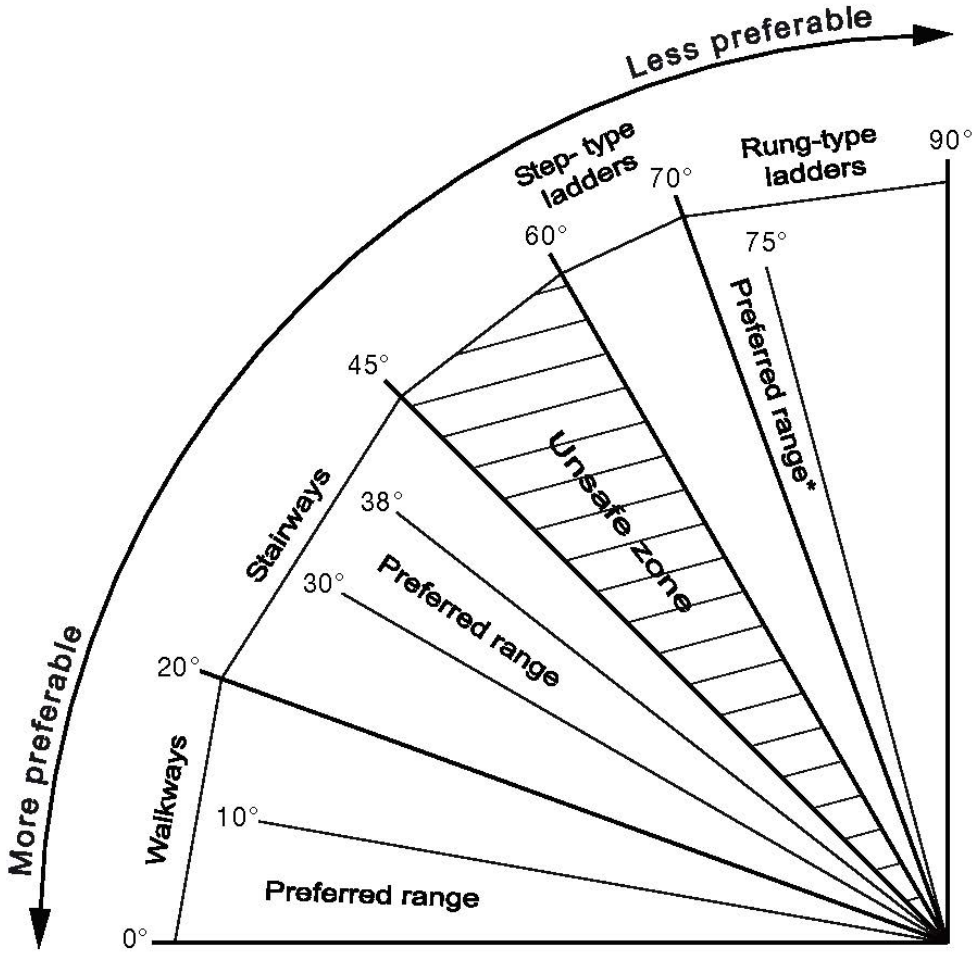


Figure 2.1 Selection of access – limits of slope
Source: AS 1657

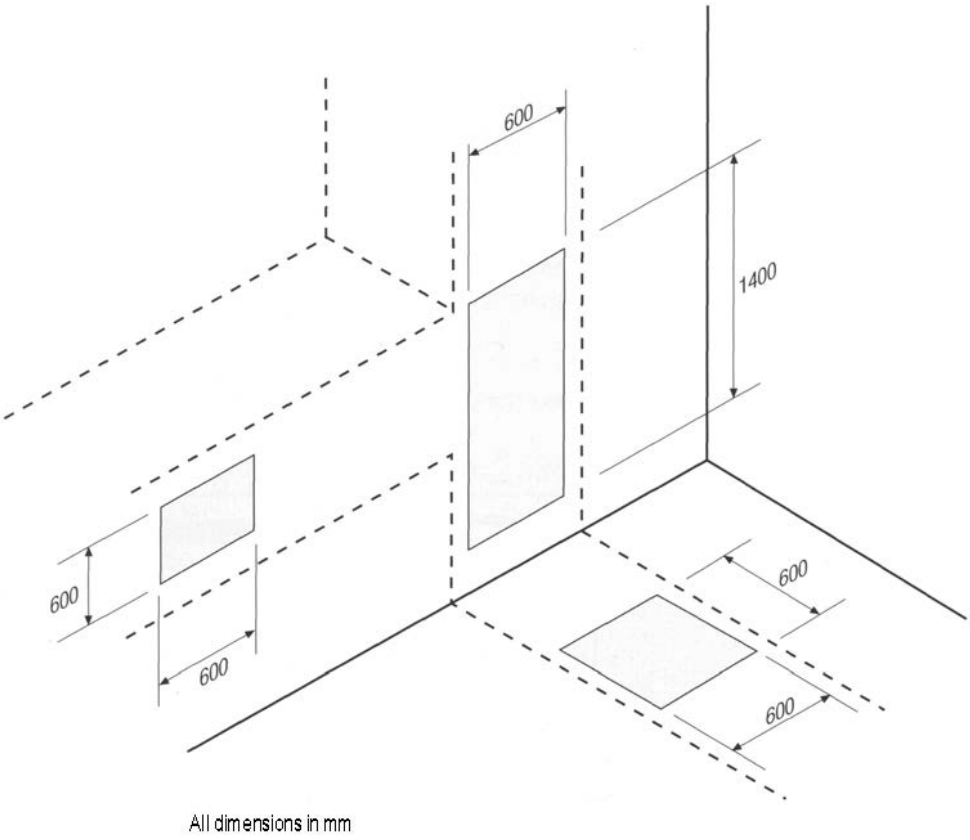


Figure 7.3 Access to distribution ducts and shafts
Source: U.K. Ministry of Defence

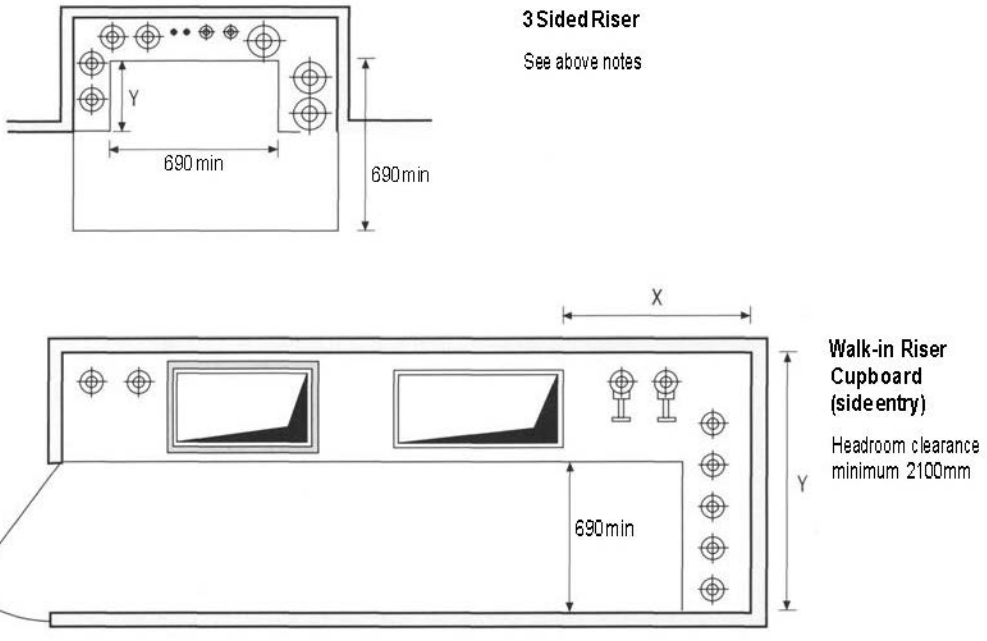


Figure 7.4 Mechanical risers
Source: U.K. Ministry of Defence

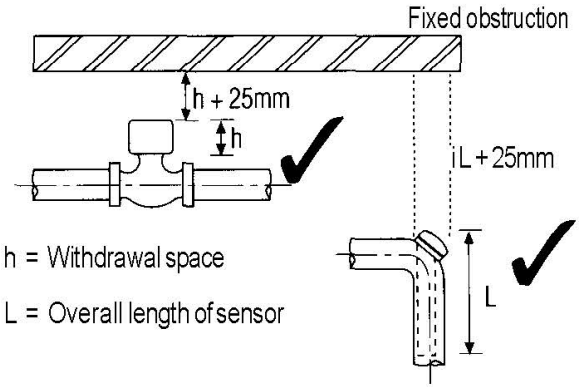
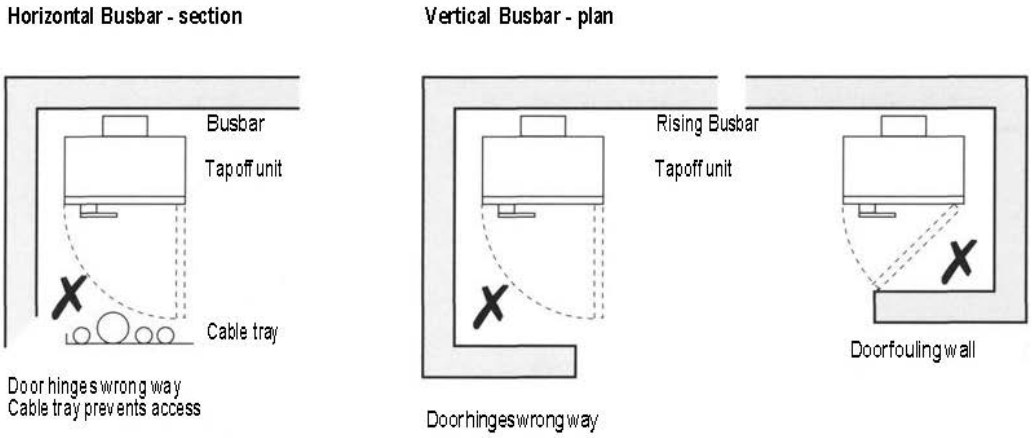


Figure 7.5 Pipework access
Source: U.K. Ministry of Defence



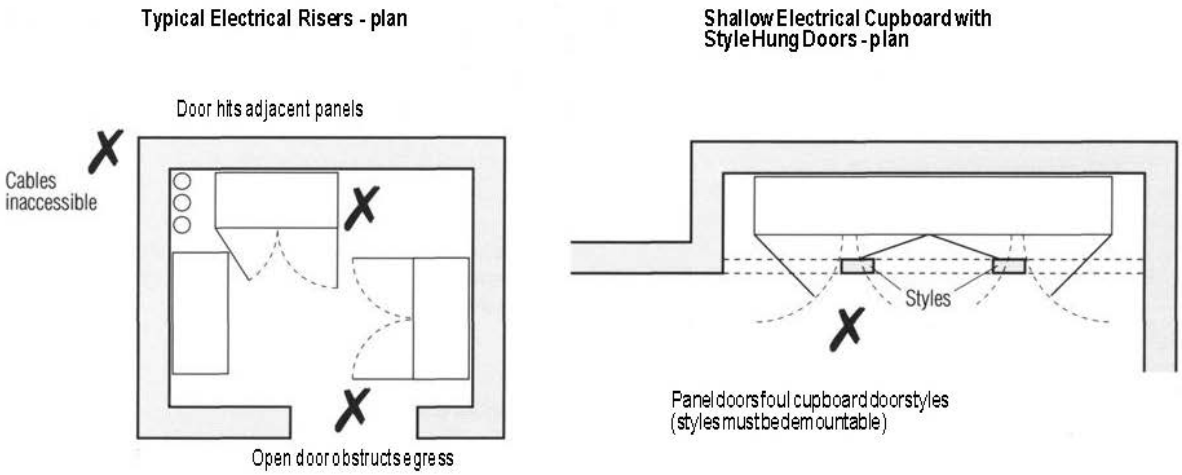


Figure 7.6 Electrical services vertical risers
Source: U.K. Ministry of Defence

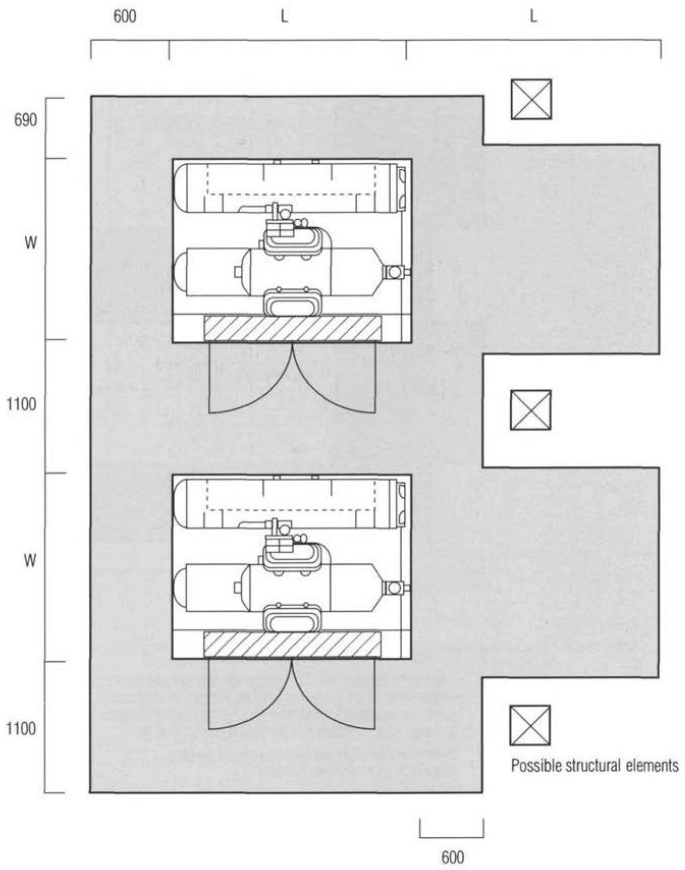


Figure 7.7 Watercooled liquid chillers space requirements
Source: U.K. Ministry of Defence

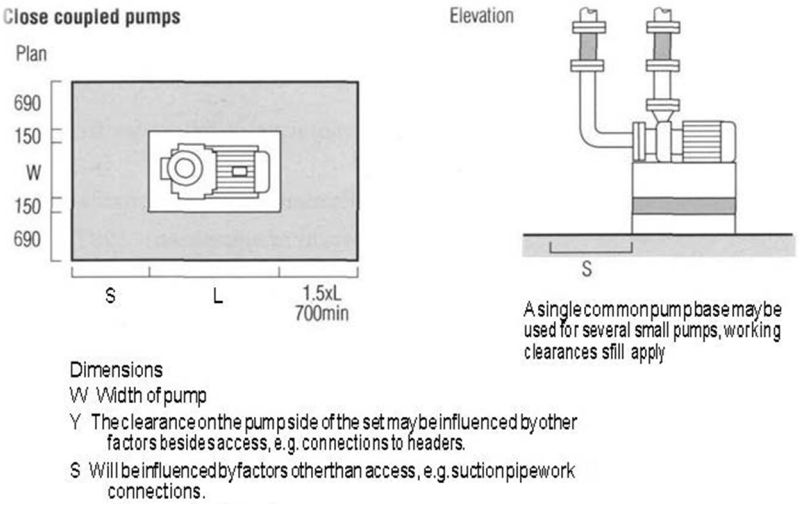


Figure 7.8 Circulating pump space requirements
Source: U.K. Ministry of Defence

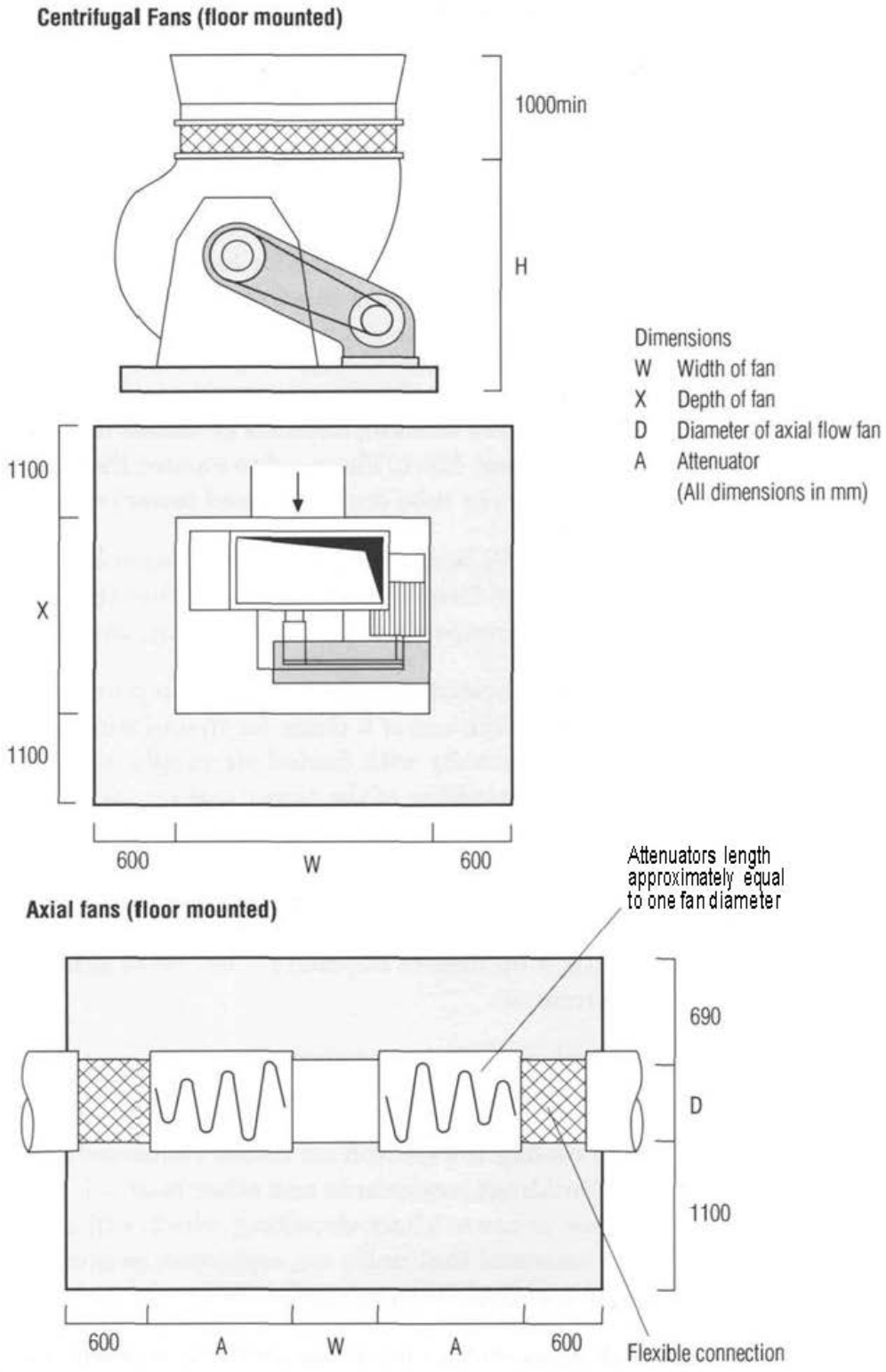


Figure 7.9 Centrifugal and axial fans space requirements
Source: U.K. Ministry of Defence

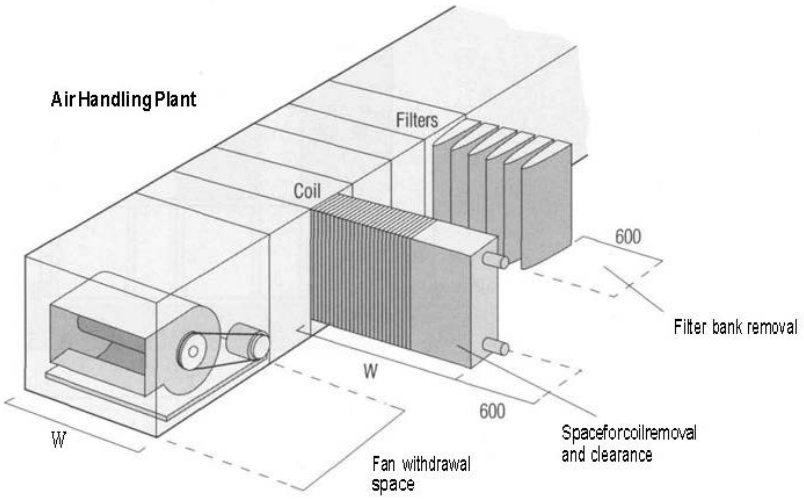


Figure 7.10 Air handling units space requirements
Source: U.K. Ministry of Defence

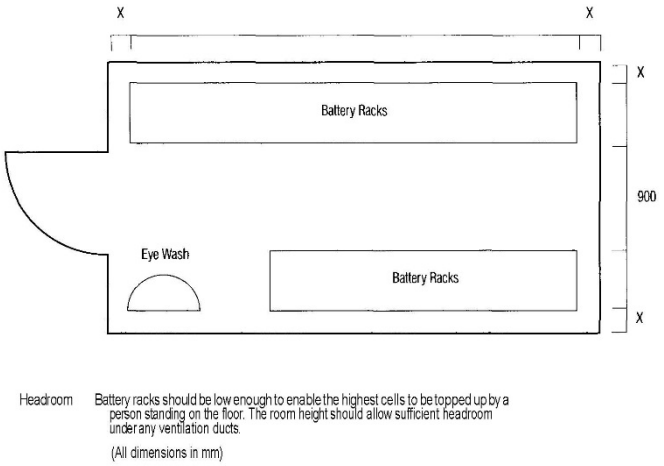


Figure 7.11 Battery room space requirements
Source: U.K. Ministry of Defence

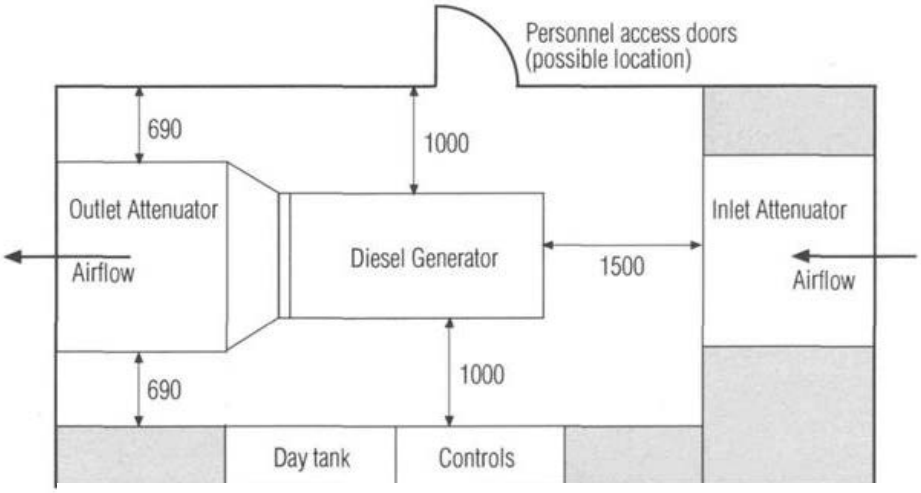


Figure 7.12 Diesel generating sets – Generator room with acoustic louvres
Source: U.K. Ministry of Defence

8 REFERENCES

The following lists standards and documents not included in 6.1, 6.2 and 6.3.

AIRAH DA19:2019 HVAC&R maintenance.

AIRAH Hygiene:2018 HVAC Hygiene: Best practice guidelines.

AS/NZS 4024.1702:2014 Safety of machinery - Human body measurements - Principles for determining the dimensions required for whole body access into machinery

BS 8313:1997 Code of practice for accommodation of building services in ducts.

Hejab, M and Parsloe, C 1992, *Space allowances for building services distribution systems: Detail design stage (TN 10/92)*, Building Services Research and Information Association, Bracknell, England.

Lecamwasam, L, Wilson, J & Chokolich, D 2012, *Guide to best practice maintenance & operation of HVAC systems for energy efficiency*, Australia Department of Climate Change and Energy Efficiency, Canberra.

Ministry of Defence 1996, *Defence works functional standard*: *Design and maintenance guide 8: Space requirements for plant access, operation and maintenance*, HMSO, London.

Parsloe, C 1992, *Design for maintainability (AG 11/92)*. Building Services Research and Information Association, Bracknell, England.