NATSPEC// Construction Information

TECHreport TR 01

April 2021

Specifying ESD

This TECHreport outlines the principles of Ecologically Sustainable Development (ESD) and their application to building specifications. It includes guidance for incorporating ESD provisions into each NATSPEC worksection.

Check www.natspec.com.au for latest version

SPECIFYING ESD WITH NATSPEC

Updating this TECHreport

This TECHreport reflects the status of ESD issues in NATSPEC at the time of its issue. NATSPEC updates this TECHreport periodically to reflect changes in NATSPEC worksections, regulations, standards, rating schemes and related developments.

If you have any comments or suggestions, please email to mail@NATSPEC.com.au

SPECIFYING ESD WITH NATSPEC

1 INTRODUCTION

1.1 ESD: An Australian definition

In 1992 the Council of Australian Governments[1] endorsed the following definition of Ecologically Sustainable Development (ESD):

> *……using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future can be increased[1].*

This broad definition of ESD is applied equally to painting walls and catching tuna. It has two goals:

- Improving environmental quality today.
- Acting, so that future generations enjoy an improved environmental quality.

In the building industry, ESD is also used as an abbreviation for Environmentally Sustainable Design. NATSPEC adopts the broader meaning of ESD, using the term 'development', to cover issues beyond design, such as construction, demolition and maintenance.

This TECHreport outlines how a NATSPEC-based specification can be used to give effect to ESD principles and opportunities in the building context.

1.2 ESD principles

The Australian Government *ESD Design Guide* identified the following principles of sustainable building design:[2]

- Client commitment.

  'The single most important principle for achieving ecologically sustainable building design is client commitment.'[3]
- Whole of life thinking.

  '[thinking] about the life cycle of the building; that is, its design, construction, use, refurbishment and demolition.'[4]
- Design influence.

  ' . . . it is at the design stage that many of the impacts of a building are locked in.'[5]
- Life Cycle Assessment (LCA):

  '. . . the whole of life impact of various initiatives on the environment.'[6]

  From these, it identifies a number of opportunities for ESD in building design:
  - Integrated design and process management.
  - Social sustainability and occupant satisfaction.
  - Indoor environment quality.
  - Energy management.
  - Commissioning and operations.
  - Transport.
  - Ozone layer depletion.
  - Choice of materials.
  - Waste minimisation.
  - Water use reduction.

These principles include not only the more familiar environmental factors such as energy and waste reduction, but also broader social factors such as accessibility by the whole community and provision of public space.

A brief recent history of ESD

1992	UN Framework Convention on Climate Change (The Earth Summit) produces the *International Environment Treaty*, Rio de Janeiro, Brazil.
	Australian Government produces a *National strategy for ecologically sustainable development.*
1995	(Australian) Building Design Professionals publishes *Environmental Design Guides.*
1997	United Nations - Kyoto Protocol – agreed an amendment to the Framework Convention on Climate Change Treaty – Kyoto, Japan.
1999	NATSPEC publishes *Sustainable Specifying – a plan for the greening of the national building specification.*
2000	Australian Building Greenhouse Rating (ABGR) Scheme goes national.
2003	Green Building Council of Australia (GBCA) launches the *Green Star* scheme.
	Australian Building Codes Board (ABCB) introduces energy efficiency measures in NCC - BCA Volume Two.
2004	ABCB introduces energy efficiency measures in NCC - BCA Volume One.
2005	Department of Environment and Heritage, (DEH), through RMIT, produces *ESD Design Guide for Australian Government Buildings*.
	NSW Department of Energy, Utilities and Sustainability (DEUS) are selected by DEH to roll out NABERS.
2006	DEH, through RMIT, produces a *Scoping study into improving the environmental sustainability of building materials.*
2007	Australian Government ratifies Kyoto Protocol.
2010	Building Energy Efficiency Disclosure Act passed.
2014	Building Energy Efficiency Amendment Bill introduced aimed at improving the program.
2015	United Nations – Paris Agreement signed by 195 UNFCCC members, ratified by 160.

1.3 The role of ESD in specifications

A basic principle of building contract documentation is that the specification puts into effect design decisions. In order to produce an ESD specification, appropriate design decisions must first be made. A non-sustainable design cannot be transformed into a sustainable one just by specifying. For example, it is not possible to achieve thermal efficiency through the specification alone, it must be designed in. The role of the specification, in this instance, is to enable the full ESD potential of the design to be achieved.

It is, however, possible to improve on the environmental impact of any design through the specification by mandating low toxicity materials, energy and water efficient appliances, and so on.

In summary, an ESD specification focuses on:

- Giving effect to ESD design decisions not shown on the drawings.
- Specifying ESD appropriate materials and methods of construction.
- Specifying components and products that permit the implementation of ESD.

Addressing barriers to effective action to reduce environmental impacts, the Department of the Environment and Energy notes that the problem is 'exacerbated by the lack of any standardised or independently developed "green" specification'.[7] NATSPEC, as a national master specification system, is not written as an exclusively green specification. It is a specification system that can be customised to give effect to a green design for specific projects.

1.4 NATSPEC's approach to ESD

The NATSPEC national specification system:

- Provides the design, build, construct and property industry with a comprehensive specification system that can be used in a variety of ways to cater for varying means of sustainable building procurement. Reference should be made to AS ISO 20400:2018 *Sustainable procurement – Guidance*.
- Recognises that most aspects of ESD relating to buildings are design issues and that a primary function of the specification is to give effect to design decisions.
- Does not mandate ESD but provides options for specifiers to choose and adopt ESD principles. Most worksections incorporate ESD provisions or the opportunity to specify ESD provisions through choices of materials, energy and water conservation measures and so on. The ESD relevance of a NATSPEC based specification will depend on options and values chosen by the designer.
- Does not attempt to arbitrate on competing claims made for the sustainability or otherwise of materials or methods. Instead NATSPEC aims to present specifiers with impartial information that they can use to make informed decisions.
- Provides material that can be used to specify ecologically sustainable, non-traditional construction materials and methods.
- Provides a means for meeting mandatory ESD requirements to the extent that these can be handled through the specification process.

1.5 ESD and the NCC

The NCC incorporates a number of mandatory environmental provisions. These primarily relate to energy conservation, reduction of greenhouse gases and water efficiency but also include improvement of comfort and amenity for building occupants.

This TECHreport indicates worksections that can be used to document provisions necessary to conform to the NCC and related ESD commitments made by designers to meet the NCC objectives. This is particularly relevant when the design is for a verification-based alternative solution, rather than the deemed-to-satisfy provisions of the NCC.

National Construction Code (NCC) - Building Code of Australia (BCA) Volumes 1-3

NATSPEC references ESD provisions in NCC Volumes 1, 2 and 3 where appropriate.

ESD references in NCC Volume 1 include:

Section F - Health and amenity

Part F1 – Damp and weatherproofing.

Part F4 – Light and ventilation.

Part F5 – Sound transmission and insulation.

Section J – Energy efficiency

Part J1 – Building fabric:

J1.2 Thermal construction - general.

J1.4 Roof lights.

J1.5 Walls and glazing.

Part J3 – Building sealing.

J3.3 Roof lights.

J3.4 Windows and doors.

J3.5 Exhaust fans.

J3.7 Evaporative coolers.

Part J5 – Air-conditioning and ventilation systems.

J5.4 Fan systems

J5.5 – Ductwork insulation

J5.12 Heat rejection equipment

Part J6 – Artificial lighting and power.

Part J8 – Facilities for energy monitoring.

Specification J6 – Lighting and power control devices.

The NCC is produced by the Australian Building Codes Board (ABCB). The ABCB is established by agreement between the Australian Government and each state and territory government. It is a cooperative arrangement between the signatories, local government and the building industry.

www.abcb.gov.au

1.6 ESD and environmental rating schemes

Incorporating ESD into a project starts with the client's commitment, either initiated by the client or suggested by the designers.

Although ESD can be on an ad hoc basis, a more structured approach, such as the adoption of an established voluntary environmental rating schemes, is more likely to result in the desired outcome. With the latter approach, designers make appropriate ESD design decisions to conform to the chosen scheme (and consequently the NCC ESD provisions).

NATSPEC TECHnote DES 014 outlines some voluntary environmental rating schemes. The schemes include:

- **The National Australian Built Environment Rating Scheme (NABERS)**

  The Australian Building Greenhouse Rating scheme (ABGR) was renamed NABERS Energy in May 2008.

  NABERS is a performance-based rating system for existing buildings. NABERS rates a building on the basis of its measured operational impacts on the environment, and provides a simple indication of how well these environmental impacts are being managed compared with equivalent buildings.

  The NABERS Energy Commitment Agreement allows developers and building owners to promote and market greenhouse performance of new and refurbished buildings. The Commitment Agreement states the commitment to design, build and commission a building to 4, 4.5, 5, 5.5 or 6 star rating.

  NCC - BCA Volume 1 Section J accepts obtainment of a minimum 5.5 stars NABERS Energy for offices base building Commitment Agreement as a verification method for Class 5 buildings.

- **Green Star**

  Green Star is a voluntary rating system administered by the Green Building Council of Australia (GBCA) for evaluating the environmental design and performance of buildings based on a number of criteria including management, indoor environmental quality, energy, transport, water, materials, land use and ecology, and emissions.

  NCC - BCA Volume 1 Section J allows the use of the Green Star Design & As-Built rating tool for Classes 2 (common areas) 3, 5, 6, 7, 8 or 9 as a verification method. In October 2020 GBCA released the new Green Star Buildings tool. The new tool is not referenced by the NCC.

  A 2010 memorandum of understanding between GBCA, Department of the Environment and Energy (formerly the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA)) and the NSW Government Office of Environment and Heritage (*formerly* NSW Department of Environment, Climate Change and Water (DECCW)), which administers NABERS, outlines a commitment to share information on rating tool development, calculators, benchmarks and methodologies to strengthen both rating systems.

This TECHreport indicates worksections that can be used to document design decisions and contractor submissions aimed at achieving rating scheme targets.

1.7 Commercial Building Disclosure (CBD)

The CBD Program requires energy efficiency information be provided in most cases when commercial office space of 1000 m² or more is offered for sale or lease. It was established by the *Building Energy Efficiency Disclosure Act 2010* and managed by the Department of the Environment and Energy. The CBD Program requires most sellers and lessors of office space to obtain a Building Energy Efficiency Certificate (BEEC) before the building goes on the market for sale, lease or sublease. BEECs include:

- The building's National Australian Built Environment Rating System (NABERS) Energy for offices star rating.
- A tenancy lighting assessment of the relevant area of the building.

Not all buildings are required to have a BEEC when they are sold or leased. For example, new buildings with a certificate of occupancy less than two years old, strata-titled buildings, leases and subleases of 12 months or less or buildings where ownership is transferred through the sale of shares do not require a BEEC.

The **National Australian Built Environment Rating System (NABERS)** measures an existing building's overall environmental performance during operation.

It provides separate ratings for commercial office buildings (including commercial office tenancies), hotels, shopping centres, data centres, hospitals (public) and apartments (including multi-unit residential common property).

NABERS rates performance on a 6 star scale. NABERS rating for office buildings covers the environmental impacts of the activities and services traditionally supplied by, or within, the control of building owners, facility managers, or tenants.

NABERS covers:

- Energy use and greenhouse gas emissions.
- Water use.
- Waste and toxic materials.
- Indoor environmental quality.

It is expected that NABERS will be extended to cover the following:

- Refrigerant use.
- Stormwater runoff and pollution.
- Sewage.
- Landscape diversity.
- Transport.

NABERS is managed nationally by the NSW Department of Planning, Industry and Environment

www.nabers.gov.au

Commercial Building Disclosure (CBD)

CBD is a national program designed to improve the energy efficiency of Australia's large office buildings that is being managed by the Australian Government Department of Industry, Science, Energy and Resources.

www.cbd.gov.au

NABERS Energy rated project

St Georges Terrace, Perth – 4 star energy rated (ABGR)

2 INCLUDING ESD CONCEPTS IN SPECIFICATIONS

2.1 Overview

The ways in which the specification can be used to implement specific ESD principles can be divided into a number of broad categories:

- Energy conservation and greenhouse gas reduction.
- Conservation of other consumables (like water).
- ESD appropriate materials e.g. materials with low volatile organic compounds (VOC) emissions, materials with recycled content materials or which can be recycled.
- Quality environment, both inside and outside the building, using ESD principles.
- Sustainable procurement by integrating sustainability requirements into the specification that address the following: mining of raw materials; material production; manufacturing; packaging; transportation and storage; emissions; waste; energy usage; and recycling. See AS ISO 20400:2018 *Sustainable procurement – Guidance.*

2.2 Energy conservation and greenhouse gas reduction

Reducing building energy consumption reduces operating costs and the greenhouse gas emissions from the energy use. Initially this involves appropriate design to reduce energy dependence through thermally efficient, passive design. The most direct way in which a specification can enhance this is by including energy efficient equipment such as for lighting, water heating and mechanical plant. The specification can also be used to document design decisions for reducing energy consumption, such as glazing and insulation performance, and air leakage.

As the application is broad and because not all clients require ESD provisions, NATSPEC does not impose ESD. Instead, it provides clients and designers a framework for incorporating ESD principles including life cycle costing but also allowing for provisions based on lowest initial cost. For example:

- *0461 Glazing* can be used to document minimum performance required by the BCA, performance to meet verification-based alternative solutions under the BCA, or ESD performance that exceeds BCA minimum requirements.
- *0731 Fans* can be used to specify a quieter fan with higher efficiency or a cheaper fan with lower efficiency and higher noise level. What is achieved will depend on the performance criteria documented in the fan schedule by the designer/specifier.

2.3 Water conservation

There is considerable potential for conserving water by specifying water efficient fixtures and equipment. *0811 Sanitary fixtures* and *0812 Tapware* contain provisions for specifying fixtures based on water efficiency ratings to AS/NZS 6400. Provisions for low water use cooling towers, reducing water use by increasing cycles of concentration and non-water consuming alternatives to cooling towers, are also included in *0713 Cooling towers*. Like most other ESD provisions, appropriate design is the first step in water conservation.

Where authorities permit the use of recycled water and rainwater, NATSPEC includes *0826 Greywater systems* and *0825 Rainwater storage systems* for specifying these systems.

2.4 Materials

The most frequent use of a specification is to prescribe specific materials to meet design objectives, including ESD objectives. The Department of Agriculture, Water and the Environment notes that:

> *The extent of knowledge gaps [about environmental impact] means that it is currently not possible to say that a given material is 'sustainable'.*[8]

It consequently recommends use of the term 'environmentally preferable'. The specifier needs to select the materials to suit their particular design objectives. ESD issues to consider are:

- Toxic and hazardous materials: If used, their use must conform to the

Current NABERS rating types

NABERS for Offices incorporates NABERS Energy for Offices (formerly the ABGR system) for greenhouse gas emission and energy rating, NABERS Water for Offices for rating water consumption, and NABERS Waste for Offices and NABERS Indoor Environment for Offices, reflecting the performance of the building relative to the market.

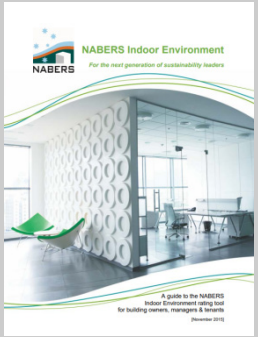
NABERS for Hotels is for rating all types of hotels and incorporates NABERS Energy for Hotels and NABERS Water for Hotels.

NABERS for Shopping centres is for rating shopping centres of more than 15,000 m² of Gross Lettable Area (Retail) and incorporates NABERS Energy for Shopping Centres and NABERS Water for Shopping Centres. It is for rating common areas, not individual retail tenancies.

NABERS for Data centres includes NABERS Energy for data centres to measure and benchmark the IT equipment, infrastructure services and the whole data centre.

NABERS for Apartments is for rating common areas including lifts, lobbies, carparks, gyms, pools and water features.

NABERS for Indoor environments is for measuring and benchmarking the indoor office environment of the base building, tenancies and the whole building.



WELS

AS/NZS 6400 forms a basis for the rating and labelling of a range of products under the mandatory Water Efficiency Labelling and Standards (WELS) scheme, as required by the Australian Water Efficiency Labelling and Standards Act 2005 (the WELS Act)

manufacturer's recommendations, usually shown in the manufacturer's Safety Data Sheets (SDS).

- Regional/local materials: Select renewable materials sources close to site.
- Alternatives: It should not be assumed that alternative materials are safer or more environmentally preferable, consider all environmental impacts, e.g. materials with recycled content may not be recyclable.
- Durability of materials: Premature failure of materials can be a significant determinant of the useful life of a building. NATSPEC provides many options for specifying materials for greater durability, e.g. corrosion resistance.
- Ongoing maintenance.

2.5 Alternative construction methods

In addition to alternatives for materials and methods for conventional construction, NATSPEC includes worksections for a number of alternative construction methods:

- *0361 Monolithic stabilised earth walls.*
- *0362 Mud brick walls.*
- *0363 Straw bale walls.*

2.6 Recycled materials, materials with recycled content and recyclability of materials

A key issue in building sustainably is the extent of recycled materials used, use of materials with recycled content, and the selection of materials that can be effectively recycled at the end of their functional life. Arguably there is considerably less ESD merit in using recycled materials initially if they cannot be later recycled or re-used. A new, non-recycled, material that can be recycled at the end of the building's life may be a better ESD choice.

As part of the life cycle assessment, consider what percentage of material can be recycled, whether recycling facilities exist at a reasonable distance from the site, and whether the proposed construction method enhances or hinders recyclability. Nail fixing, for example, may make otherwise recyclable timber unsuitable for recycling.

Specifiers also have the option of specifying the reuse of materials and equipment reclaimed/salvaged on site (in *0201 Demolition*).

2.7 Ozone depleting substances

The most common ozone depleting substances are chlorofluorocarbon (CFC) refrigerants, which are now prohibited and hydrochlorofluorocarbon (HCFC), which is in the process of being phased out. There are, however, other substances of lower (but not zero) ozone depletion potential that remain in use. NATSPEC generally prohibits their use in the manufacture of insulation materials. NATSPEC TECHnote *PRO 007 Refrigerants* provides advice on choosing ESD refrigerants.

NATSPEC also includes provisions for responsible management and recovery of ozone depleting substances during demolition of existing plant and appliances.

2.8 Indoor air quality

Indoor air quality can be affected by the following:

- Contaminants originating within the building such as:
  - Off-gassing from building materials and furnishings.
  - Carbon dioxide generated by the occupants.
  - Microbial contaminants including bacteria and moulds.
- Contaminants originating outside the building such as carbon/pollen particulates.
- Temperature and humidity.

These can be addressed by the following:

- Contaminants caused by building materials and furnishings can be reduced by

GBCA Green Star

Green Star is a national, voluntary rating system for evaluating the environmental design and/or as built performance of buildings based on a number of criteria, including energy and water efficiency, indoor environmental quality and resource conservation.

Green Star rating tools
Green Star - Design & As Built
Green Star - Buildings
Green Star - Interiors
Green Star - Communities
Green Star - Performance

Green Star was developed by the Green Building Council of Australia (GBCA) in conjunction with the Property Council of Australia.

www.gbca.org.au

Green Star rated projects

The Gauge, Melbourne – achieved 6 Star *Green Star – Office As Built v2* in 2008.

Global Change Institute (GCI), St Lucia, Queensland – achieved 6 Star *Green Star – Education Design V1* in 2014

Nishi Commercial, Canberra – achieved 6 Star *Green Star – Office As Built v3* in 2014.

- specifying materials with low/zero volatile organic compound (VOC), e.g. paints and adhesives.
- Contaminants originating from other sources can be reduced by a combination of appropriate design and specification. For example, carbon dioxide levels due to occupants can be reduced by appropriate fresh air ventilation levels (design) while particulate levels can be reduced by efficient filtration (a combination of design and specification).
- Microbial contaminants (including Legionella) inside the building can be reduced by designing and specifying systems to reduce or eliminate potential microbial breeding conditions.
- Mould can be reduced by designing and specifying to prevent moisture accumulation, rain infiltration and condensation.

Measures to improve indoor air quality are primarily dealt with in the 05 INTERIOR, 06 FINISHES and 07 MECHANICAL SERVICES workgroups.

2.9 Outdoor air quality

NATSPEC contains many provisions for improving outdoor air quality in the immediate vicinity of the building and in the wider environment:

- Reducing the risk of microbial contamination, particularly Legionella (a combination of design and specification).
- Reducing emissions from plant (e.g. boilers).
- Reducing dust and other emissions during demolition and construction.

2.10 Lighting

Artificial

Artificial lighting represents a major energy load in buildings and designers can minimise its impact by:

- Designing illuminance and luminance levels to suit the application.
- Selecting lamps and ballasts to minimise energy consumption.
- Designing lighting control systems to minimise energy use, particularly in unoccupied spaces.
- Providing lighting controls to reduce lighting levels in day-lit spaces.

The NATSPEC *Electrical services* worksections include clauses for specifying energy efficient lighting products and control systems to reduce lighting energy use.

Natural

Commensurate with daylight and sun glare constraints, the building fenestration design should optimise both the level and penetration of natural lighting within the building.

Daylight controls

NATSPEC worksections cover controls to reduce artificial lighting and make use of available daylight. Include internal and external sun control devices for natural lighting and thermal control.

2.11 Noise and vibration

NATSPEC includes provisions for specifying building elements that reduce the transmission of impact and airborne noise. For noise-generating equipment, it includes provisions for specifying limits on noise generated and, if appropriate, noise reducing equipment such as acoustic louvres.

In general, if a building is designed and documented by others, the contractor's liability for meeting specific noise targets is limited to complying with the documents. Specifying both the detailed performance of components and acoustic performance to be achieved is likely to be fruitless contractually. The building and its systems must have either the required acoustic performance designed in, or if performance is specified, the contractor must be allowed to make changes to meet it.

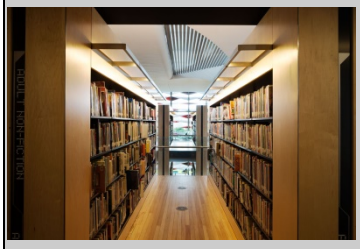
In addition to covering noise generated after the building is completed, NATSPEC also provides a framework for specifying limits on construction noise.

Green Star rated projects

Dandiiri Contact Centre, Zillmere, Brisbane – achieved 6 Star *Green Star – Office Design V2* in 2010.

8 Chifley Square, Sydney – achieved 6 Star Green Star - Office As Built v2 in 2015.

Other projects with ESD provisions



Bankstown Library, Sydney.

Includes Living wall and a combination of adaptive re-use with use of salvaged materials. 95% of the building's new timber floor is from salvaged materials.

2.12 Living roofs and walls

Living roofs and walls can be included in projects to provide the following benefits for building owners and occupants:

- Reduced energy consumption and greater temperature control.
- Noise reduction when combined with insulation.
- Indoor walls can improve indoor air quality.
- Increased usable open space and comfort.
- Increase biodiversity.
- Reduce heat island effect.

See TECHnote DES 026 for other benefits and guidance on using NATSPEC to specify living walls and roofs.

2.13 Other environmental concerns

As part of NATSPEC's broad scope, it specifies a number of other environmentally enhancing measures including:

- Termite management.
- Control of electromagnetic radiation.
- Remediation of soils.
- Corrosion resistance and durability.
- Vapour transmission.
- Weed management.
- Services commissioning.
- Maintenance. See *NATSPEC Maintenance reference*.

NATSPEC *0172 Environmental management* calls for the preparation of plans for waste and weed management, soil erosion and sediment control, and the incorporation of actions and follow-up monitoring of environmental issues.

Life Cycle Assessment (LCA)

Included among the many transactions that buildings relate to are:

Resource use

- Concrete
- Steel
- Timber
- Renewable energy
- Non-renewable energy

Air pollution

- VOCs – volatile organics
- NOx – nitrogen oxides
- SOx – sulfur oxides

Water pollution

- Manufacturing process
- Heavy metals
- Faecal matter

Solid waste

- Construction
- Demolition

Economics

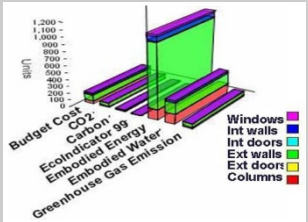
- Transport
- Material – salvage value
- Durability
- Maintenance
- Operation – energy consumption level

Human impact

- Carcinogens
- Greenhouse gas
- Climate change

LCADesign software

Developed by the Sustainable Built Environment National Research Centre (SBEnrc), formerly the Australian Cooperative Research Centre for Construction Innovation (CRCCI), LCADesign assists designers to make quantitatively informed decisions on the full spectrum of operational and embodied environmental impacts of commercial buildings. LCADesign allows environmental assessments to be made in real time, directly and automatically from 3D CAD Building Information models. Building product life cycle inventory (LCI) databases are available for the supply chains of Australia, Netherlands, Belgium, Luxembourg, Germany and California.



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3 ESD INFORMATION IN NATSPEC

3.1 Worksections

This TECHreport includes several appendices identifying ESD provisions in NATSPEC worksections.

- Appendix A is a guide for incorporating ESD provisions into NATSPEC worksections.
- Appendix B lists the ESD related provisions in NATSPEC worksections.
- Appendix C lists BCA ESD provisions covered in NATSPEC arranged by BCA clause number. It can be used as a specification check list for BCA ESD compliance within NATSPEC.
- Appendix D lists standards related to ESD.

3.2 Guidance notes

All NATSPEC worksections include *Guidance* text which provide suggestions on available ESD options and explain implications of requirements in NATSPEC worksections.

3.3 TECHnotes

NATSPEC provides a number of brief TECHnotes covering ESD related matters. See the following TECHnotes:

- DES 011 for rainwater harvesting.
- DES 013 for NCC energy efficiency protocol and software for housing.
- DES 014 for environmental rating schemes for buildings.

- DES 015 for NCC – BCA Volume One: Energy efficiency provisions.
- DES 016 for NCC – BCA Volume Two: Energy efficiency provisions.
- DES 024 for water sensitive urban design (WSUD).
- DES 026 for living walls and roofs.
- GEN 028 for specifying recycled materials for road works using AUS-SPEC.
- PRO 001 for CCA (copper chrome arsenate) treated timber.
- PRO 005 for formaldehyde - indoor air quality.
- PRO 007 for refrigerant options.

REFERENCES

AIRAH Refrigerant Selection Guide (2003)

www.airah.org.au/Content_Files/TechnicalPublications/AIRAH_RSG2003.pdf

AS/NZS 6400 (2016) Water efficient products - Rating and labelling

Ecologically Sustainable Development Steering Committee, *National Strategy on Ecologically Sustainable Development* (1992) (Council of Australian Governments)

Green Star rating tools:

new.gbca.org.au/rate/rating-system

Sustainable Built Environments, and Centre for Design at RMIT University, *ESD Design Guide for office and public buildings* (3rd) (2007) (Commonwealth of Australia.

The Centre for Design at RMIT University, BIS Shrapnel, CSIRO, Deni Greene Consulting Services, and Seneca Consulting. 'Scoping Study into Improving the Environmental Sustainability of Building Materials.' Canberra: Australian Greenhouse Office, 2006. Download the study at www.environment.gov.au.

NATSPEC DES 011 *Rainwater harvesting (2016)*

NATSPEC DES 013 *NCC Energy efficiency protocol and software for housing (2019)*

NATSPEC DES 014 *Environmental rating schemes for buildings (2019)*

NATSPEC DES 015 *NCC - BCA Volume One: Energy efficiency provisions (2019)*

NATSPEC DES 016 *NCC - BCA Volume Two: Energy efficiency provisions (2019)*

NATSPEC DES 024 *Water sensitive urban design (WSUD) (2019)*

NATSPEC DES 026 *Living walls and roofs (2015)*

NATSPEC GEN 028 *Specifying recycled materials for road works using AUS-SPEC (2019)*

NATSPEC PRO 001 *CCA (copper chrome arsenate) treated timber (2015)*

NATSPEC PRO 005 *Formaldehyde - indoor air quality (2018)*

NATSPEC PRO 007 *Refrigerant options (2017)*

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[1] Ecologically Sustainable Development Steering Committee, *National Strategy on Ecologically Sustainable Development* (1992) (Council of Australian Governments) <http://www.deh.gov.au/esd/national/nsesd/strategy/index.html> [accessed 20March 2009] (9)

[2] Sustainable Built Environments and Centre for Design at RMIT University, *ESD Design Guide for Australian Government Buildings* (2nd) (2006) (Commonwealth of Australia).

[3] Ibid. (09)

[4] Ibid.

[5] Ibid.

[6] Ibid. (10)

[7] The Centre for Design at RMIT University et al., 'Scoping Study into Improving the Environmental Sustainability of Building Materials,' (Canberra: Australian Greenhouse Office, 2006).

[8] Ibid.

Appendix A: Guide to specifying ESD provisions in NATSPEC worksections

1 USING NATSPEC TO DOCUMENT ESD REQUIREMENTS

NATSPEC information can be used to assist specifiers to document environmentally sustainable developments and if required, assist in attaining a voluntary environmental rating such as Green Star as follows:

1.1 Document design decisions in the specification

The national master specification can be used to document design decisions/construction requirements/verification procedures by retaining relevant default text, completing prompts, adding additional text to the relevant technical worksections by converting *Optional* style text to *Normal* style text or options provided in *Guidance* and/or by adding relevant text to worksections from sources other than NATSPEC. Refer to Appendix B for locating ESD provisions in NATSPEC worksections and this appendix for sample ESD related text, which may be incorporated into appropriate worksections and edited to suit the project.

1.2 Provide specification text which can be extracted for submission for environmental rating assessment

For example, the Green Star Design & As Built rating tool identifies specifications in a List of Evidence (documents which may demonstrate conformance with GBCA requirements) as follows:

- Written descriptions of the works to be completed for the project.
- Specifications used to determine the required works, the requirements for a product and for verifying the installed item or the works completed.
- A list of mandatory requirements, including applicable standards.

1.3 Document requirements for contractor submissions of evidence for voluntary environmental rating assessment

Use the **SUBMISSION** clause in the appropriate worksection to document required contractor submissions for commissioning information, and verification of accredited sources and products/materials as built.

2 INCORPORATING ESD PROVISIONS IN NATSPEC WORKSECTIONS

The following are suggested ESD related content which may be incorporated into appropriate worksections and edited to suit the project.

< WORKSECTION TITLE>

1 GENERAL

X.X RESPONSIBILITIES

For worksections with design components, the following clause may be included.

Design for durability and maintainability

Design for durability: Develop the design so the systems achieve the documented performance, reliability, service life, energy efficiency and safety requirements, and are easily maintainable.

Access for maintenance: Develop the design so the systems conform to **ACCESS FOR MAINTENANCE** in *0171 General requirements*.

X.X INTERPRETATION
Definitions

General: For the purposes of this worksection, the following definitions apply:

- Recycled material content:
  - . Post-consumer material: Waste generated by the end consumer of the product (or waste stream), which can no longer be used for its intended purpose.

Appendix A: Guide to specifying ESD provisions in NATSPEC worksections

e.g. recycled glass used in bricks. The higher the post-consumer recycled material content, the more waste is diverted from disposal. 100% is the ideal goal.

. Pre-consumer material: Material diverted from the waste stream during the manufacturing process and re-introduced into the finished product.

e.g. sawdust, planer shavings, glass cullet used in wood based products. This does not include utilising reclaimed material by such processes as regrinding or reworking.

X.X SUBMISSIONS
Certification

Supply chain certificate: Submit evidence that products/materials are obtained from a **<certification body>** accredited source.

Products and materials

Recycled material content: Submit documentation from the **<material/product>** manufacturer showing the following:

- Post-consumer recycled content: [complete/delete]
- Pre-consumer recycled content: [complete/delete]

VOC emissions: Submit a list of all the adhesives, sealants, paints and coatings used in the **<material/component>** system, which states the VOC emission level and includes all chemical components.

Urea formaldehyde: Submit a list of the following used in the building and evidence that they do not contain urea formaldehyde:

- Composite wood products.
- Laminating adhesives.
- Core and adhesive products.

Rating scheme

<Rating scheme> conformance documents: Submit evidence of conformance to the following:

- **<Criteria/material>**: **<Document + information on document>**
- [complete/delete]

See TECHnote DES 014 for information on the different voluntary environmental rating schemes for buildings.

Documents required: e.g. product data, testing certificates, inspection certificates.

Information on documents: e.g. WELS rating for sanitary fixtures.

Recovered materials

Re-use of recovered items/materials: Submit a proposal describing the cleaning, repair and reconditioning of recovered items and the location where each item is to be reused.

Appendix A: Guide to specifying ESD provisions in NATSPEC worksections

2 PRODUCTS

X.X LOCAL MATERIALS
General

Requirements: Provide materials that have been extracted/harvested/recovered/manufactured, within **<XXX>** km of the project site.

Calculation of local material content: If only a fraction of a product or material is extracted/harvested/recovered/manufactured locally, only include that percentage (by weight) to the local cost value.

Project local materials content: Minimum **<XXX>**% of building materials, based on cost.

X.X <PRODUCT>
Recycled material content

Post-consumer recycled content: **<XXX>**%

Pre-consumer recycled content: **<XXX>**%

Certified product

e.g. wood-based material obtained from a certified sustainable source such as Australian FSC certified timber. This includes wood-based panels and engineered wood products.

Requirement: Provide **<XXX>**% (by cost) of wood-based material from timber obtained from forests certified by **<certification body>**.

This may be applicable to the following worksections:

- Structural timber.
- Light timber framing.
- Sheet flooring and decking.
- Cladding – flat sheets and panels.
- Cladding – planks and weatherboards.
- Lining.
- Joinery.
- Engineered panel flooring.
- Timber flooring.

Appendix A: Guide to specifying ESD provisions in NATSPEC worksections

Timber source certification

Requirement: Use timber products originating from sustainably managed forests.

Application: Items requiring source certification:

- [complete/delete]

Itemise the types of timber structures or elements that require source certification, e.g. Timber trusses, Hardwood flooring.

Certification: [complete/delete]

Forests may be certified to more than one forest management scheme but products from these forests can be certified to one chain of custody scheme only. If certified forest products are required, select from the following schemes available in Australia.

- **Responsible Wood**: (formerly Australian Forestry Standard (AFS) and endorsed by PEFC) Certification of sustainable forest management to AS 4708 and chain of custody for forest products to AS 4707. AS 4707 also allows chain of custody certification of mixed products (virgin and recycled raw material). Forest management and suppliers are certified by JAS-ANZ accredited organisations. Select Responsible Wood to verify that forest products are sourced from Australian forests and controlled sources, and manufactured, processed and distributed through a sustainable Australian supply chain. www.responsiblewood.org.au
- **PEFC (Programme for the Endorsement of Forest Certification)**: Certification of sustainable forest management to PEFC ST 1003 (or PEFC ST 1002 for Group Certification) and chain of custody to PEFC ST 2002. PEFC is a federation of internationally recognised and mutually endorsed forest certification schemes. Some like Australia (Responsible Wood), Malaysia (MFCC), Indonesia (IFCC), China (CFCC), and Japan (SGEC) are national branded schemes whilst others are branded as PEFC. All mutually endorsed forest certification schemes can provide a PEFC claim on forest products. Forest management and suppliers are certified by JAS-ANZ accredited organisations or mutually recognised accreditation bodies. Select PEFC or PEFC endorsed certification to verify that forest products and supply chains meet these international standards. www.pefc.org
- **FSC (Forestry Stewardship Council)**: Certification of sustainable forest management to FSC-STD-AUS-01-2018 EN and chain of custody for forest products to FSC-STD-40-004 V3-0. FSC is a global eco-label. Certifiers are accredited by ASI International, a member of ISEAL, a global membership association for sustainability standards. Select FSC certification to verify forest products originate from well-managed forests, controlled sources, reclaimed materials, or a mixture of these. fsc.org/en-au

VOC emission limits

e.g. wood-based material obtained from a certified sustainable source such as Australian FSC certified timber. This includes wood-based panels and engineered wood products. List limits required by the certification scheme for materials and finishes, including for:

- Paints.
- Carpets and other flooring materials.
- Adhesives and sealants.

Requirement: Provide materials conforming to the following limits for VOC content:

- **<Material>**: **<XXX>** µg/m^2/h.

Typical limits include the following:

- Carpets and other flooring materials: 500 µg/m^2/h.

Low VOC emitting paints

Requirement: Provide paints with maximum **<XXX>** g/L VOC content.

See AS/NZS 2311 clause 1.5.2.6 and Table 4.2 for guidance on low VOC paint types.

Appendix A: Guide to specifying ESD provisions in NATSPEC worksections

Urea formaldehyde resin

Requirement: Do not use composite wood, adhesives or other products that contain urea formaldehyde resins.

Prohibited materials

Insulation blowing agents:

- Materials that use chlorofluorocarbon (CFC) or hydrochlorofluorocarbon (HCFC) in the manufacturing process.
- A blowing agent with a global warming potential (GWP) ≥ 700.

ESD provision: Some blowing agents have very high global warming potential (GWP). Typical values are:

- HCFC-142b:1800 (HCFC-142b is primarily used in extruded (not expanded) polystyrene).
- HFC-134a:1300.
- HFC-152a:140.
- Carbon dioxide: 1.

3 EXECUTION

X.X PRE-INSTALLATION MEETINGS
General

Requirement: Before start of works, arrange for meeting at **<location>** to review **<rating scheme>** requirements, submissions and action plans for conformance.

X.X CONSTRUCTION WASTE MANAGEMENT
General

Packaging: Salvage/recycle 100% of the following uncontaminated packaging material:

- Paper.
- Cardboard.
- Plastic sheet and film.
- Polystyrene.
- Wood crates/pallets.
- Plastic pails.
- [complete/delete]

Recycling of off-cuts: Collect off-cuts as work progresses and store in separate containers as recommended by the material/product manufacturer for collection at completion of works.

List off-cut materials to be recycled, e.g. gypsum, vinyl flooring.

Disposal: Remove from site and dispose of as recommended by the material/product manufacturer.

Appendix A: Guide to specifying ESD provisions in NATSPEC worksections

Salvaging waste for re-use

Items for re-use in the work: Salvage items for re-use as follows:

- Pack/crate items after cleaning. Label contents on the containers, indicating component, date of removal, quantity, and location of removal.
- Store in a secure area until required for installation.
- Protect from damage during transportation and storage.

X.X <MATERIAL> REMOVAL
Removal for recycling

Requirement: Remove **<material/product>** with as little damage as possible to the material. If required, separate construction debris from the material, including adhesives and fasteners. Pack and store as recommended by the recycling operator for transportation.

Alternatively the following text could be included:

Delivery: Deliver to **<facility name>** recycling facility.

X.X INDOOR AIR QUALITY ASSESSMENT
Flush-out:

Requirement: After completing installation of all interior finishes and before occupancy, flush-out building by supplying **<XXX>** L of outdoor air per m^2 of floor area while maintaining an internal temperature of at least **<XXX>**ºC and a relative humidity no higher than **<XXX>**%.

Appendix B: ESD provisions in NATSPEC worksections

Worksection Number	Worksection title	ESD provision	
			Legend:
		■	**Default** text
		●	**Optional** provisions (in prompts, guidance or schedules)
		▲	**Other** potential provisions
0171	General requirements	■	Access for maintenance, commissioning, operation and maintenance manuals, record drawings and training for improved operational efficiency and ongoing maintenance.
		■	Corrosivity category for appropriate durability to maximise material life cycle of metallic components.
		■	Prohibition on hazardous materials.
		■	Provisions for reducing services noise and vibration level.
		●	Bushfire resistance design and construction to extend material life cycle.
		●	Green Star certification requirements.
		▲	Re-use of existing services systems.
		▲	Materials/products with recycled material content, low toxic emissions, low embodied energy and water, and able to be easily recycled.
		▲	Materials sourced close to site.
0172	Environmental management	■	Environmental management plan.
		■	Soil erosion and sediment control.
		■	Waste management, including mulching for re-use.
		■	Weed management.
		■	Ground contamination control.
		■	Environmental controls for air quality, dust, water quality, fauna protection, vehicular and equipment contamination, noise and vibration.
0181	Adhesives, sealants and fasteners	■	Fasteners: Corrosion resistance for durability to improve material life cycle.
		●	Adhesives: Limiting VOC levels.
		●	Architectural sealants: Limiting VOC levels.
0182	Fire-stopping	■	Prohibition on use of toxic materials including asbestos and lead.
		●	Recycled material content, e.g. for mineral fibre products.
0183	Metals and prefinishes	▲	Options for durable components.
		▲	No cadmium plating.
0184	Termite management	■	Non-chemical management systems.
		▲	Low toxicity chemical treatments.
		▲	Chemical free accessories, e.g. resins, grouts, mortars and collars.
0185	Timber products, finishes and treatments	■	Recycled timber.
		■	Timbers with natural durability.
		■	Timber sourced locally/close to the site, from a sustainable source, and forest certification.
		●	Hazard class selection for preservatives.
		●	Reconstituted wood-based panels.
		▲	Preservatives, adhesives and finishes with low VOC emission, e.g. water-based finishes.
0191	Sundry items	▲	Energy star rating for electrical appliances e.g. Refrigerators and clothes dryers
		▲	Water start rating for fittings and appliances e.g. Dishwashers and washing machines.
0201	Demolition	■	Recovered items for re-use in the works.
		■	Demolished materials for recycling in the works.
		■	Demolished materials for recycling off-site.
		■	Dismantle for relocation as part of the works.
		■	Demolition of refrigeration systems and hazardous materials and disposal of them.
		■	Dust protection.
0202	Demolition (Interior and alterations)	■	Recovered items for re-use in the works.
		■	Demolished materials for recycling off-site.
		■	Demolition of refrigeration systems and hazardous materials and disposal of them

Appendix B: ESD provisions in NATSPEC worksections

Worksection Number	Worksection title	ESD provision	
			Legend:
		■	**Default** text
		●	**Optional** provisions (in prompts, guidance or schedules)
		▲	**Other** potential provisions
0202	Demolition (Interior and alterations) (cont.)	■	Dust protection.
		▲	Demolished materials for recycling in the works
		▲	Dismantled items for relocation as part of the work
0221	Site preparation	■	Tree protection.
		●	Waste minimisation through re-use of land clearing debris.
0222	Earthwork	●	Re-use of material recovered from excavation.
		●	Topsoil for re-use.
0223	Service trenching	▲	The use of recycled materials for backfilling trench and surface reinstatement
0224	Stormwater – site	●	Material selection criteria, e.g. low impact requirements such as recycled content, energy required for transportation and manufacturing, recyclability and maintenance requirements.
		▲	Stormwater harvesting to reduce stormwater runoff, mitigate downstream flooding and improve water quality of nearby waterways.
0241	Landscape – walling and edging	●	Maximising life cycle of materials, e.g. by selecting Durability class 1 hardwood.
		▲	Timber sourced locally/close to the site, from a sustainable source, e.g. native state forest.
0242	Landscape – fences and barriers	●	Maximising life cycle of materials, e.g. by selecting Durability class 1 hardwood.
		▲	Timber sourced locally/close to the site, from a sustainable source, e.g. native state forest.
0250	Landscape – combined	■	Automatically controlled irrigation, micro-irrigation and drip systems to minimise water consumption.
		▲	Low water use plant species.
		▲	Recycled products, e.g. soil, mulch, water basins, pavers and stakes.
		▲	Products sourced locally/close to the site from, a sustainable source, e.g. rocks, pebbles, timbers.
		▲	Plant species and other landscaping components requiring minimal power tool maintenance.
0251	Landscape – soils	■	Soil/embankment stabilisation.
		▲	Limits on externally sourced topsoils.
0252	Landscape –natural grass surfaces	●	Manual or other non-toxic method of weed eradication.
		●	Temporary grassing of stockpiles and earthworks to minimise erosion.
0253	Landscape – planting	▲	Low water use plant species.
		▲	Indigenous plant species.
		▲	Plant species requiring minimal power tool maintenance, e.g. lawn mowers, trimmers and chain saws.
		▲	Seeds or cuttings sourced locally/close to the site to minimise transportation.
		▲	Plants selected to minimise runoff.
0254	Irrigation	■	Water efficient micro-irrigation and drip irrigation systems.
		▲	Blackwater, greywater or stormwater/rainwater harvesting for irrigation.
		▲	Water efficient products and systems, e.g. soil moisture monitors and rain sensors which suspends automatic irrigation systems during and shortly after rainfall to minimise overwatering.
0255	Landscape – plant procurement	▲	Seeds or cuttings sourced as close as possible to the site, to minimise transportation.
0256	Landscape – establishment	▲	Non-toxic weed and pest control methods.
0259	Landscape maintenance	▲	Plant replacement sourced-as close as possible to the site, to minimise transportation.
		▲	Non-toxic weed and pest control methods.
0261	Landscape – furniture and fixtures	▲	Maximising life cycle of materials.
		▲	Products made from recycled materials.

Appendix B: ESD provisions in NATSPEC worksections

Worksection Number	Worksection title	ESD provision	
			Legend:
		■	**Default** text
		●	**Optional** provisions (in prompts, guidance or schedules)
		▲	**Other** potential provisions
0261	Landscape – furniture and fixtures (cont.)	▲	Timber sourced locally/close to site.
		▲	Products which may be recycled.
0262	External sports and playground surfacing	●	Colour selection to reduce ambient temperatures and cooling loads of surrounding buildings.
		●	Recycled rubber in polymeric surfacing systems.
0271	Pavement base and subbase	▲	Use of recycled material, e.g. crushed concrete from demolished work, recycled brick/masonry aggregate.
0272	Asphalt	■	Reclaimed asphalt pavement (RAP).
		●	Removed asphaltic concrete stockpiled for use later as a base course material.
		▲	Recycled crushed concrete aggregate.
		▲	Crushed glass fines.
		▲	Scrap rubber additives.
0273	Sprayed bituminous surfacing	▲	Reclaimed asphalt pavement (RAP).
		▲	Recycled crushed concrete aggregate.
0274	Concrete pavement	■	Pre-consumer supplementary cementitious materials (SCM) as partial replacement for portland cement.
		■	Recycled concrete aggregate.
		▲	Reinforcing from recycled steel.
		▲	Recycled plastic in fibre reinforced concrete.
		▲	Pervious concrete pavement to reduce stormwater runoff.
0275	Paving – mortar and adhesive bed	▲	Colour selection to reduce ambient temperatures and cooling loads of surrounding buildings.
		▲	Recovered pavers.
		▲	Water harvesting to reduce rainwater run-off.
0276	Paving – sand bed	▲	Permeable pavers for water infiltration and retention for water sensitive urban design (WSUD).
		▲	Colour selection to reduce ambient temperatures and cooling loads of surrounding buildings.
		▲	Recovered pavers.
0278	Granular surfaces	●	Recycled granular surface materials such as crushed gravel, granite or brick.
		●	Low toxicity herbicide, e.g. non-residual glyphosate.
0279	Paving – on pedestals	▲	Colour selection to reduce ambient temperatures and cooling loads of surrounding buildings.
		▲	Recovered pavers.
		▲	Water harvesting to reduce rainwater run-off.
0301	Piling	▲	Recycled steel tubes
		▲	Pulverised fuel ash (PFA) in grout products
		▲	Recycled aggregate.
		▲	Precast modular foundations to minimise concrete and steel, and waste materials.
0310	Concrete – combined	■	Profiled steel sheeting composite formwork.
		■	Pre-consumer supplementary cementitious materials (SCM) as partial replacement for portland cement, e.g. fly ash, slag cement and amorphous silica.
		▲	Re-useable formwork.
		▲	Engineered wood form panels.
		▲	Timber forms from a sustainable source, e.g. plantation.
		▲	Other permanent formwork, e.g. unfinished or prefinished fibre cement, polymer formwork, aluminium composite panels and insulating formwork.
		▲	Fabric formwork to reduce formwork material weight.
		▲	Reinforcing with recycled steel content
		▲	Fibre-reinforced bars and grids.
		▲	Recycled plastic in fibre-reinforced concrete.

Appendix B: ESD provisions in NATSPEC worksections

Worksection Number	Worksection title	ESD provision	
			Legend:
		■	**Default** text
		●	**Optional** provisions (in prompts, guidance or schedules)
		▲	**Other** potential provisions
0310	Concrete – combined (cont.)	▲	High-grade reinforcing to reduce the amount of reinforcement and/or concrete required to achieve the same performance.
		▲	Reinforcement with improved corrosion resistance for enhanced concrete durability.
		▲	Wire and welded mesh to use less reinforcing material.
		▲	Reinforcement manufactured using electric arc furnace instead of basic oxygen steel to reduce required energy input.
		▲	Recycled concrete aggregate.
		▲	Admixtures to reduce CO_2 of the concrete.
		▲	Exposed concrete slab to reduce finish materials required, e.g. polished or honed concrete floor, off-form walls and ceilings.
		▲	Low odour and low VOC emitting sealers and stains, e.g. water-based dyes and sealers.
0311	Concrete formwork	■	Profiled steel sheeting composite formwork.
		▲	Re-usable formwork.
		▲	Engineered wood form panels.
		▲	Timber forms from a sustainable source, e.g. plantation.
		▲	Other permanent formwork, e.g. unfinished or prefinished fibre cement, aluminium composite panels and insulating formwork.
		▲	Fabric formwork to reduce formwork material weight.
0312	Concrete reinforcement	▲	Reinforcing with recycled steel content.
		▲	Fibre-reinforced bars and grids.
		▲	Recycled plastic in fibre-reinforced concrete.
		▲	High-grade reinforcing to reduce the amount of reinforcement and/or concrete required to achieve the same performance.
		▲	Reinforcement with improved corrosion resistance for enhanced concrete durability.
		▲	Wire and welded mesh to use less reinforcing material.
		▲	Reinforcement manufactured using electric arc furnace instead of basic oxygen steel to reduce required energy input.
0313	Concrete post-tensioned	▲	Recycled concrete aggregate.
		▲	Pre-consumer supplementary cementitious materials (SCM) as partial replacement for portland cement, e.g. fly ash, slag cement and silica fume.
		▲	Reinforcing with recycled steel content.
		▲	Admixtures to reduce CO_2 of the concrete.
0314	Concrete in situ	■	Pre-consumer supplementary cementitious materials (SCM) as partial replacement for portland cement, e.g. fly ash, slag cement and amorphous silica
		▲	Recycled concrete aggregate.
		▲	Admixtures to reduce CO_2 of the concrete..
0315	Concrete finishes	▲	Exposed concrete slab to reduce finish materials required, e.g. polished or honed concrete floor, off-form walls and ceilings.
		▲	Low odour and low VOC emitting sealers and stains, e.g. water-based dyes and sealers.
0318	Shotcrete	▲	Pre-consumer supplementary cementitious materials (SCM) as partial replacement for portland cement, e.g. fly ash, slag cement and amorphous silica
		▲	Amorphous silica: Add to improve energy absorption and impact resistance
		▲	Fibres: add to improve energy absorption and impact resistance.
		▲	Accelerators: add to improve placement in adverse conditions and therefore, reduce fallouts on structures subject to vibration.
0321	Precast concrete	■	Prestressed concrete to allow for longer spans with less supports.
		■	Pre-consumer supplementary cementitious materials (SCM) as partial replacement for portland cement. e.g. fly ash, slag cement and amorphous silica.

Appendix B: ESD provisions in NATSPEC worksections

Worksection Number	Worksection title	ESD provision	
			Legend:
		■	**Default** text
		●	**Optional** provisions (in prompts, guidance or schedules)
		▲	**Other** potential provisions
0321	Precast concrete (cont.)	●	Off-form finishes including coloured oxides or polished finishes to eliminate the need for additional finishes and reduce ongoing maintenance.
		▲	Re-use of moulds including standardising wood form parts for multiple re-use.
		▲	Hollow core floor planks as ducting to channel air around the building, eliminating the need for additional ductwork.
		▲	Recycled concrete aggregate.
		▲	Reinforcing with recycled steel content.
		▲	Insulated precast sandwich panels, e.g. by incorporating extruded polystyrene, to improve thermal mass.
		▲	Reduced cement requirements by lowering water:cement ratios.
		▲	Admixtures such as hardening accelerators to eliminate applied heat in curing.
		▲	Self-compacting concrete additive to assist setting without the aid of energy demanding vibration beds.
		▲	Carbon fibre reinforcement to allow lighter and larger concrete sections with less embedded energy and no corrosion.
		▲	Enclosed sandblasting facilities with 100% process-waste control.
0322	Tilt-up concrete	■	Pre-consumer supplementary cementitious materials (SCM) as partial replacement for portland cement. e.g. fly ash, slag cement and amorphous silica.
		●	Off-form finishes including coloured oxides or polished finishes to eliminate the need for additional finishes and reduce ongoing maintenance.
		▲	Recycled concrete aggregate.
		▲	Reinforcing with recycled steel content
		▲	Insulated precast sandwich panels, e.g. by incorporating extruded polystyrene, to improve thermal mass
		▲	Re-use of formwork and moulds including standardising wood form parts for multiple re-use.
		▲	Reduced cement requirements by lowering water:cement ratios.
		▲	Admixtures such as hardening accelerators to eliminate applied heat in curing.
		▲	Carbon fibre reinforcement to allow lighter and larger concrete sections with less embedded energy and no corrosion.
0331	Brick and block construction	■	Minimum durability classification for steel components, including reinforcement.
		▲	Re-use of reclaimed brick and blocks.
		▲	Recycled material content, e.g. recycled glass aggregate.
		▲	Concrete blocks incorporating recycled concrete, fly ash content as a replacement of more energy intensive cement.
		▲	Corrosion protection with the appropriate durability for metallic components to extend material/product life.
		▲	Lightweight blocks with high recycled material content.
0332	Stone masonry	■	Minimum durability classification for steel components, including reinforcement.
		▲	Re-use of reclaimed stone.
		▲	Stone sealers with low/zero VOC emitting and/or solvent free materials.
		▲	Stone sourced from quarries with sustainable management systems, e.g. water use minimisation, waste water collection and re-use.
0334	Block construction	■	Minimum durability classification for steel components, including reinforcement.
		▲	Re-use of reclaimed masonry units.
		▲	Recycled material content, e.g. recycled glass aggregate.
		▲	Concrete blocks incorporating recycled concrete, fly ash content as a replacement of more energy intensive cement.

Appendix B: ESD provisions in NATSPEC worksections

Worksection Number	Worksection title	ESD provision	
			Legend:
		■	**Default** text
		●	**Optional** provisions (in prompts, guidance or schedules)
		▲	**Other** potential provisions
0334	Block construction (cont.)	▲	Corrosion protection with the appropriate durability for metallic components to extend material/product life.
		▲	Lightweight blocks with high recycled material content.
0335	Brick construction	■	Minimum durability classification for steel components, including reinforcement.
		▲	Re-use of reclaimed masonry units.
		▲	Recycled material content, e.g. recycled glass aggregate.
		▲	Concrete blocks incorporating recycled concrete, fly ash content as a replacement of more energy intensive cement.
		▲	Corrosion protection with the appropriate durability for metallic components to extend material/product life.
		▲	Lightweight blocks with high recycled material content.
0341	Structural steelwork	●	Environmentally sustainable steelwork conforming to the requirements of the ASI Environmental Sustainability Charter
		▲	Recycled material content.
		▲	High strength steel to reduce the amount of steel required to achieve the same performance.
		▲	Use of recycled water by the steel manufacturing plant.
0342	Light steel framing	▲	Recycled material content.
		▲	High strength steel to reduce the amount of steel required to achieve the same performance.
		▲	Use of recycled water by the steel manufacturing plant.
0343	Tensioned membrane structures	■	Corrosivity category for appropriate durability to maximise material life cycle.
		●	Self-cleaning coatings, e.g. titanium dioxide.
		●	Non-toxic silicone coated glass for higher translucency and chemical inertness compared to PTFE.
		●	Composite membranes with an insulating layer to reduce heating/cooling loads.
		●	Protection category to maximise ultraviolet effectiveness for shade structures.
		▲	Translucent tensile fabric membranes, e.g. PTFE, or transparent ETFE films to maximise daylight and reduce artificial lighting requirements.
		▲	Photovoltaic cell attachments.
		▲	Prefabrication to minimise off-cut waste.
		▲	Recycling programs for off-cuts, e.g. for PVC and ETFE films.
		▲	Structures which may be relocated and re-used.
		▲	Recyclable material.
0344	Steel – hot-dip galvanized coatings	●	Corrosivity category for appropriate durability to maximise material life cycle.
		●	Coating metal thickness for appropriate durability to maximise material life cycle.
		▲	Recycled material content, e.g. zinc.
		▲	Recycling of galvanizing residues, e.g. recovering and re-using of zinc, molten iron, zinc ash.
		▲	Additional paint finish to extend material life cycle.
		▲	Use of recycled water by the steel manufacturing plant.
0345	Steel – protective paint coatings	■	Waterborne coating systems instead of solvent borne systems for lower VOC emissions.
		■	Durable coatings appropriate to the corrosivity category to maximise steel life cycle.
		▲	Systems which have low hazard air pollutants (HAP) emissions.
0361	Monolithic stabilised earth walls	■	Minimum durability classification for steel components, including reinforcement.
		●	Alternative stabilising agents other than cement include clay, fibre, bituminous emulsion and lime.
		▲	Insulation, e.g. extruded polystyrene, to lower thermal conductivity.

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			Legend:
		■	**Default** text
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0361	Monolithic stabilised earth walls (cont.)	▲	Re-usable formwork.
		▲	Mud/soil plasters.
0362	Mud brick walls	■	Minimum durability classification for steel components, including reinforcement.
		●	Water repellent additive to improve material durability.
		▲	Insulation, e.g. extruded polystyrene, to lower thermal conductivity.
		▲	Finishes to protect from erosion, e.g. mud slurry with waterproofing additive, linseed oil, turpentine or natural plastic cellulose.
		▲	Earth render interior finish.
0363	Straw bale walls	●	Water repellent additive to improve material durability.
		▲	Lime render finish.
		▲	Interior finishes such as clay render, clay paint and lime wash.
0381	Structural timber	■	Recycled timber.
		▲	Timber from a sustainable source.
		▲	Adhesives with low VOC emission for laminated timber.
		▲	Water-based, solvent free finish.
0382	Light timber framing	▲	Recycled timber.
		▲	Timber from a sustainable source.
		▲	Adhesives with low VOC emission for laminated timber.
		▲	Water-based, solvent free finish.
0383	Sheet flooring and decking	■	Recycled timber decking.
		■	Composite decking.
		■	Formaldehyde emission limit for particleboard and plywood.
		●	LOSP preservative treatment.
		▲	Timber from a sustainable source.
		▲	Adhesives with low VOC emission, e.g. for particleboard and plywood.
		▲	Water-based, solvent free finish.
0385	Cross-laminated timber	■	The use of CLT could allow extra points to be obtained in the GreenStar rating tool, for example ‘innovation’ or ‘materials’.
		■	Carbon absorbed by sustainably grown trees is stored long-term.
		■	CLT production generally results in less greenhouse gas emissions than the production of many non-wood building materials.
		▲	Recycled timber.
		▲	Timber from a sustainable source.
		▲	Adhesives with low VOC emissions.
		▲	Water-based, solvent free finish.
0411	Waterproofing – external and tanking	▲	Low VOC emitting liquid membrane systems.
		▲	Recycling of construction scrap materials.
0421	Roofing – combined	■	Skylights, roof windows.
		●	Recycled material content, e.g. steel and aluminium roofing has high recycled content and is easily recycled post-use.
		●	Rainwater tanks.
		▲	Green roofs.
		▲	High performance roofing systems to extend building service life.
		▲	Roofing systems with high thermal mass to reduce heating/cooling load.
		▲	Fibre cement composite with waste paper or wood fibres.
		▲	Recycled plastic roofing materials.
0423	Roofing – profiled sheet metal	■	Skylights, roof windows.
		●	Recycled material content.
		●	Rainwater tanks.
		▲	Green roofs
		▲	High performance roofing systems to extend building service life.
		▲	Recycled material content.
		▲	Fibre cement composite with waste paper or wood fibres.
		▲	Recycled plastic roofing materials.

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0424	Roofing – seamed sheet metal	■	Skylights, roof windows.
		●	Recycled material content.
		●	Rainwater tanks.
		▲	High performance roofing systems to extend building service life.
		▲	Recycled plastic roofing materials.
0425	Roofing – shingles and shakes	■	Skylights, roof windows.
		●	Rainwater tanks.
		▲	High performance roofing systems to extend building service life.
		▲	Recycled material content.
		▲	Roofing systems with high thermal mass to reduce heating/cooling load.
		▲	Asphalt shingles with recycled content, e.g. mixed paper in the base or reclaimed minerals in the surface aggregate.
		▲	Fibre cement composite with waste paper or wood fibres.
		▲	Recycled plastic roofing materials.
0426	Roofing – slate	■	Skylights, roof windows.
		●	Rainwater tanks.
		▲	High performance roofing systems to extend building service life.
		▲	Recycled material content.
		▲	Roofing systems with high thermal mass to reduce heating/cooling load.
		▲	Fibre cement composite with waste paper or wood fibres.
		▲	Recycled plastic roofing materials.
0427	Roofing – tiles	■	Skylights, roof windows.
		●	Rainwater tanks.
		▲	High performance roofing systems to extend building service life.
		▲	Recycled material content.
		▲	Roofing systems with high thermal mass to reduce heating/cooling load.
		▲	Recycled plastic roofing materials.
0428	Roofiing – insulated panel systems	■	Energy efficient roofing.
		■	Durable and low maintenance roofing.
		■	Skylights, roof windows.
		▲	Rainwater tanks.
0429	Roofing - glazed	▲	Recycled material content.
		▲	Recycled plastic roofing materials.
		▲	Glazing performance above minimum standards.
0431	Cladding – combined	■	Renewable materials with low embodied energy such as timber weatherboards and plywood cladding.
		▲	Maximising life cycle of materials, e.g. by selecting naturally durable hardwood.
		▲	Timber species with natural resistance to termites.
		▲	Timber from a sustainable source.
		▲	Metal cladding manufactured from recycled metal and/or is recyclable.
		▲	Metal cladding finished with low VOC or non-VOC finish.
		▲	Anti-bacterial finish that inhibits growth of bacteria.
		▲	Polycarbonate which is recyclable.
0432	Curtain walls	▲	High performance glass, e.g. low-e glass.
		▲	Aluminium and steel frames manufactured from recycled metal and/or is recyclable.
		▲	Double skin systems with a ventilated space between the inner and outer skin.
0433	Stone cladding	▲	Insulation R-values.
		▲	Re-use of materials.
		▲	Limiting sealant VOC levels.

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0434	Cladding – flat sheets and panels	■	Renewable materials with low embodied energy such as plywood cladding.
		▲	Maximising life cycle of materials, e.g. by selecting naturally durable hardwood.
		▲	Timber from a sustainable source.
		▲	Metal cladding manufactured from recycled metal and/or is recyclable.
		▲	Metal cladding finished with low VOC or non-VOC finish.
		▲	Polycarbonate which is recyclable.
0435	Cladding – planks and weatherboards	■	Renewable materials with low embodied energy such as timber weatherboards.
		●	Maximising life cycle of materials, e.g. by selecting naturally durable hardwood.
		▲	Timber species with natural resistance to termites.
		▲	Timber from a sustainable source.
0436	Cladding – profiled and seamed sheet metal	▲	Metal cladding manufactured from recycled metal and/or is recyclable.
		▲	Metal cladding finished with low VOC or non-VOC finish.
0437	Cladding – insulated panel systems	■	Energy efficient wall cladding.
		■	Durable and low maintenance wall cladding.
		▲	Metal cladding finished with low VOC or non-VOC finish.
		▲	Anti-bacterial finish that inhibits growth of bacteria.
0451	Windows and glazed doors	■	Louvre assemblies for natural ventilation.
		■	Insulating glass units (IGUs).
		■	Window seals to minimise air leakage when window is shut.
		●	Thermal performance to reduce heating/cooling load by specifying the required Total system U-value, Total system SHGC, frame material (e.g. metal has higher conductivity than timber).
		●	Operable shutter or window hardware for natural ventilation.
		●	Glass and frame selection with an acceptable visible transmittance for natural lighting.
		●	High performance glass, e.g. low-e.
		▲	Re-use of salvaged windows.
		▲	Recycled material content, e.g. aluminium frames.
0453	Doors and access panels	■	Door seals to minimise air leakage when door is shut.
		■	Revolving doors to minimise heating and cooling losses from air movement.
		▲	Low VOC adhesives, stains and finishes.
		▲	Re-use of salvaged doors.
		▲	Recycled/reconstituted materials, e.g. paper honeycomb infill manufactured from post-consumer reclaimed cardboard.
		▲	Frames and infills manufactured from off-cuts, e.g. engineered, laminated or finger jointed members.
		▲	Timber from a sustainable source.
0454	Overhead doors	▲	Improved corrosion resistance for low maintenance and to extend door service life, e.g. steel frames with galvanic protection under paint coating, Class I anodic coatings.
		▲	Heavy duty weatherstripping including vinyl or wool pile weatherstrips along jambs, neoprene bulb wiper strips at the front of curtains, and neoprene baffles at the top of coils to improve air penetration resistance.
0455	Door hardware	■	Re-use of recovered hardware.
		▲	Recycled material content, e.g. steel, brass, aluminium.
		▲	Selecting products, if chrome plated, using the trivalent instead the hexavalent process.
		▲	Door closers for self-closing doors to minimise air leakage.
		▲	Selecting durable products for low maintenance and to extend material/product life cycle.

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0456	Louvre windows	■	Louvre assemblies for natural ventilation.
		■	Window seals to minimise air leakage when louvres shut.
		●	Thermal performance to reduce heating/cooling load by specifying the required Total system U-value, Total system SHGC, frame material (e.g. metal has higher conductivity than timber).
		●	Glass and frame selection with an acceptable visible transmittance for natural lighting.
		●	High performance glass, e.g. low-e.
		▲	Re-use of salvaged louvres.
		▲	Recycled material content, e.g. aluminium frames.
0457	External screens	■	P/H values, as defined in BCA J1.5a clause 7 Shading and BCA Figure 3.12.2.2. The P/H value is the ratio between the dimensions of a shading projection (P) located above glazing and the height (H) of the outer edge of the projection above the base of the glazing.
		■	External screens, louvres and awnings to reduce solar heat gain in summer and hence reduce energy consumption for cooling buildings.
		▲	Adjustable screens/louvres, with motorised screens controlled by rain and sun sensors, to reduce solar heat gain in summer and enable passive solar heating in winter, hence reducing energy consumption for heating and cooling buildings.
		▲	Composite timber screens and louvres.
		▲	Recycled material content, e.g. aluminium frames.
0461	Glazing	●	Thermal performance to reduce heating/cooling load by specifying the required U-value and SHGC.
		●	Glass selection with an acceptable Visible transmittance for natural lighting.
		●	High performance glass, e.g. low-e, self-cleaning glass.
		▲	Recycled material content.
0462	Structural silicone glazing	▲	Thermal performance to reduce heating/cooling load by specifying the required Total system U-Value and Total system SHGC.
		▲	Insulating glass units (IGUs).
0463	Glass blockwork	■	Seals to minimise air leakage.
		●	Thermal performance to reduce heating/cooling load by specifying the required Total system U-Value, Total system SHGC, frame material (e.g. metal has higher conductivity than timber).
		▲	Re-use of salvaged blocks.
0466	Structural glass assemblies	▲	High performance glass such as low-e glass.
		▲	Aluminium and steel frames manufactured from recycled metal and /or is recyclable.
		▲	Double skin systems with a ventilated space between the inner and outer skin.
0471	Thermal insulation and pliable membranes	■	Framed roof and wall thermal break strips.
		■	Natural wool derived from the fleece of sheep.
		●	Thermal performance to reduce heating/cooling load by specifying the required R-Value for roof/ceiling, walls and floors.
		▲	Recycled material content, e.g. recycled waste glass in glass wool insulation.
		▲	Other natural materials such as cellulose insulation, perlite, agricultural fibres and cementitious foam.
		▲	Cellulose insulation: Manufactured from recycled paper.
		▲	Perlite: Volcanic minerals, e.g. used as loose fill insulation in concrete block cavities.
		▲	Agricultural fibres: Manufactured from mill waste, low grade and recycled cotton treated with non-toxic fire retardant.

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0471	Thermal insulation and pliable membranes (cont.)	▲	Cementitious foam insulation: Made from magnesium from sea water.
		▲	Wood foam: Made from wood particles.
0472	Acoustic insulation	■	Recycled rubber/cork flexible sheets.
		■	Bio-soluble fibres in polyester blankets and batts.
		▲	Recycled material content, e.g. recycled waste glass in glass wool insulation.
		▲	Wood wool insulation boards with no VOCs.
0511	Lining	▲	Reduced/zero formaldehyde emissions: For plywood, blockboard, particleboard, and wet and dry processed fibreboard (including MDF). Alternatively, select panels manufactured using water-based adhesives.
		▲	Recycled material content: For plasterboard, fibre cement, particleboard and MDF. For example, plasterboard may consist of recycled core content and liner paper manufactured from recycled newspaper and cardboard.
		▲	Recycling of plasterboard waste/offcuts into new plasterboard or as soil conditioner.
		▲	Fibre cement for resistance to termites and fungal decay.
		▲	Alternative panel materials such as strawboard made from waste straw with zero formaldehyde, paperboard made from recycled paper, and bamboo panels.
0520	Partitions – combined	■	Demountable panels for re-use to maximise product/material life cycle.
		▲	Reduced/zero formaldehyde emissions: For plywood, blockboard, particleboard, and wet and dry processed fibreboard (including MDF).
		▲	Recycled material content: For steel framing, plasterboard, fibre cement, particleboard and MDF. For example, plasterboard may consist of recycled core content and liner paper manufactured from recycled newspaper and cardboard.
		▲	Recycling of plasterboard waste into new plasterboard or as soil conditioner.
		▲	Fibre cement for resistance to termites and fungal decay.
		▲	Alternative panel materials such as strawboard made from waste straw with zero formaldehyde, paperboard made from recycled paper, and bamboo panels.
		▲	Systems which are 100% recyclable at the end of service life.
0521	Partitions – demountable	■	Demountable panels for re-use to maximise product/material life cycle.
		▲	Reduced/zero formaldehyde emissions: For plywood, blockboard, particleboard, and wet and dry processed fibreboard (including MDF).
		▲	Recycled material content. For steel framing, plasterboard, fibre cement, particleboard and MDF. For example, plasterboard may consist of recycled core content and liner paper manufactured from recycled newspaper and cardboard.
		▲	Recycling of plasterboard waste into new plasterboard or as soil conditioner.
		▲	Fibre cement for resistance to termites and fungal decay.
		▲	Alternative panel materials such as strawboard made from waste straw with zero formaldehyde, paperboard made from recycled paper, and bamboo panels.
		▲	Systems which are 100% recyclable at the end of service life.
0522	Partitions – framed and lined	▲	Reduced/zero formaldehyde emissions: For plywood, blockboard, particleboard, and wet and dry processed fibreboard (including MDF). Alternatively, select panels manufactured using water-based adhesives.

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0522	Partitions – framed and lined (cont.)	▲	Recycled material content: For plasterboard, fibre cement, particleboard and MDF. For example, plasterboard may consist of recycled core content and liner paper manufactured from recycled newspaper and cardboard.
		▲	Recycling of plasterboard waste/offcuts into new plasterboard or as soil conditioner.
		▲	Fibre cement for resistance to termites and fungal decay.
		▲	Alternative panel materials such as strawboard made from waste straw with zero formaldehyde, paperboard made from recycled paper, and bamboo panels.
		▲	Systems which are 100% recyclable at the end of service life.
0523	Partitions – brick and block	▲	Re-use of reclaimed brick and blocks.
		▲	Recycled material content, e.g. recycled glass aggregate.
		▲	Concrete blocks incorporating fly ash content as a replacement of more energy intensive cement.
		▲	Corrosion protection with the appropriate durability for metallic components to extend material/product life.
		▲	Lightweight blocks with high recycled material content.
0524	Partitions – glazed	▲	Recycled material content, e.g. aluminium frames.
		▲	Glass Visible Transmittance to allow natural light to adjacent spaces to reduce artificial lighting requirements.
0525	Cubicle systems	▲	Recycled material content.
		▲	Materials free of urea-formaldehyde resins.
		▲	Low or no VOC emitting materials.
		▲	Materials recyclable at the end of service life.
0526	Terrazzo precast	▲	Recycled material content, e.g. glass, porcelain, cement aggregate, crushed stone/gravel, plastic, shells or broken terrazzo.
		▲	Resins or binders with low or no VOC content.
0527	Room dividers	▲	Recycled material content, e.g. aluminium and steel.
		▲	Timber from a sustainable source.
		▲	Re-use/salvaging of construction scraps/waste.
		▲	Water based adhesives.
		▲	Paints with low or no VOC emission.
		▲	Materials recyclable at the end of service life.
0531	Suspended ceilings – combined	●	Demountability, e.g. modular ceiling panel systems can be disassembled and re-used during tenancy fitouts.
		▲	Recycled material content, e.g. steel and aluminium for ceiling panels and ceiling suspension systems, recycled paper, synthetic mineral wool manufactured from slag, a waste product of steel production.
		▲	Renewable raw materials, e.g. ceiling panels with corn or wheat starch binders, wood wool panels made from sustainable timber.
		▲	Mineral tiles with post-consumer contents and an off-cut recycling program.
		▲	Ceiling panels with zero or low formaldehyde emission.
		▲	Ceiling panels with high light reflectance to improve the quality and quantity of natural lighting and thus reduce artificial lighting demands.
		▲	Ceiling products manufactured using processes incorporating sustainability measures, e.g. recycling of water and waste.
0532	Suspended ceilings – flush lined	▲	Recycled material content, e.g. steel and aluminium for ceiling panels and ceiling suspension systems, recycled paper, synthetic mineral wool manufactured from slag, a waste product of steel production.
		▲	Renewable raw materials, e.g. ceiling panels with corn or wheat starch binders, wood wool panels made from sustainable timber.
		▲	Ceiling panels with zero or low formaldehyde emission.

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0532	Suspended ceilings – flush lined (cont.)	▲	Ceiling panels with high light reflectance to improve the quality and quantity of natural lighting and thus reduce artificial lighting demands.
		▲	Ceiling products manufactured using processes incorporating sustainability measures, e.g. recycling of water and waste.
0533	Suspended ceilings – ceiling units	●	Demountability, e.g. modular ceiling panel systems can be disassembled and re-used during tenancy fitouts.
		▲	Recycled material content, e.g. steel and aluminium for ceiling panels and ceiling suspension systems, recycled paper, synthetic mineral wool manufactured from slag, a waste product of steel production.
		▲	Renewable raw materials, e.g. ceiling panels with corn or wheat starch binders, wood wool panels made from sustainable timber.
		▲	Mineral tiles with post-consumer contents and an off-cut recycling program.
		▲	Ceiling panels with zero or low formaldehyde emission.
		▲	Ceiling panels with high light reflectance to improve the quality and quantity of natural lighting and thus reduce artificial lighting demands.
		▲	Ceiling products manufactured using processes incorporating sustainability measures, e.g. recycling of water and waste.
0541	Access floors	▲	Recycled material content, e.g. steel and aluminium for panels and pedestals, surface finishes.
		▲	Recycling of off-cut panels.
		▲	Re-use of reclaimed panels.
		▲	Waste minimisation by maximising usable amounts of cut panels to the perimeter.
		▲	Panels with no adhesives, laminations or PVC.
		▲	Panels using adhesives with zero or low VOC emission.
		▲	Sub-floor sealers with zero or low VOC emission.
		▲	Panel cutting at the point of manufacture to minimise waste and transport weight.
0551	Joinery	■	Linoleum.
		▲	Low/zero VOC adhesives and finishes, e.g. water based or soy based adhesives.
		▲	Recycled timber or timber from a sustainable source.
		▲	Recycling of off-cut panels.
		▲	Recycled material content, e.g. for fibreboards and particleboards, benchtops manufactured from bamboo fibres and post-consumer paper.
		▲	Veneers and laminates which contain paper based products, recycled content and no urea formaldehyde added.
		▲	Alternative wood materials, e.g. bamboo.
		▲	Selecting timbers with higher durability.
		▲	Joinery systems which are modular, reconfigurable, relocatable and re-usable.
		▲	Recyclable materials, e.g. linoleum.
0552	Metalwork – fabricated	▲	Recycled material content.
		▲	Recycling of off-cuts or scraps.
0553	Stainless steel benching	▲	Recycled material content.
		▲	Recycling of off-cuts or scraps.
0571	Workstations	▲	Plywood, blockboard, particleboard and medium density fibreboard (MDF): Low/zero formaldehyde emissions.
		▲	Powder coating: Low VOC emission.
		▲	Adhesives and sealants: Low VOC emission.

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0571	Workstations (cont.)	▲	AFRDI Green Tick product certification: Select certification level silver, gold or platinum level. This scheme requires products to be assessed against AFRDI Standard 150 Sustainability Standard – Commercial Furniture.
		▲	High pressure decorative laminate sheets: Low/zero formaldehyde emission.
0572	Miscellaneous furniture	▲	Fabric/leather: Low VOC emission, low formaldehyde emission or recycled material.
		▲	Low/zero VOC adhesives and finishes, e.g. water based or soy based adhesives.
		▲	Recycled material content
		▲	Recycled timber or timber from a sustainable source.
		▲	Veneers and laminates which contain paper based products and recycled content.
		▲	Selecting timbers with higher durability.
		▲	Joinery systems which are modular, reconfigurable, relocatable and re-usable.
0574	Window coverings	▲	Recycled material content, e.g. for aluminium blinds, fabrics with recycled fibres.
		▲	Automation systems, e.g. sun sensors, to manage thermal comfort and light levels to reduce heating/cooling loads and artificial lighting requirement.
		▲	Timber from a sustainable source.
		▲	Fabrics printed using water based inks instead of solvent based inks.
		▲	Natural fabrics instead of synthetics.
		▲	Insulating curtains.
0611	Rendering and plastering	▲	FGD (flue gas desulphurisation) gypsum, a waste product from power stations.
		▲	Non-toxic and low embodied energy natural/clay or lime plaster and render.
		▲	Corrosion resistance for the appropriate durability to maximise product/material life cycle.
0612	Cementitious toppings	▲	Low VOC emitting materials.
		▲	Recycled material content.
		▲	Lightweight products, reducing transportation requirements.
		▲	Products resistant to mould when applied in damp environments.
0613	Terrazzo in situ	▲	Recycled material content, e.g. glass, porcelain, cement aggregate, crushed stone/gravel, plastic, shells or broken terrazzo.
		▲	Resins or binders with low or no VOC content.
0621	Waterproofing – wet areas	▲	Low VOC emitting and/or solvent free materials.
		▲	Recycled material content.
		▲	Materials which can be used on supplementary cementitious materials, e.g. fly ash and slag.
		▲	Materials recyclable at the end of service life.
0631	Ceramic tiling	▲	Tile adhesives with low VOC emitting and/or solvent free materials.
		▲	Recycled material content for tiles and tile adhesive.
		▲	Tiles with programs for recycling of scraps, e.g. to be ground and reformed into new materials.
		▲	Tiles manufactured using processes incorporating sustainability measures, e.g. recycling of water and waste.
0632	Stone and terrazzo tiling	▲	Re-use of salvaged stone tiles.
		▲	Tile adhesives and stone sealers with low/zero VOC emitting and/or solvent free materials.
		▲	Terrazzo tiles using binders with low or no VOC content

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0632	Stone and terrazzo tiling (cont.)	▲	Recycled material content for tiles and tile adhesive, e.g. terrazzo tiles with glass, porcelain, cement aggregate, crushed stone/gravel, plastic, shells or broken terrazzo.
		▲	Tiles with programs for recycling off scraps, e.g. to be ground and reformed into new materials.
		▲	Tiles manufactured using processes incorporating sustainability measures, e.g. recycling of water and waste.
0641	Applied wall finishes	■	Plywood, particleboard and medium density fibreboard (MDF) with low/zero formaldehyde emissions.
		▲	Timber from a sustainable source.
		▲	Recycled material content for composite panels, resin/polymer panels, fibreboards and particleboards.
		▲	Water-based adhesives.
		▲	Coatings with low or no VOC emission.
		▲	Fabrics printed using water-based inks instead of solvent-based inks.
		▲	Natural fabrics instead of synthetics.
		▲	Materials recyclable at the end of service life.
0642	Wallcoverings	▲	Wallcoverings manufactured from recycled paper or paper sourced from sustainable forests.
		▲	Papers made from natural woven fibres, e.g. bamboo, seagrass or reeds.
		▲	Timber veneers sourced locally/close to the site, from sustainable forests, and forest certification.
		▲	Low or no VOC emitting and PVC free vinyl wallcoverings, coatings, glues, paste and backings.
		▲	Papers printed or dyed with HAP free, water based, heavy metal free inks, dyes or paints.
		▲	Recycled material content, e.g. for vinyl wallcoverings, papers printed with recycled inks.
0651	Resilient finishes	■	Natural and biodegradable flooring including linoleum, cork, corklinoleum and rubber.
		●	Scrap recycling, finishes with programs for recycling off-cuts.
		▲	Recycled material, e.g. for PVC and rubber flooring.
		▲	PVC finishes and adhesives low or no VOC emission.
		▲	Planks or tiles not requiring underlays or adhesives, reducing materials for installation.
		▲	Materials recyclable at the end of service life.
0652	Carpets	■	VOC emission limits.
		●	Carpet Institute of Australia Environmental Certification scheme (ECS).
		▲	Recycled material.
		▲	Recovered carpet grippers for re-use in the works.
		▲	Carpets with programs for recycling off-cuts.
		▲	Lighter weight carpets, carpets manufactured with less materials.
		▲	Materials recyclable at the end of service life.
0654	Engineered panel flooring	●	Recycled timber wearing surfaces.
		▲	Timber from a sustainable source.
		▲	Adhesives with low VOC emission.
		▲	Water-based, solvent free finish.
		▲	Parquet flooring panels made from scrap material.
		▲	Flooring panels requiring no adhesive for installation.
0655	Timber flooring	●	Recycled timber.
		▲	Timber from a sustainable source.
		▲	Adhesives with low VOC emission.
		▲	Water based, solvent free finish.
		▲	Parquet flooring panels made from scrap material.
		▲	Underlays with low VOC emission and/or recycled material content.

Appendix B: ESD provisions in NATSPEC worksections

Worksection Number	Worksection title	ESD provision	
			Legend:
		■	**Default** text
		●	**Optional** provisions (in prompts, guidance or schedules)
		▲	**Other** potential provisions
0656	Floor sanding and finishing	■	Water-based, solvent free finish.
0657	Resin based seamless flooring	▲	Systems with low/zero VOC emission.
		▲	Recycled materials, e.g. recycled glass aggregate.
0657	Resin based seamless flooring (cont.)	▲	Water-based, solvent free systems.
		▲	Patching end of life floors to improve floor life cycle, instead of removal and replacement.
		▲	Nonylphenol free systems.
0671	Painting	▲	Coatings with low/zero VOC emission.
		▲	Recycled material, e.g. using recycled paint.
		▲	Water-based instead of solvent based coatings.
		▲	Plant/mineral based paints, e.g. using linseed oil.
		▲	Paints with recovery programs for unused/unwanted paints.
0672	Textured and membrane coatings	▲	Coatings with low/zero VOC emission.
		▲	Recycled material, e.g. recycled glass.
		▲	Waterborne instead of solvent borne coatings.
		▲	Paints with recovery programs for unused/unwanted paints.
0673	Powder coatings	●	Powder coating MDF instead of conventional liquid coatings to reduce VOC emissions.
		▲	Coating systems where powder overspray is recovered and recycled back into the system.
		▲	Coatings systems using energy efficient resin curing methods to reduce energy requirements, through more efficient curing ovens or thinner film coatings.
		▲	Coatings systems incorporating bio-resins instead of petrochemical-based resins
0701	Mechanical systems	▲	Other ESD requirements relating to mechanical systems not covered elsewhere.
0702	Mechanical design and install	▲	Energy conservation, including in packaged air conditioning plant for reduced operating costs and greenhouse gas emissions.
0711	Chillers – combined	■	Air cooled chillers as an alternative for eliminating Legionella risk from cooling towers and reducing water usage (but normally at greater energy use).
		■	Air cooled condenser coils specified by atmospheric corrosivity category for appropriate durability.
		■	Liquid cooler insulation to BCA (i.e. exceeds industry practice).
		■	High efficiency scroll compressor.
		■	Heat recovery chiller option as a free heat source.
		■	Capacity control to exclude energy wasting part load control.
		●	High energy efficiency chillers for reducing operating costs and greenhouse gas emissions.
		●	Site specific NPLV for improved energy performance.
		●	Particular refrigerants to meet factors such as energy efficiency in greenhouse gas emissions global warming potential (GWP) and ozone depletion potential (ODP).
		●	Provisions for reducing transmitted noise and vibration.
		●	Compressor type selection for energy efficiency and/or environmentally appropriate refrigerants.
		●	Durable water side components.
0712	Water heating boilers	■	Durable components including boiler flues.
		■	BCA energy efficiency requirements for reducing operating costs and greenhouse gas emissions.
		▲	High energy efficiency boilers for further reduced operating costs and greenhouse gas emissions.
0713	Cooling towers	■	Provisions for environmental noise levels.
		■	Durable components and materials, particularly for corrosion resistance, to enhance material life cycle.
		■	Closed circuit coolers as an option to cooling towers.
		■	BCA energy efficiency requirements for fans and pumps.

Appendix B: ESD provisions in NATSPEC worksections

Worksection Number	Worksection title	ESD provision	
			Legend:
		■	**Default** text
		●	**Optional** provisions (in prompts, guidance or schedules)
		▲	**Other** potential provisions
0713	Cooling towers (cont.)	■	Microbial controls.
		■	Hybrid cooling towers.
		●	Material selection to enhance material life cycle.
		●	Provisions for reducing transmitted noise and vibration.
		▲	High energy efficiency cooling towers for further reduced operating costs and greenhouse gas emissions.
0714	Mechanical pumps	■	Durable components, particularly for corrosion resistance.
		■	BCA energy efficiency requirements for fans and pumps.
		●	Provisions that reduce pump energy consumption for all pumps.
		●	Material selection to enhance life cycle, recyclability and environmental impact.
		●	High efficiency motors.
		●	Provisions to reduce transmitted noise and vibration.
		●	Higher efficiency pumps for further energy efficiency.
0715	Tanks, vessels and heat exchangers	■	Durable components.
		■	Material selection to enhance life material cycle and for recyclability and environmental impact, etc.
		▲	High energy efficiency heat transfer.
		▲	Provisions for handling leaks, drainage and overflows, e.g. bunding to prevent contamination of floor waste.
0716	Chillers – centrifugal	■	Heat recovery chiller as a free heat source.
		■	Capacity control to exclude energy wasting part load control.
		●	High energy efficiency chillers for reducing operating costs and greenhouse gas emissions.
		●	Site specific NPLV for improved energy performance.
		●	Particular refrigerants to meet factors such as energy efficiency in greenhouse gas emissions global warming potential (GWP) and ozone depletion potential (ODP).
		●	Provisions to reduce transmitted noise and vibration.
		●	Durable water side components.
0717	Chillers – water cooled screw	■	Capacity control to exclude energy wasting part load control.
		●	High energy efficiency chillers for reducing operating costs and greenhouse gas emissions.
		●	Site specific NPLV for improved energy performance.
		●	Particular refrigerants to meet factors such as energy efficiency in greenhouse gas emissions global warming potential (GWP) and ozone depletion potential (ODP).
		●	Provisions for reducing transmitted noise and vibration.
		●	Durable water side components.
0718	Chillers –air cooled screw and scroll	■	Heat recovery chiller as a free heat source.
		■	Capacity control to exclude energy wasting part load control.
		●	High energy efficiency chillers for reducing operating costs and greenhouse gas emissions.
		●	Site specific NPLV for improved energy performance.
		●	Particular refrigerants to meet factors such as energy efficiency in greenhouse gas emissions global warming potential (GWP) and ozone depletion potential (ODP).
		●	Provisions for reducing transmitted noise and vibration.
		●	Durable water side components.
0719	Chillers – absorption	■	Liquid cooler insulation to BCA (i.e. exceeds industry practice).
		●	Durable water side components.
		●	Site specific NPLV for improved energy performance.
0721	Packaged air conditioning	■	High energy efficiency packaged air conditioning equipment for reducing operating costs and greenhouse gas emissions using this worksection as a framework.
		■	NCC provisions and published MEPS.
		■	Durable components.

Appendix B: ESD provisions in NATSPEC worksections

Worksection Number	Worksection title	ESD provision	
			Legend:
		■	**Default** text
		●	**Optional** provisions (in prompts, guidance or schedules)
		▲	**Other** potential provisions
0721	Packaged air conditioning (cont.)	■	Additional fan and coil corrosion protection for aggressive environments.
		■	Energy conserving coil pressure drops.
		■	Refrigerant meeting factors such as energy efficiency, reduction in greenhouse gas emissions and ozone depletion.
		■	Close control packaged air conditioners for high energy efficiency.
		■	Reverse cycle units for low heating energy cost and reduced greenhouse gas emissions.
		■	Provisions to reduce transmitted noise and vibration.
0722	Room air conditioners	■	High energy efficiency packaged air conditioning equipment for reducing operating costs and greenhouse gas emissions using this worksection as a framework.
		■	Refrigerant meeting factors such as energy efficiency, reduction in greenhouse gas emissions and ozone depletion.
		■	NCC provisions.
		■	Durable components.
		●	Published energy star rating.
0723	Evaporative air coolers	■	Microbial control for reducing Legionella risk.
		■	Durable components, particularly for corrosion resistance.
		■	Provisions for reducing water consumption.
		■	Minimum evaporation efficiency for improved energy and water efficiency.
		●	Coolers with variable fan speed for improved energy and water efficiency.
		▲	Use of rainwater, depending on local regulations.
		▲	Environmental noise levels.
0724	Air handling plant – combined	■	Microbial control to the recommendations of AS/NZS 3666.1, AS/NZS 3666.2 and SA/SNZ HB 32.
		■	Measures to minimise condensation to increase equipment life and reduce the risk of microbial growth.
		■	Prohibition on blowing agents using CFCs, HCFCs and products with high global warming potential.
		■	Provisions to reduce energy consumption including leakage minimisation and better coil performance.
		■	Provisions to improve plant performance, including leakage minimisation, and hence improve the indoor environment.
		■	A higher standard of sealing than some commercial products to reduce energy waste, improve performance and reduce condensation risk.
		■	Polyurethane for sandwich panels which is less hazardous in fires than expanded polystyrene.
		■	Damper performance exceeding some commercial values to reduce energy waste, improve control and indoor environment.
		■	Durable components, particularly for corrosion resistance.
		■	Provisions to reduce transmitted noise and vibration.
		■	Measures to minimise health risks associated with mineral fibres.
		■	Air to air heat exchangers to reduce energy consumption.
		●	Insulation thicknesses for sandwich panels exceeding standard commercial practice for improving energy efficiency and reducing risk of moisture condensation.
0725	Air handling plant – built up	■	Microbial control to the recommendations of AS/NZS 3666.1, AS/NZS 3666.2 and SA/SNZ HB 32.
		■	Measures to minimise condensation to increase equipment life and reduce the risk of microbial growth.
		■	Prohibition on blowing agents using CFCs, HCFCs and products with high global warming potential.
		■	Provisions to reduce energy consumption including leakage minimisation and better coil performance.

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Worksection Number	Worksection title	ESD provision	
			Legend:
		■	**Default** text
		●	**Optional** provisions (in prompts, guidance or schedules)
		▲	**Other** potential provisions
0725	Air handling plant – built up (cont.)	■	Provisions to improve plant performance, including leakage minimisation, and hence improve the indoor environment.
		■	A higher standard of sealing than some commercial products to reduce energy waste, improve performance and reduce condensation risk.
		■	Polyurethane for sandwich panels which is less hazardous in fires than expanded polystyrene.
		■	Damper performance exceeding some commercial values to reduce energy waste, improve control and indoor environment.
		■	Limits for coil pressure drops to reduce energy use.
		■	Water coils to minimise water wastage and treatment chemicals.
		■	Durable components, particularly for corrosion resistance.
		■	Provisions to reduce transmitted noise and vibration.
		■	Measures to minimise health risks associated with mineral fibres.
		●	Insulation thicknesses for sandwich panels exceeding standard commercial practice for improving energy efficiency and reducing risk of moisture condensation.
0726	Air handling plant – minor	■	Microbial control to the recommendations of AS/NZS 3666.1, AS/NZS 3666.2 and SA/SNZ HB 32.
		■	Measures to minimise condensation to increase equipment life and reduce the risk of microbial growth.
		■	Provisions to reduce energy consumption including leakage minimisation and better coil performance.
		■	Provisions to improve plant performance, including leakage minimisation, and hence improve the indoor environment.
		■	A higher standard of sealing than some commercial products to reduce energy waste, improve performance and reduce condensation risk.
		■	Polyurethane for sandwich panels which is less hazardous in fires than expanded polystyrene.
		■	Damper performance exceeding some commercial values to reduce energy waste, improve control and indoor environment.
		■	Limits for coil pressure drops to reduce energy use.
		■	Water coils to minimise water wastage and treatment chemicals.
		■	Durable components, particularly for corrosion resistance.
		■	Provisions to reduce transmitted noise and vibration.
		■	Measures to minimise health risks associated with mineral fibres.
0727	Air handling plant – packaged	■	Microbial control to the recommendations of AS/NZS 3666.1, AS/NZS 3666.2 and SA/SNZ HB 32.
		■	Measures to minimise condensation to increase equipment life and reduce the risk of microbial growth.
		■	Prohibition on blowing agents using CFCs, HCFCs and products with high global warming potential.
		■	Provisions to reduce energy consumption including leakage minimisation and better coil performance.
		■	Provisions to improve plant performance, including leakage minimisation, and hence improve the indoor environment.
		■	A higher standard of sealing than some commercial products to reduce energy waste, improve performance and reduce condensation risk.
		■	Polyurethane for sandwich panels which is less hazardous in fires than expanded polystyrene.
		■	Damper performance exceeding some commercial values to reduce energy waste, improve control and indoor environment.
		■	Limits for coil pressure drops to reduce energy use.
		■	Water coils to minimise water wastage and treatment chemicals.
		■	Durable components, particularly for corrosion resistance.
		■	Provisions to reduce transmitted noise and vibration.

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Worksection Number	Worksection title	ESD provision	
			Legend:
		■	**Default** text
		●	**Optional** provisions (in prompts, guidance or schedules)
		▲	**Other** potential provisions
0727	Air handling plant – packaged (cont.)	■	Measures to minimise health risks associated with mineral fibres.
		●	Insulation thicknesses for sandwich panels exceeding standard commercial practice for improving energy efficiency and reducing risk of moisture condensation.
0731	Fans	■	Durable components, particularly for corrosion resistance.
		■	Provisions to reduce transmitted noise and vibration.
		●	Higher efficiency fans; this includes provisions to reduce fan energy consumption for all fans.
		●	High efficiency fan motors.
		●	Low noise fans.
0732	Air filters	■	A variety of filters, including those which have re-usable frames and are resistant to vermin attack.
		■	Filters with increased efficiency, reduced energy consumption and have longer periods between cleaning or changing.
		■	Microbial control for reducing microbial growth risk.
		■	Durable components, particularly for corrosion resistance.
		■	HEPA, MEPA and gas phase absorber (odour) filters.
0733	Air coils	■	Relatively low air and water pressure drops to reduce energy consumption and greenhouse gas emissions.
0733	Air coils (cont.)	■	Durable components, particularly for corrosion resistance.
0734	Humidifiers	■	Durable components, particularly for corrosion resistance.
		■	Precautions to prevent free moisture entering air stream and reduce microbial growth risk.
0736	Space heating	■	Durable components
		■	Provision to reduce transmitted noise and vibration.
		■	Some heating equipment, e.g. radiant tube heaters enables spot heating which is more economical than heating the entire space.
0741	Ductwork	■	Sealing and leakage testing more stringent than AS 4254.1 and AS 4254.2 for reducing operating costs and greenhouse gas emissions. BCA J5.6 requires duct sealing to AS 4254.1 and AS 4254.2 on systems over 3000L/s. This worksection requires sealing of all systems
		■	Microbial control for improved indoor air quality and reducing Legionella risk.
		■	Selection of corrosion resistant materials for fire dampers and ductwork based on atmospheric corrosivity category.
		■	PVC-U ductwork for durability in very corrosive environments.
		■	Low leakage motorised dampers for reducing operating costs and greenhouse gas emissions.
		■	Access provisions for improved maintenance (and durability) and to facilitate duct cleaning for improved indoor air quality and reducing Legionella risk.
0744	Ductwork insulation	■	Different insulation materials and installation methods to facilitate varying environmental and WHS factors to maximise performance and material life cycle.
		■	Criteria for evaluating alternatives not covered, primarily in terms of environmental factors (e.g. durability, thermal and noise reduction performance).
		■	Materials and methods for durability, a major issue with duct insulation.
		■	Insulation to improve thermal performance for reducing operating costs and greenhouse gas emissions.
		▲	Minimum acoustic performance for reduced noise levels.
0745	Attenuators and acoustic louvres	●	Durable components, particularly for corrosion resistance.
0746	Air grilles	■	Durable components, particularly for corrosion resistance.
		■	Provisions to reduce noise caused by air grilles.

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Worksection Number	Worksection title	ESD provision	
			Legend:
		■	**Default** text
		●	**Optional** provisions (in prompts, guidance or schedules)
		▲	**Other** potential provisions
0747	Variable air volume terminals	■	Provisions to reduce noise caused by variable air volume terminals.
		■	Durable components, particularly for corrosion resistance.
		●	Low energy consumption types.
0748	Chilled beams	■	Durable components, particularly for corrosion resistance.
0751	Mechanical piping	■	Piping materials alternative to traditional materials (e.g. copper, steel).
		■	Measures relating to commissioning to improve performance and reduce mechanical systems energy consumption.
		■	Durable components, particularly for corrosion resistance.
0752	Mechanical piping insulation	■	Different insulation materials and installation methods to facilitate varying environmental and WHS factors to maximise performance and material life cycle.
		■	Criteria for evaluating alternatives not covered, primarily in terms of environmental factors (e.g. durability, thermal and noise reduction performance).
		■	Materials and methods for durability, a major issue with duct insulation.
		■	Insulation to improve thermal performance for reducing operating costs and greenhouse gas emissions.
0753	Water treatment	■	Water treatment systems intended to reduce corrosion rates.
		■	Prohibition of materials that may be hazardous in normal use.
		■	Strategies for reducing water consumption, e.g. by increasing cycles of concentration.
		■	Compliance with the AS/NZS 3666 series to control microbial growth.
		■	Automatic bleed to reduce waste.
		▲	Water meter to monitor cooling tower water consumption.
0754	Liquid fuels	■	Durable components, particularly for corrosion resistance.
		■	Double wall underground tanks providing higher protection than single walled tanks and facilitates early detection of leakage into and out of tanks.
0755	Medical gas systems	■	Central suction systems with lower energy consumption and better contamination control than traditional venturi suction.
		■	Durable components, particularly for corrosion resistance.
0761	Refrigeration	■	Durable water side components.
		■	Air cooled condensers as alternative for eliminating Legionella risk from cooling towers and reducing water usage (but normally at greater energy use).
		■	Air cooled condenser coils by atmospheric corrosivity category for appropriate durability.
		■	Liquid cooler insulation to BCA (i.e. exceeds industry practice).
		■	High efficiency scroll compressor.
		■	Provisions to reduce transmitted noise and vibration.
		●	Compressor type selection for energy efficiency and/or environmentally appropriate refrigerants.
		▲	High energy efficiency refrigeration plant for reducing operating costs and greenhouse gas emissions.
		▲	Particular refrigerants to meet factors such as energy efficiency in greenhouse gas emissions global warming potential (GWP) and ozone depletion potential (ODP).
0762	Cool rooms	■	Measures to minimise condensation to improve equipment life and limit microbial growth risk.
		■	Prohibition of CFCs and HCFCs as blowing agents.
		■	Durable components, particularly for corrosion resistance.
		■	Provisions for reducing vibration.
		■	Features recommended by AIRAH DA12 to increase energy efficiency.

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Worksection Number	Worksection title	ESD provision	
			Legend:
		■	**Default** text
		●	**Optional** provisions (in prompts, guidance or schedules)
		▲	**Other** potential provisions
0771	Automatic controls	■	Interoperable systems to promote flexibility and make expansion and extension easier.
		■	Component performance to maintain accuracy and hence long term benefits of the control systems.
		■	Control valves to minimise leakage.
		■	Detailed commissioning strategy to assist in achieving the required operation.
		■	Sensors for detecting refrigerant leaks.
		■	Duct-mounted sensors for carbon dioxide or carbon monoxide monitoring and control.
0772	Automatic controls – minor	■	Component performance to maintain accuracy and hence long term benefits of the control systems.
0773	Building management systems	■	Interoperable systems to promote flexibility and make expansion and extension easier.
0781	Mechanical electrical	■	Material selection options.
0782	Mechanical electrical – minor	■	Material selection.
0784	Motors and starters	■	Minimum energy performance standards.
		■	Variable speed drives for reducing energy consumption.
		▲	Material selection.
0791	Mechanical commissioning	■	Commissioning for improved energy efficiency.
		■	Commissioning for safety.
		■	Commissioning for improved noise and vibration levels.
		▲	Commissioning for improved indoor air quality.
0792	Mechanical maintenance	■	Effective and regular maintenance is essential if the performance of systems is not to deteriorate over time. Poor maintenance leads to excessive energy use, higher greenhouse gas emissions and unsatisfactory conditions. It can also lead to the systems being unsafe.
		■	Efficient water management.
		■	Strategies for regular maintenance and timely corrective action in the event of plant failure.
		■	Required maintenance records.
0801	Hydraulic systems	▲	Other ESD requirements relating to hydraulic systems not covered elsewehere.
0802	Hydraulic design and install	■	Water efficient products including rainwater tanks and greywater systems.
		■	Energy efficient water heaters, including solar and heat pump systems.
0811	Sanitary fixtures	■	Water Efficiency Labelling Scheme (WELS) rating.
		■	Material selection, e.g. durable, easily maintained materials.
		▲	Water efficient products.
		▲	Best environmental practice (BEP) PVC to AS/NZS 1260 for drain, waste and vent (DWV) applications.
0812	Tapware	■	Water Efficiency Labelling Scheme (WELS) rating.
		▲	Material selection, e.g. durable, easily maintained materials.
		▲	Water efficient products.
0813	Water heaters	■	Energy efficient water heaters, including solar and heat pump water heaters.
		■	Flue damper to reduce losses from gas fired water heaters.
		■	Prohibition of CFC and HCFC blown insulation.
0814	Hydraulic pumps	■	Minimum efficiency for motors.
		■	Components for rainwater harvesting systems.
		●	Pump efficiency.
		●	High efficiency pump motor.
0815	Drinking water dispensers	▲	Renewable energy for water heating
0816	Tanks	■	Tank material selection for durability.

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Worksection Number	Worksection title	ESD provision	
			Legend:
		■	**Default** text
		●	**Optional** provisions (in prompts, guidance or schedules)
		▲	**Other** potential provisions
0821	Stormwater – buildings	●	Material selection criteria, e.g. low impact requirements such as recycled content, locally available materials, recyclability and maintenance requirements.
		▲	Rainwater harvesting. See also *0825 Rainwater storage systems*.
0822	Wastewater	●	Material selection.
		●	Waterless composting toilets.
		▲	Greywater or blackwater systems. See also *0826 Greywater systems*.
0823	Cold and heated water	■	Insulation of piping to solar water heaters.
		●	Increasing insulation above BCA and PCA minimum.
		●	Material selection.
		▲	Water efficient products.
		▲	Details of removal provisions for insulation on items requiring regular maintenance.
0824	Fuel gas	●	Material selection.
0825	Rainwater storage systems	●	Material selection.
		▲	Rainwater harvesting, collecting and re-using rainwater to reduce mains water consumption.
0826	Greywater systems	●	Greywater recycling.
		●	Material selection.
0826	Greywater systems (cont.)	▲	Rainwater harvesting, collecting and re-using rainwater to reduce mains water consumption.
0882	Hydraulic electrical - minor	▲	Material selection.
0891	Hydraulic maintenance	■	Effective and regular maintenance, essential if the performance of systems is not to deteriorate over time. Poor maintenance leads to excessive energy use, higher greenhouse gas emissions and unsatisfactory conditions. It can also lead to the systems being unsafe.
		■	Efficient water management.
		■	Strategies for regular maintenance and timely corrective action in the event of plant failure.
		■	Required maintenance records.
0901	Electrical systems	▲	ESD systems.
0902	Electrical design and install	■	Minimum energy performance standards (MEPS) for lighting.
		■	Fluorescent or LED lighting for reduced energy consumption.
		▲	Installations with lower energy usage.
		▲	Sensors for lighting.
		▲	Other material and products selection.
0911	Cable support and duct systems	●	Material and product selection.
0921	Low voltage power systems	▲	Material and product selection.
0931	Power generation – engine driven	■	Automatic controls to minimise unnecessary usage.
		■	Acoustic and exhaust requirements.
		▲	Material and product selection.
0933	Power generation – photovoltaic	▲	Automatic controls to minimise unnecessary usage.
		▲	Material and product selection.
0937	Uninterruptible power supply	▲	Material and product selection.
0941	Switchboards – proprietary	▲	Material and product selection.
0942	Switchboards – custom-built	▲	Material and product selection.
0943	Switchboards components	▲	Material and product selection.
0947	Power factor correction	●	Power factor range.
		▲	Material and product selection.
0951	Lighting	■	Minimum energy performance standards (MEPS) for lighting.
		■	Fluorescent or LED lighting for reduced energy consumption.
		●	NCC energy efficiency requirements.
		▲	Other material and product selections, e.g. lower energy consuming lamps.

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Worksection Number	Worksection title	ESD provision	
			Legend:
		■	**Default** text
		●	**Optional** provisions (in prompts, guidance or schedules)
		▲	**Other** potential provisions
0951	Lighting (cont.)	▲	Lighting controls to minimise ON time, e.g. sensors.
		▲	High frequency ballasts.
0961	Information and communication technology (ICT) systems	▲	Material and product selection.
0962	Television distribution systems	▲	Material and product selection.
0971	Emergency evacuation lighting	▲	Material and product selection.
0972	Fire detection and alarms	▲	Material and product selection.
0973	Emergency warning and intercommunications	▲	Material and product selection.
0979	Lightning protection	▲	Material and product selection.
0981	Electronic security	▲	Material and product selection.
0991	Electrical maintenance	■	Effective maintenance essential for maintaining the ESD objectives of the electrical services, enabling the systems to achieve their full potential life.
		■	Detailed specification for maintenance manuals.
		■	Strategies for regular maintenance and timely corrective action in the event of plant failure.
		■	Required maintenance records.
1001	Fire services systems	●	Other ESD requirements relating to fire services systems not covered elsewhere.
1014	Fire services pumps	■	Durable materials and corrosion protection.
1016	Fire service tanks	■	Tank material selection for durability
1030	Combined wet fire suppression systems	▲	Materials selection.
		▲	Water conservation during testing
1031	Hydrants	●	Material selection.
1032	Hose reels	●	Material selection.
1033	Sprinklers	▲	Material selection.
		▲	Water conservation during testing
1072	Fire detection and alarms	▲	Materials and products selection.
1073	Emergency warning and intercommunication	▲	Materials and products selection.
1082	Fire services electrical - minor	▲	Material selection.
1091	Fire services maintenance	■	Effective and regular maintenance, essential if the performance of systems is not to deteriorate over time. Poor maintenance leads to excessive energy use, higher greenhouse gas emissions and unsatisfactory conditions. It can also lead to the systems being unsafe
		■	Strategies for regular maintenance and timely corrective action in the event of plant failure.
		■	Required maintenance records.
2011	Lifts design and install	■	Durable, low maintenance finishes.
		■	Effective machine room mechanical ventilation.

Appendix C: Worksections cross referenced to BCA provisions

NCC-BCA Vol 1 Reference	NCC-BCA Vol 1 Clause	Worksection Number	Worksection Title	ESD Provision
Section F Health and amenity				
F1.7	Waterproofing of wet areas in buildings	0621	Waterproofing – wet areas	Refer TR01 - Appendix B
F4	Light and ventilation	0701	Mechanical systems	
		0702	Mechanical design and install	
FP1.4	Weatherproofing	0431	Cladding - combined	Refer TR01 - Appendix B
		0434	Cladding – flat sheets and panels	
		0435	Cladding – planks and weatherboards	
		0436	Cladding – profiled and seamed sheet metal	
		0437	Cladding – insulated panel systems	
Section J Energy efficiency				
J1.3	Thermal construction - general	0471	Thermal insulation and pliable membranes	Refer TR01 - Appendix B
J3.7	Evaporative coolers	0723	Evaporative air coolers	
		0731	Fans	
Part J5	Air conditioning and ventilation systems	0702	Mechanical design and install	
		0711	Chillers - combined	
		0712	Water heating boilers	
		0713	Cooling towers	
		0714	Mechanical pumps	
		0716	Chillers - centrifugal	
		0717	Chillers – water cooled screw	
		0718	Chillers – air cooled screw and scroll	
		0721	Packaged air conditioning	
		0722	Room air conditioners	
		0724	Air handling plant - combined	
		0725	Air handling plant - built up	
		0727	Air handling plant - packaged	
		0731	Fans	
		0741	Ductwork	
		0744	Ductwork insulation	
		0752	Mechanical piping insulation	
		0761	Refrigeration	

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ENERGY CONSERVATION AND GREENHOUSE GAS REDUCTION

AS 2047:2014	Windows and external glazed doors in buildings
AS/NZS 2712:2007	Solar and heat pump water heaters - Design and construction
AS/NZS 3000:2018	Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3823.2:2013	Performance of electrical appliances - Air conditioners and heat pumps -Energy labelling and minimum energy performance standards (MEPS) requirements
AS 3999:2015	Bulk thermal insulation - Installation
AS 4426:1997	Thermal insulation of pipework, ductwork and equipment - Selection installation and finish
AS 4594:various	Internal combustion engines - Performance
AS 4666:2012	Insulating glass units
AS/NZS 4692.2:2005	Electric water heaters - Minimum energy performance standard (MEPS) requirements and energy labelling
AS 61800.2:2004	Adjustable speed electrical power drive systems - General requirements - Rating specifications for low voltage adjustable frequency a.c. power drive systems
AS 61800.3:2005	Adjustable speed electrical power drive systems - EMC requirements and specific test methods
AHRI 551/591(SI):2020	Performance rating of water chilling and heat pump water-heating packages using the vapor compression cycle
AIA EDG 80 UR:2014	Environment Design Guide - Residential building sustainability rating tools in Australia
AIA EDG 66 MS:2016	Environment Design Guide – BCA Section J and commercial building facade design – 2016 update
AIA EDG 83 NH:2015	Environment Design Guide - Low – energy hot water systems
AIA EDG DES 2:2003	Environment Design Guide - Revisiting energy efficiency in commercial buildings
AIA EDG DES 4:2006	Environment Design Guide - Thermal mass in building design
AIA EDG GEN 13:2007	Environment Design Guide - Greenhouse gas emissions and the residential sector
AIA EDG GEN 77:2007	Environment Design Guide - 2006 Australia state of the environment - human settlements
AIA EDG PRO 2:2006	Environment Design Guide - Embodied energy of building materials
AIA EDG TEC 6:2004	Environment-Design Guide - An introduction to ground source heat pump systems
EEGO:2007	Energy efficiency in government operations
NATSPEC DES 013	BCA energy efficiency protocol and software for housing
NATSPEC DES 014	Environmental rating schemes for buildings
NATSPEC DES 015	NCC - BCA Volume One: Energy efficiency provisions
NATSPEC DES 016	NCC - BCA Volume Two: Energy efficiency provisions
NATSPEC DES 033	Duct leakage and leakage testing
NATSPEC GEN 010	Mechanical commissioning strategies
NATSPEC TR 05	Selection and design of building IT systems
CIBSE Guide F:2012	Energy efficiency in buildings
AAMA 701/702:2011	Voluntary specification for pile weatherstripping and replaceable fenestration weatherseals
AAMA 1503:2009	Voluntary test method for thermal transmittance and condensation resistance of windows, doors and glazed wall sections
AIRAH DA 12:2020	Energy efficiency in cold rooms
ANSI/ASHRAE 135:2020	BACnet: A data communication protocol for building automation and control networks
ASHRAE 90.1:2019	Energy standard for buildings except low-rise residential buildings
ASHRAE 90.2:2018	Energy-efficient design of low-rise residential buildings
ASTM E283/E283M:2019	Standard test method for determining the rate of air leakage through exterior windows, curtain walls, and doors under specified pressure differences across the specimen
NFRC 100:2020	Procedure for determining fenestration product U-factors
NFRC 200:2020	Procedure for determining fenestration product solar heat gain coefficient and visible transmittance at normal incidence
IEC 60034-30-1:2014	Rotating electrical machines - Efficiency classes of line operated AC motors (IE code)
ISO 9229:2020	Thermal insulation – Vocabulary
AS ISO 20400:2018	Sustainable procurement – Guidance

WATER CONSERVATION

AS/NZS 1546.2:2008	On-site domestic wastewater treatment units -Waterless composting toilets
AS/NZS 3500.1:2018	Plumbing and drainage - Water services
AS/NZS 3500.2:2018	Plumbing and drainage - Sanitary plumbing and drainage
AS/NZS 3500.3:2018	Plumbing and drainage - Stormwater drainage

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AS/NZS 3500.4:2018	Plumbing and drainage - Heated water services
AS 3662:2013	Performance of showers for bathing
AS/NZS 3718:2005	Water supply - Tapware
AS/NZS 4766:2020	Rotationally moulded buried, partially buried and non-buried storage tanks for water and chemicals.
AS/NZS 6400:2016	Water efficient products - Rating and labelling
SA HB 230:2008	Rainwater tank design and installation handbook
SA HB 326:2008	Urban greywater installation handbook for single households
AIA EDG DES 13:2001	Environment Design Guide - An introduction to water sensitive design
AIA EDG DES 14:2001	Environment Design Guide - Design solutions for water efficiency
AIA EDG DES 24:2005	Environment Design Guide - On-site domestic wastewater treatment and reuse
AIA EDG DES 27:2005	Environment Design Guide - Sustainable water use - Efficient then effective
NATSPEC DES 011	Rainwater harvesting
PCA: 2019	NCC - BCA Volume Three: Plumbing Code of Australia

MATERIALS

Concrete - masonry

AS 2870:2011	Residential slabs and footings
AS 3600:2018	Concrete structures
AS 3700:2018	Masonry structures
EN 13055:2016	Lightweight aggregates

Glass

AS 1288:2006	Glass in buildings - Selection and installation
NFRC 100:2020	Procedure for determining fenestration product U-factors
NFRC 200:2020	Procedure for determining fenestration product solar heat gain coefficient and visible transmittance at normal incidence
JIS A 5212:1993	Hollow glass blocks

Metal

AS 1627:various	Metal finishing - Preparation and pretreatment of surfaces
AS 2312.1:2014	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings – Paint coating
AS/NZS 2312.2:2014	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings - Hot dip galvanizing
AS 4100:2020	Steel structures
AS 4506:2005	Metal finishing - Thermoset powder coatings
AS/NZS 4534:2006	Zinc and zinc/aluminium-alloy coatings on steel wire
AS/NZS 4680:2006	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS 4750:2003	Electrogalvanized (zinc) coatings on ferrous hollow and open sections
AS/NZS 4791:2006	Hot-dip galvanized (zinc) coatings on ferrous open sections, applied by an in-line process
AS/NZS 4792:2006	Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process
IGC:2013	Industrial galvanizers specifiers manual
NATSPEC DES 010	Atmospheric corrosivity categories for ferrous products

Paints

AS 1580:various	Paints and related materials - Methods of test
AS/NZS 2311:2017	Guide to the painting of buildings
AS 3730:various	Guide to the properties of paints for buildings
AS/NZS 3750.9:2009	Paints for steel structures - Organic zinc-rich primer
AS 4049.3:2005	Paints and related materials - Pavement marking materials - Waterborne paint - For use with surface applied glass beads
AS/NZS 4361.2:2017	Guide to hazardous paint management – Lead paint in residential, public and commercial buildings

Plastic

AS 1366:various	Rigid cellular plastics sheets for thermal insulation

Timber

AS/NZS 1080.1:2012	Timber - Methods of test - Moisture content
AS/NZS 1328.1:1998	Glued laminated structural timber - Performance requirements and minimum production requirements
AS/NZS 1604: various	Specification for preservative treatment
AS 1684:various	Residential timber-framed construction
AS 1720:various	Timber structures
AS/NZS 1748.1:2011	Timber - Solid - Stress-graded for structural purposes - General requirements
AS/NZS 1748.2:2011	Timber - Solid - Stress-graded for structural purposes -Qualification of grading method

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AS 1810:1995	Timber - Seasoned cypress pine - Milled products
AS/NZS 1859:various	Reconstituted wood-based panels - Specifications
AS 1860.2:2006	Particleboard flooring - Installation
AS 2082:2007	Timber - Hardwood - Visually stress-graded for structural purposes
AS/NZS 2269.0:2012	Plywood - Structural - Specifications
AS/NZS 2270:2006	Plywood and blockboard for interior use
AS/NZS 2271:2004	Plywood and blockboard for exterior use
AS 2688:2017	Timber and composite doors
AS 2796.1:1999	Timber - Hardwood - Sawn and milled products - Product specification
AS 2796.2:2006	Timber - Hardwood - Sawn and milled products - Grade description
AS 2796.3:1999	Timber - Hardwood - Sawn and milled products - Timber for furniture components
AS 2858:2008	Timber - Softwood - Visually stress-graded for structural purposes
AS/NZS 2878:2000	Timber - Classification into strength groups
AS 3519:2005	Timber - Machine proof-grading
AS 3818.1:2009	Timber - Heavy structural products - Visually graded - General requirements
AS 3818.3:2010	Timber - Heavy structural products - Visually graded - Piles
AS 3818.11:2009	Timber - Heavy structural products - Visually graded - Utility poles
AS/NZS 4266.1:2017	Reconstituted wood-based panels - Methods of testing - Base panels
AS 4707:2014	Chain of custody for forest products
AS 4708:2013	Sustainable forest management – Economic, social, environmental and cultural criteria and requirements
AS 4785.1:2002	Timber - Softwood - Sawn and milled products - Product specification
AS 4785.2:2002	Timber - Softwood - Sawn and milled products - Grade description
AS 4785.3:2002	Timber - Softwood - Sawn and milled products - Timber for furniture components
AS/NZS 4858:2004	Wet area membranes
AS/NZS 4859.1:2018	Thermal insulation materials for buildings - General criteria and technical provisions
AS 5068:2006	Timber - Finger joints in structural products - Production requirements
AS 5604:2005	Timber - Natural durability ratings
SA HB 108:2013	Timber Design Handbook
AIA EDG PRO 15:2002	Environment Design Guide - The sustainability of timber resources
NATSPEC DES 002	Moisture content in timber floors
NATSPEC PRO 001	CCA (Copper chrome arsenate) treated timber
NOHSC 3007:1989	Guidance Note for the Safe Handling of Timber Preservatives and Treated Timber
EN 13986:2004	Wood-based panels for use in construction. Characteristics, evaluation of conformity and marking

Other

AS/NZS 4200.1:2017	Pliable building membranes and underlays - Materials
AS 4200.2:2017	Pliable building membranes and underlays - Installation
SAA HB 154:2002	Geosynthetics - Guidelines on durability
AIA EDG PRO 11:2002	Environment Design Guide - Renewable resources - A survey of materials
ICANZ:2003	Industry code of practice for the safe use of glass wool and rock wool insulation
NATSPEC PRO 002	Mineral wool
Safe Work Australia: 2020	Guide to handling refractory ceramic fibres
SUSMP	Poisons Standard (SUSMP)
EN 688:2011	Resilient floor coverings. Specification for corklinoleum
ASTM E330/E330M:2014	Standard test method for structural performance of exterior windows, doors, skylights and curtain walls by uniform static air pressure difference

ALTERNATIVE CONSTRUCTION METHODS

SA HB 195:2002	The Australian earth building handbook
NZS 4297:2020	Engineering design of earth buildings
NZS 4298:2020	Materials and workmanship of earth buildings
NZS 4299:2020	Earth buildings not requiring specific design

RECYCLED AND RECYCLABLE MATERIALS

AS 2601:2001	The demolition of structures
AS/NZS 3831:1998	Waste management - Glossary of terms

SUBSTANCES WITH OZONE DEPLETING AND GREENHOUSE WARMING POTENTIAL

AS/NZS 5149.1:2016	Refrigerating systems and heat pumps – Safety and environmental requirements -Definitions, classification and selection criteria (ISO 5149-1:2014, MOD)

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AS/NZS 5149.2:2016	Refrigerating systems and heat pumps - Safety and environmental requirements - Design, construction, testing, marking and documentation (ISO 5149-2:2014, MOD)
AS/NZS 5149.3:2016	Refrigerating systems and heat pumps – Safety and environmental requirements - Installation site (ISO 5149-3:2014)
AS/NZS 5149.4:2016	Refrigerating systems and heat pumps – Safety and environmental requirements - Operations, maintenance, repair and recovery (ISO 5149-4:2014, MOD)
AIRAH:2003	Air conditioning and refrigeration industry refrigerant selection guide

AIR QUALITY

AS 1324.1:2001	Air filters for use in general ventilation and airconditioning - Application, performance and construction
AS 1668.2:2012	The use of ventilation and air conditioning in buildings - Mechanical ventilation in buildings
AS/NZS 3666.1:2011	Air-handling and water systems of buildings - Microbial control - Design, installation and commissioning
AS/NZS 3666.2:2011	Air-handling and water systems of buildings - Microbial control - Operation and maintenance
AS/NZS 3823.1.2:2012	Performance of electrical appliances - Air conditioners and heat pumps - Ducted airconditioners and air-to-air heat pumps - Testing and rating for performance (ISO 13253: 2011, MOD)
AS 4254.1:2012	Ductwork for air-handling systems in buildings - Flexible duct
AS 4254.2:2012	Ductwork for air-handling systems in buildings - Rigid duct
AS/NZS 4266.1:2017	Reconstituted wood-based panels - Methods of testing - Base panels
SA/SNZ HB 32:1995	Control of microbial growth in air-handling and water systems of buildings
AIRAH/IRHACE 2:2007	Australia and New Zealand Refrigerant Handling Code of Practice – Systems other than self-contained low charge systems.
AIA EDG 80 RA:2014	Environment Design Guide - Natural ventilation in passive design
AIA EDG GEN 34:2005	Environment Design Guide - Urban air quality
AIRAH DA26:2004	Indoor air quality
ASTM D5116:2017	Standard guide for small-scale environmental chamber determinations of organic emissions from indoor materials/products

LIGHTING

AS/NZS 1158:Various	Lighting for roads and public spaces
AS/NZS 1680.1:2006	Interior and workplace lighting -General principles and recommendations
AS/NZS 4782.1:2020	Double-capped fluorescent lamps - Performance specifications – General (IEC 60081:1997+AMD1: 2000 CSV (ED.5.1), MOD)
AS 4782.2:2019	Double-capped fluorescent lamps - Performance specifications - Minimum Energy Performance Standard (MEPS)
AS/NZS 4783.1:2001	Performance of electrical lighting equipment - Ballasts for fluorescent lamps - Method of measurement to determine energy consumption and performance of ballasts lamp circuits
AS/NZS 4783.2:2002	Performance of electrical lighting equipment - Ballasts for fluorescent lamps - Energy labelling and minimum energy performance standards requirements
AS 4847.2:2019	Self-ballasted lamps for general lighting services - Minimum energy performance standards (MEPS)
AS/NZS 4934.1:2014	Incandescent lamps for general lighting service - Test methods - Energy performance
AS/NZS 60598:various	Luminaires
AS/NZS 60929:2020	AC and/or DC-supplied electronic control gear for tubular fluorescent lamps - Performance requirements (IEC 60929:2011+AMD1:2015 CSV (ED.4.1) MOD)
AIA EDG DES 6:2004	Environment Design Guide - Daylighting of buildings
AIA EDG 92 JG:2018	Environment Design Guide - Light Pollution

NOISE AND VIBRATION

AS/NZS ISO 140.7:2006	Acoustics - measurement of sound insulation in buildings and of building elements -Field measurements of impact sound insulation of floors (ISO 140-7:1998, MOD)
AS/NZS ISO 717.1:2004	Acoustics - Rating of sound insulation in buildings and of building elements - Airborne sound insulation
AS ISO 717.2:2004	Acoustics - Rating of sound insulation in buildings and of building elements - Impact sound insulation
AS/NZS 2107:2016	Acoustics - Recommended design sound levels and reverberation times for building interiors

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AS 2436:2010	Guide to noise and vibration control on construction, demolition and maintenance sites
AIRAH DA02:1995	Noise control

OTHER ENVIRONMENTAL CONCERNS

Commissioning

AIRAH DA24:2003	Water system balancing
CIBSE CCA: 1996	Commissioning Code A - Air distribution systems
CIBSE CCB:2002	Commissioning Code B - Boilers
CIBSE CCC:2001	Commissioning Code C - Automatic controls
CIBSE CCM:2003	Commissioning Code M - Commissioning management
CIBSE CCR:2002	Commissioning Code R - Refrigerating systems
CIBSE CCW:2010	Commissioning Code W - Water distribution systems
ASHRAE STD 111:2008	Measurement, testing, adjusting, and balancing of building HVAC systems

Earth

AS 4482.1:2005	Guide to the investigating and sampling of sites with potentially contaminated soil - Non-volatile and semi-volatile compounds
AS 4482.2:1999	Guide to the investigating and sampling of sites with potentially contaminated soil - Volatile compounds
AS 4874:2000	Guide to the investigation of potentially contaminated soil and deposited dust as source of lead available to humans
AS/NZS ISO 14001:2016	Environmental management systems - Requirements with guidance for use
AS/NZS ISO 14004:2018	Environmental management systems - General guidelines on implementation
ISO 14031:2021	Environmental management - Environmental performance evaluation - Guidelines
AS/NZS ISO 19011: 2019	Guidelines for auditing management systems
SA HB 203:2012	Managing environment-related risk
AIA EDG DES 52:2003	Environment Design Guide - Erosion and sediment control

Fire

AS 2118:various	Automatic fire sprinkler systems
AS 3959:2018	Construction of buildings in bushfire-prone areas

Health

AIA EDG GEN 79:2008	Environment Design Guide - Impact of indoor environment quality on occupant productivity and well-being in office buildings
AIA EDG PRO 20:2004	Environment Design Guide - Lead hazards in construction - A designer's guide
CFMEU:2016	Asbestos kills

Maintenance

AS/NZS 3666.2:2011	Air-handling and water systems of buildings - Microbial control - Operation and maintenance
AS/NZS 3666.3:2011	Air-handling and water systems of buildings - Microbial control - Performance-based maintenance of cooling water systems
AIRAH DA19: 2019	HVAC&R maintenance

Termites - pests

AS 3660.1:2014	Termite management - New building work
AS 3660.2:2017	Termite management - In and around existing buildings and structures
AS 3660.3:2014	Termite management - Assessment criteria for termite management systems
AS 4349.3:2010	Inspection of buildings - Timber pest inspection
AIA APN: 2011	Acumen Practice Notes -Termite Management
AIA EDG PRO 23:2000	Environment Design Guide – Management of subterranean termites for new buildings

Other

AS 3740:2010	Waterproofing of domestic wet areas
AS 4654.1:2012	Waterproofing membranes for external above-ground use - Materials
AS 4654.2:2012	Waterproofing membranes for external above-ground use - Design and installation
AS/NZS 61000:various	Electromagnetic compatibility (EMC)
AIA EDG 71 RC:2012	Environment Design Guide - Life cycle energy analysis
AIA EDG DES 53:2003	Environment Design Guide - Roof and facade gardens
AIA EDG DES 56:2003	Environment Design Guide - Birds and buildings
AIA EDG TEC 27:2009	Environment Design Guide - Green roofs – Understanding their benefits for Australia
AIRAH DA19: 2019	HVAC&R maintenance
NATSPEC DES 001	Slip resistance performance
NATSPEC DES 004	Air, moisture and condensation
NATSPEC DES 005	Preventing condensation on ducts and air handling plant

Appendix D: Standards relating to ESD

Safe Work Australia: 2020	Model Code of practice: How to manage and control asbestos in the workplace:
Safe Work Australia:2020	Model Code of practice: How to safely remove asbestos.