

0762P DELTA PANELS IN COOL ROOMS

Branded worksection

This branded worksection *Template* has been developed by NATSPEC in conjunction with **DELTA PANELS Pty Ltd** (the Product Partner) and may be used whilst the Product Partner is licensed to distribute it. The copyright remains with NATSPEC. As with all NATSPEC worksections, it is the responsibility of the user to make sure it is completed appropriately for the project. The user should also review its applicability for local conditions and regulations. Check www.natspec.com.au for the latest updated version.

Worksection abstract

This branded worksection *Template* is applicable to refrigerated cool rooms and components with a room operating temperature below 5°C including those operating below freezing. It includes the construction of the room using DELTA PANELS insulated panels, and its associated refrigeration system and controls.

Guidance text

All text within these boxes is provided as guidance for developing this worksection and should not form part of the final specification. This *Guidance* text may be hidden or deleted from the document using the hidden text *Hide* and *Delete* functions of your word processing system. For additional information visit FAQs at www.natspec.com.au.

Optional style text

Text in this font (blue with a grey background) covers items specified less frequently. It is provided for incorporation into *Normal* style text where it is applicable to a project.

Related material located elsewhere in NATSPEC

If a listed worksection is not part of your subscription package and you wish to purchase it, contact NATSPEC.

Related material may be found in other worksections. See for example:

- 0310 Concrete – combined.
- 0315 Concrete finishes.
- 0428p DELTA PANELS insulated roofing systems.
- 0437p DELTA PANELS insulated cladding systems.
- 0612 Cementitious toppings.
- 0631 Ceramic tiling.
- 0651 Resilient finishes.
- 0657 Resin based seamless flooring.

Material not provided by DELTA PANELS

This branded worksection includes generic material which may not be provided by the Product Partner including:

- Condensers.
- Evaporators.
- Refrigerant plant.

Material not included in NATSPEC

Some projects may include items not covered by NATSPEC. For these you may need to create new text or modify this text or a suitable worksection. For example:

- Cool rooms using glycol or ammonia as refrigerant.
- Temperature controlled rooms using sandwich panels similar to cool rooms but operating at above ambient temperature.
- Cool rooms exposed to weather.

Design and Construct specifications

This worksection can be used as the basis for fully documented installations or for a variety of design and construct approaches in which the contractor provides all or part of the system design. Some possible approaches are:

- Full Design and Construct: The contractor designs the whole of the installation.
- Partial Design and Construct: The documents show most details leaving the contractor only to edit to suit project requirements.
- Fully documented design: The documents show all necessary details for construction by the contractor.

Material relating to the contractor's design responsibilities should be located in **SELECTIONS**. *Guidance* text with **SELECTIONS** includes some material that must be edited to suit the project requirements and intended contractor's responsibilities.

The sample material provided in **SELECTIONS** assumes that the location, overall size, doors, room operating temperatures and the like are documented and that the contractor will undertake the remaining design including sizing and selecting the plant, detailing the construction and so on.

Documenting this and related work

You may document this and related work as follows:

- Coordinate cool room details with the base building. For example, cool rooms with floors at the same level as the adjacent floor require set downs in the slab.
- Likewise some internal finishes (e.g. floor tiles) may need to be coordinated with building finishes.
- Show the location of refrigeration equipment on the drawings, paying attention to adequate provision of cooling air intakes and discharge.
- Local regulations may apply, notably in relation to Work Health and Safety, health (food storage), laboratory safety and practices.
- Access to the space above cool rooms and equipment. Sandwich panels, although rigid, may not be adequate for the applied loads.
- If shelving and the like are to be attached to cool room walls consider the method of fixing.
- Make sure there is adequate air flow into and away from condensing units, particularly if mounted indoors or if drop in units are documented.
- Since cool rooms vary in temperature more than the surrounding spaces, make adequate provision to accommodate thermal movement, particularly near doors with anti-condensation heater cables.
- This worksection includes the option of Class 2L (lower flammability) refrigerants to AS/NZS ISO 817. If used, make sure the relevant provisions of AS/NZS 5149.1, AS/NZS 5149.2, AS/NZS 5149.3 and AS/NZS 5149.4 are incorporated. Issues to consider include plant location, plant room size, plant room ventilation and refrigerant alarms.
- This worksection contains text, including *Optional* text, which may be adapted for use in design and construct projects. See NATSPEC TECHreport TR 03 for information on specifying Design and Construct for mechanical services.

The *Normal* style text of this worksection may refer to items as being documented elsewhere in the contract documentation. Make sure they are documented.

Specifying ESD

The following may be specified by retaining default text:

- Energy efficient wall cladding.
- Durable and low maintenance wall cladding.
- Anti-bacterial finish that inhibits growth of bacteria.

Refer to the NATSPEC TECHreport TR 01 on specifying ESD.

1 GENERAL

DELTA PANELS is a 100% Australian owned and operated manufacturer of insulated panels. Its range of products includes roof, wall and patio systems, plus a wide range of accessories. The range of panels (in various styles and colours) has been engineered for enhanced performance in Australia's harsh environment.

1.1 RESPONSIBILITIES

General

Requirement: Provide refrigerated cool rooms using DELTA PANELS insulated panels, and associated work, as documented.

Documented is defined in 0171 *General requirements* as meaning contained in the contract documents.

DESIGN

Cool rooms are provided by specialist subcontractors on essentially a design and construct basis to meet specified performance parameters.

The *Optional* style text in this clause may be changed to *Normal* style text when the contractor is to design and select the cool rooms and associated refrigeration equipment. Use 0701 *Mechanical systems* to describe design parameters for mechanical systems, as a whole, including the basis for calculating the cool room capacities.

Selection parameters included in the **SELECTIONS** schedules should not be repeated here. The schedules' *Guidance text* includes suggestions for modification to suit design and construct projects.

General

Requirement: Design refrigerated cool rooms, as documented.

Cool room design, application and calculations

Standards: Conform to the recommendations of one or more of the following:

- AIRAH Design Application Manuals.
- ASHRAE Handbooks.
- CIBSE Guides.

Methods of calculation: Manual or software that employs the data and methods in the applicable standard.

Documentation

This is a partial list of items only. Edit to suit the project. Drawings relating to whole systems should be included in *0701 Mechanical systems*.

Drawings: Show the following on the drawings:

- Cool room construction details including vapour barriers and means for preventing cold bridging.
- Coordination with building elements.
- Provisions for differential thermal movement.
- Location of refrigeration equipment.
- Access to space above cool rooms and equipment.
- Location of refrigeration equipment.
- Condensate drainage.
- Details of shelving.
- Details of external and internal finishes and protection.
- Arrangement for adequate air flow into and away from condensing units.
- [complete/delete]

1.2 COMPANY CONTACTS**DELTA PANELS technical contacts**

Website: www.deltapanel.com.au/contact

1.3 CROSS REFERENCES**General**

Requirement: Conform to the following:

- *0171 General requirements*.

0171 General requirements contains umbrella requirements for all building and services worksections.

List the worksections cross referenced by this worksection. *0171 General requirements* references the *018 Common requirements* subgroup of worksections. It is not necessary to repeat them here. However, you may also wish to direct the contractor to other worksections where there may be work that is closely associated with this work.

NATSPEC uses generic worksection titles, whether or not there are branded equivalents. If you use a branded worksection, change the cross reference here.

- *0701 Mechanical systems*.
- *0771 Automatic controls*.
- *0781 Mechanical electrical*.

1.4 STANDARDS**General**

Refrigeration systems: To AS/NZS 5149.1, AS/NZS 5149.2, AS/NZS 5149.3 and AS/NZS 5149.4.

AS/NZS 5149.1, AS/NZS 5149.2, AS/NZS 5149.3 and AS/NZS 5149.4 deal with safety and environmental aspects of refrigeration systems. They are based on the corresponding ISO 5149 series standards but with Australian amendments including a performance option in Appendix ZZ of each part of the standard.

See NATSPEC TECHnote PRO 007 on refrigerant options.

Cool rooms for food storage: To AS 4674.

This standard covers matters including finishes, fixtures, fittings and lighting.

1.5 MANUFACTURER'S DOCUMENTS

Technical manuals

Cladding system product range: www.deltapanel.com.au/deltacool

1.6 INTERPRETATION

Abbreviations

General: For the purposes of this worksection the following abbreviations apply:

- MW: Mineral wool.
- PIR: Polyisocyanurate.
- EPS: Expanded polystyrene.

Edit the Abbreviations subclause to suit the project or delete if not required. List alphabetically.

Definitions

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

- BMS: Building management system.

Building management system is the term used in AS 2896 and this is a common abbreviation for it. Similar terms are DDC (direct digital control) and BAC (building automation and control system). Adjust to suit the project terminology.

- Cool room: A refrigerated space which is designed to maintain a temperature below 5°C and is used primarily for the storage of product.

Product is used generically to refer to the contents stored and so encompasses perishable materials such as food and temperature sensitive materials such as some pharmaceuticals.

To avoid ambiguity, in this worksection the terms cold room and freezer room have not been used and instead requirements are specified in terms of room operating temperature. AS 4674 uses the terms chiller and freezer without defining them.

Edit the **Definitions** subclause to suit the project or delete, if not required. List alphabetically after the **General** subclause.

1.7 SUBMISSIONS

Fire performance

Fire hazard properties: Submit evidence of conformance to PRODUCTS, **FIRE PERFORMANCE**, **Fire hazard properties**.

Operation and maintenance manuals

Requirement: Submit a manual of recommendations from DELTA PANELS for annual maintenance of the cladding system, including recommended methods of access, inspection, cleaning, repair and replacement.

Products and materials

Thermal insulation performance: Submit evidence of conformity to AS/NZS 4859.1 and AS/NZS 4859.2.

This is primarily to verify claimed R-Values for NCC compliance.

Type tests: Submit results as follows:

Type tests are carried out off-site. However, submission of evidence of a successful type test may be called up here for requirements specified in SELECTIONS or PRODUCTS if there are no SELECTIONS.

- Refrigeration requirements.

Samples

General: Submit a sample, drawing or photograph of each of the following:

- Wall to wall to ceiling corner joint.
- Panel to panel joint.
- Wall to floor joint.
- Door jamb.
- Floor cross-section.

Cutaway sections: For each sample, provide cutaway sections or standard drawings to permit inspection of application details including insulation materials, adhesives, mastics and fixings.

Subcontractors

General: Submit names and contact details of proposed installers.

Contact DELTA PANELS for details of DELTA PANELS recommended installers appropriate to construction in your area.

Tests

Pre-completion tests: Submit test results for the following:

- Pressure testing of refrigeration equipment.

Warranties

General: Submit evidence of warranties for all proposed materials and components clearly defining the warranty period and any conditions.

DELTA PANEL's standard warranty is 2 years for workmanship and 20 years for materials.

1.8 INSPECTION

Notice

General: Give notice so that inspection may be made of the following:

- Floor slab: Ready for installation of subbase.
- Heated subbase: Complete and before commencing floor laying.
- Vapour barrier: Installed with locating angle in position ready for wall panel installation.
- Membrane: Installed ready for placing wearing surface.

Amend to suit the project, adding critical stage inspections required.

Hold points, if required, should be inserted here. For critical installations, it may be desirable to make the above witness points into hold points.

2 PRODUCTS

2.1 GENERAL

Product substitution

Other products: Conform to PRODUCTS, **GENERAL**, **Substitutions** in *0171 General requirements*.

The *0171 General requirements* clause sets out the submissions required if the contractor proposes alternative products. Refer also to NATSPEC TECHnote GEN 006 for more information on proprietary specification.

Storage and handling

Requirement: Store and handle materials to the manufacturer's recommendations and the following:

- Protect materials including edges and surfaces from damage.
- Keep dry and unexposed to weather.
- Do not drag metal sheets or panels across each other or over other materials.
- Composite panels: Store unpacked panels by size in racks and protect from scratching, warping or bending.

Product identification

General: Marked to show the following:

- Manufacturer's identification.
- Product brand name.
- Product type.
- Quantity.
- Product reference code and batch number.
- Date of manufacture.

Edit the list to suit the project or delete if not required.

Operating conditions

General: Provide equipment that operates within an ambient temperature range of 0°C to 45°C, without excessive head pressure or unstable operation.

Amend upper and lower temperature to suit the actual conditions of the project area, if necessary.

Sealants

Materials: One-component compounds with a neutral curing mechanism, vulcanising at room temperature. Provide sealants that:

- Do not foster microbial growth.

The requirement that sealants not foster microbial growth is consistent with AS/NZS 3666.1. Sealants that support mould growth (e.g. some grades of silicone) and are unsuitable for use in food preparation areas, laboratories, health facilities and the like.

- Maintain their sealing performance for the life of the cool room.
- Bond to the surface of application without primers.
- Are resistant to oils, food acids and water after curing.
- Are non-toxic.
- After curing retain their elastomeric properties over the range of room operating temperatures.
- Are suitable for application by gun or hand tools.
- Are approved for the application by DELTA PANELS and conform to IPCA 004.3
- *Code of practice.*

Corrosion protection

Ferrous metals: Either stainless steel or protected from corrosion by hot-dip galvanizing or metallic coating.

Fasteners: Stainless steel or non-ferrous only.

Fasteners

Rivets: Expanding solid end type 4.0 mm diameter approved by DELTA PANELS.

Refrigerants

Requirement: Provide refrigerants as follows:

- Listed as Safety Group A1 or A2L in AS/NZS ISO 817.

Safety Group A1 refrigerants have low toxicity and no flame propagation. Safety Group A2L refrigerants have low toxicity and lower flammability. Refrigerants not listed in AS/NZS ISO 817 are not covered by AS/NZS 5149.1, AS/NZS 5149.2, AS/NZS 5149.3 or AS/NZS 5149.4 so should be avoided.

- Ozone Depletion Potential: 0.
- Global Warming Potential: ≤ 700 .

A Global Warming Potential of 700 represents moderate requirement. Refrigerants with higher and lower values are available. Lower values tend to be associated with higher flammability.

Safety Group, Ozone Depletion Potential and Global Warming Potential for refrigerants are listed in AS/NZS 5149.1 Annex B. See NATSPEC TECHnote PRO 007 on refrigerant options.

2.2 FIRE PERFORMANCE

See DELTA PANELS website for fire performance test reports.

Fire hazard properties

Group number: To AS 5637.1.

DeltaCool-EPS-FR tested to AS ISO 9705: Group number 1.

DeltaCool-PIR tested to AS ISO 9705: Group number 1.

Non-sprinklered buildings: Wall and ceiling linings must either have an *average specific extinction area* less than 250 m²/kg or a *smoke growth rate index* not more than 100 as determined by AS 5637.1.

Refer to NATSPEC TECHnote DES 020 for information on fire hazard properties.

Materials: Tested to AS/NZS 1530.3. Fire hazard properties as follows:

- Refrigeration pipe insulation:
 - . Spread-of-Flame: 0.
 - . Smoke-Developed Index: ≤ 3 .
- Other materials:
 - . Spread-of-Flame Index: ≤ 9 .
 - . Smoke-Developed Index: ≤ 8 if Spread-of-Flame > 5 .

Materials with reflective facing: Test to AS/NZS 1530.3 and the recommendations of Appendix A6.

The requirements above are consistent with the NCC.

AS/NZS 1530.3 is a mandatory standard in the NCC. Smoke-Developed Index and Spread-of-Flame Index are determined under AS/NZS 1530.3. See also BCA C1.10.

For more stringent fire performance, consider requiring that both insulation material and facing individually meet the fire hazard indices, not just as a composite material.

AS/NZS 1530.3 Informative Appendix A6, recommends that reflective surfaces of test specimens (which would otherwise generally pass this test) be blackened and diagonally scored in order to simulate soot deposition onto reflective surfaces in a real fire situation. Note also that AS/NZS 1530.3 clause 4.12.2(c) requires three test specimens of laminated reflective surface materials to incorporate a vertical joint. For flexible ducting see also clause 4.9.2(a).

This above list does not include combustibility. That is, in keeping with the NCC this clause does not prohibit the use of combustible insulation materials provided they meet the other fire properties.

- DeltaCool-EPS-FR: Spread-of-Flame Index: 0.
- DeltaCool-PIR: Spread-of-Flame Index: 0.

- Smoke-Developed Index: ≤ 8 if Spread-of-Flame Index > 5 .

- DeltaCool-EPS-FR: Smoke Developed Index: 2.
- DeltaCool-PIR: Smoke Developed Index: 3.

2.3 PRE-COMPLETION TESTS

Standards

General: Provide refrigeration equipment that has been subjected to physical test conforming to the following:

- Pressure tests: To AS/NZS 5149.2.
- Type tests: Factory type test packaged refrigerating plant for capacity and operating performance.

2.4 DELTA PANELS INSULATED PANELS

DELTA PANELS DeltaCool insulated panels comprise a roll-formed metal skin on two sides, factory bonded to a choice of core-Expanded Polystyrene Fire Retardant (EPS-FR) or Polyisocyanurate (PIR). Skins are coated with an anti-bacterial paint that inhibits the growth of bacteria. All DeltaCool panels are 1200 mm wide and can be rolled to the required length.

DeltaCool-EPS-FR

Description: Composite panels comprising pre-painted, roll form steel skins, bonded to an insulating core of fire retardant grade expanded polystyrene rigid cellular foam.

DeltaCool-PIR

Description: Composite panels comprising pre-painted, roll form steel skins, bonded to an insulating core of polyisocyanurate rigid cellular foam.

Insulation core

Standard: To AS/NZS 4859.1.

AS/NZS 4859.1 categorises insulation as follows: Formed shapes, Formed in situ, Compressible, Loose fill, IR reflective and Vacuum panels.

Insulation blowing agents

Restricted agents: Conform to **MATERIALS AND COMPONENTS, Prohibited materials** in 0171 *General requirements*.

Internal and external skins

Skin material and thickness: As documented.

The available skin thickness are 0.4 mm and 0.6 mm depending on requirements for structural performance and fire resistance.

Factory pre-coating: Polyester to a dry film thickness of 25 microns. Antibacterial.

Finish: As documented.

Panel profile: As documented.

Dimensions

Panel thickness:

- Room operating temperature $> 0^{\circ}\text{C}$: ≥ 75 mm.
- Room operating temperature $\leq 0^{\circ}\text{C}$: ≥ 150 mm.
- Between cool rooms: ≥ 100 mm.

Panel width:

- Standard module width: 1200 mm.

2.5 DOORS

Door type

Requirement: Provide DELTA PANELS insulated swing or sliding doors, as documented.

Document in the **Cool room schedule**, on the drawings, or if there is only one type, delete alternatives.

Door assembly

Type: Sliding or hinged panels as documented that close against a door frame. Provide all necessary door hardware, gaskets and the like.

Escape provisions: Provide the following:

- Access doors openable from both from the inside and outside.
- If the door is electrically or pneumatically operated provide a means for opening the door manually.
- One of the following:
 - . A telephone in every room.
 - . Unlocked insulated safety exit door which can only be opened from the inside.
 - . A panel removable from the door or adjacent wall from the inside of the room making an opening large enough for a person to pass through easily.

Thermal performance: Provide doors and door sets which, when closed, have thermal insulation properties equal to those of the wall in which they are located.

Seal: Provide face sealing doors.

Sill-less doors: If the door has no sill, provide Fermod 473 adjustable camrise hinges to elevate the door clear of the floor surface during opening and closing.

Door panel

Construction: Provide doors of panel type construction, free of studding with skins bonded to both sides of an insulation core.

Insulation: Conform to **DELTA PANELS INSULATED PANELS**.

Insulation thickness: Same thickness and material as the wall in which the door is located.

Edging: Form door edging from a heavy gauge aluminium extrusion with double web seal to both skins. Mitre corner and firmly secure to panel stainless steel with countersunk head screws.

Viewing panel

Type: Triple glazed, vacuum insulated with thermally broken aluminium frame.

Size: As documented.

Include in the **Cool room schedule** or on the drawings.

Anti-condensation heater cables

Heater cables: Incorporate a thermal break and heater cables to prevent condensation on outside face of door.

Type: 230 V self-temperature regulating heater cable terminating in coiled tails. Provide earth leakage protection.

Installation: Install heater cables, accessible for replacement, under removable aluminium cover in the door frame and threshold.

Door frame

Construction: Form frame stiles and head from 3 mm aluminium or 10 mm PVC-U extrusions incorporating rebates if required for door seating. Mitre corners and fix frame firmly to the inner and outer wall skins. Maintain the vapour seal of the wall panel. Make suitable provision for fixing the specified hardware.

Heater cables: Incorporate a thermal break and dual heater cables (1 spare) to prevent condensation on outside face of door.

Threshold

Heater cable section below doors: Locate heater cables as follows:

- Freezer door threshold flush with external floor: Locate heater cable in a channel formed in the external floor between two 25 mm x 25 mm x 3 mm aluminium angles recessed into the floor. Provide polyurethane packing below the heater cable and removable silicone seal above it.
- Freezer door threshold higher than the external floor: Locate heater cable in a removable section on the external face of the cool room, below the door threshold. Fix section with countersunk stainless steel screws.

Gaskets

Construction: Provide welded, easily removable, one piece type neoprene door gaskets which are resistant to the effects of food acids, fats and oils. Fit in place with sealant and stainless steel screws.

Door protection

Requirement: If door protection is documented, provide 2.5 mm thick embossed aluminium checker plate, the width of the door, to both sides of the door and to a height of 1200 mm.

If required, include door protection in **SELECTIONS** or show on the drawings.

2.6 EMERGENCY ACCESS DOORS**General**

Requirement: Conform to **DOORS** with the following exception:

- Provide easily accessible internal release mechanisms fitted with luminous identification and instruction plates which do not require power.

2.7 DOOR HARDWARE**Catches**

Construction: Provide externally lockable door catches with overriding internal safety release mechanism and internal handles for closing of door.

Hinges

Hinged doors: Hang hinged doors on edge mounted, rising butt type, self-closing hinges capable of holding the door fully open.

Materials: Heavy duty brass or gunmetal, chromium plated to AS 1192, service condition number 2, satin finish, for catches, hinges, handles and similar items.

Sliding track

Sliding doors: Hang sliding doors on an overhead sliding track mechanism of capacity suitable to the door, comprising an extruded aluminium track section, top carriages and bottom roller guides with turned nylon ballbearing rollers and a door height adjustment mechanism. Provide heavy duty rubber stops at both ends of the door travel.

Installation

Fixing: Securely bolt hardware to the door and frame. Minimise cold bridging and formation of condensation on the outside of the cool room.

Alarm bell

Bell: Provide a manually operated bell on the door with the operating mechanism on the inside and the bell on the outside. Recess the operating mechanism so that it is flush with the inside face of the door.

2.8 REFRIGERATION PLANT GENERALLY**Construction**

Requirement: Provide one or more complete packaged systems per room consisting of condensing and evaporator units, designed and rated by the manufacturer to operate together.

Consider the need for duty-standby or dual systems rather than a single system per room.

Refrigeration system types

Type: Provide refrigeration systems as documented of the following types:

Include refrigeration system type in **SELECTIONS** or on the drawings.

- Split system: Two piece package system with separate evaporator and air cooled condensing unit.

Preferably show the location of the condensing unit on the drawing.

Selection: Select system components to match the documented capacities and to operate without excessive saturated suction temperature.

- Single drop in unit: Drop in or slide in unit, self-contained one piece factory sealed unit, fully wired and complete with all controls.

Components

Requirement: Provide the following or each system:

- Air cooled condensing unit.
- One or more evaporators with fans.
- Automatic controls.

- Capacity control on systems over 30 kW(R).
- Manual reset high pressure and auto reset low pressure cutouts.
- High and low side test points.
- Associated refrigerant and drain piping.
- Refrigeration plant power circuits.
- Vibration isolating mountings.
- Pressure relief to AS/NZS 5149.2.
- Phase failure protection on motors ≥ 5.5 kW.
- Permanent, weatherproof, wiring diagram fixed on or next to the control panel.

Split systems: Provide in addition:

- Liquid line solenoid valve.
- Liquid-suction heat exchanger.
- Thermostatic or electronic expansion valve.
- Compressor service valves.
- Integral positive temperature coefficient type crankcase heaters if required for safe compressor operation. Energise when the compressor is off.
- Schrader type connections for evacuation and refrigerant charging.
- Test valves.
- Liquid receiver with service valves. Size to hold the full refrigerant charge.
- Suction line vibration eliminator.
- Replicable filter-dryer.
- Low oil pressure cutout.
- Liquid line sight glass and moisture indicator.
- Room temperature $\leq 0^{\circ}\text{C}$: Provide also:
 - . Crankcase pressure regulator.
 - . Liquid line accumulator with liquid heat exchanger.
 - . Insulated oil separator.

2.9 EVAPORATORS

Description

General: Provide low-silhouette evaporators which include an extended surface aluminium finned copper cooling coil with externally mounted externally equalised expansion valve, refrigerant distributors one or more fan and motors, one or more fan and motors, stainless steel or aluminium condensate drain pan and accessories. Locate the expansion valve bulb or sensor to the valve manufacturer's recommendations.

Type: Low profile induced draft (IDC) or forced draft (FDC).

Casing: Stainless steel or heavy gauge aluminium.

Coils

Fins: ≤ 236 fins per m.

Room air to coil temperature difference: ≤ 5 K.

Face velocity: ≤ 2.5 m/s.

Fans

Type: Axial flow, aluminium blade, propeller with an IP54 motor, class E insulation and inbuilt auto-resetting overload protection.

Noise level in room with all fans operating: ≤ 65 dB(A).

Installation: Provide a corrosion resistant fan guard and aerodynamic contoured tube housing. Provide easy access to each fan and motor for inspection and maintenance.

Air delivery: Direct to the room with a throw of not less than three quarters of the room length.

Consider EC fan motors as they are more energy efficient. (High voltage permanent magnet DC with built in AC to DC conversion.)

Motors: ≥ 0.37 Kw: Three phase only.

Heaters

Room operating temperature $\leq 2^{\circ}\text{C}$: Provide coil defrost heaters and drain pan heaters consisting of totally enclosed sheathed heater elements, in banks designed for separate and easy removal in the case of failure. Provide dual heater circuits.

2.10 CONDENSING UNITS**Description**

Type: Provide packaged condensing units comprising liquid receiver, compressor, hot gas line, condenser and accessories. Mount the components on a common grid corrosion protected steel base.

Room operating temperature $\leq 0^{\circ}\text{C}$: In addition, provide the following:

- Open surge tank suction accumulator.
- Back pressure regulator.
- Oil separator.

Consider EC fan motors as they are more energy efficient. (High voltage permanent magnet DC with built in AC to DC conversion.)

Compressor types

Type: Provide open type compressors as follows and as documented:

- Belt drive.
- Direct drive.
- Semi-hermetic.
- Hermetic.

Include compressor type in **SELECTIONS** or show on the drawings.

Hermetic and semi-hermetic compressors

Crankcase heaters are assumed to be provided simply to manufacturer's instructions.

Enclosure: Welded or accessible hermetic steel enclosure with minimum 3 mounting feet. Provide the following:

- Mounting: Vibration isolating mountings.
- Service valves: Packed and capped, backseating refrigerant suction valve.
- Charging connections: Schrader type connections for evacuation and refrigerant charging.

Crankcase heaters: Provide integral positive temperature coefficient type crankcase heaters if required for safe compressor operation.

Scroll compressors: Provide reverse rotation protection.

Gauges

Requirement: If documented, provide suction and discharge pressure gauges to nominated condensing units.

If required, include in **SELECTIONS** or show on the drawings.

Air cooled condensers

Condenser coils:

- Tubes: Copper to AS/NZS 1571 or AS 1572 designation C12200.
- Fins: Aluminium alloy plate fins ≥ 0.12 mm thick to AS 2848.1, designation 3003 or 8011.
- Fin pitch: ≤ 550 fins/m.
- Subcooling: $> 5\text{K}$.

For some environments e.g. close to the ocean, additional coil treatment may be needed. If so see **ADDITIONAL COIL CORROSION TREATMENT** in 0733 Air coils.

Propeller fan: Direct drive with single thickness fixed pitch aluminium or ultraviolet light protected polypropylene blades.

Aerofoil axial flow fan: Direct drive with adjustable pitch aerofoil section blades of ultraviolet light protected glass reinforced plastic or polypropylene, or aluminium.

Fan motors:

- Over 0.37 kW: Three phase.
- Speed: < 25 rev/s.

- Bearings: Sealed for life ball bearings.
- Minimum degree of protection: IP55.

Head pressure control: Provide head pressure control by fan cycling.

Water cooled condensers

Type: Mechanically cleanable shell and tube condensers with steel end plates and shells and copper or copper alloy extended surface tubes.

Performance rating: Rate to AHRI 450.

Design pressures:

- Water side: ≤ 1000 kPa.
- Refrigerant side: To AS/NZS 5149.2.

Drain and vent: Provide valved water side drain and vent connections to each condenser.

Compressor cooling: If the compressor is not refrigerant cooled, provide a compressor cooling fan.

Sacrificial anodes: Provide sacrificial anodes conforming to AS 2129 and AS 2239 in the condenser water boxes to protect all ferrous metals.

Head pressure control: Provide a water flow control valve to maintain head pressure.

Condensing unit enclosure

Requirement: If documented, provide an enclosed powder coated casing enclosure rated at IP54 to nominated condensing units. Arrange to be easily removable for service.

If required, include in **SELECTIONS** or show on the drawings.

2.11 REFRIGERATION PIPE INSULATION

Material

Thickness:

- Room operating temperature $> 2^{\circ}\text{C}$:
 - . Suction line: 19 mm.
 - . Condensate line: Not required.
- Room operating temperature $\leq 2^{\circ}\text{C}$:
 - . Suction line: 38 mm (2 to 19 mm layers).
 - . Condensate line: 13 mm.

Type: Chemically blown closed cell nitrile rubber or polyethylene in tubular form.

Physical properties:

- Maximum thermal conductivity: $0.04 \text{ W}/(\text{m.K})$ at 0°C .
- Moisture absorption: Non-hygroscopic.
- Water vapour diffusion resistance μ : ≥ 5000 to EN 13469.

2.12 SHELIVING

General

Shelving: Provide proprietary adjustable modular shelving as follows:

- Posts: $25 \times 25 \times 1.2$ mm cold rolled angle section with 25 mm diameter foot with 65 mm height adjustment. Provide slotted holes at regular centres in the posts for shelf height adjustment.
- Shelf frames: 32×2.5 mm cold rolled angle section at front and rear.
- Wire grid shelves: Welded frame with 4 mm wires at 25 mm centres supported on 8 mm centre and edge bars.
- Dunnage shelves: Welded frame with $25 \times 25 \times 1.6$ mm square hollow section (SHS) tubes at 65 mm centres.

Consider this construction also for shelves that are subject to high loadings and/or greater wear and tear.

Material: Metallic-coated steel, hot-dip galvanized steel or stainless steel as documented.

Include material in **SELECTIONS** or show on the drawings.

3 EXECUTION

3.1 PANEL INSTALLATION

Manufacturer's instructions

Requirement: Conform to the recommendations of DELTA PANELS, IPCA 004.3 *Code of practice* and construction drawings.

Completion: Register the project's certificate of compliance to IPCA 004.3 *Code of practice* Annex D.

Joints

General: Provide each panel as a 1200 mm wide module, tightly drawn and interlocked with the joint system to provide structural integrity, thermal efficiency and a vapour barrier.

Joint finish: Provide aluminium extrusions or steel flashings of the same material as the panel skin, internally and externally as follows:

- At panel junctions, except where DELTA PANELS proprietary panel to panel joint is used.
- Between panels and building structures, if documented.

Sealant: Apply a continuous bead of sealant along extrusions to form a vapour seal.

Floor joint: Provide aluminium F extrusion base mould with mitred corners at the base of walls. Fix at 300 mm centres and/or to Professional engineer's recommendations.

See 0171 *General requirements for the definition of Professional engineer.*

Panel butt jointing

General: Join using DELTA PANELS proprietary panel to panel joint with sealant applied to inside and outside to DELTA PANELS recommendations.

Cut panels

Position: Locate cut panels at the corners of the room.

Cutting: Use only DELTA PANELS approved blades.

Joint type

External corner joints: 50 x 50 mm folded extruded aluminium angle trim. Fix the external trim with sealed blind rivets.

Internal corner joints: 40 x 40 mm folded extruded aluminium channel or angle. Provide an extruded aluminium cove moulding with more than 25 mm radius to internal joints.

Aluminium cove is optional and can be fixed over the top of the internal angle for hygiene or aesthetic reasons.

Wall to ceiling joints: Form a rebate in the wall panel to receive the ceiling panel. If the room temperature is less than 0°C, cut back the internal skin of the panel that is not rebated for the width of the rebate.

This is to prevent cold bridging at this point.

Floor insulation to wall joint: If the room temperature is less than 0°C, remove the inside skin of the cool room floor wall panels for the height of the floor insulation.

This is to prevent cold bridging at this point.

Joint covers

External wall and ceiling joint cover: Provide 50 x 50 mm extruded aluminium angle or 0.55 mm steel angle of the same material and finish as the panel skin.

Internal wall and ceiling joint cover: Coved aluminium extrusion or 0.55 mm steel angle of the same material and finish as the panel skin.

Delete steel angle if only coved extrusion required.

Internal floor joint cover: Coved aluminium extrusion.

Joint cover fixing: Fix the joint covers to panels with sealed blind rivets.

Panel penetrations

Non fire-rated construction: Provide flanged PVC-U sleeves for service penetrations through wall and ceiling panels. Fill the void between the service and the sleeve with a one component polyurethane sealant. Vapour seal the panel.

Fire-rated construction:

- Penetrations: Provide steel sleeve fire collar where services penetrate fire-rated wall and ceiling panel. Fill the void between the service and the sleeve with fire-rated foam approved by DELTA PANELS.
- Flashing: Provide a colour coated steel flashing around the penetration fixed with 4 mm diameter stainless steel rivets to the wall, sealed with sealant recommended by DELTA PANELS..

External flashing

Construction: Provide extruded aluminium or colour coated steel channel or angle to the base of walls. If this is exposed to the elements, provide either an apron flashing of colour coated steel to prevent ingress of water into the base joint, or a cove moulding of not less than 25 mm radius, as a flashing between the external wall and the external floor.

This is typical. Edit to suit external floor finish.

Internal wall protection

Requirement: If documented, provide wall protection to internal walls of the cool room.

If required, include in **SELECTIONS** or show on the drawings.

Cool rooms with no shelving:

- Concrete wearing surface floor: Provide a 50 mm x 50 mm x 3 mm hot-dip galvanized RHS rail 100 mm from the wall. Support rail 100 mm above the finished floor on 44 mm x 6 mm hot-dip galvanized brackets at ≤ 1500 mm centres.
- Aluminium checker plate or plywood wearing surface: Provide 4 heavy duty 100 mm x 25 mm extruded aluminium bump rail sections fixed horizontally to the full width of each wall. Locate at 250 centres vertically with the lowest bump rail 100 mm above the floor.

Cool rooms with shelving: Provide heavy duty 100 mm x 25 mm extruded aluminium bump rail sections fixed horizontally to the full width of the wall. Provide one per shelf at a height to suit the shelving.

3.2 SEALING

Manufacturer's instructions

Requirement: Conform to the recommendations of DELTA PANELS, IPCA 004.3 *Code of practice* and construction drawings.

Sealants

Type: Use a mastic sealant for internal mating surfaces and a sealant as a secondary vapour barrier on external joints.

Sealants for fire-rated cool room construction

Type: Use a mastic sealant for internal mating surfaces and an acrylic fire-rated sealant as an intumescent barrier on external joints. Where fire-rated sealants are required on internal slip joints, provide breathing gap for 1 m or 10% of the height of the joint, whichever is the greater.

Vapour sealing

Construction: Form a continuous external vapour barrier around the cool room by vapour sealing the external wall and ceiling joints and penetrations, and by sealing the locating section to the base of the wall panels and to the vapour barrier membrane.

Water sealing for internal wash down areas

Construction: Form a waterproof joint between walls and floor wearing surfaces by sealing the internal cove and external flashing mouldings to the respective wall and floor surfaces. Seal all internal butt and corner joints up to 1 m above the floor when wash-down required.

3.3 PRESSURE RELIEF

Relief port

Requirement: For all rooms with an operating temperature not more than 0°C provide 2 relief ports on one wall.

Construction: Round polypropylene or square injected with internal vertical hinged vanes.

Size: ≥ 150 mm.

Heater: Provide an electric heater in each relief port to prevent malfunction resulting from freezing.

3.4 CEILING SUPPORT

Manufacturer's instructions

Requirement: Conform to the recommendations of DELTA PANELS and construction drawings.

Ceiling joints over internal walls

Overlap: If ceiling panels butt join over internal wall panels, locate the ceiling joint not less than 25 mm from the face of the wall panels.

Ceiling suspension

Requirement: To IPCA 004.3 *Code of practice*.

3.5 HEATED FLOOR SUBBASE

Heated subbase

Requirement: Provide a heated subbase incorporating a heating mat over the floor slab under cool rooms as follows:

- Under all cool rooms constructed on suspended floors.
- Under all room with an operating temperature not more than 0°C.

Heating mat

Construction: Provide a heating mat with twin overlapping circuits, each of 100% of the required heating capacity.

Cables: 230 V self temperature regulating heating cable, factory-assembled into mats each with not more than 500 mm between adjacent coils and terminating in cold tails.

Output of heating mat: 15 W/m².

Mat installation

Location: Lay the mats on insulated spacers to cover the whole floor area to within 200 mm of the walls.

Termination: Terminate the tails in a junction box located on the inside wall of the room.

Alternatively, show location on the drawings.

Screed: Embed the heating mats in a 1:3 cement: sand screed to provide not less than 25 mm minimum cover. Provide a smooth level surface finish, free of loose material and projections, suitable for receiving the vapour barrier membrane.

Testing

Continuity: Test the heating mat cables for electrical continuity:

- Before laying the screed.
- Continuously during the laying process and for the following 24 hours.

Method: Use a continuity warning device temporarily connected to the circuits during this period.

Tanking option

Tanking: If documented, provide bituminous sheeting over the subbase or subfloor and sides of a rebated floor. Lap all joints 150 mm. Install to the manufacturer's recommendations.

If required, include in **SELECTIONS** or show on the drawings.

3.6 FLOOR VAPOUR BARRIER MEMBRANE

General

Material: Polyethylene film branded continuously:

- AS 2870 CONCRETE UNDERLAY 0.2 mm HIGH IMPACT RESISTANCE.

Installation

General: Install as follows:

- Lay over the base, lap joints at least 200 mm and seal the laps and penetrations with non-hardening mastic spread in a continuous strip 75 mm wide.
- Tape over joints with polyethylene pressure-sensitive adhesive tape, applied without wrinkles. Face the laps away from the direction of concrete pour.
- Patch or seal punctures or tears before pouring concrete. Cut back as required after concrete has gained strength and forms have been removed.

Base preparation: Remove projections above the plane surface, and loose material.

Locating section: Fix over the vapour barrier membrane, extruded aluminium angles mitred at the corners to form a locating frame for positioning the walls of the cool room. Fix the locating frame by securing to the sub-floor using masonry anchors. Vapour seal the fastener penetration with sealant before inserting the fastener.

Vapour seal: Apply continuous mastic sealant between locating section and vapour barrier membrane and between the locating section and the wall panels.

3.7 FLOOR INSULATION

Concrete wearing surface

Construction: Lay rigid cellular polyurethane sheet insulation to AS 1366.3 over the whole of the internal floor area tightly fitted without gaps immediately above the vapour barrier membrane. Lay the insulation boards in two layers, if appropriate.

Insulation thickness:

- Room operating temperature > 0°C: ≥ 75 mm on suspended slab (1 layer 75 mm).
- Room operating temperature ≤ 0°C: ≥ 150 mm (2 layers each 75 mm).

Aluminium checker plate or plywood wearing surface

Floors with an aluminium checker plate or plywood wearing surface: Provide floor insulation in the form of prefabricated panels, bonded to the wearing surface. Lay panels immediately above the vapour barrier membrane and tightly fitted without gaps.

Aluminium and plywood are not generally suitable for rooms below freezing.

Insulation thickness:

- Room operating temperature > 0°C: ≥ 100 mm.
- Room operating temperature ≤ 0°C: ≥ 150 mm.

3.8 RECESSED COOL ROOM FLOORS

General

Grout: If the cool room floor is recessed into a slab such that a space exists between the cool room wall panels and slab, grout the space.

3.9 WATERPROOF MEMBRANE

General

Membrane and sealing: Conform to **FLOOR VAPOUR BARRIER MEMBRANE**.

Installation: Lay the membrane over the floor insulation with 150 mm overlaps at the joints. Turn the edges up against the wall inner skin, to the lesser of a height of 50 mm or the top of the cove moulding.

3.10 FLOOR WEARING SURFACE

General

Requirement: Provide a wearing surface to:

- Accept the floor in service loads without damage to the floor insulation.
- With a hard wearing surface finish.

Include the wearing surface type in **SELECTIONS** or show on the drawings.

Grading: Grade the surface to doorway.

Cool rooms for food storage: To AS 4674 Section 3.

AS 4674 Section 3 includes acceptable floor finishes and coving. It prohibits feather edge skirting.

Concrete wearing surface

Construction: Provide a concrete slab reinforced with steel fabric to AS/NZS 4671 SL72 mesh. Locate the fabric to provide a top cover of 25 mm, by means of reinforcement supports, chairs, blocks or supports resting on metal or plastic chairs, blocks or supports.

Coving: Provide a 75 mm radius cove in the concrete at the junction between the wearing surface and the wall inner skin. Finish the cove under an aluminium coving angle. Seal gaps to **SEALING**.

Concrete strength: 40 MPa.

Entrained air: If the room operating temperature is not more than 0°C, conform to AS 3600 clause 4.7.

For 10 mm aggregate and concrete subject to freezing, AS 3600 clause 4.7 limits the percentage of entrained air to between 4% and 8%.

Maximum aggregate size: 10 mm.

Slab thickness: ≥ 75 mm.

This thickness should allow for falls (1:100 in AS 4674).

Finish: Provide a finish to the concrete conforming to the following:

- As laid concrete: Finish the concrete surface in a slip-resistant finish by trowelling silicone carbide or aluminium oxide grains into the surface.
- Epoxy coating: Apply a 3 mm thick slip-resistant epoxy coating to the floated concrete surface.
- Steel tiles: Bed and grout steel tiles to the concrete surface.
- Ceramic tiles: Requirement: Bed and grout selected slip-resistant ceramic tiles to the concrete surface.

Aluminium checker plate wearing surface

Construction: Provide 20 mm thick marine plywood to AS/NZS 2272, formaldehyde emission class E₁ or lower, bonded over the whole surface area to the floor insulation metal skin. Over this bond over the whole surface area 2.5 mm thick aluminium embossed checker plate, with a 2 pack epoxy adhesive. Extend aluminium plate into the door threshold.

Joints: Locate aluminium plate joints to overlap the joints in the marine plywood by ≥ 50 mm. Fix aluminium plate joints to the marine ply with stainless steel screws and seal with sealant.

Coving: Provide an extruded aluminium cove moulding, ≥ 25 mm radius, at the junction between the wearing surface and the wall inner skin. Seal gaps to **SEALING**.

Consider aluminium checker plate for cool rooms where the floors will be subject to a significant abuse, e.g. kegs being rolled and dropped often. Stainless steel is another option but is far less common because of its significantly greater expense. Aluminium checker plate is an alternative to metal tiles that were previously used for such applications. Consider including this *Optional style text by changing to Normal style text.*

Plywood wearing surface

Construction: Provide 20 mm thick marine plywood to AS/NZS 2272, formaldehyde emission class E₁ or lower, bonded to the floor insulation metal skin. Apply a 3 mm thick slip-resistant epoxy coating to the marine plywood.

Coving: Provide an extruded aluminium cove moulding, not less than 25 mm radius at the junction between the wearing surface and the wall inner skin. Seal gaps to **SEALING**.

3.11 REFRIGERANT PLANT

General

Access for maintenance: To **ACCESS FOR MAINTENANCE** in 0171 *General requirements*.

Vibration suppression: To **VIBRATION SUPPRESSION** in 0171 *General requirements*.

Evaporators

Location: Mount the evaporator below the ceiling, with 450 mm between the wall and the rear of the evaporator and at least 2100 mm clearance under.

Support: Suspend the unit from cold rolled metallic coated steel bearers mounted above the room. Extend the bearers to the cool room walls and size. Size bearers to suit the load and span.

Hardware: Nylon or stainless steel to suit the load.

Condensing units

Vibration isolation: Mount each condensing unit on 4 vibration isolators.

Support: Support condensing units on either a concrete plinth or hot-dip galvanized steel frame securely fixed to the wall, floor or slab above using anchor bolts.

Arrangement: Provide clearance around units for condenser air flow and maintenance access. Make sure discharge air does not short-circuit to condenser intake.

Alternatively adjust outdoor coil air entering temperature to compensate for elevated air temperature due to recirculation.

Plinths: If located on grassed or similar permeable surfaces, provide concrete plinths under outdoor equipment.

For plinths see 0171 *General requirements*. Preferably show plinths on the drawings. Consider security of outdoor equipment.

Refrigerant leak detection

Requirement: Provide refrigerant leak detection to AS/NZS 5149.3.

Sensors: To **GAS SENSORS, Refrigerant sensor** in 0771 *Automatic controls*.

3.12 REFRIGERATION PIPING**General**

Requirement: Conform to equipment manufacturer's recommendations for the refrigerant used. Provide refrigeration piping designed and installed so that the complete system meets the documented performance and operating conditions.

Design

Suction lines: Size for pressure drop less than 1.0 K saturated suction temperature.

Correct sizing of suction lines is essential to the efficient operation of the system. Normally units are selected with a capacity above that documented. If the suction line is undersized the loss in capacity may be hidden behind the excess plant capacity. For the owner however excess suction line pressure drop means wasted energy. In more extreme situations it can result in the unit failing to meet required latent cooling capacity as the excess suction line pressure drop appears as an elevated evaporator suction temperature and hence coil dew point.

Oil return: Size for oil return to compressor. Where velocity for oil return would result in the suction line pressure drop exceeding pressure drop limit, provide double suction risers. Prevent oil draining back during the off cycle.

Liquid lines: Size for pressure drop of less than 1.0 K saturated liquid temperature when handling the manufacturer's unit capacity under the operating temperatures stated in the schedules.

Layout

General: Install pipework in straight lines and uniform grades without sags. Grade horizontal hot gas lines and suction lines at not less than 1 in 200 in the direction of gas flow.

Location: When possible, run suction and liquid lines inside common insulation.

This reduces condensation and the resulting heat transfer increases refrigeration efficiency.

Connections to vibrating equipment. Provide flexibility to resist vibration by way of coiled pipe connections or braided hose.

Pipe support

General: Provide hangers, brackets, saddles, clips, and support system components, incorporating provisions for adjustment of spacing, alignment, grading and load distribution. Support pipework from associated equipment or building structure. Support valves, strainers and major line fittings so that no load is placed on adjacent tubes or transmitted to them during operation and maintenance.

Support type: Proprietary metallic-coated steel channel section with clamps and hangers sized match external diameter of pipe being supported.

Stand-off brackets: If pipes are exposed within the cool room or in food preparation areas, support on brackets to provide the clearances from adjacent surfaces to AS 4674, clause 3.2.9.

Vertical pipes: Provide anchors and guides to maintain long pipes in position, and supports to balance the mass of the pipe and its contents.

Saddles: Do not provide saddle type supports for pipes more than DN 25.

Uninsulated pipes: Clamp piping supports directly to pipes.

Insulated pipe support:

- Spacers: Provide spacers at least as thick as the insulation between piping supports and pipes. Extend either side of the support by at least 20 mm.
- Spacer material: Rigid insulation material of sufficient strength to support the piping and suitable for the temperature application.
- Vapour barriers: For cold pipes apply aluminium foil tape over the circumference of the spacer to form a vapour barrier.
- Metal sheathing: Provide a 0.55 mm thick metallic-coated steel band between the aluminium foil tape and the support, for the full width of the spacer.

Pipe support spacing table

Nominal pipe size, DN	Maximum spacing (m)	
	Horizontal	Vertical

Nominal pipe size, DN	Maximum spacing (m)	
	10	1
≥ 15, ≤ 20	1.5	2.5
25	2	3
32	2.5	3
40	2.5	4
50	3	4
65	3	4

Pipes

Piping: Provide copper tubes as follows:

- ≤ DN 15: To AS/NZS 1571-O.
- > DN 15: To AS/NZS 1571-1/2H. Use annealed copper only for pulled bends.

O temper = fully softened condition (annealed). 1/2H = intermediate temper (half hard).

Pipe wall thickness:

- Pipes ≤ DN 50: To Type B.
- Pipes > DN 50: ≥ 1.6 mm.

Deemed-to-satisfy for split systems under 7.5 kW cooling capacity: Split system manufacturer's standard pre-charged piping kit.

Bends

Pulled bends: Form bends without flattening or wrinkling with an inside radius not less than 3 pipe diameters using the correct tool size for the pipe diameter.

Pipe fittings

Copper alloy fittings: To AS 3688, dezincification resistant, welded, brazed or compression type only.

Preformed fittings: Preformed refrigerant capillary line tees, bushes, couplings and elbows. Wherever possible make reductions at elbows, tees, line devices or equipment connections with reducing fittings, otherwise provide reducing bushes or reducing couplings.

Compression fittings: Flareless twin ferrule, torque free, mechanical grip fittings which can be gauged using a precision ground and hardened metal gap inspection gauge. Provide frost proof flare nuts.

Screwed joints: Use only if equipment items are not available with flare, flanged or brazed capillary connections.

Brazed joints

General: Provide preformed capillary fittings or form capillary unions by expanding one pipe end. Prevent flux and brazing alloy from entering pipes. Use dry nitrogen to purge air from pipes before brazing. During brazing, maintain a flow of dry nitrogen through pipes to prevent oxidation.

Avoid flared screwed or flanged joints wherever possible. In addition to using nitrogen, where possible clean internal accessible joints before proceeding with further assembly work, to provide the maximum possible internal cleanliness.

Brazing alloy: To AS/NZS 1167.1 Table 2 alloy B4 not less than 15% silver content.

Brazing alloy for jointing dissimilar metals: To AS/NZS 1167.1 Table 1 alloy A18 or an alloy with an equivalent silver content (≥ 34%) and impurity levels.

Sleeves

General: Provide pipe sleeves where pipes pass through building elements. Insulate the space between the pipe and sleeves.

Sleeves are covered in 0171 General requirements.

Valves

General: Provide valves to AS/NZS 5149.2. Make provision for charging and withdrawal of refrigerant. If a gauge is not permanently connected (for example commissioning connections), seal the outlet of the isolating valve with a flared seal cap nut.

Valve types

Expansion valves: To maintain correct superheat over the operating range.

Line valves: Packed and capped line globe valves: Back seating valves with renewable nylon or PTFE seats, packed spindle and removable gland cap. Incorporate mounting feet integral with valve body with adequate fixing holes.

Service valves: Backseating type with gasketed cap.

Solenoid line valves: Solenoid coil and valve parts replaceable without disturbing valve body or refrigerant piping.

Piping protection

Extent: Protect refrigeration piping exposed to view, weather or potential damage with piping covers fabricated from 0.6 mm thick prefinished metallic coated steel.

e.g. Colorbond.

Section: Folded hat sections to suit piping.

Weatherproofing: Weatherproof external joints and fasteners with non-setting mastic.

3.13 CONDENSATE DRAINS

See AS/NZS 3666.1 clauses 2.8 and 2.9 for drainage requirements and recommendations. See NATSPEC TECHnote DES 022 for more information on requirements for microbial control in buildings.

General

Condensate drains: Provide trapped drain lines with uniform and continuous fall to connect condensate trays to the nearest building drain point.

Preferably show the location of building drain points on the drawings. There may be local statutory restrictions on where condensate can be discharged.

Material:

- Room operating temperature > 0°C: PVC-U.
 - Room operating temperature ≤ 0°C:
 - Inside room: Copper.
 - Outside room: PVC-U.
 - All cool rooms in kitchens: Chrome plated copper.
- Size: The greater of unit drain connection size and DN 20.
- Pipe support spacing: To AS/NZS 3500.1 Table 5.6.4.

AS/NZS 3500.1 Table 5.6.4 includes copper and PVC-U, and other materials.

Sealing: Seal drain pipes where they penetrate casing.

Termination: Terminate drains to allow visual inspection of condensate flow.

Traps: To withstand more than 2 times fan static pressure. Construct from either:

- Transparent, kink resistant hose.
- PVC-U trap with removable caps and a visible air break.

Falls and drains: Check that the condensate tray falls conform to AS/NZS 3666.1 and in particular that trays and sumps are graded to the outlet to prevent moisture retention. Test drains by pouring a measured quantity of water into upstream end.

Trace heating

Room operating temperature ≤ 2°C: Provide trace heating to condensate drain piping to prevent their contents from freezing.

It may be necessary to insulate drains in high humidity environments (e.g. tropical locations). If the condensate drain discharges into a waste line that has intermittent flows from other sources the waste may also require insulation.

Control: Integrate heater operation with defrost termination and fan delay thermostat.

Insulation

General: If drains run in ceilings above occupied areas or other locations where condensation could cause damage or nuisance provide not less than 13 mm thick insulation to **REFRIGERATION PIPE INSULATION**.

Consider including this *Optional* style text by changing to *Normal* style text.

3.14 REFRIGERATION PIPE INSULATION

Installation

General: Insulate all refrigerant piping that may sweat. Apply insulation un-slitted where possible. If slitted, refix slitted faces with adhesive applied to full area.

Joining: Use only an adhesive or jointing system supplied by the insulation manufacturer.

Timing: Leak test piping before insulating joints, fittings and valves.

Finish: Where exposed to sunlight or to view in occupied areas, provide 2 coats of tintable, water-based, rubberised, ultraviolet-resistant, flexible paint finish.

Penetrations through fire rated elements: If insulated pipe penetrates a fire-resistance rated element, provide a section of non-combustible, non-hygroscopic insulation for the thickness of the element and 150 mm each side.

3.15 EVACUATION OF REFRIGERANT GAS SYSTEMS

General

System evacuation: Dehydrate the refrigerant gas system before charging with the refrigerant gas.

Evacuation: Use a high-vacuum pump, capable of reducing the pressure in the system to less than 53 Pa (400 microns) connected to both high and low pressure sides of the system with valves open and controls connected. Measure the pressure with approved calibrated electronic or similar gauges.

Test time: Maintain vacuum for a period not less than 12 hours to verify the vacuum is stable.

3.16 ELECTRICAL GENERALLY

General

Requirement: Conform to *0781 Mechanical electrical*.

Alternatively, consider *0782 Mechanical electrical - minor for a stand-alone cool room contract*.

Conduits: Box type sealed internally.

Stand-off brackets: If conduits are exposed within the cool room or in food preparation areas, support on brackets to provide the clearances from adjacent surfaces to AS 4674 clause 3.2.9.

Control panel cabinets

Construction: Provide control panels documented as follows:

- Metallic-coated steel: Construction to *0781 Mechanical electrical*.
- Proprietary: Proprietary IP65 polycarbonate enclosure with removable front cover retained by quarter turn fasteners with front cover fasteners and wall fixing holes located outside the sealed space. In all other respects conform to *0781 Mechanical electrical*.

Include panel type in **SELECTIONS** or show on the drawings.

3.17 BATTERY SUPPLY

General

Requirement: Provide a mains powered battery charger and battery to serve alarms and emergency lighting, independent of all other emergency power supply within the building.

Batteries

Type: Provide maintenance free, sealed, lead acid type batteries 12 volt.

Battery capacity: 7 amp hour or sufficient to run all emergency lights for 2 hours, whichever is the greater.

Battery charger

Type: Provide a battery charger suitable for continuous float charge use in conformance with the battery manufacturer's recommendations.

Charging current: 2.5 Amps maximum continuous current and a terminal voltage of 13.7 V d.c. Incorporate individual connections for battery and load output with a re-settable current overload protection device, with visual device incorporated in the charger.

Installation

Mounting: Securely mount the charger and battery in a separate enclosure with hinged door, of the same construction as the Control Board, attached to and mounted below the Control Board. Provide a label on the door BATTERY AND CHARGER.

Connection: Polarise the connections from the charger to the battery and load or clearly mark to prevent reverse connection.

Label

Battery installation/replacement date: Attach a stamped metal tag to the battery indicating the installation date and advised replacement date to the battery manufacturer's recommendations.

3.18 LIGHTING

Service lighting

Cool rooms for food storage: To AS 4674.

Service lighting requirement: Provide at least one single 18 W service light fitting in each cool room.

Luminaires

Cool rooms for food storage: To AS 4674.

Type: Provide fluorescent luminaires specifically designed for use at both ambient temperature and the cool room operating temperature.

Diffuser: High impact acrylic or UV stabilised polycarbonate.

Protection: Provide luminaires to IP65. House the controlgear in a moisture proof moulded polycarbonate glass reinforced plastic (GRP) box. Seal all wiring entries.

Switching requirements

Service lights: Provide an ON/OFF control switch on the inside of the cool room adjacent to the door, to control the service light(s). Arrange so that the light cannot be switched off from outside the room.

Pilot light: Provide a pilot light on the outside of the cool room to indicate when the service lights are on.

3.19 EMERGENCY LIGHTING

General

Location: Provide an emergency light within each cool room adjacent to the exit door, positioned to illuminate the emergency door release mechanism, alarm and emergency instructions.

Luminaire: Prismatic bulkhead type, fitted with a 10 watt 12 volt quartz halogen incandescent lamp, with non-corrosive body and hinged one piece polycarbonate cover, separated by a neoprene gasket. The fitting to be completely waterproof and suitable for use at both the cool room operating temperature and ambient temperature.

Switching: Power the emergency light from the emergency lighting battery supply, to operate automatically in the event of mains power supply failure to the cool room lighting circuit.

Luminaires

The contractor is responsible for locating the single point luminaires for conformance to AS/NZS 2293.3.

Visual indicator lights: Provide a red indicator, readily visible when the luminaire is in its operating location, which indicates that the battery is being charged.

Inverter system: Provide protection of the inverter system against damage in the event of failure, removal or replacement of the lamp, while in normal operation.

Local test switches: Provide a momentary action test switch, accessible from below the ceiling, on each luminaire to temporarily disconnect the mains supply and connect the battery to the lamp.

Common test switches: Provide a common test switch on the distribution board which disconnects main supply to the luminaires and tests for discharge performance, after testing, this switch must automatically revert to normal operating mode.

Batteries

Location: Locate batteries outside the cool room.

Type: Lead acid or nickel cadmium batteries capable of operating each lamp at its rated output continuously at least 2 hours during final commissioning, pre-practical completion tests and 1.5 hours during subsequent tests.

Battery life: At least 3 years when operating under normal conditions at an ambient temperature of 25°C and subjected to charging and discharging at 6 monthly intervals.

5 or 6 years is possible in some circumstances. See AS/NZS 2293.2 for system checks, and AS/NZS 2293.2 clause 2.3.

Marking: Indelibly mark each battery with its date of manufacture.

See also AS/NZS 2293.1 clause 6.4.8.

Power supply

General: Provide an unswitched active supply to each luminaire and exit sign.

3.20 PERSONNEL SAFETY ALARM

Ensure that personnel safety conforms to local Work Health and Safety requirements.

Alarm

Requirement: Provide each cool room with a personnel safety alarm consisting of an emergency pushbutton switch and an audible alarm and indicator light in all cool rooms as follows:

- Emergency switch: Mechanical illuminated latching mushroom type located in cool room adjacent to the exit door and suitable for use at the cool room operating temperature.
- Audible alarm: Bell or siren type located above (outside) the cool room door. Alarm to be silenced by reversing the emergency switch.
- Indicator light: Flashing red, ≥ 50 mm diameter, located outside and above the cool room door.
- Label the light: PERSON TRAPPED IN COOL ROOM.

3.21 CONTROLS GENERALLY**Control module**

General: Provide a microprocessor based electronic control module, to monitor and control each cool room and its refrigeration system. Locate each control module outside the cool room it serves. Provide the following functions:

- Control the cool room temperature.
- Adjustable set point and control differential.
- Measure, log (hourly) and display the cool room temperature.
- Display highest and lowest room temperature logs for period.
- Sensor calibration.
- High room temperature alarm.
- Automatic duty/standby change over for cool rooms with duty/standby systems.
- Alarm outputs.
- Phase failure relay.
- Automatic defrost cycle control.
- Defrost cycle sequencing to prevent simultaneous defrost if the cool room has multiple refrigeration systems.
- Separate fuses for each evaporator.
- Manual defrost initiate and termination.
- Display time to next defrost and time from last defrost.
- Anti-short cycle adjustable timer limits compressor starts per hour.
- Self test function.
- Memory retention in the event of power failure.

Consider location of the control module. Possible arrangements are flush mounted on the fascia of the fixed panel above the door of the control board or surface mounted adjacent to the cool room door.

Evaporator shutdown: Provide a labelled switch to **LIGHTING, Switching requirements** matching the light switch for each cool room to shut down the evaporator fans and refrigerant solenoid valves.

Temperature control

Control accuracy: Maintain the required room temperature within ± 0.5 K of set point.

Evaporator fans: To run continuously during normal (non defrost) operation.

Defrost cycle

Room operating temperature $> 0^{\circ}\text{C}$: Provide a defrost cycle controlled by the electronic control module, with time initiation and evaporator temperature termination. Run evaporative fans continuously during defrost.

Room operating temperature $\leq 0^{\circ}\text{C}$: Provide a defrost cycle controlled by the electronic control module, time initiated and evaporator temperature terminated. De-energise the evaporator fan during

the defrost cycle and delay it from restarting on termination of the defrost cycle until the evaporator reaches operating temperature.

Installation protection

Requirement: Provide the following:

- Motor thermal overload.
- Manually reset low and high pressure cutouts.
- Separate fuses for multiple evaporator fans.

BMS interface

BMS points: Provide the alarm and monitoring points to interface with the BMS.

Include BMS points in **SELECTIONS** or show on the drawings. Coordinate the BMS interface with *0773 Building management systems*. Refer to that worksection for interface issues such as interoperability, e.g. via ANSI/ASHRAE 135 (BACnet) compliance.

The **DIGITAL SYSTEM CONTROLLER INTERFACE** clause (*Optional style text*) in *0773 Building management systems* used as a basis for specifying the interface in this worksection.

Connection: Provide voltage-free contacts wired to a dedicated terminal strip in the respective cool room switchboard.

Coordinate with *0773 Building management systems*.

Independent operation: Arrange the interface so that failure or fault in the BMS does not render the cool room installation inoperative in any way.

3.22 CONTROLS FOR COOL ROOMS WITH DROP IN AND SLIDE IN SINGLE PACKAGED REFRIGERATION UNITS

General

Control: If a drop-in or slide-in packaged refrigeration unit is documented for the cool room, provide the unit fully factory wired and complete with all refrigeration controls, other controls and safeties.

Include refrigeration system type in **SELECTIONS** or show on the drawings.

Thermometer: Provide a 100 mm dial thermometer to each cool room.

Defrost: Incorporate electric defrost heaters in refrigeration units. Defrost to be time initiated, pressure or temperature terminated, with fail-safe override and evaporator fan delay.

3.23 PAINTING AND LABELLING

General

Requirement: Conform to *0171 General requirements*.

Standards

Refrigeration systems: To AS/NZS 5149.2.

Safety signs: To AS 1319.

Emergency instructions

Notice: Provide a notice located within the cool room adjacent to the door indicating the locations of the personnel safety alarm switch and door release mechanism with instructions on how to activate the alarm and operate the door release mechanism.

Construction: Photo luminescent type with lettering at least 15 mm high. Screw fix to the cool room wall panel. Provide a photo luminescent exit sign above the cool room door.

Photo luminescent sign output: ≥ 2 mcd/m², 60 minutes after light source is removed.

Labels

General: Provide labels for the following:

- Controls.
- Switches.
- Switchboard components.
- Indicator lights.
- Alarms.
- Each cool room door.
- Control boards.

- Condensing units.

3.24 COMPLETION

Reinstatement

Fasteners: If required, adjust for weather tightness without distortion of external panel face.

Extent: Repair or replace damage to the roofing and rainwater system. If the work cannot be repaired satisfactorily, replace the whole area affected.

Touch up: If it is necessary to touch up minor damage to prepainted metal roofing, do not overspray onto undamaged surfaces.

Cleaning

Requirement: Remove excess debris, metal swarf, solder, sealants and unused materials.

Exposed metal surfaces: Clean surfaces of substances that interfere with uniform weathering or oxidisation.

Protection: Remove protective coatings using methods required by the manufacturer after completion.

Protective film will withstand exposure to weather for a limited period of time before losing its peel-off characteristics and causing staining. The gloss coating changes when exposed to plasticizers.

Composite panels: Clean surfaces to the manufacturer's recommendations.

Warranties

General: Provide warranties for materials and workmanship from the supplier and the installer.

Form: Against failure of materials and execution under normal environment and use conditions.

- Warranty for workmanship: 2 years. Warranty for materials: 20 years.

Use only if warranties extending beyond the defects liability period are available for the particular system. Insert the required warranty period and terms, which should be negotiated beforehand. If the warranty is in the form of separate material and installation warranties, the signatures of both manufacturer and installer are required.

The form(s) required should be provided as part of the contract documentation.

Labelling of insulated panels

Requirement: To IPCA 004.3 *Code of conduct* Annex B.

4 SELECTIONS

Schedules are a way of documenting a selection of proprietary or generic products or systems by their properties. Indicate their locations here and/or on the drawings. Refer to NATSPEC TECHnote GEN 024 for guidance on using and editing schedules.

4.1 COOL ROOMS

Cool room schedule

Property	Cool room 1	Cool room 2	Cool room 3
DELTA panel type			
Room function			
Room internal dimensions: Length (mm)			
Room internal dimensions: Width (mm)			
Room internal dimensions: Height (mm)			
Room operating temperature (°C)			
Room operating temperature tolerance (°C)			
Ambient conditions: Dry bulb (°C)			
Ambient conditions: Wet bulb (°C)			

Property	Cool room 1	Cool room 2	Cool room 3
Air cooled condenser: Air entering temperature (°C)			
Water cooled condenser: Water entering temperature (°C)			
Water cooled condenser: Water leaving temperature (°C)			
Refrigeration plant capacity at above conditions (kW(r))			
Refrigeration plant operating hours per day			
Panel thickness			
Panel skin profile			
Panel skin thickness (mm): Internal and external			
Panel skin profile			
Panel finish and colour: External			
Panel finish and colour: Internal			
R-value (m ² .K/W)			
Panel protection: Internal wall protection			
Panel protection: Door protection			
Floor: Floor wearing surface type			
Floor: Concrete wearing surface finish			
Floor: Tanking option			
Main door: Door type			
Main door: Door clear opening (width (mm) x height (mm))			
Main door: Viewing panel size (width (mm) x height (mm))			
Emergency access doors: Number required			
Emergency access doors: Door action			
Emergency access doors: Door clear opening (width (mm) x height (mm))			
Refrigeration plant: Type			
Refrigeration plant: Acceptable refrigerants			

Property	Cool room 1	Cool room 2	Cool room 3
Refrigeration plant: Compressor type			
Refrigeration plant: Compressor drive			
Refrigeration plant: Suction and discharge pressure gauges			
Refrigeration plant: Condensing unit enclosure			
Refrigeration plant: Condenser fan motor			
Refrigeration plant: Evaporator fan motor			
Control panels: Enclosure material			
Service lighting: Number of luminaires			
Control options: Phase failure relay			
Control options: Condensing unit fault indication			
Control options: Lamp test switch			
Remote alarms: Refrigeration plant fault			
Remote alarms: Room over temperature			

Some items in this schedule may be omitted if the respective clauses are deleted (e.g. Internal wall protection if the **INTERNAL WALL PROTECTION** clause is deleted. Alternatively, some or all of the details in this schedule may be shown on the drawings and deleted from the schedule.

DELTA panel type: Select from the following:

- DeltaCool-EP-FR.
- DeltaCool-PIR.

Room function: e.g. Restaurant service, Pharmaceutical storage.

Air cooled condenser: Air entering temperature (°C): To suit site and plant configuration. If air flow is restricted consider specifying a value higher than design ambient to compensate. Delete if there are no air cooled units.

Water cooled condenser water entering/leaving temperature (°C): Delete if there are no water cooled units.

Refrigeration plant operating hours per day: e.g. 18. This is used to calculate plant capacity allowing for defrost. Omit if the refrigeration plant is fully specified.

Panel thickness: Select from 35 mm, 50 mm, 75 mm, 100 mm, 125 mm, 150 mm, 175 mm, 200 mm, 225 mm and 250 mm.

Panel skin thickness: e.g. 0.4 mm, 0.5 mm or 0.6 mm.

Panel skin profile: Select from the following:

- Smooth.
- Ribbed.
- 5V.
- SatinLine.
- Mesa.
- Single V.

Panel finish and colour: External:

- 0.4 mm: Off-white Colorbond Permagard.
 - 0.6 mm: Select from standard Colorbond® range.
- Panel finish and colour: Internal:
- 0.4 mm: Off-white Colorbond Permagard.
 - 0.6 mm: Select from standard Colorbond® range.
- R-Value:
- DeltaCool-EPS-FR: R-Values range from 1.40 to 6.1.
 - DeltaCool-PIR: R-Values range from 2.16 to 8.62.
- Panel protection: Internal wall panel protection: e.g. Required, Not required.
- Door panel type: e.g. Swing or horizontal sliding, Full face or Flush, Sill or Sill-less. Consult DELTA PANELS documentation for options.
- Door panel protection: e.g. Required, Not required.
- Floor: Floor wearing surface type: e.g. Concrete, Aluminium checker plate, Plywood.
- Floor: Concrete wearing surface finish: e.g. As laid, Epoxy coated, Ceramic tiles.
- Floor: Tanking option: e.g. Required, Not required.
- Main door: Door type: e.g. Hinged, Sliding.
- Main door: Door protection option: e.g. Required, Not required.
- Main door: Viewing panel size (width (mm) x height (mm)): Insert dimensions or Not required.
- Refrigeration plant:
- Type: e.g. Split system, Single drop in unit, Single slide in unit.
 - Acceptable refrigerants: This may be omitted if the refrigerants permitted under the respective legislation are acceptable. See NATSPEC TECHnote PRO 007 on refrigerant options.
 - Compressor type: e.g. Belt driven open drive, Direct driven open drive, Hermetic, Semi hermetic.
 - Compressor drive: e.g. a.c., inverter, digital.
 - Suction and discharge pressure gauges: e.g. Required, Not required.
 - Condenser fan motor: e.g. a.c., or EC.
 - Evaporator fan motor: e.g. a.c. or EC.
 - Condensing unit enclosure: e.g. Required, Not required (omit for drop in and slide in types).
- Control panels: Enclosure material: e.g. Metallic-coated steel, Polycarbonate.
- Control options:
- Phase failure relay: e.g. Required, Not required.
 - Condensing unit fault indication: e.g. Required, Not required.
 - Lamp test switch: e.g. Required, Not required.
- Remote alarms:
- Refrigeration plant fault: e.g. Required, Not required.
 - Room over temperature: e.g. Required, Not required.
- Adapting the Cool room schedule for design and construct projects**
- If the contractor is to calculate the required performance and to select the equipment, the **SELECTIONS** schedules can be used to set generic selection parameters. Note that the documents should include sufficient information for items to be determined by the contractor, for example from documented performance parameters and drawing information. For these items, insert suitable text such as, *To the documented requirements*. The **Cool room schedule** can then form the basis of the contractor's submissions with the text replaced by design values:
- Refrigeration plant capacity at above conditions (kW(r)).

4.2 BMS INTERFACE

Cool room BMS points schedule

Equipment item and point description	Point type	Scheduled	Trend log	Alarm	Include in graphic

Equipment item and point description	Point type	Scheduled	Trend log	Alarm	Include in graphic
Legend AI: Analog input (hardware point). AO: Analog output (hardware point). DI: Digital input (hardware point). DO: Digital output (hardware point).					

Use this schedule to define interface requirements to the building management system so their values can be transmitted to the BMS.

Other possible inclusions are software points e.g. AV (analog value), BV (binary value).

Points schedules are often restricted to hardware points; however software points may be included so their values can be transmitted to the BMS. Exercise caution if including software points. Failure to include points may give rise to variations.

Key to schedule

Equipment item and point description: e.g. Cool room temperature.

Point type: See **Legend**.

Trend log: If logging is required (e.g. Required, Not required).

Alarm: If alarm is required (e.g. Required, Not required).

Include in graphic: If the point is to be included in a BMS graphic (e.g. Yes, No).

Adapting the Cool room BMS points schedule for design and construct projects

Insert the information described in the above guidance.

4.3 COOL ROOM ACCESSORIES

Shelving schedule

Property	Cool room 1	Cool room 2	Cool room 3
Number of shelving modules			
Size of modules (width x depth x height) (mm)			
Number of shelves per module			
Post and frame material			
Shelf material			
Number of dunnage shelves			
Size of dunnage selves (width x depth) (mm)			
Dunnage shelf material			

Some or all of the details in this schedule may be shown on the drawings and deleted from the schedule.

Post and frame material: e.g. Metallic-coated steel, Stainless steel.

Shelf material: e.g. Metallic-coated steel, Stainless steel.

Dunnage shelf material: e.g. Metallic-coated steel, Stainless steel.

Adapting the Shelving schedule for design and construct projects

Insert the information described in the above guidance.

REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

AS/NZS ISO 817	2016	Refrigerants - Designation and safety classification
AS/NZS 1167		Welding and brazing - Filler metals
AS/NZS 1167.1	2005	Filler metal for brazing and braze welding
AS 1192	2004	Electroplated coatings - Nickel and chromium
AS 1319	1994	Safety signs for the occupational environment

AS 1366		Rigid cellular plastics sheets for thermal insulation
AS 1366.3	1992	Rigid cellular polystyrene - Moulded (RC/PS - M)
AS 1530		Methods for fire tests on building materials, components and structures
AS/NZS 1530.3	1999	Simultaneous determination of ignitability, flame propagation, heat release and smoke release
AS/NZS 1571	1995	Copper - Seamless tubes for airconditioning and refrigeration
AS 1572	1998	Copper and copper alloys - Seamless tubes for engineering purposes
AS 2129	2000	Flanges for pipes, valves and fittings
AS 2239	2003	Galvanic (sacrificial) anodes for cathodic protection
AS/NZS 2272	2006	Plywood - Marine
AS 2848		Aluminium and aluminium alloys - Compositions and designations
AS 2848.1	1998	Wrought products
AS 2870	2011	Residential slabs and footings
AS/NZS 3500		Plumbing and drainage
AS/NZS 3500.1	2018	Water services
AS 3600	2018	Concrete structures
AS/NZS 3666		Air-handling and water systems of buildings - Microbial control
AS/NZS 3666.1	2011	Design, installation and commissioning
AS 3688	2016	Water supply and gas systems - Metallic fittings and end connectors
AS/NZS 4671	2019	Steel for the reinforcement of concrete
AS 4674	2004	Construction and fit out of food premises
AS/NZS 4859		Thermal insulation of buildings
AS/NZS 4859.1	2018	General criteria and technical provisions
AS/NZS 4859.2	2018	Design
AS/NZS 5149		Refrigerating systems and heat pumps – Safety and environmental requirements.
AS/NZS 5149.1	2016	Definitions, classification and selection criteria (ISO 5149-1:2014, MOD)
AS/NZS 5149.2	2016	Design, construction, testing, marking and documentation (ISO 5149-2:2014, MOD)
AS/NZS 5149.3	2016	Installation site (ISO 5149-3:2014)
AS/NZS 5149.4	2016	Operations, maintenance, repair and recovery (ISO 5149-4:2014, MOD)
AS 5637		Determination of fire hazard properties
AS 5637.1	2015	Wall and ceiling linings
IPCA 004.3	2017	Insulated Panel Council Australasia (IPCA) Code of Practice
AHRI 450	2007	Performance Rating Of Water-cooled Refrigerant Condensers, Remote Type
EN 13469	2012	Thermal insulation products for building equipment and industrial installations – Determination of water vapour transmission properties of preformed pipe insulation.
The following documents are mentioned only in the <i>Guidance</i> text:		
AS/NZS 2293		Emergency lighting and exit signs for buildings
AS/NZS 2293.1	2018	System design, installation and operation
AS/NZS 2293.2	2019	Routine service and maintenance
AS/NZS 2293.3	2018	Emergency luminaires and exit signs
AS 2896	2011	Medical gas systems - Installation and testing of non-flammable medical gas pipeline systems
AS ISO 9705	2003	Fire tests - Full-scale room test for surface products
BCA C1.10	2019	Fire resistance - Fire resistance and stability - Fire hazard properties
NATSPEC DES 020	2018	Fire behaviour of building materials and assemblies
NATSPEC DES 022	2014	Microbial control
NATSPEC GEN 006	2015	Product specifying and substitution
NATSPEC GEN 024	2015	Using NATSPEC selections schedules
NATSPEC PRO 007	2017	Refrigerant options
NATSPEC TR 01	2019	Specifying ESD
NATSPEC TR 03	2018	Specifying design and construct for mechanical services
ANSI/ASHRAE 135	2016	BACnet: A data communication protocol for building automation and control networks
ISO 5149 series		Refrigeration systems and heat pumps - Safety and environmental requirements