

**0762P ASKIN® XFLAM PERFORMANCE PANELS IN COOL ROOMS****Branded worksection**

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**Worksection abstract**

This branded worksection *Template* is applicable to refrigerated cool rooms using ASKIN® XFLAM Performance Panels and components with a room operating temperature below 5°C including those operating below freezing. It includes the construction of the room 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 NATSPEC Toolbar or the hidden text *Hide* and *Delete* functions of your word processing system. For additional information visit FAQs at [www.natspec.com.au](http://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 ASKIN XFLAM performance panel roofing.
- 0437p ASKIN XFLAM performance panel cladding.
- 0612 Cementitious toppings.
- 0631 Ceramic tiling.
- 0651 Resilient finishes.
- 0657 Resin based seamless flooring.

**Material not provided by ASKIN®**

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

ASKIN® XFLAM Performance Panels have the following sustainable product attributes:

- Thermal and acoustic performance.
- Easy to seal slip joint facilitating efficient hermetically sealed construction to allow controlled air flow and heating and cooling of the internal environment.
- 100% recyclable and may incorporate a proportion of granulated offcuts. The steel skins are recovered and recycled into new steel.
- Measures to minimise condensation, leading to greater equipment life and limiting risk of microbial growth.
- Prohibition on the use of CFCs and HCFCs as blowing agents.
- Durable components, particularly for corrosion resistance.
- Provisions to reduce transmitted noise and vibration.
- pH neutral matrix which is inert and resistant to water ingress.
- Production plants with extremely low carbon footprint, nil water use and minimal atmospheric or other emissions.
- During its lifetime, ASKIN® XFLAM insulating material will save many times more energy through reduction of heating and cooling requirements than the energy or resources required to manufacture it.

Refer to the NATSPEC TECHreport TR 01 on specifying ESD.

## 1 GENERAL

**ASKIN®** is a leading manufacturer and installer of insulated architectural facade systems, roofing systems and temperature controlled facilities in Australasia. We embrace a customer first approach in delivering sustainable, lifetime value. With a network of 12 sites throughout Australia and New Zealand, ASKIN®'s vast experience has been built upon a strong foundation dating back to 1964. ASKIN®'s culture of customer first, constant improvement, quality and safety assurance is supported with our technical expertise and ISO 9001:2015 accreditation.

### 1.1 RESPONSIBILITIES

#### General

Requirement: Provide refrigerated cool rooms using ASKIN® XFLAM Performance Panels, 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

### ASKIN® contacts

Website: [www.askin.net.au/contact](http://www.askin.net.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

Brochures and technical information: [www.askin.net.au/downloads/#askin-spec-sheets](http://www.askin.net.au/downloads/#askin-spec-sheets)

ASKIN® provides technical information in a variety of formats including CAD files of details.

## 1.6 INTERPRETATION

### 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**.

Fire-resistance level: Submit evidence of conformance to PRODUCTS, **FIRE PERFORMANCE**, **Fire-resistance of building elements**.

### Operation and maintenance manuals

Maintenance manuals: Submit ASKIN® *Warranty and maintenance* for care and maintenance of ASKIN® XFLAM Performance Panels including frequency of inspection and recommended methods of access, cleaning, repair and replacement.

### Products and materials

Thermal insulation performance: Submit evidence of conformance to AS/NZS 4859.1.

This is primarily to verify claimed R-values for BCA compliance. For calculated values, it is important that calculations comply with AS/NZS 4859.1 including de-rating in Normative Appendix K.

### 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 proposed ASKIN® approved installer.

**Warranties**

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

ASKIN® standard warranty is 2 years for workmanship and 10 years for materials.

Subject to maintenance conforming to the ASKIN® *Warranty and maintenance*, ASKIN® standard warranty for corrosion or blistering of the skin material is 10 years for general application subject to location and can be up to 25 years depending on the substrate used and the application of it.

**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.

**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.

**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.

**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 ASKIN® approved for the application.

### 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: ASKIN® approved expanding solid end type 4.0 mm diameter.

### 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:  $\leq 700$ .

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

### Fire hazard properties

Group number: To AS 5637.1.

ASKIN 100 mm XFLAM panels 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 m<sup>2</sup>/kg tested to AS/NZS 3837 or a smoke growth rate index not more than 100 tested to AS ISO 9705 and determined to AS 5637.1.

Insulation materials: Tested to AS/NZS 1530.3. Fire hazard indices as follows:

ASKIN 50 mm thick with Z275 G300 steel skins tested to AS/NZS 1530.3:

- Ignitability index: 0.
- Spread-of-Flame Index: 0.
- Heat Evolved Index: 0.
- Smoke Developed Index: 1.

Spread-of-Flame Index:  $\leq 9$ .

Smoke-Developed Index:  $\leq 8$  if Spread-of-Flame Index  $> 5$ .

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

See NATSPEC TECHnote DES 003 for more information on the fire hazard properties of insulation

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 Spec C1.10.

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.

ASKIN® can provide BRANZ, FM and CSIRO tests reports on request.

The FM Approvals certification mark is intended to verify that the products described meet FM Approvals' stated conditions of performance, safety and quality useful to the ends of property conservation. Visit [www.fmglobal.com](http://www.fmglobal.com) for further information.

### Fire-resistance of building elements

Fire-resistance level: Test to AS 1530.4.

ASKIN® XFLAM panels provide a FRL of -/30/30. This is the requirement for a non-loading external wall in a Bushfire Attack Level (BAL) FZ to AS 3959.

See NATSPEC TECHnote DES 020 for information on fire-resistance levels.

## 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 ASKIN® XFLAM PERFORMANCE PANELS

### General

Description: Proprietary panel cladding system comprising manufactured, prefinished structural composite panels with metal faces bonded to each side of an insulating, ASKIN® XFLAM core.

### ASKIN® XFLAM Panel insulation core

Material: Syntactic foam sheet with Factory Mutual certification to FM 4471, FM 4880 and FM 4881.

Blowing agents: Do not provide materials that use the following:

- CFC or HCFC as blowing agents in the manufacturing process.
- A blowing agent with a global warming potential  $\geq 140$ .

This follows BRANZ recommendations. Some blowing agents have extremely high global warming potential. Typical values are:

- HCFC-142b:1800 (HCFC-142b is primarily used in extruded (not expanded) polystyrene).
- HFC134a:1300.
- HFC-152a:140.
- Carbon dioxide: 1.

ASKIN® XFLAM is a market leading, insurer endorsed, innovative product. It is a syntactic foam with excellent mechanical properties, superior insulation values, low toxicity and is completely recyclable. ASKIN® XFLAM achieves a high insulation rating to easily achieve BCA Section J compliance (R-Values of 1.5 to 8.10 m<sup>2</sup>K/W). The high insulation value reduces the energy costs required for maintaining a comfortable and efficient environment within the building. ASKIN® XFLAM Performance Panels were the first in Australasia to achieve FM accreditation in all three relevant certifications for Insulated Panel Systems – FM 4471, FM 4880 and FM 4881. These Approvals cover full scale fire, severe hail, and hurricane conditions.

### Internal and external skins

Document requirements in the **ASKIN® XFLAM Performance Panel schedule**. If there is only one type, delete alternatives.

Skin material and thickness: As documented.

The standard skin material is 0.5 mm Z275 colour coated steel. AM100, AZ150, PVDF or HPS200 are available for some applications. All Colorbond® colours are available. The available skin thicknesses are 0.4, 0.5, or 0.6 mm depending on requirements for structural performance, and fire resistance (minimum 0.5 mm external).

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

Colorbond® Permagard® (antibacterial) Off-white is standard.

Finish: As documented.

### Dimensions

Panel thickness:

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

Panel width:

- Standard module width: 1200 mm.

## 2.5 DOORS

### Door type

Requirement: Provide ASKIN® 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 the following:

- Swing doors: ASKIN® wedge style with fully integrated thermally broken aluminium frame and the following requirements:
  - . Hardware: Fermod 431 key lockable latches with matching Fermod 473 adjustable camrise hinges.
  - . Latch: Push safety release from the inside of the room.
- Sliding doors: ASKIN® heavy duty type. Conform to the following:
  - . Rounded edge style, powder coat finished aluminium frames.
  - . SV3 packer thermal break.
  - . Heavy duty G track.
  - . 75 mm OD nylon wheels.
  - . Matching cone/locator, stops and door guide system.

Dimension: 2100 mm clear opening height, width as documented.

Insulation: Conform to **ASKIN® XFLAM PERFORMANCE PANELS**.

Insulation thickness: Equivalent thermal thickness 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 with stainless steel countersunk head screws or countersunk 4.0 mm rivets.

### 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 cold 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: Fabricate frames from ASKIN® split frame with 80 x 20 mm aluminium architrave and 6 mm thick PVC threshold. 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 documented hardware.



Heater cables: Where required for freezer applications, provide ASKIN® heater cable in an easily accessible recess within the frame extrusion, concealed by a removable aluminium cover.

### 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  $\geq 5.5$  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:  $\leq 236$  fins per metre.

Room air to coil temperature difference:  $\leq 5$  K.

Face velocity:  $\leq 2.5$  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:  $\leq 65$  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:  $\geq 0.37$  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  $\geq 0.12$  mm thick to AS 2848.1, designation 3003 or 8011.

- Fin pitch:  $\leq 550$  fins/m.
- Subcooling:  $> 5K$ .

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:  $\leq 1000$  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 SHELVING

### General

Shelving: Provide proprietary adjustable modular shelving as follows:

- Posts: 25 x 25 x 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 x 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 x 25 x 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 ASKIN® *Coldroom Construction Guide* and construction drawings.

**Joints**

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

Joint finish: Provide prepainted steel jointing sections internally and externally to all principal connections. Provide powder coated aluminium extrusions to base fixing connections and at any secondary detailing as follows:

- At panel junctions.
- Between panels and building structures.

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 300mm centres and/or to Professional engineer's recommendations.

See 0171 General requirements for the definition of Professional engineer.

**Panel butt jointing**

General: Join using ASKIN® T section to the internal face with expansion flashing riveted to the external face. Apply sealant to provide external vapour barrier.

**Cut panels**

Width: ≥ 300mm.

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

Cutting: Use only ASKIN® approved blades.

**Joint type**

Corner joints: Form a mitred or rebated joint in one panel to receive the other. Cut back the internal skin of the panel that is not rebated to the 20 mm thick internal joint line.

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

Internal corner joints: 40 mm x 40 mm folded Colorbond® 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.

**Floor insulation to wall joint**

Construction: 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.

**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 an ASKIN® approved fire-rated foam. Select from the following:
  - . Alfasbond FR.
  - . Sikaboomb FR.
- Flashing: Provide a colour coated steel flashing around the penetration fixed with 4 mm diameter stainless steel rivets to the wall, sealed with Sika Firerate or Fosroc Flamex One sealant.

**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:

- With pallet access - Concrete wearing surface floor: Provide a hot-dipped galvanized 100 x 100 x 6 mm steel angle bolted to the floor at 600 mm centres and 100 mm from the wall.
- Aluminium checker plate or plywood wearing surface: Provide 2 ASKIN® heavy duty Rub Rail extrusions, either two 100 mm x 25 mm or one 150 mm x 60 mm x 1.8 mm extruded aluminium rub rail section, fixed horizontally to the full width of each wall. Locate at 250 mm centres vertically, with the lowest rub rail 100 mm above the floor.

### 3.2 SEALING

#### Manufacturer's instructions

Requirement: Conform to the recommendations of ASKIN® *Cool room Construction Guide* and construction drawings.

#### Sealants

Type: Use a mastic sealant for internal mating surfaces and a sealant as a secondary vapour barrier on external joints. Provide an ASKIN® approved sealant. Select from the following:

- Selleys N Mastic.
- Sika PRO PU sealant.

#### 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. Provide an ASKIN® approved sealant. Select from the following:

- Fosroc Flamex One.
- Sika Fire Rate.

#### 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: Conform to the following:

- For rooms with an operating temperature not more than 0°C and volume of 300 m<sup>3</sup> or less, provide one ASKIN® PP1 relief ports per 100 m<sup>3</sup> of included volume.
- For rooms with operating temperature not more than 0°C and volume of 300 m<sup>3</sup> or more, provide one ASKIN® PP2 relief port per 3000 m<sup>3</sup> of included volume.

Type: ASKIN® approved or supplied

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 ASKIN® *Coldroom Construction Guide* 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. Cover joints with a V crimp flashing.

#### Ceiling suspension

Requirement: Conform to ASKIN® standard drawings.

### 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/m<sup>2</sup>.

#### 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 FLOORS

#### Concrete wearing surface

Construction: Lay rigid cellular ASKIN® Polystyrene FR 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 to ASKIN® XFLAM PERFORMANCE 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.

The NCC cites AS 3600-2009.

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

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. The following is *Optional text*:

**Construction:** Provide 20 mm thick marine plywood to AS/NZS 2272, formaldehyde emission class E<sub>1</sub> 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**.

#### Plywood wearing surface

**Construction:** Provide 20 mm thick marine plywood to AS/NZS 2272, formaldehyde emission class E<sub>1</sub> 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
10	1	2
≥ 15, ≤ 20	1.5	2.5
25	2	3

Nominal pipe size, DN	Maximum spacing (m)	
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.

The NCC also cites AS/NZS 3500.1:2015.

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**.

#### 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**.

### 3.14 REFRIGERATION PIPE INSULATION

#### Material

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

Thickness:

- Room operating temperature > 2°C:
  - . Suction line: 19 mm.
  - . Condensate line: Not required.
- Room operating temperature ≤ 2°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 W/(m.K) at 0°C.
- Moisture absorption: Non-hygroscopic.
- Water vapour diffusion resistance  $\mu$ : ≥ 5000 to EN 13469.

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,  $\geq 50$  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  $\pm 0.5$  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 15mm high. Screw fix to the cool room wall panel. Provide a photo luminescent exit sign above the cool room door.

Photo luminescent sign output:  $\geq 2 \text{ mcd/m}^2$ , 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.

**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
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)			
Air cooled condenser: Air entering temperature (°C)			
Water cooled condenser: Water entering temperature (°C)			
Water cooled condenser: Water leaving temperature (°C)			
Refrigeration plant			

Property	Cool room 1	Cool room 2	Cool room 3
capacity at above conditions (kW(r))			
Refrigeration plant operating hours per day			
Panel skin material: Internal and external	Z275		
Panel skin thickness (mm): Internal and external	0.5 mm		
Panel profile	Flat		
Panel finish and colour: Internal and external	Colorbond® Permagard® White		
R-Value			
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			
Refrigeration plant: Compressor type			
Refrigeration plant: Compressor drive			
Refrigeration plant: Suction and discharge pressure gauges			
Refrigeration plant: Condensing unit enclosure			

Property	Cool room 1	Cool room 2	Cool room 3
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.

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 skin material:

- Z275 colour coated steel.
- Stainless steel.
- Aluminium.

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

Panel finish and colour: Select from Colorbond® or Printech® (PDVF) ranges.

R-Value: R-Values for ASKIN XFLAM Performance Panels range from 1.5 to 1.0 for Flat profile panels.

Panel protection: Internal wall panel protection: e.g. Required, Not required.

Door panel type: e.g. ASKIN swing or horizontal sliding, full face or flush, sill or sill-less. Consult ASKIN 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

**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	Refrigerating systems - Refrigerant 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 1530.4	2014	Fire-resistance tests for elements of construction
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 - Metallic fittings and end connectors
AS/NZS 4671	2001	Steel reinforcing materials
AS 4674	2004	Construction and fit out of food premises
AS/NZS 4859		Materials for the thermal insulation of buildings
AS/NZS 4859.1	2002	General criteria and technical provisions
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
AHRI 450	2007	Performance Rating Of Water-cooled Refrigerant Condensers, Remote Type

FM 4471	2010	Approval standard for Class 1 panel roofs
FM 4880	2015	Approval standard for Class 1 fire rating of insulated wall or wall and roof/ceiling panels, interior finish materials or coating sand exterior wall systems
FM 4881	2016	Approval standard for Class 1 exterior wall systems
EN 13469	2012	Thermal insulation products for building equipment and industrial installation – Determination of water vapour transmission properties of performed pipe insulation.
<b>The following documents are mentioned only in the Guidance text:</b>		
AS 2293		Emergency escape lighting and exit signs for buildings
AS/NZS 2293		Emergency escape lighting and exit signs for buildings
AS/NZS 2293.1	2018	Emergency lighting and exit signs for buildings
AS/NZS 2293.2	1995	Inspection and maintenance
AS/NZS 2293.3	2018	Emergency lighting and exit signs for buildings
AS 2896	2011	Medical gas systems - Installation and testing of non-flammable medical gas pipeline systems
AS/NZS 3500		Plumbing and drainage
AS/NZS 3500.1	2015	Water services
AS 3600	2009	Concrete structures
AS/NZS 3837	1998	Method of test for heat and smoke release rates for materials and products using an oxygen consumption calorimeter
AS 3959	2009	Construction of buildings in bushfire prone areas
AS ISO 9705	2003	Fire tests - Full-scale room test for surface products
BCA Spec C1.10	2016	Fire resistance - Fire hazard properties
BCA Section J	2016	Energy efficiency
NATSPEC DES 003	2006	Fire hazard properties of insulation and pliable membranes
NATSPEC DES 020	2011	Fire behaviour of building materials and assemblies
NATSPEC DES 022	2010	Microbial control
NATSPEC GEN 006	2007	Product specifying and substitution
NATSPEC GEN 024	2015	Using NATSPEC selections schedules
NATSPEC PRO 007	2016	Refrigerant options
NATSPEC TR 01	2018	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
ISO 9001	2015	Quality management systems - Requirements