AUSTRALIA AND NEW ZEALAND

REFRIGERANT HANDLING CODE OF PRACTICE

PART 1
SELF-CONTAINED LOW CHARGE SYSTEMS

2025 EDITION

PREFACE

The first edition of this Code of Practice was originally developed in 1990 by the Association of Fluorocarbon Consumers and Manufacturers (AFCAM). This code has been periodically revised over time with assistance from the Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH), Standards Australia, the Institute of Refrigeration Heating and Air Conditioning Engineers of New Zealand (IRHACE) and other institutions.

This 2025 edition of the code has been updated from the 2007 version to reflect changes in the Standards and Regulations the industry currently works with:

- Requirements and recommendations on design, manufacture and maintenance, have been updated based on the applicable Australian and New Zealand standards and industry guidelines.
- Procedures have been outlined for (on-site) evacuation, charging, inspection and repair.
- More focus and clarity are provided around leak inspection, leak detection and leak testing.

Sections on refrigerant recovery, recycling, reclamation, handling and storage and Appendices A and B on refrigerants are identical in both Part 1 and Part 2 of this code.

This code only applies to activities involving, and equipment containing, scheduled refrigerants. It does not apply to activities involving non-scheduled refrigerants such as hydrocarbons, ammonia, carbon dioxide, water and non-scheduled fluorinated refrigerants.

While they have a lower global warming potential, some non-scheduled refrigerants present additional safety risks, including toxicity (e.g. ammonia), higher flammability (e.g. hydrocarbons), and higher pressure (e.g. carbon dioxide). As the Australian Government phases down hydrofluorocarbons and these are replaced by more environmentally friendly alternatives, technicians are increasingly likely to come across non-scheduled refrigerants in their work.

Technicians who may be working with these non-scheduled refrigerants will require knowledge and skills outside the scope of this code. This code contains references to standards, codes and guides that may apply or be relevant to working with non-scheduled refrigerants. For instance, information on flammable scheduled refrigerants may also be relevant to non-scheduled flammable refrigerants.

There are a range of resources available regarding the use of flammable refrigerants, including but not limited to:

- Heads of Workplace Safety Authorities' (HWSA) Flammable Refrigerant Gases Position Paper as published by the relevant state or territory WHS authority
- Australian Institute of Refrigeration, Air Conditioning and Heating's (AIRAH) Flammable Refrigerants Safety Guide
- Australian Refrigeration Council's (ARC) Handle Class A2/A2L Flammable Refrigerants

and a range of fact sheets produced in Australia by Refrigerants Australia and in New Zealand by CCCANZ.

Anyone working with scheduled or non-scheduled refrigerants that present safety risks, should be competent to do so. Some jurisdictions may also have additional safety or licencing requirements for certain types of non-scheduled refrigerants.

Scope

This code provides mandatory requirements, best practice recommendations and information concerning the proper handling of scheduled refrigerants (see shortlist in Appendix A), and any equipment containing them. The practices are intended to reduce emissions of scheduled refrigerants to the environment, providing both environmental benefits and cost savings.

This Part 1 of the code covers self-contained equipment which contains a refrigerant charge of 2kg or less, and where no work on the refrigerating system is required at the time of installation. Self-contained systems can include refrigerating appliances such as fridges and freezers, ice and ice-cream makers, window/wall and portable room air conditioners, standalone dehumidifiers, commercial dispensing appliances, vending machines, and heating appliances such as tumble dryers and some hot water heat pumps.

Part 2 of the code applies to all other systems which use scheduled refrigerants, including heat pumps and air conditioning systems, commercial and industrial refrigeration, and transport refrigeration, collectively referred to as RAC equipment. A separate code, the Australian automotive code of practice, covers motor vehicle air conditioning (MVAC) systems.

In Australia, this code is referenced in a Determination under the Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995 (the Regulations). The mandatory requirements in this code are mandated through the *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* (the Australian Act), the Regulations, permit conditions on licence holders, and the standards referred in the Determination. Some requirements originate from other applicable legislation including electrical safety, work health and safety, consumer protection and building regulations.

In New Zealand, ozone depleting substances, hydrofluorocarbons, and perfluorocarbons are subject to controls under the *Ozone Layer Protection Act 1996* and the *Climate Change Response Act 2002*. This Code does not have mandatory legislative status in New Zealand.

This code only applies to activities involving scheduled refrigerants and equipment containing them. Other refrigerants such as hydrocarbons, ammonia, carbon dioxide, water and non-scheduled fluorinated refrigerants are outside the scope of this code unless used in a blend with a scheduled refrigerant.

Acknowledgments

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How to read this code

Text containing the term **'must'** underlined in bold font indicates compliance is mandatory under applicable legislation. Sections containing the terms **'should'** or **'recommended'** are not mandatory but are recommended as best practice. Other sections are explanatory notes for informative purposes only.

Definitions for some of the terms used are provided in Appendix C. Standards are referred to by their numerical code, and a complete list of their titles and the other documents referred to can be found in Appendix D.

Any provisions contained in the applicable legislation take precedence over the provisions contained in this code. The provisions in this code, however, take precedence over any original equipment manufacturer instructions (except where specified otherwise herein).

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Australia and New Zealand Refrigerant Handling Code of Practice
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1. GENERAL

1.1 Personnel

1.1.1 Australian licensing

In Australia, any person who carries out work that involves handling a scheduled refrigerant, or a component of refrigeration and air conditioning (RAC) equipment with a risk of scheduled refrigerant being emitted, **must** ensure that they and/or any of their employees who handle scheduled refrigerant are appropriately licensed under the Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995 (the Regulations).

Such work activities include decanting of scheduled refrigerant, and manufacturing, installing, commissioning, servicing and modifying RAC equipment that contains, will be charged with, or will be manufactured incorporating any scheduled refrigerant, whether or not refrigerant is present. It also includes decommissioning RAC equipment in which scheduled refrigerant is present.

Apprentices and other trainees working with refrigerant and RAC equipment **must** hold a trainee licence and work under the supervision of a fully qualified licence holder.

A person or company **must** also be appropriately authorised to acquire, possess, or dispose of bulk scheduled refrigerant.

Refrigerant Trading Authorisation holders and some Refrigerant Handling Licence holders **must** include their permit number on advertising, invoices, receipts and quotes, as detailed in their permit conditions.

Other relevant national licensing scheme conditions are referred to in the relevant section of this code. Permit holders **must** comply with the conditions of their permit. Conditions may be added or changed as outlined in the Regulations. For further details on the Australian licensing system, see www.dcceew.gov.au or www.arctick.org.

1.1.2 New Zealand certification

In New Zealand, any person who carries out work including the manufacturing, installation, servicing, modifying, or dismantling of any RAC equipment which contains, will be charged with, or will be manufactured incorporating any refrigerant, **must** ensure that they and/or any of their employees who carry out refrigerant charging or recovery, possess a refrigerant filler and handler training and certification.

In New Zealand, it is a legal requirement that any person who fills gas containers with gases under pressure, **must** be trained and hold a current, approved filler compliance certificate. This applies to all gases under pressure, including air. The Refrigerant License Trust Board operates under the name Refrigerant License New Zealand (RLNZ) and provides refrigerant filler and handler training and certification for HVAC&R practitioners in New Zealand.

For more details on filler certification see www.irhace.org.nz and www.rlnz.org.nz.

1.1.3 Standard of work

Any person who carries out work including the manufacturing, installation, servicing, modifying, or dismantling of any RAC equipment which contains, will be charged with, or will be manufactured

incorporating, any scheduled refrigerant, **must** ensure that they and/or any of their employees who handle scheduled refrigerant are provided with a copy of this code and work to the standards set out herein.

1.2 Refrigerant

1.2.1 Refrigerant discharge

The *Australian Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* prohibits conduct that results in (or is likely to result in) the discharge of a scheduled substance to the atmosphere. See section 45B of the Australian Act for more details.

Examples of such discharges may include:

- venting refrigerant directly or indirectly to atmosphere
- charging refrigerant into equipment with known or suspected leaks
- using refrigerant to flush refrigerant pipework clean internally
- using refrigerant as the pressure medium during leak tightness testing
- using refrigerant to clean heat exchanger fins or coils.

1.2.2 Prohibited refrigerant charging

Systems **must not** be charged with a higher global warming potential (GWP) refrigerant than the refrigerant the equipment was designed to use (the design refrigerant), unless the design refrigerant was an ozone-depleting hydrochlorofluorocarbon (HCFC). To do so is an offence under the Australian Regulations.

Systems that were not designed to operate with scheduled refrigerants **must not** be charged with a scheduled refrigerant.

See Australian regulations 2AAA, 111A, 135 and 141, including for information on when this prohibition does not apply.

1.2.3 Refrigerant classification

All refrigerants used in RAC equipment **must** have been classified according to AS/NZS ISO 817 (See Appendix B).

1.2.4 Flammable scheduled refrigerant

Under AS/NZS ISO 817 refrigerants are assigned to one of four flammability classes: 1, 2L, 2 or 3. Flammable refrigerants include Class A2L, A2, A3 and B2L refrigerants (see Appendix B).

Flammable scheduled refrigerants are currently either Class A2L (common) or Class A2 (uncommon).

It **should** be noted that lubricant/refrigerant mixtures may be flammable even if the refrigerant is classified as non-flammable.

Manufacturers and suppliers include additional safety information in the installation and service manuals for equipment using a flammable scheduled refrigerant.

Technicians **should** follow these instructions.

For more information on the duties associated with flammable refrigerants refer to the Heads of Workplace Safety Authorities (HWSA) Flammable Refrigerant Gases Position Paper and the AIRAH *Flammable Refrigerants Safety Guide.*

2. DESIGN CONSIDERATIONS

This section deals with the design considerations for new RAC systems and components as well as modifications to existing systems. It also identifies potential sources of refrigerant losses to atmosphere.

2.1 Design of mass-manufactured systems

All systems **must** be designed so that they are able to be:

- manufactured
- installed
- operated
- maintained
- decommissioned,

without the loss of refrigerant.

The system design **must** comply with Clauses 2.2 to 2.9 of this code.

Where the designer can provide evidence that a system has been designed to an equivalent or better standard than is set out in this section, and complies with this clause, the design may be considered exempt from Clauses 2.3 to 2.9 inclusive.

2.2 Design compliance standards

Good system design is necessary for the prevention of refrigerant leakage.

All systems **must** be designed in accordance with the applicable Australian and New Zealand standards. These standards set minimum compliance requirements to ensure all potential hazards are eliminated or reduced to an acceptable level.

Refrigerating appliances or systems **must** also adhere to the following product standards as applicable:

- AS/NZS 60335.1 – Household and Similar Electrical Appliances – Safety – General requirements
- AS/NZS 60335.2.11 – Particular requirements for tumble dryers
- AS/NZS 60335.2.24 – Particular requirements for refrigerating appliances, ice cream appliances and ice makers
- AS/NZS 60335.2.34 – Particular requirements for motor compressors
- AS/NZS 60335.2.40 – Particular requirements for electrical heat pumps, air conditioners and dehumidifiers
- AS/NZS 60335.2.75 – Particular requirements for commercial dispensing appliances and vending machines
- AS/NZS 60335.2.89 – Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant condensing unit or compressor

Appliances that meet these standards are considered to comply with AS/NZS 5149.2 with the exception of electrical heat pumps, air conditioners and dehumidifiers. For these appliances, AS/NZS 60335.2.40 mandates that they also adhere to the mechanical strength requirements outlined in AS/NZS 5149.2.

2.3 Working fluids

2.3.1 Refrigerant charge

Systems **should** be designed to optimise the amount of refrigerant required. The designer **should** always aim to minimise the specific refrigerant charge, i.e. the ratio of design refrigerant charge mass to system design heating or cooling capacity (kg/kW).

Design parameters that affect refrigerant charge include:

- system architecture
- selection of refrigerant type
- diameters and lengths of pipes
- sizing of receivers
- the technology of the expansion device
- the technology of the heat exchangers employed.

2.3.2 Maximum refrigerant charge – standards

The maximum refrigerant charge limits of design standards **must** be complied with.

Refrigerant charge limit (RCL) is the maximum amount of refrigerant allowed in a product or system to reduce the risks of toxicity, asphyxiation and flammability hazards.

AS/NZS 60335 standards contain RCLs for particular products. Refrigerant charges are restricted according to the level of risk posed by the appliance application.

Practical limits, used for simple calculations for non-toxic and non-flammable refrigerants, are based on the RCL or historically established charge limitations.

Alternative provisions such as system valving, ventilation, detection and alarm can be used in accordance with the design standards to modify the RCL allowed in some circumstances.

2.3.3 Lubricants

All lubricants used should be compatible with the refrigerant and equipment as indicated by the refrigerant/equipment manufacturer's specifications.

2.4 Compressors

Ensuring proper initial installation and adhering to a thorough maintenance program should minimise leaks associated with compressors in self-contained low charge systems, which are typically from the internal connecting pipework.

Given the small amount of refrigerant contained in them, these sealed systems are not generally provided with service valves.

2.4.1 Process tubes in compressors

Where compressors are fitted with a process tube, a length greater than 100mm **must** be provided to the compressor for the purpose of evacuating and charging the system with refrigerant and the subsequent sealing and the later use (if ever required for servicing) of a temporary clamp-on piercing type valve assembly.

2.4.2 Vibration isolation

The compressor **must** be mounted to avoid leaks caused by vibration.

Eliminating vibration in the suction and delivery refrigerant pipelines connected to the compressor will also minimise the potential for leaks.

2.5 Refrigerant condensers and evaporators

2.5.1 Corrosion

All systems **should** be designed with materials selected to minimise the risk of corrosion.

2.5.2 Erosion

The system **should** be designed to avoid excessive fluid velocity through the heat exchangers, which can cause vibration and erosion failures.

2.6 Refrigerant pipelines and fittings

2.6.1 General

All pipelines **must** be designed so that the number of joints is kept to the practical minimum.

2.6.2 Pipes

Welding, brazing or another permanent hermetic sealing method are **recommended** for joining refrigerant pipes wherever practicable, since these methods offer increased resistance to pressure, temperature, and vibration stresses.

2.6.3 Joining

All joints **must** be hermetically sealed and not flanged.

Where compression/crimped fittings are used, they **should** be installed following the manufacturer's preparation and fitting instructions.

2.6.4 Vibration

Pipelines **must** be designed to minimise breakage due to vibration.

2.7 Valves

2.7.1 General

Due to the size of self-contained low charge systems, service valves are not normally included in the design.

2.7.2 Tap valves

Tube piercing or line tap valves and other similar devices **must** be used only to gain service access to the system in order to remove refrigerant.

They **must** be removed before the completion of service. The system design **must not** require these valves to be left on the system after the completion of service.

2.7.3 Schrader valves

The use of Schrader valves **should** be kept to the practical minimum.

Schrader valves fitted to the system **must** be sealed with a cap when not in use to prevent loss of refrigerant.

The specification **should** include a requirement for all valves to be capped. The valve cap **should** be attached to the valve to prevent its loss when uncapped.

2.8 Pressure relief

Pressure relief arrangements in self-contained low charge systems **must** be designed in accordance with the applicable appliance standard, AS/NZS 5149.2 or AS/NZS 1200, which specifies the type and size of pressure relieving device permitted for different system types.

2.9 Refrigerant pump down capability

Due to the size of self-contained low charge systems, liquid receivers used for pump down are not normally included in the design.

For these applications, one of the following two options **must** be undertaken:

1. Valves fitted to the system to allow the connection of a recovery unit for the removal of refrigerant prior to service or repair operations.
2. A process tube can be used for this purpose with the addition of a temporary clamp-on piercing type valve.

3. MANUFACTURE AND ASSEMBLY

3.1 Personnel

All supervisory personnel involved in the manufacturing process **must** be conversant with refrigerant technology and familiar with all aspects of the manufacturing process.

3.2 Complete systems

Complete systems **must** be supplied clean, dry, leak tightness tested, evacuated, pressurised, sealed and labelled with the refrigerant type before delivery.

If the system is pressurised with a substance other than the specified refrigerant, this substance **must** be identified on the system label.

3.3 Strength/tightness testing

All manufactured systems and components **must** be factory tested for leak tightness in accordance with the applicable manufacturing standard or **must** be pressure tested to the required pressure level in accordance with AS/NZS 5149.2 or AS 4041.

All refrigerant-containing parts, units or systems **must** be tested and proved tight by the manufacturer at not less than the design pressure for which they are rated.

3.4 Evacuation

All systems **must** be evacuated prior to charging with refrigerant.

All systems **should** be evacuated to less than 500 microns/67Pa absolute pressure before charging with refrigerant.

3.5 Charging of refrigerant

All charging **must** be carried out in accordance AS/NZS 5149.4, with the exception that manufacturers are not required to charge solely into the low-pressure side of the system.

3.6 Installation, operation and maintenance instructions

The manufacturer or installer **must** supply an adequate number of instruction manuals and also provide safety instructions.

3.6.1 Instructions

Installation, operation and maintenance instructions **must** be provided with each new appliance, detailing the correct methods and recommended procedures for installation, operation, and maintenance that:

- prevent the deliberate emission of scheduled refrigerant
- minimise the potential for accidental emission of scheduled refrigerant.

3.6.2 Standards

Installation, operation and maintenance instructions **must** be provided in accordance with the applicable compliance standard or be in accordance with AS/NZS 5149.2.

Instructions **should** encourage the owner to pass on operation and maintenance procedures for the appliance to the purchaser if the system is sold.

4. INSTALLATION PROCEDURES

4.1 System installation

The systems covered by this code are self-contained products that are manufactured and sold as completed units. As no work on the refrigeration system is required on site, installation is normally the responsibility of the purchaser. The manufacturer's installation instructions **should** be followed.

4.2 System commissioning

The manufacturer's instructions for commissioning **should** be followed. Manufacturer's instructions **must not** specify a practice that will result in emission of scheduled refrigerant.

4.3 System documentation

Appliances that are manufactured, assembled and tested prior to being delivered to site **must** be provided with installation, operation and maintenance instructions in accordance with Section 3.

Manufacturer's instructions **must not** specify a practice that will result in emission of scheduled refrigerant.

5. LABELLING

5.1 Identification plate

A clearly readable identification plate **must** be located on the appliance. The identification plate **must** contain at least the following data:

- the name or identification of the supplier or manufacturer
- the model, serial number, or reference number
- the year of manufacture

Note: The year of manufacture can be part of the serial number, and all information can be part of the identification plate of the equipment and can be coded.

- the number designation of the installed refrigerant in accordance with AS/NZS ISO 817
- the refrigerant charge
- the maximum allowable pressure, high- and low-pressure sides
- when flammable refrigerants are used, the flame symbol (ISO 7010 W021).

5.2 Change of refrigerant or lubricant

Whenever the type of refrigerant and/or lubricant in a system is changed, see Section 10, the technician **must** clearly label the system with:

- the number designation of the new replacement refrigerant in accordance with AS/NZS ISO 817
- the refrigerant charge
- the maximum allowable pressure, high- and low-pressure sides
- when flammable refrigerants are used, the flame symbol
- name of technician, licence number (Australia only) and service organisation
- date of change
- whether any ultraviolet dye has been added.

Whenever the type of lubricant in a system is changed (other than when it has been pre-charged into a replacement compressor by its manufacturer), the service technician **must** also clearly label the system with:

- the lubricant type.

6. EVACUATION PROCEDURES

This section refers to evacuation in the field only, following repair or recommissioning, not evacuation during the manufacturing process. Evacuation is the final step before recharging a system with refrigerant and is critical for the removal of air and moisture from the system. It also serves as a final verification of system tightness.

6.1 General

Systems **must** be evacuated prior to system recharging, every time the refrigerant is removed from the system, e.g. during repair or replacement.

6.2 Manufacturers' evacuation instructions

Manufacturers' evacuation instructions **must not** specify a practice that will result in emission of scheduled refrigerant.

Manufacturers' instructions **should** be followed if the system manufacturer has supplied instructions for evacuation.

If the manufacturer's instructions are followed, the evacuation procedure is exempt from the requirements of this section.

The relevant parts of this section of this code **must** be complied with if there are any evacuation procedures not covered by the manufacturer's instructions.

Evacuation of all other systems, or systems where the manufacturer's instructions are not supplied, **must** comply with this section of this code in its entirety.

6.3 Equipment

Evacuation **should** be carried out with dedicated evacuation hoses (large diameter/as short as practical) and vacuum gauges and not service manifolds/gauges.

Depth of vacuums **must** be measured using accurate measuring equipment selected for the specific application, i.e. a dedicated vacuum gauge, not a standard manifold pressure gauge.

6.4 Procedures

Scheduled refrigerants **must** be recovered from the system prior to evacuation. Before beginning the evacuation process the system **must** be completely depressurised, ensuring that air is not introduced into the pipework.

Procedures **must** be planned so breaking the vacuum with refrigerant does not introduce contaminants into the system.

If the system manufacturer has not supplied instructions with the system for evacuation, the system **must** be evacuated to below 500 microns/67Pa absolute.

Note: When evacuating a wet system in ambient temperatures below 0°C, it will take a lot longer for the system dehydration to be achieved. If a wet system has a vacuum pulled below 4,500 microns, some of the internal moisture can change to solid ice. Where possible, warm the equipment up. Do not use flame-based methods.

After the system has been evacuated, the vacuum pump **must** be isolated from the system to check if the system vacuum pressure rises. This is known as the 'drop test'.

As a guide, with constant ambient conditions, the vacuum **should not** rise more than 100 microns (13.33Pa absolute) in one hour. A greater rate of rise during the drop test may indicate a leak or the presence of moisture, and the system **must** be leak tightness tested and all leaks repaired.

7. REFRIGERANT CHARGING PROCEDURE

This section refers to charging in the field only, following repair or recommissioning, not charging during the manufacturing process. Charging to a known mass is the most accurate method of achieving the correct refrigerant charge – use this when possible.

7.1 General

All refrigerant containing pipework and components **must** be evacuated before refrigerant charging.

7.2 Charging procedure

The system refrigerant charge limits for any appliance **must not** be exceeded, see Clause 2.3.

All charging **must** be carried out in accordance with AS/NZS 5149.4, Section C.2 Handling. Note that pure refrigerants can be charged as a vapour or liquid but refrigerant blends can only be charged as a liquid.

Hoses, fittings and procedures used during charging **must** be those which minimise the loss of refrigerant.

7.3 Verified hose connections

The hoses connecting a cylinder to a self-contained low charge system **must** be leak-tested before the cylinder valve is fully opened. This can be done by partially opening and then closing the cylinder valve to pressurise the connecting hoses and testing for a leak.

7.4 Refrigerant mass

Refrigerant **must** be weighed into and weighed out of the system.

Refrigerant being transferred **must** be accurately measured into the system with due reference to temperature in accordance with AS 4211.3.

The refrigerating system **must not** be overfilled.

7.5 Charging precautions

Charging lines **should** be as short as possible and have suitable fittings to minimise losses during disconnection at the end of the transfer.

Care **should** be taken to avoid refrigerant liquid being trapped between closed valves, as high pressures may develop.

Refrigerant cylinders **must not** be connected to a system at a higher pressure, or to a hydraulic leg, where the pressure is sufficient to cause a back flow of refrigerant into the cylinder.

Refrigerant cylinders **must not** be connected to systems or other cylinders at a higher temperature for similar reasons.

Back flow of refrigerant can result in cylinders being contaminated or overfilled, resulting in the subsequent danger from the development of a pressure high enough to burst the cylinder.

7.6 Flammable scheduled refrigerant

Before charging a refrigerating system with a flammable refrigerant, it is essential to ensure that the immediate area (deemed a temporary flammable zone) is suitable for working safely and the appropriate precautions are in place. This **should** include an assessment of the area for ventilation, sources of ignition, fire hazards, fire safety equipment and include the use of detection equipment and personal protective equipment (PPE).

Refer to the *AIRAH Flammable Refrigerants Safety Guide* for further details on temporary flammable zones.

The refrigerating system **must** be earthed prior to charging with flammable refrigerant.

Technicians have the opportunity to reduce leakage when servicing or maintaining systems. Conversely, poor service and maintenance will increase the risk of leakage occurring.

8. MAINTENANCE, REPAIR AND DECOMMISSIONING

8.1 General

Technicians handling equipment containing a scheduled refrigerant **must** be competent (i.e. suitably qualified and holding a relevant national licence where required, see definition in Appendix C).

Scheduled refrigerant **must not** be discharged to atmosphere. All scheduled refrigerants **must** be recovered and either recycled, reclaimed, or held for destruction in an approved manner.

If the technician doubts the integrity of the system, it **must not** be recharged until appropriate repairs and leak testing have been undertaken.

Having identified and located a leak, all remaining refrigerant **must** be recovered to a separate cylinder, if isolation is impractical, after which the repair can be undertaken.

The cylinders designated for the recovery of scheduled refrigerants **should not** be used for recovery of any other refrigerants. Technicians **should** always read and understand the instructions and advice of the manufacturers and suppliers of all equipment, and apply as relevant and appropriate.

8.2 Refrigerant type

A technician **should** be aware of the possibility that the system may have been incorrectly charged or incorrectly labelled.

Before working on an unfamiliar system, the technician **should** first establish the type of refrigerant contained in the system by checking the pressure/temperature relationship or by using a refrigerant analyser or other methods, to verify that the labelling is correct.

Any refrigerant that cannot be identified **must not** be vented from the system.

If identification of the refrigerant is not possible it **should** be treated as a flammable refrigerant.

8.3 Flammable scheduled refrigerant

When working on appliances containing flammable scheduled refrigerant, instructions conforming to the requirements of AS/NZS 60335.2.40: Annex DD **must** be adhered to.

Manufacturers and suppliers include additional safety information in the operation and maintenance manuals for equipment using a flammable refrigerant. Technicians **should** always read and understand the instructions and advice of the manufacturers and suppliers of all equipment, and apply as relevant and appropriate.

Tools and equipment **must** be rated for use with the appropriate flammability grade (2 or 2L).

For flammable refrigerants, if a leak is suspected, all sources of ignition and naked flames **must** be removed/extinguished.

Before beginning work on systems containing flammable refrigerants, safety checks are necessary to ensure that the risk of ignition is minimised. Ensure that the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. Any mechanical ventilation

utilised **should** be suitable for use in a potentially hazardous environment. Electrical devices, leads or ignition sources in the vicinity **should not** be energised, unless rated for hazardous environments.

For more information, refer to the flammable refrigerant resources mentioned in the Preface of this code.

8.4 Maintenance

8.4.1 Inspection

The owner of the unit is responsible for its use and care. All systems **should** be regularly inspected for issues.

8.4.2 Preventative maintenance

AS/NZS 5149.4 requires that preventive maintenance be carried out in accordance with the manufacturer's instruction manual.

8.4.3 Faults

A malfunctioning unit **should** be attended to by a competent service technician as soon as the condition occurs to ensure that any leakage of refrigerant is minimised.

'Topping-up' a system's refrigerant charge **must not** be done until all leaks have been repaired.

8.5 In-service leakage inspection

Including in-service leak inspections as part of a preventative maintenance program allows the technician to find and fix small leaks before they lead to complete loss of refrigerant charge.

The in-service leak inspection is carried out with the refrigerant in place and the appliance operating as normal.

'Inspected for leakage' means the equipment or system is examined primarily for leakage using direct or indirect measuring methods, focusing on those parts of the equipment or system most likely to leak.

The technician **should** check, and repair as necessary, all potential leak sites.

8.5.1 Visual inspection

The technician **should** complete a visual inspection of the operating system including but not limited to, identifying any:

- visible oil or dust stains on joints, components or insulation
- movement or stresses due to vibration or thermal expansion
- signs of corrosion, thermal stress, wear or metal to metal contact points
- unusual level of noise or vibration from the appliance.

8.5.2 Diagnostic analysis

The technician **should** assess the system/refrigerant operating temperatures and pressures and compare against the manufacturer's data and operation instructions to determine whether the refrigerant charge is low.

8.5.3 Leak inspection

A variety of technology is available for leak detection:

- Electronic leak detector – gas detector designed and calibrated for the gas being detected (**recommended**).
- Ultrasonic leak detector – electronic detectors designed to detect the sound of leaking gas.
- UV additives – fluorescent additives that can reveal the location of leaks using a UV light.
- Proprietary leak detection spray – commercial non-corrosive spray purpose-designed for leak testing.

All equipment **should** be used in accordance with the manufacturer's instructions. The use of an electronic leak detector is **recommended**, with leak detection spray limited to point source leak verification.

Electronic leak detectors **must** be specific to the refrigerant type. Systems containing flammable refrigerants require the use of a leak detector designed specifically for combustible gases. Traditional halide leak detectors can create a spark and **must not** be used for flammable refrigerants.

The detection equipment **should** be calibrated periodically. The sensitivity of portable gas detection devices **should** be at least 5g per year.

Where a leak is detected, all refrigerant **must** be removed from the appliance, and the leak repaired.

Where a leak is suspected but not detected, all refrigerant **must** be removed, and the appliance **must** be leak tightness tested.

8.5.4 Common leakage points

The following areas **should** be individually assessed with a leak detector:

- joints – flare joints, mechanical joints and flanges, brazed joints, catalyst cured joints
- valves – Schrader valves, service valves, manual valves, pressure relief valves/devices, expansion valves, line tap valves
- evaporators and condensers – corroded areas, return bends, valves and joints
- seals – shaft seals (open compressor), compressor gaskets, seals on replaceable driers and filters, seals on gauge points, seals on caps
- other – capillary tubes, control bellows, O rings and pressure switches.

Access valves **must** have their caps refitted.

8.6 Repairs

Replacement of components or changes to the refrigerating system **should** be ordered and carried out by a competent person.

System components **should** be replaced with parts that are more leak resistant or have a reduced number of potential leak sources.

An equivalent replacement 'O' ring seal **should** be used each time an 'O' ring connection is remade.

8.6.1 Repair procedure

Repairs on refrigerant containing components **should** be carried out in the following order, where applicable:

1. recovery of refrigerant, emptying and evacuation

2. disconnecting and safeguarding of the components to be repaired
3. cleaning and purging, e.g. with oxygen-free nitrogen (OFN)
4. carrying out the repair
5. testing and checking of the repair (pressure test, leakage test, functional test)
6. evacuating and recharging with refrigerant.

Following any repair, all safety, control and measurement devices as well as alarm systems **must** be checked to verify operation.

8.6.2 Breaking into systems

Where not in the open, the area **must** be adequately ventilated before breaking into the system or conducting any hot work.

Systems **must** be evacuated and purged with OFN prior to any hot work.

If the system contains any refrigerant, or any other gas under pressure, it **must not** be broken into by means of cutting or breaking pipework.

A portable leak detector **should** be considered when completing cut-in tasks for toxic or flammable fluids.

8.6.3 Brazing and de-brazing

Where repair work requires brazing or de-brazing or any hot work, all refrigerant **must** be recovered from the system.

OFN **must** then be purged through the system both before and during the brazing process.

8.6.4 Oil removal

The compressor crankcase **must** be brought to atmospheric pressure before oil is removed.

Refrigerant content of the oil **must** be minimised using procedures such as evacuation, or the use of crankcase heaters, since the refrigerant vapours are soluble in compressor lubricating oils.

8.6.5 Tube piercing/line tap valves

Tube piercing/line tap valves or equivalent devices **must** only be used to gain temporary access to the system. They **must** be removed prior to the completion of service.

Where a tube piercing or line tap valve has been used and the remaining length of process tube is still 100mm or greater, the tube **must** be crimped off, the process fitting removed, and the end of the pipe sealed.

Where a tube piercing or line tap valve has been used and the remaining length of process tube is less than 100mm, a new process pipe of equal length to that originally fitted to the system **must** be fitted and sealed.

8.6.6 Testing

If work has been done on the refrigeration circuit, the systems **must** be leak tested after service and any identified leaks **must** be repaired. Refrigerant **must not** be put into the system for the purpose of leak testing.

A system **must not** be recharged until appropriate repairs and leak testing have been undertaken.

8.7 Cleaning and flushing

This procedure covers cleaning and flushing a contaminated system after a hermetic or semi-hermetic compressor failure or motor burnout.

Where possible, self-contained low charge systems **should** be taken to a workshop with appropriate facilities for cleaning and reinstating. When the system is empty and at atmospheric pressure, the faulty component parts **should** be removed and the system capped off.

8.7.1 Refrigerant recovery

All scheduled refrigerants including contaminated refrigerant **must** be fully recovered.

The recovery cylinder **must not** be over-filled, as per AS 2030.5, see Clause 12.4.

Contaminated refrigerant **must not** be recovered in the same cylinder as clean/reusable refrigerant.

Flammable scheduled refrigerants **must** be recovered into appropriately labelled cylinders.

8.7.2 Cleaning with solvents

Scheduled refrigerant **must not** be used for flushing components.

WHS/OHS safety standards **must** be observed when handling solvents. Relevant Safety Data Sheets **must** be obtained and made available to the technician handling solvents.

The cleaning solvent **should** be pumped throughout the system until only clean solvent emerges. After ensuring the system has been thoroughly cleaned, caution **should** be taken to ensure no solvent residue remains in the system after purging.

All spent solvents **must** be disposed of in accordance with Australian state and territory hazardous substance disposal regulations or New Zealand Hazardous Substances (Health and Safety Reform Revocations) Regulations 2017, as applicable.

Each Australian state and territory has its own laws and policies, and relevant permits, licences and/or registrations that cover transporting, storing, treating and disposing of hazardous waste.

8.7.3 Cleaning with filter dryers

If it has been established after testing the refrigerant and oil for acidity that the system has only been locally contaminated by the burnout, moisture, or mechanical failure, and does not require the cleaning procedure outlined in Clause 8.7.2, then cleaning of the system by using purpose selected suction and liquid line filter dryers is an acceptable alternative.

When using this method all filters fitted **must** be capable of being replaced with a minimal loss of refrigerant to the atmosphere.

8.7.4 Reassembly and test

When cleaning is complete, the major component parts **should** be reassembled in the system with the replacement compressor.

It is **recommended** that a suction line filter/dryer (a burnout dryer) be fitted.

The system **must** be pressurised and strength and leak tested before evacuation and recharging.

8.7.5 Evacuation

The system **must** then be evacuated before charging with refrigerant. Refer to Section 6.

A new dryer **should** be fitted while there is zero gauge pressure in the system.

The system can then be recharged with refrigerant.

8.8 Recharge

The system **must not** be recharged before the system has been fully leak tested, all identified leaks repaired and the system has been evacuated in accordance with Section 6.

Refrigerant used to recharge a system **must** meet the specification for new refrigerant set out by AHRI 700.

Because most lubricants are very hygroscopic and will absorb moisture from the air, they **should not** be exposed to atmosphere for any longer than is necessary.

The system **should** be recharged to the refrigerant quantity shown on the identification plate.

8.9 Decommissioning

8.9.1 Refrigerant

All scheduled refrigerant **must** be recovered from all parts of the system at the time of decommissioning.

Recovered refrigerant **must** be reclaimed or disposed of in accordance with Section 11.

8.9.2 Equipment labelling

The equipment **must** be labelled stating that it has been decommissioned and emptied of refrigerant.

The label **must** be dated and signed.

9. ADVICE TO EQUIPMENT OWNERS AND OPERATORS

9.1 Owner's responsibilities

The owner of a refrigerating appliance is responsible for its use and care.

A malfunctioning unit **should** be attended to by a competent service technician as soon as the condition occurs to ensure that any leakage of refrigerant is minimised.

All scheduled refrigerants **must** be recovered and either recycled, reclaimed, or sent for destruction in an approved manner.

The appliance **must not** be recharged before the system has been fully leak tightness tested and all identified leaks repaired.

Scheduled refrigerant **must** never be deliberately vented or leaked from a refrigerating system.

9.2 Leaking systems

Owners and operators of refrigerating appliances in Australia are advised that licenced service technicians are required by legislation to observe this code of practice. A system known to be leaking **must not** be topped up with refrigerant until all leaks are fixed. A technician **must not** do other work on leaking equipment without repairing the leak.

Some modification to appliances may be necessary to avoid leaks and achieve the aim of the code of practice to minimise loss of refrigerant.

9.3 Maintenance

To keep a system operating efficiently and effectively, and reduce the chance of major breakdown, it is in the interest of the operator to properly maintain the system by following the operating and maintenance instructions from the manufacturer, ensuring the appliance is regularly maintained and accepting the necessary repairs and adjustments proposed by the service technician.

It is **recommended** that a routine maintenance agreement for the appliance be undertaken with a competent service technician.

All users **should** monitor the operation of their installation and call the service technician immediately if any abnormal condition is found. Apart from minimising the loss of refrigerant to the atmosphere this may also save the cost of an expensive repair or replacement and ensure the ongoing efficient operation of the system.

10. CHANGE OF REFRIGERANT/ LUBRICANT PROCEDURE

10.1 Prohibited refrigerant charging

Under Australian regulations, systems **must not** be charged with a higher global warming potential (GWP) refrigerant than the equipment was designed to use. See Clause 1.2.2 for more detail.

10.2 Procedures

The procedures specified in AS/NZS 5149.4 *Change of refrigerant type* **must** be followed when a refrigerant change is to be carried out.

10.3 Manufacturer's advice

Guidance on equipment suitability for refrigerant type change **should** be sought from the original equipment manufacturer, new refrigerant manufacturer and lubricant manufacturer.

10.4 Change of safety classification

The system **should not** be changed to a replacement refrigerant with a more hazardous AS/NZS 817

Safety Group Classification (see Appendix B) unless:

- The system has been re-engineered by a competent refrigeration or air conditioning engineer.
- The required changes to the system have been designed in accordance with the applicable compliance standard and carried out and documented, in accordance with AS/NZS 5149.4.
- Any introduced flammability concerns have been addressed in accordance with AS/NZS 5149 and AS/NZS 3000.
- The system complies with other relevant standards such as those relating to electrical and gas safety.

The person changing a refrigerant to a more hazardous refrigerant takes on a role similar to that of a designer of a refrigeration system. Where a different classification of refrigerant is being considered (e.g. changing from A1 to A2, A2L, or A3), a system conversion process is required.

Refer to the Heads of Workplace Safety Authorities (HWSA) Flammable Refrigerant Gases Position Paper and the AIRAH *Flammable Refrigerants Safety Guide* for more details on the system conversion process for flammable refrigerants.

10.5 Compatibility

The replacement refrigerant **must** be compatible with all parts of the system it is in contact with. This includes the lubricant, seals and all other wetted components.

A new filter dryer appropriate for the replacement refrigerant **must** be fitted.

10.6 Labelling and documentation

Refrigerating systems modified on site **must** be labelled, in accordance with Clause 5.2.

When a system refrigerant has been changed, the system's labelling, colour coding (if applicable) and nameplates **must** be changed to permanently identify the replacement refrigerant now contained in the system.

System operation and maintenance documentation **must** be updated.

11. REFRIGERANT RECOVERY, RECYCLING, RECLAMATION AND DISPOSAL

11.1 General

Refrigerant cylinders will often be used as temporary receivers for all or part of the refrigerant charge. Hazards can arise in the use of refrigerant cylinders in this way and the requirements of this section **must** be complied with.

Warning: Non-condensable gases mixed with refrigerant can be extremely hazardous, increasing the pressure above normal vapour pressure. They can cause a cylinder to burst during filling or warming.

Flammable refrigerants **must** be recovered using equipment rated for use with the appropriate flammability grade (2, 2L or 3). Refrigerant cylinders used **must** be designed for the refrigerant in use.

In Australia, it is an offence to act in a way that results in the unlawful discharge of scheduled refrigerants. Recovery and disposal of refrigerant at the end of its useful life using appropriate recovery equipment or recovery/recycling equipment is mandatory. Any person who handles a scheduled refrigerant **must** hold a Refrigerant Handling Licence.

In New Zealand, it is an offence under the *Ozone Layer Protection Act 1996* to wilfully release an ozone-depleting substance. It is also illegal to release synthetic greenhouse gases into the atmosphere under the *Climate Change Response Act (CCRA) 2022*.

In New Zealand, any person refilling a cylinder **must** hold a current Refrigerant Fillers Certificate relevant to the refrigerant involved.

To avoid mixing refrigerants that can be recycled or reused it is necessary to use dedicated recovery equipment for each refrigerant type being recovered.

To ensure that no recovery cylinder is over-filled, it is necessary to ensure that only cylinders marked with the correct filling ratio are used, and that this filling ratio is not exceeded for the refrigerant or mixture being reclaimed.

11.2 Refrigerant recovery

In Australia all scheduled refrigerant being removed from equipment **must** be recovered and either recycled, reclaimed or disposed of, in accordance with this section.

Scheduled refrigerants **must** be recovered into an appropriately labelled cylinder of suitable pressure rating for the refrigerant being recovered. Refrigerant **must not** be recovered into a flexible bag.

The entire refrigerant charge, refrigerant vapour as well as refrigerant liquid, **must** be recovered when a system is emptied.

11.2.1 Recovery equipment

Portable equipment is available for recovery of refrigerant in the field.

Refrigerant recovery equipment and recovery/recycling equipment **must** conform to AS 4211.3, ISO 11650 or AHRI 740. Refrigerant recovery units **must** be appropriate for the refrigerant being recovered.

Hoses, fittings and procedures used during recovery **must** be those which minimise the loss of refrigerant.

Recovery equipment **should** be used and maintained in accordance with the manufacturer's instructions.

11.2.2 Flammable scheduled refrigerant tools and equipment

Tools and equipment **must** be rated for use with the appropriate flammability grade.

A2L and A2 refrigerants are generally not compatible with the following servicing tools used to work with A1 refrigerants, due to the flammable nature of the refrigerant:

- vacuum pumps
- recovery units
- refrigerant cylinders.

New or existing servicing tools **must** be assessed individually to ensure:

- they conform with relevant international/Australian/New Zealand Standards
- the manufacturer's manual/specification states that it is designed for use with flammable refrigerants.

11.2.3 Recovery cylinders

Cylinders used for recovery **must** conform with AS 4484, AS 2030.1 and AS/NZS 1200.

Refrigerant **must not** be recovered into an out-of-date recovery cylinder, i.e. the current date **must not** be later than the expiry date of the most recent test station stamp on the cylinder.

Note: Refrigerant/oil mixtures have a lower density than refrigerant alone and for this reason the carrying capacity of refrigerant cylinders will be reduced for refrigerant/oil mixtures compared to pure refrigerants.

The designed maximum safe working pressure of a refrigerant cylinder determined in accordance with AS 2030.5 **must not** be exceeded in any filling operation, no matter how temporary.

Particular care **should** be taken when recovering modern high-pressure refrigerants because their ambient pressures can be much higher than previous generation refrigerants.

Cylinders **must** only be used within the application for which they are designed. The recovery cylinder **must** be appropriate for the refrigerant being recovered. A2/A2L refrigerant **must** be recovered into A2/A2L specific cylinders with the correct design pressure ratings.

The permission of the owner of the cylinder **must** be obtained in advance if a refrigerant cylinder belonging to a third party (for example, a refrigerant manufacturer, wholesaler or hirer) is to be used as a temporary receiver. Where granted, the owner **must** be given the opportunity to carry out an internal inspection for corrosion and contamination immediately after such use, and the refrigerant cylinder **must** be labelled indicating such use.

Valves and non-return valves on refrigerant cylinders **must not** be tampered with without the permission of the owner.

11.2.4 Contaminated refrigerant

Cross contamination of refrigerants and lubricants **should not** occur within the recovery equipment if the refrigerant is to be recycled or reused.

If contaminated refrigerant is decanted into a recovery cylinder, corrosion and contamination may occur.

If a cylinder is filled with contaminated refrigerant, an internal examination followed by cleaning **should** be carried out before it is reused.

Refrigerant suspected to be contaminated **must** be either disposed of or tested if it is to be re-used. If necessary, it may be recycled or reprocessed to ensure it complies with the provisions of AHRI 700 prior to re-sale or re-use.

11.2.5 Refrigerant mixtures

Cross contamination of scheduled refrigerants with non-scheduled refrigerants **must not** occur within the RAC equipment or during the recovery process. Where these mixtures are encountered, they **must** be recovered by a competent technician. They **must not** be vented to the atmosphere and **must** be reclaimed.

Note: It is possible that non-design refrigerants and mixtures of refrigerants with a different safety classification have been incorrectly used as replacements for HFCs, HCFCs and CFCs or have been used to 'top up' a refrigerant charge in existing systems. There is a risk that the equipment in question was not appropriately redesigned and/or relabelled to indicate that a more hazardous (flammable and/or toxic) refrigerant has been used. As the operating pressures of these replacements and mixtures can be similar to those of the original design refrigerant, identification in the field can be extremely difficult.

When technicians encounter RAC equipment in the field that they are not familiar with, and where the refrigerant cannot be positively identified, they **should** treat the system as if it contained a flammable and toxic refrigerant. If the presence of a flammable or toxic refrigerant is suspected in a system that is not appropriately redesigned and relabelled, proper care **should** be taken to recover it. Only personnel trained in using equipment designed to recover these types of mixtures **should** perform this task.

Mixing different types of refrigerants during recovery may render large quantities of refrigerant unable to be recycled or reclaimed, as separation may be impossible.

11.3 Refrigerant recycling and reclamation

Recycled refrigerant is refrigerant that is re-used, with or without some cleaning taking place.

Reclaimed refrigerant is refrigerant that is re-used after it has been reprocessed to meet the AHRI 700 specification.

The use of recycled refrigerant that has not been cleaned can be detrimental to a refrigerating system. Recovered refrigerant can contain moisture, oils, acidity, particulates and non-condensable gases. Re-using this refrigerant without cleaning may cause corrosion to copper and aluminium components, shortening the life of heat transfer coils and compressors.

Analysis of the recycled refrigerant to ensure it is fit for use **should** be undertaken prior to re-use.

Contaminated recycled refrigerant **should** be reclaimed prior to re-use.

Recovered refrigerant **should** be reclaimed before being used in a different system. Using recovered refrigerant that has not been reclaimed may void equipment warranty and seriously damage the system.

11.3.1 Refrigerant recycling

In some cases the recycling of refrigerant involves simple cleaning processes using filters and driers that remove certain contaminants, such as moisture and particulate. The recycling process is more complicated for blended refrigerants, because preferential leakage or separation within the system may have resulted in a change of blend composition.

These refrigerant recycling cleaning processes can be carried out on site using portable equipment. Some refrigerant recovery units include cleaning (for recycling) stages.

Refrigerant recovery/recycling equipment **must** conform to AS 4211.3, ISO 11650 or AHRI 740.

11.3.2 Refrigerant reclamation

Refrigerant reclamation **must** only be carried out at a specialist facility that reprocesses the refrigerant to a specification that is equivalent to the original refrigerant state.

Reclaimed refrigerant **must** be treated and processed so that it conforms to the AHRI 700 standard.

After reclamation, the refrigerant can be reused in any system designed for that refrigerant.

11.4 Disposal

11.4.1 Disposal of refrigerants

Unwanted scheduled refrigerant **must not** be discharged to the atmosphere and **must** be returned to a supplier or collection agent for safe disposal.

In Australia, under the Regulations, unwanted scheduled refrigerant **must** be recovered and recycled or sent to an appropriately licensed facility for reclamation or disposal. A Refrigerant Trading Authorisation holder **must** accept any surrendered refrigerant or scheduled substance that appears to be intended for use in RAC equipment. They **must** also ensure that destruction of refrigerant is carried out only by the operator of a refrigerant destruction facility.

See refrigerantreclaim.com.au for more information.

In New Zealand all refrigerant importers are required to accept refrigerant back under product stewardship requirements. Locations that accept returned refrigerant in New Zealand include A Gas NZ Ltd, Patton NZ Ltd and RefSpecs NZ Ltd. For additional locations that accept returned refrigerant in New Zealand, visit coolsafe.org.nz.

11.4.2 Appliance disposal

Scheduled refrigerant **must** be recovered from all appliances containing refrigerating systems before their disposal.

All domestic and commercial refrigerator and freezer cabinets **should** have any locks removed or rendered inoperative upon removal from service. Doors, drawers and/or lids **should** be removed or otherwise rendered safe and inaccessible where refrigerators and freezer cabinets are stored or removed from service and left in any public place or any other place where children could have access.

11.5 Disposable refrigerant containers (New Zealand only)

The importation and storage of scheduled refrigerant in disposable (non-refillable) refrigerant containers is prohibited by law in Australia. The following requirements apply to New Zealand only:

1. Any residual refrigerant in a disposable container **must** be recovered
2. A disposable container **must not** be refilled or used as a temporary receiver during service
3. A disposable container **must not** be repaired or modified in any way
4. Empty disposable containers **must** be disposed of at a recycling centre.

12. HANDLING AND STORAGE OF REFRIGERANTS

12.1 Chemical hazards

Under Australian WHS/OHS regulations, and New Zealand *Hazardous Substances and New Organisms Act 1996 (HSNO)*, hazardous chemicals including refrigerants are classified according to the Globally Harmonised System for the Classification and Labelling of Chemicals (GHS).

The GHS is designed to provide information for the safe storage, handling and use of a hazardous chemical. This system is independent of the refrigerant classifications of AS/NZS ISO 817.

A refrigerant is required to have a Safety Data Sheet (SDS) developed and supplied by the manufacturer or importer which describes the hazard classification/s. The SDS provides the chemical hazard information on a product which is used as a basis for safely managing the related storage, and handling risks. Asphyxiation and freeze burns are also a risk.

Refrigerant SDS **should** be readily available and personnel **should** refer to the SDS before handling refrigerants.

12.2 Flammability hazards

For flammable scheduled refrigerants, technicians **must** take the relevant safety measures for the correct transport, storage, and handling of a flammable gas.

This includes ensuring that the refrigerant is not exposed to open flames or other ignition sources. Toxic substances like hydrogen fluoride and carbon monoxide are created when fluorinated refrigerants are burnt.

For additional information on flammability hazards refer to resources such as those listed in the Preface of this code.

12.3 Handling and storage losses

Losses of refrigerant to the atmosphere can occur during the handling and storage of refrigerant cylinders. Competent technicians can minimise such losses.

Where a scheduled refrigerant is to be transferred to a charging station, refrigerant vapour vented to atmosphere **must** be minimised.

12.4 Cylinder filling

12.4.1 Australian requirements

In Australia, it is a legal requirement that any person who handles a scheduled refrigerant, including a person filling cylinders, **must** hold a Refrigerant Handling Licence.

In Australia, refillable containers **must** be used for the storage of scheduled refrigerant.

12.4.2 New Zealand requirements

In New Zealand, it is a legal requirement that any person who fills gas containers with gases under pressure **must** be trained and hold a current, approved filler compliance certificate. This applies to all gases under pressure, including air.

All refillable gas cylinders approved for filling in New Zealand **must** be stamped with a record number, normally done at the time of manufacture. The record number is in the form of LAB YYYY, or in the case of special cylinders, LAB YYYY SP. The inspection interval for refrigerant cylinders in New Zealand is every 5 years from date of manufacture.

12.4.3 General filling

The maximum gross weight **must not** be exceeded when filling refrigerant cylinders. The cylinder **must not** be used if the maximum gross weight is not marked on the cylinder. The cylinder supplier **should** determine the maximum gross weight in accordance with AS 2030.5.

The maximum gross weight is a function of the internal volume of the cylinder, refrigerant composition and oil content and temperature.

The safe fill capacity (SFC) is the quantity of liquid refrigerant that can be safely added to a storage cylinder without causing undue stress on the cylinder. The SFC, expressed in kilograms, is determined by multiplying the water capacity (WC) stamped on the cylinder, expressed in litres, by the maximum fill ratio (FR) specified for the refrigerant in accordance with AS 2030.5, i.e.:

$$SFC = FR \times WC$$

The FR is a number that is based on the refrigerant properties, cylinder material and design, temperature

considerations and the safety factor or ullage, the vacant space between the top of the liquid refrigerant and the top of the cylinder. AS 2030.5 requires a minimum ullage of 3% at the mean bulk liquid temperature of 57 °C for refrigerants except high pressure refrigerants such as carbon dioxide (R744). So, the FR can be obtained from refrigerant's specific gravity or liquid density (ρ_{liquid}) expressed in kg/L at 57 °C, i.e.:

$$FR = 0.97 \times \rho_{liquid@57\,°C}$$

Calculated FR based on AS 2030.5 Clause 7.1.3 and tabulated FR from AS 2030.5 Table 4 for some refrigerants are listed in the following table.

Common scheduled refrigerant fill ratios (FR)

Refrigerant	Tabulated FR taken from AS 2030.5 Table 4	Calculated FR based on AS 2030.5 Clause 7.1.3 (a), with liquid density* at 57 °C
R12	1.15	1.15
R22	1.03	1.02
R32	0.78	0.77
R134a	1.04	1.04
R410A	-	0.82
R404A	0.82	0.82
R407C	0.94	0.94
R448A	-	0.90
R454B	-	0.82
R454C	-	0.89

* liquid density predicted by NIST REFPROP software

For recovered and recycled refrigerants the safe fill capacity formula from AS 4211.3 requires a minimum ullage of 20%, so the SFC calculation becomes:

$$SFC = 0.80 \times FR \times WC$$

Refilling a cylinder **must** only be undertaken with the permission of the cylinder owner.

Refrigerant **must not** be vented to the atmosphere from the receiving cylinder.

The receiving cylinder may be cooled in an operating refrigerator or freezer.

Warming of the discharging cylinder is permissible under controlled conditions to increase the rate of discharge of refrigerant during transfer.

Refrigerant cylinders **must not** be directly heated by flame, radiant heat or uncontrolled direct contact heat. Heating of cylinders using indirect forms of heating, e.g. controlled temperature air flow, **must** only be conducted where the control system is designed to be fail safe.

12.5 Refrigerant transfer between cylinders

The provisions of Clause 12.4 also apply to refrigerant transfer between cylinders.

Where refrigerant is to be transferred from one cylinder to another, a pressure or height difference **must** be established between the cylinders and this may be achieved by means of a pump or temperature differential.

Refrigerant cylinders **should not** be manifolded together if there is a possibility of temperature differences between the cylinders, since this will result in refrigerant transfer and the danger of overfilling the cold cylinder.

Where cylinders are manifolded together:

- Care **should** be taken to ensure all the cylinders are at the same height to avoid gravity transfer between cylinders.
- It is **recommended** that single direction flow or check valves be installed at each cylinder.

12.6 Cylinder storage

12.6.1 Hazards

There are numerous hazards associated with the storage of refrigerant. These include asphyxiation in confined spaces due to leakage from refrigerant cylinders, and fire, which may overheat and explode refrigerant cylinders or decompose refrigerant into toxic substances.

Technicians **should** make reference to refrigerant manufacturer's Safety Data Sheets when handling refrigerant cylinders.

Gauges **should** be removed from the cylinder for storage and transport.

12.6.2 Storage

Cylinders containing scheduled refrigerants **must** be stored in accordance with AS/NZS 4332.

Refrigerant **must** be stored securely with appropriate signage (to provide ready identification by emergency teams).

There are limits on the amount that can be stored and reference **must** be made to current local legislation.

In Australia, to meet their permit conditions, holders of a Refrigerant Trading Authorisation **must**:

- regularly check refrigerant containers in their possession for leaks
- implement a risk management plan for handling and storing refrigerant in their possession.

They **must** also keep records relating to:

- refrigerant purchase, sale, recovery and disposal
- checks, tests and maintenance of equipment and refrigerant containers/cylinders, including leak checks.

12.6.3 Handling

The refrigerant cylinder and its valve **must** be handled carefully to avoid mechanical damage.

When a refrigerant cylinder is not in use its valve **must** be closed, the valve outlet sealing cap put in place and the valve protected.

Cylinders **must** be leak tested every 3 months. Refrigerant leak detectors can be used for this purpose.

The contents of a leaking cylinder **must** be transferred to a recovery cylinder immediately. The leaking cylinder **must** be returned to the supplier.

In Australia, Refrigerant Trading Authorisation holders **must** ensure that refrigerant in their possession is handled in accordance with applicable standards by the holder of an appropriate licence, and keep records of these licensees.

12.7 Refrigerant transport

12.7.1 Transporting in Australia

In Australia, the Australian Code for the Transport of Dangerous Goods by Road and Rail (the ADG Code) provides detailed technical specifications and recommendations applicable to the transport of dangerous goods by road and rail.

The ADG Code covers the requirements for classification, packaging, marking and labelling of substances and articles that meet the United Nations classification criteria for dangerous goods. The ADG Code adopts the structure, format, definitions and concepts of the United Nations Recommendations on the Transport of Dangerous Goods Model Regulations while retaining Australian-specific provisions.

12.7.2 Transporting in New Zealand

In New Zealand, the regulations for transporting dangerous goods on land are outlined in the Land Transport Rule: Dangerous Goods 2005. This rule, also based on the UN Dangerous Goods Model Regulations, covers various aspects related to dangerous goods, including packaging, identification, documentation, segregation of incompatible goods, transport procedures, and the responsibilities of those involved in transporting dangerous goods.

New Zealand Standard NZS 5433 provides detailed technical information to meet the requirements of the Land Transport Rule.

12.7.3 Flammable scheduled refrigerants

For transportation purposes, flammable scheduled refrigerants are classified as a Dangerous Goods Division 2.1 flammable gas under the Australian Dangerous Goods Code and therefore require additional handling and storage safeguards compared to Division 2.2 non-flammable gases (see also Appendix B). Cylinders for transport **should** be marked with the ADG Flammable Gas 2.1 Class Label (red diamond). Note that WHS regulations allow GHS pictograms to be substituted by the correct ADG class labels.

Refer to the AIRAH *Flammable Refrigerants Safety Guide* for additional details on transporting flammable refrigerants and a self-assessment tool for vehicle storage.

Appendix A
SCHEDULED REFRIGERANTS

The values listed in the tables below for common pure scheduled refrigerants are taken from Schedule 1 of the *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* (the Australian Act). The GWPs are the 100-year time-horizon values from the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, 2007 (AR4). These are the same as used in the Montreal Protocol on Substances that Deplete the Ozone Layer.

The Australian Act and Montreal Protocol continue to use AR4 values to maintain consistency with HFC phase-down baseline calculations. Blend GWP values are calculated based on the AR4 values of their constituent HFCs.

Where possible, the refrigerant safety classification is sourced from AS/NZS ISO 817. Where this was not available it is sourced from other reputable sources such as the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). This information is provided for general reference only and anyone working with refrigerants **must** independently check the safety classification of any refrigerant.

In Australia, reporting on the import, export and manufacture of bulk ozone depleting substances and synthetic greenhouse gases, and imports of pre-charged equipment, under Part VII of the Australian Act **must** refer to the figures listed in Schedule 1 of that Act. For details on reporting requirements, contact the Ozone Protection and Synthetic Greenhouse Gas Team in the Australian Department of Climate Change, Energy, the Environment and Water.

New Zealand reference values differ to those listed here. New Zealand regulations require the use of GWP values prescribed under the IPCC Fifth Assessment Report (AR5). For details on reporting requirements, contact the Ministry for the Environment in New Zealand.

For refrigerants or refrigerant blends not listed below, consult the relevant national legislation or government department, or the latest IPCC assessment report, as applicable.

Common scheduled refrigerants (Australia only)

HFC

Refrigerant number	Chemical name	Chemical formula	GWP (AR4)	Safety classification
R23	Trifluoromethane/fluoroform	CHF_3	14,800	A1
R32	Difluoromethane	CH_2F_2	675	A2L
R125	Pentafluoroethane	CHF_2CF_3	3,500	A1
R134a	1,1,1,2-Tetrafluoroethane	CH_2FCF_3	1,430	A1
R143a	1,1,1-Trifluoroethane	CF_3CH_3	4,470	A2L
R152a	1,1-Difluoroethane	CH_3CHF_2	124	A2

HFC blends

Refrigerant number	Blend composition	GWP (AR4)	Safety classification
R404A	HFC-125 (44%) HFC-134a (4%) HFC-143a (52%)	3,922	A1
R407C	HFC-32 (23%) HFC-125 (25%) HFC-134a (52%)	1,774	A1
R407F	HFC-32 (30%) HFC-125 (30%) HFC-134a (40%)	1,825	A1
R410A	HFC-32 (50%) HFC-125 (50%)	2,088	A1
R417A	HFC-125 (46.6%) HFC-134a (50%) HC-600a (3.4%)	2,346	A1
R422D	HFC-125 (65.1%) HFC-134a (31.5%) HC-600a (3.4%)	2,729	A1
R427A	HFC-32 (15%) HFC-125 (25%) HFC-143a (10%) HFC-134a (50%)	2,138	A1
R438A	HFC-32 (8.5%) HFC-125 (45%) HFC-134a (44.2%) HC-600 (1.7%) HC-601a (0.6%)	2,264	A1
R448A	HFC-32 (26%) HFC-125 (26%) HFC-134a (21%) HFO-1234yf (20%) HFO-1234ze (7%)	1,386	A1
R449A	HFC-32 (24.3%) HFC-125 (24.7%) HFC-134a (25.7%) HFO-1234yf (25.3%)	1,396	A1
R450A	HFC-134a (42%) HFO-1234yf (58%)	601	A1
R452A	HFC-32 (11%) HFC-125 (59%) HFO-1234yf (30%)	2,139	A1
R454B	HFC-32 (68.9%) HFO-1234yf (31.1%)	465	A2L
R454C	HFC-32 (21.5%) HFO-1234yf (78.5%)	145	A2L
R507A	HFC-125 (50%) HFC-143a (50%)	3,985	A1
R508B	HFC-23 (46%) PFC-116 (54%)	13,396	A1
R513A	HFC-134a (44%) HFO-1234yf (56%)	629	A1
R515B	HFO-1234ze (91.1%) HFC-227ea (8.9%)	292	A1

HCFC

Refrigerant number	Chemical name	Chemical formula	GWP (AR4)	Safety classification	ODP
R22	Chlorodifluoromethane	$CHClF_2$	1,810	A1	0.055
R123	Dichlorotrifluoroethane	$C_2HCl_2F_3$	77	B1	0.02

Appendix B
SAFETY CLASSIFICATIONS

B.1 Safety classification of refrigerants

Refrigerants are classified into safety groups according to the criteria of AS/NZS ISO 817.

The safety classifications consist of two alphanumeric characters (e.g. A2 or B1). The capital letter indicates the toxicity and the numeral denotes the flammability.

B.2 Toxicity classification

Refrigerants are assigned to one of two classes, A or B, based on the following exposure:

- **Class A (lower chronic toxicity)** signifies refrigerants that have an occupational exposure limit of 400ppm or greater,
- **Class B (higher chronic toxicity)** signifies refrigerants that have an occupational exposure limit of less than 400ppm.

B.3 Flammability classification

Refrigerants are assigned to one of four classes based on flammability: 1, 2L, 2 or 3.

Class 1 (no flame propagation)

Single compound refrigerants or refrigerant blends that do not exhibit flame propagation when tested in air at 60°C and 101.3kPa.

Examples: R22, R134a, R404A. R410A, R744.

Class 2L (lower flammability)

Single compound refrigerants or refrigerant blends that meet all of the following conditions:

- exhibit flame propagation when tested at 60°C and 101.3kPa
- have a lower flammability limit (LFL) ≥ 3.5% by volume
- have a heat of combustion < 19,000kJ/kg
- have a maximum burning velocity of < 10cm/s when tested at 23°C and 101.3kPa.

Examples: R32, R1234yf, R1234ze, R717.

Class 2 (flammable)

Single compound refrigerants or refrigerant blends that meet all of the following conditions:

- exhibit flame propagation when tested at 60°C and 101.3kPa
- have an LFL ≥ 3.5% by volume
- have a heat of combustion < 19,000kJ/kg.

Examples: R152a, R439A.

Class 3 (higher flammability)

Single compound refrigerants or refrigerant blends that meet the following conditions:

- exhibit flame propagation when tested at 60°C and 101.3kPa
- have an LFL < 3.5% by volume
- have a heat of combustion that is ≥ 19,000kJ/kg.

Examples: R290, R600, R601, R1270.

B.4 Safety classification of refrigerant blends

Blends whose flammability and/or toxicity characteristic may change as the composition changes during fractionation are assigned a dual safety group classification, with the two classifications separated by a slash (/).

Each of the two classifications has been determined according to the same criteria as a single component refrigerant.

- The first classification listed is the classification of the 'as formulated' composition of the blend.
- The second classification is the classification of the blend composition of the 'worst case fractionation'.

For flammability, 'worst case of fractionation' is defined as the composition during fractionation that results in the highest concentration of the flammable component(s) in the vapour or liquid phase.

For toxicity, 'worst case of fractionation' is defined as the composition during fractionation that results in the highest concentration(s) in the vapour or liquid phase for which the Threshold Limit Value – Time Weighted Average (TLV-TWA) is less than 400ppm. The TLV-TWA for a specified blend composition has been calculated from the TLV-TWA of the individual components.

B.5 ADG Code classification

The Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code), available online at www.ntc.gov.au, provides detailed technical specifications and recommendations applicable to the transport of dangerous goods in Australia by road and rail including refrigerants.

The ADG Code covers the requirements for classification, packaging, marking and labelling of substances and articles that meet the United Nations classification criteria for dangerous goods.

ADG Class 2 substances are assigned to one of three divisions based on the primary hazard of the gas during transport. These divisions are designated:

- Division 2.1 Flammable gases,
- Division 2.2 Non-flammable, non-toxic gases
- Division 2.3 Toxic gases.

Division 2.1 Flammable gases

Division 2.1 Flammable gases are gases which at 20°C and a standard pressure of 101.3kPa:

- are ignitable when in a mixture of 13% or less by volume with air, or
- have a flammable range with air of at least 12 percentage points regardless of the lower flammable limit. Flammability should be determined by tests or by calculation in accordance with methods adopted by ISO (see ISO 10156). Where insufficient data are available to use these methods, tests by a comparable method recognised by the relevant authority may be used.

Examples: R32, R143A, R600, R1270.

Division 2.2 Non-flammable, non-toxic gases

Division 2.2 Non-flammable, non-toxic gases are gases which:

- are asphyxiant – gases that dilute or replace the oxygen normally in the atmosphere, or
- are oxidising – gases that may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does, or
- do not come under the other divisions.

Examples: R22, R134a, R404A, R407A, R410A, R744 (carbon dioxide).

Division 2.3 Toxic gases

Division 2.3 Toxic gases are gases which:

- are known to be so toxic or corrosive to humans as to pose a hazard to health, or
- are presumed to be toxic or corrosive to humans because they have an LC_{50} value equal to or less than 5,000ml/m^3 (ppm).

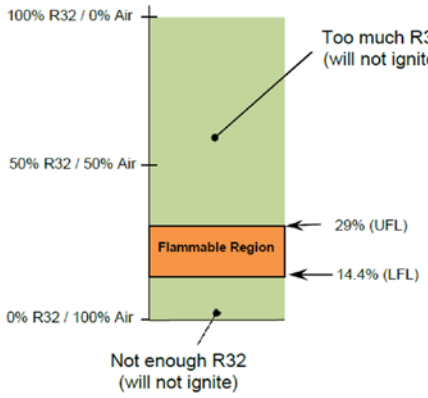
Example: R717 (ammonia).

B.6 Lower flammability limit (LFL)

Class 2L, 2 and 3 flammable refrigerants (under AS/NZS ISO 817) are flammable when mixed with air (oxygen) at a percentage range specific to each refrigerant.

The lower flammability limit (LFL) is the minimum concentration of the refrigerant that can propagate a flame through a homogeneous mixture of the refrigerant and air under the specified test conditions at 23°C and 101.3kPa. That is, the mixture capable of producing a flame.

For example, R32 is flammable when mixed with air (or oxygen) at a certain percentage and ignited. The quantity of R32 vapour required to make the mixture flammable sits within a narrow band of 14.4% to 29%, see the diagram below. The LFL of 14.4% for R32 is equivalent to 307g/m^3.



R32 lower flammability limit

Referring to the figure above, if there is less than 14.4% of R32 in the air then there is insufficient fuel (the R32) for combustion. If there is more than 29% then there is insufficient oxygen (air) for combustion. When the mixture is within these concentrations it is said to be in its 'flammable region'.

The bottom of this region is called the 'lower flammability limit' (LFL) and minimum design standards attempt to ensure that the LFL of the refrigerant cannot be reached if there is a leak. Note that these percentage values may also be expressed in kg/m^3 or g/m^3.

Appendix C
DEFINITIONS AND ACRONYMS

C.1 Definitions

For the purpose of this code the following definitions apply:

Blend
A combination of two or more refrigerants in a defined ratio which form a refrigerant with specified thermodynamic properties and a refrigerant R number designation.

Compatible
Components having features and composition that do not significantly degrade longevity or functionality of the composite system.

Competent
A person who has acquired, through training, qualifications, experience or a combination of these, the knowledge and skill, and where relevant the applicable licence, enabling the person to safely perform the assigned work

Contaminated refrigerant
A refrigerant containing oil, acid, non-condensable substances and/or moisture and/or other foreign substances. This could include mixed refrigerants (cocktails) which are not a manufactured product.

Cylinder
A portable storage vessel designed for the safe storage and handling of refrigerant under pressure.

Decommissioning
The process whereby a system is deliberately rendered inoperable, including the removal and recovery of any scheduled refrigerant.

Destruction
A process whereby a refrigerant is permanently transformed or decomposed into other substances.

Disposable container, disposable refrigerant container
A non-refillable cylinder.

Flammable refrigerant
A refrigerant with a flammability classification of Class 2L, Class 2 or Class 3 in accordance with AS/NZS ISO 817.

Flammable scheduled refrigerant
A flammable refrigerant that is also listed under Schedule 1 of the *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989*, (see Appendix A).

Fluorocarbon
A hydrocarbon in which some or all of the hydrogen atoms have been replaced by fluorine.

Global warming potential (GWP)
The atmospheric warming impact of a refrigerant compared with an equal mass of carbon dioxide over a specified period of time (usually 100 years).

Heat pump
A piece of equipment capable of using ambient or waste heat from air, water or ground sources to provide heat or cooling. It is based on the interconnection of one or more components forming a closed cooling circuit in which a refrigerant circulates to extract and release heat.

Major components and sub-assemblies
Equipment including compressors, air/water cooled condensers, liquid receivers, chilled water heat exchangers, evaporators and air/water cooled condensing units.

Maximum allowable pressure (PS)
Maximum pressure which system or component is designed for, as specified by the manufacturer in accordance with AS/NZS 5149.2.

Must
When used for a provision, indicates that the provision is mandatory for compliance with this code.

Ozone depletion potential (ODP)
The capacity of a refrigerant to destroy stratospheric ozone. ODP is stated relative to the ODP of CFC-11, which is taken as having an ODP of 1.

Plant
A combination of one or more refrigerating systems at a single site.

Reclaim
To reprocess used refrigerant to new product specification by means that may include distillation. Chemical analysis of the refrigerant is required to determine that appropriate product specifications have been met. This term usually implies the use of processes or procedures available only at a specialised reclaim or manufacturing facility.

Recover, recovery
To remove refrigerant in any condition from a system and store it in an external cylinder, without necessarily testing or processing it in any way.

Refrigerant
The medium used for heat transfer in a refrigerating system, which absorbs heat on evaporating at a low temperature and a low pressure and rejects heat on condensing at a higher temperature and higher pressure. The term 'gas' should be avoided when referring to refrigerants. Unless specified otherwise, 'refrigerant' in this code refers to scheduled refrigerants only.

Refrigerating system
An assembly of piping, vessels, and other components in a closed circuit in which a refrigerant is circulated for the purpose of transferring heat.

RAC equipment (refrigeration and air conditioning equipment)
Equipment used for the cooling or heating of anything, and that uses a scheduled refrigerant.

Retrofit
To replace the original refrigerant (and components, lubricant, etc. as required) in a system with an alternative.

Returned refrigerant
Refrigerant recovered from a system and returned to the supplier or equivalent for reclaim or destruction.

Scheduled refrigerant
A refrigerant with an Ozone Depletion Potential and/or a Global Warming Potential that is listed under Schedule 1 of the *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989*, (see Appendix A). Generally synthetic chemicals consisting of or containing fluorocarbon, which include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFC), but not hydrofluoroolefins (HFO).

Self-contained low charge systems
Appliances that contain a refrigerant charge of 2kg or less, and do not require any work to be done on the refrigerating system at the time of installation.

Should, recommended
Indicate provisions that are not mandatory for compliance with this code but which are desirable as good and best practice.

Split systems

Systems that require interconnecting pipework and electrical connections between the separate evaporator unit and the condensing unit. Note that split systems fall outside the scope of this code. Refer instead to the Australia and New Zealand refrigerant handling code of practice Part 2 – *Systems other than self-contained low charge systems.*

For definitions of other components, refer to AS/NZS 5149.1, Section 3: Terms and definitions.

C.2 Acronyms and initialisms

Acronyms and abbreviations for standards organisations and relevant websites

Acronym / abbreviation	Standard / organisation	Website
AIRAH	Australian Institute of Refrigeration Air Conditioning and Heating	www.airah.org.au
ANSI	American National Standards Institute	www.ansi.org
ARC	Australian Refrigeration Council	www.arctick.org
AHRI	The Air-Conditioning, Heating, and Refrigeration Institute (American)	www.ahrinet.org
AS	Australian Standard	www.standards.org.au
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers	www.ashrae.org
CCCANZ	Climate Control Companies Association of New Zealand	CCCANZ - HVAC&R Centre
DCCEEW	Department of Climate Change, Energy, Environment and Water	www.dcceew.gov.au
IRHACE	Institute of Refrigeration, Heating and Air Conditioning Engineers New Zealand	www.irhace.org.nz
NZCCO	New Zealand Climate Change Office	www.mfe.govt.nz
NZS	New Zealand Standard	www.standards.co.nz
RRA	Refrigerant Reclaim Australia	www.refrigerantreclaim.com.au

Other acronyms and initialisms used in this code have the following meaning:

GWP Global warming potential
IPCC Intergovernmental Panel on Climate Change
LFL Lower flammability limit
ODP Ozone depletion potential
OFN Oxygen-free nitrogen
OHS Occupational Health and Safety
PPE Personal protective equipment
RAC Refrigeration and air conditioning
RCL Refrigerant charge limit
SDS Safety Data Sheets
SFC Safe fill capacity
WHS Work Health and Safety

Appendix D
REFERENCED DOCUMENTS AND RESOURCES

The documents referenced in this code are listed in this Appendix.

Standards in place at the time of publication of this code **should** be referred to.

The standards and other documents listed are revised and updated from time to time. Best practice is to always consult the latest current versions and any amendments.

D.1 Regulatory documents

Australia

- *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989*
- Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995
- Australia and New Zealand Refrigerant Handling Code of Practice Part 2 – Systems other than self-contained low charge systems
- Australian automotive code of practice for the control of refrigerant gases during manufacture, installation, servicing or de-commissioning of motor vehicle air conditioners
- Australian Code for the Transport of Dangerous Goods by Road and Rail
- Heads of Workplace Safety Authorities: Flammable Refrigerant Gases Position Paper.

New Zealand

- *Ozone Layer Protection Act 1996*
- *Climate Change Response (Zero Carbon) Amendment Act 2019*
- *Hazardous Substances and New Organisms Act 1996*
- NZ Approved Code of Practice – Pressure Equipment (excluding Boilers).
- Guide to gas cylinders – Worksafe NZ
- Land Transport Rule: Dangerous Goods 2005 (NZ)

D.2 Australian, New Zealand and international standards

AS/NZS ISO 817	Refrigerants – Designation and safety classification
AS/NZS 1200	Pressure Equipment
AS 2030.1	Gas cylinders. Part 1: General requirements
AS 2030.5	Gas cylinders. Part 5: Filling, inspection and testing of refillable cylinders
AS/NZS 3000	Electrical installations (known as the Australian/New Zealand Wiring Rules)

AS 4211.3	Gas recovery on combined recovery and recycling equipment. Part 3: Fluorocarbon refrigerants from commercial/domestic refrigeration and air conditioning systems
AS/NZS 4332	Storage of gases in cylinders
AS 4484	Gas cylinders for industrial, scientific, medical and refrigerant use – Labelling and colour coding
AS/NZS 5149	Refrigerating systems and heat pumps – Safety and environmental requirements
AS/NZS 5149.1	– Part 1: Definitions, classification and selection criteria (ISO 5149-1:2014, MOD) (incorporating Amd 1 and Amd 2)
AS/NZS 5149.2	– Part 2: Design, construction, testing, marking and documentation (ISO 5149-2:2014, MOD)
AS/NZS 5149.4	– Part 4: Operation, maintenance, repair and recovery (ISO 5149-4:2014, MOD)
AS/NZS 60335.1	Household and Similar Electrical Appliances – Safety – General requirements
AS/NZS 60335.2.11	Particular requirements for tumble dryers
AS/NZS 60335.2.24	Particular requirements for refrigerating appliances, ice cream appliances and ice makers
AS/NZS 60335.2.34	Particular requirements for motor compressors
AS/NZS 60335.2.40	Particular requirements for electrical heat pumps, air conditioners and dehumidifiers (IEC 60335-2-40 Ed 7)
AS/NZS 60335.2.75	Particular requirements for commercial dispensing appliances and vending machines
AS/NZS 60335.2.89	Particular requirements for commercial refrigerating appliances with an incorporated or remote refrigerant condensing unit or compressor
NZS 5433	Transport of dangerous goods on land
ISO 10156	Gas cylinders — Gases and gas mixtures — Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets
ISO 11650	Performance of refrigerant recovery and/or recycling equipment

D.3 Other documents

AIRAH	Flammable Refrigerants Safety Guide (including update 1 2018)
AIRAH DA19	HVAC&R Maintenance
ANSI/AHRI 580	Non-Condensable Gas Purge Equipment for Use with Low Pressure Centrifugal Liquid Chillers
AHRI 700	Specification for Refrigerants
AHRI 740	Performance Rating of Refrigerant Recovery Equipment and Recovery/ Recycling Equipment
ARC	Handle Class A2/A2L Flammable Refrigerants
NIST REFPROP	Reference Fluid Thermodynamic and Transport Properties Database (REFPROP): Version 10

D.4 Fact sheets

Refrigerants Australia	Flammables fact sheets (WA)
CCCANZ	Flammable refrigerants – be informed, be aware (NZ)

Notes:

Notes: