



FLAMMABLE REFRIGERANTS – BE INFORMED, BE AWARE

Installing systems with flammable refrigerants

This fact sheet explores the rules for the installation of A2L, A2 and A3 flammable refrigerant-based stationary air conditioning and refrigeration systems. Significant consequences may arise if you, as an installer, fail to follow appropriate installation or decommissioning practices. The content is based on the Australian Institute of Refrigeration, Air Conditioning and Heating [AIRAH] *Flammable Refrigerants Safety Guide* – available from www.airah.org.au.

SYSTEM CONVERSIONS

Flammable A2L, A2 or A3 refrigerants are not a suitable 'drop-in' replacement for non-flammable A1 refrigerants. System conversion is usually required. When converting an existing A1 refrigerant-based system to use an A2L, A2 or A3 refrigerant:

- the converted system must comply with all applicable standards and regulations
- the technician must be trained to safely handle the specific refrigerant
- the equipment manufacturer and flammable refrigerant manufacturer should be contacted for advice on the application, including advice on warranties.

Any conversion that is not implemented in the correct way is unsafe.

APPLICABLE STANDARDS

- AS/NZS 5149 *Refrigerating systems and heat pumps – Safety and environmental requirements series*
- AS/NZS 60079 *Explosive atmospheres series*

INSTALLATION CHECKLISTS

Installation work should comply with AS/NZS 5149 parts 2 and 3. Installation checklists are provided in AS/NZS 5149.2:2016 Annex A and AS/NZS 5149.3:2016 clause 10. Installers can also use the checklists in Appendix A of the *Flammable Refrigerants Safety Guide*, which outline the steps and issues that need to be addressed by installers of new or converted high-wall split systems, coolroom systems and plantroom-based refrigeration systems.



TEMPORARY FLAMMABLE ZONES

Temporary flammable zones can arise during system installation and maintenance activities. A temporary flammable zone is an area where at least some emission of refrigerant is anticipated to occur during the normal working procedures (refrigerant charging and recovery), typically where hoses may be connected or disconnected. The requirements for zone 2 in AS/NZS 60079.14:2017 apply. Prevention of ignition sources and provision of adequate ventilation to disperse any gas leaks are critical safety factors.

VENTILATION

Ventilation is a key consideration in the assessment of risk posed by a flammable refrigerant application. Machinery room ventilation should be independent and safely disperse any released refrigerant to the outside. Protection by ventilation provisions must meet the requirements of the AS/NZS 60079 series. Where there is a jet release, the use of ventilation will not eliminate a hazardous area close to the source of the jet.

SOURCES OF IGNITION

There must be no potential sources of ignition associated with or in the vicinity of the equipment. Systems should not be installed or located in areas that have naked flames (or sparks) present, such as areas with gas cooktops or ranges, gas water heaters and gas or wood-fired space heaters.

POOLING RISK

Some common flammable refrigerants are heavier than air and can tend to pool at floor level. The pooling risk from leaked refrigerant in refrigerated coolrooms is lessened by the usual practice of running the evaporator fans continuously even on the refrigeration system off cycle. The risk can be further reduced by the system automatically doing a pump down cycle whenever the refrigeration system is off or, in the case of freezer rooms, when the evaporator is in defrost mode. The liquid line solenoid valve that controls the pump down cycle should not be located at the evaporator inlet but should be outside the coolroom to minimise the risk further.

LABELLING

An identification plate must show the manufacturer/installer name, model number, manufacture year, refrigerant designation, refrigerant charge and maximum allowable pressures for high-pressure and low-pressure sides of the refrigerant circuit. Machinery rooms must have notices warning that unauthorised persons must not enter and naked lights or flames are prohibited. The installing contractor who charges the system must ensure that all



units containing flammable refrigerant are marked with a visible and clearly identifiable red diamond class label for class 2.1 flammable gases.

Where units must also carry the international symbol ISO 7010 W021, both labels need to be applied. Interconnecting refrigerant pipework should be marked with the red diamond class label:

- near valves and where walls are penetrated, and
- every 2 metres where the pipework is visible or in a ceiling space or void that a person may access for maintenance or repair work.

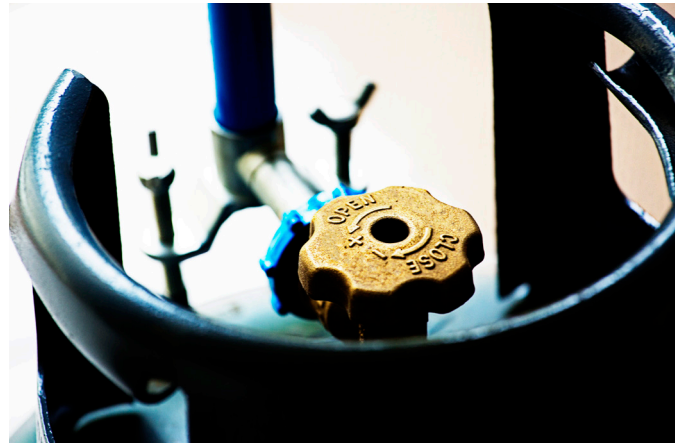
PIPEWORK

Joints should be minimised where possible, and installers should use brazed or permanent mechanical joints. Serviceable type joints such as flare nuts should be avoided in the occupied space or in any area where leaked refrigerant could pool. The final connection to the indoor unit can be a non-permanent joint. Piping must be enclosed or protected to avoid mechanical damage.

DETECTOR LOCATIONS

Ideal gas detector locations are influenced by the physical and chemical properties of the refrigerant. The installer should consider:

- density – whether the refrigerant is heavier than air
- ventilation and its effect on gas movement
- safety characteristics – whether the refrigerant is flammable, toxic or an asphyxiant
- the likely release temperature of any leaked refrigerant.



CYLINDERS

Cylinders for storage and transport should be suitable for use with flammable refrigerants and have collars to protect valving and relief devices. Storage of A2L, A2 and A3 cylinders in quantities not exceeding 500 litres (empty, full or combined) is classed as minor storage and can be in accordance with section 2 of AS 4332-2004 (R2016) *The storage and handling of gases in cylinders*. For larger quantities, the full requirements of the standard will apply – see Table 11.2 of the *Flammable Refrigerants Safety Guide*.

The maximum quantity of gas cylinders stored at residential premises must not exceed 216 litres. The storage area should be:

- well ventilated and free of combustible or waste materials.
- free of sources of ignition such as electrical power points, lights and switches, electric motors and like equipment
- out of the sun and away from sources of heat.



Protect all gas cylinders from falling over, and secure them to prevent theft or tampering.

Storage areas should be provided with safety signs and appropriate fire protection – see section 11 of the *Flammable Refrigerants Safety Guide*.

TRANSPORTING REFRIGERANTS

Appropriate safety practices must be followed during transfer of refrigerant from a refrigerating system to a refrigerant container for transport or storage. Cylinders containing flammable refrigerants must be labelled and transported in accordance with the Land Transport Rule: Dangerous Goods 2005 (and its amendments).

Gas cylinders must be marked with:

- the proper shipping name for the dangerous goods
- the United Nations number, preceded by the letters UN
- a class label (red diamond).

The following minimum requirements apply for transport of up to 450 litres of flammable gas cylinders:

- Gas cylinders must not be stored on the transport vehicle near a source of heat.
- The cylinder must be stored upright so the pressure release device communicates with the vapour space.
- The main cylinder valve must be shut and any regulator removed prior to loading.
- Ventilation is required to prevent the build-up of flammable gas in the event of a leak. For enclosed vehicles like vans, stationwagons and utilities with a

canopy/cover, one means of providing ventilation is to stow the gas cylinders in a cabinet that is vented externally only, i.e. not into the vehicle.

- In the case of an open tray truck or utility vehicle, gas cylinders need to be in a locked cage for security.
- The vehicle should be fitted with a fire extinguisher that has a preferable rating of at least 30B.

For larger quantities, additional requirements apply – see the Land Transport Rule: Dangerous Goods 2005.

Unodourised flammable refrigerant, including recovered refrigerant that has suffered from odourant fade, should not be transported in an enclosed vehicle or stored in an enclosed space, regardless of the quantity.

Contractors can use the self-audit tool in Appendix B of the *Flammable Refrigerants Safety Guide* to assess their particular arrangements for transporting refrigerant cylinders.

TRAINING

Installers should be competent in all safety aspects of flammable refrigerants and be aware of their individual risks and requirements. Training is available from Refrigerant License New Zealand: www.rlnz.org.nz

CERTIFICATION

Since 1 January 2015, responsible wholesalers restrict the sales of refrigerant to only those persons who have evidence of certification (from Refrigerant License New Zealand) to safely handle that refrigerant.

These fact sheets have been produced by the Climate Control Companies Association New Zealand (CCCANZ) supported by BRANZ and in association with the Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH). They provide an overview of the key elements of safe operation for flammable refrigerant-based systems and an introduction to the pathways, plans and processes towards a new cooling environment. The fact sheets cover:

1. Introduction and overview
2. System design considerations
3. Installing systems with flammable refrigerants (this fact sheet)
4. Operating and maintaining flammable refrigerant-based systems

Designers/installers/service providers should access the AS/NZS 5149 *Refrigerating systems and heat pumps – Safety and environmental requirements* series in order to ascertain the precise requirements for an individual installation.