Safety and Legal Requirements for Refrigerant Replacement

1. Hydrofluorocarbon (HFC) phase-down

HFCs generally have a high global warming potential which means they have a greater ability to trap heat in the atmosphere compared to a similar mass of carbon dioxide. For example, the release of one tonne of HFC 23 is equivalent to releasing 14,800 tonnes of carbon dioxide into the atmosphere.

Australia's HFC phase-down started on 1 January 2018. The HFC phase-down is a gradual reduction in the maximum amount of HFCs permitted to be imported into Australia. Industry has already driven significant change to reduce their direct and indirect emissions through changes in product design by using:

- lower global warming potential refrigerants which result in less harmful emissions if the gas is released to the atmosphere;
- more energy efficient equipment which uses less power, therefore emissions from power production are reduced.

The HFC phase-down is being implemented through the Ozone Protection and Synthetic Greenhouse Gas Management Act 1989 and associated Regulations through a quota system for imports of HFCs as bulk gas which has regular, smaller step-downs than the Montreal Protocol requirements. The annual starting limit of HFC imports was 8.0 million tonnes CO_2e which will be reduced gradually to 15%, which is 1.607 million tonnes CO_2e, by 2036.

The HFC phase-down covers only imports of bulk gas such as in cylinders. Existing operating equipment is not affected by the phase-down except that in the future the quantity of HFCs imported will be gradually reduced, making it difficult to purchase the gas and more expensive if required to service the equipment.

The phase-down applies to all HFCs covered by the Montreal Protocol which includes pure HFCs for example R32, R125 and R134a and blend HFCs for example R404A, R-407A. R410A and R513A. Refrigerant importers can import more refrigerant if it has a low GWP for example R32 (675 GWP) instead of high GWP refrigerant for example R410A (2088 GWP).

Therefore, some existing refrigeration and air conditioning equipment will need to be retrofitted with a lower GWP refrigerant in the future. So what are the safety and legal requirements for replacing the refrigerant?

The safety and legal requirements for replacing the refrigerant are prescribed in the following Regulations, Standards, Code of Practice and other relevant documents.

2. Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995 Requirements

2.1 Prohibited Refrigerant Replacement

On 1 January 2020 a new condition was added to the ARC's Refrigerant Handling Licence requirements which states that RAC equipment must not be charged with a refrigerant that has a higher global warming potential (GWP) than the refrigerant that the equipment was designed to use, as recorded on the equipment compliance plate.

Such charging is an offence under the Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995 and penalties apply. This offence applies to any person carrying out work on RAC equipment, regardless of whether they have a permit.

Examples of charging that is now prohibited:

- In the automotive industry, you cannot replace R1234yf (GWP of <1) with R134a (GWP of 1,430).
- In medium temperature commercial refrigeration, you cannot replace R407A (GWP of 2,107) with R404A (GWP of 3,922).

Exemptions to prohibited charging offence:

- The ban does not apply to RAC equipment designed to operate using hydrochlorofluorocarbons (HCFCs), which are ozone depleting substances. For example, R22 is a HCFC refrigerant which has an ozone depleting potential (ODP) of 0.05 and GWP of 1700; it can be replaced by R407C because it has an ODP of 0 even though its GWP is higher at 1,774.
- If RAC equipment is essential for health or public safety and there is no originally designed refrigerant or no low GWP or no GWP refrigerant available, you can charge it with a higher GWP refrigerant.

2.2 Relevant Standards and Codes of Practice

The following relevant Standards and Codes of Practice are called up in the Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995, Table 135.

2.2.1 AS/NZS 5149.4:2016 Refrigerating systems and heat pumps – Safety and environmental requirements, Part 4: Operation, maintenance, repair and recovery (ISO 5149-4:2014, MOD)

The following clause provides the procedure to change the refrigerant type which MUST be followed.

Clause 5.4 Change of refrigerant type

- 5.4.1 General

  In the event of a change of the refrigerant type used in the refrigerating system, the following planning and execution steps shall be taken.

- 5.4.2 Planning the change of refrigerant type

  Before changing the refrigerant type, a plan shall be prepared. It shall include at least the following actions:

  a) verify that the refrigerating system and components are suitable for the refrigerant type change;

  b) examine all materials used in the refrigerating system to ensure they are compatible with the new refrigerant type;

  c) determine whether the existing lubricant type is suitable for use with the new refrigerant type;

d) verify that the system allowable pressure (PS) shall not be exceeded;

e) verify that the relief valve required discharge capacity is adequate for the new refrigerant type;

f) verify that the motor and switchgear current ratings are adequate for the new refrigerant type;

g) verify that the liquid receiver is sufficiently large for the new refrigerant charge;

h) if the new refrigerant has a different classification, ensure that the consequences of the change of refrigerant classification are addressed.

This means that a system should not be retrofitted with a refrigerant with a higher flammability or toxicity class than the original refrigerant, for example A1 to A3, unless the system has undergone a complete redesign by a competent engineer to ensure the additional safety issues are addressed.

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

- 5.4.3 Execution of the change of refrigerant type

  Follow the recommendations of the equipment manufacturer; the compressor manufacturer; the refrigerant supplier or apply the following procedure in accordance with the plan developed according to 5.4.2 above:

  a) record a full set of system operating parameters to establish baseline performance;

  b) repair any issues identified by a);

  c) conduct a thorough leak check and identify any joints and seals to be replaced;

  d) recover the original refrigerant in accordance with Clause 6.2;

  e) drain the lubricant;

  f) check whether the lubricant is in good condition. If not, then remove the residual lubricant from the system;

  g) change the joints, seals, indicating and control devices, filters, oil filters, driers and relief valves as required;

  h) evacuate the system to less than 32 Pa absolute pressure;

  i) charge with lubricant;

  j) charge with refrigerant;

  k) adjust indicating and control devices, including software modifications if required;

  l) amend all indications as to the refrigerant type used, including the log book and documentation at operating site;

  m) conduct a thorough leak check and repair any joints and seals as required;

  n) record a full set of system operating parameters to compare with the previous baseline performance.

2.2.2 AS/NZS 60335.2.40:2023 Refrigerant handling code of practice 2007, Part 1 — Self-contained low charge systems

The following clause provides the procedure to change the refrigerant type which MUST be followed.

Clause 11 Retrofitting

11.1 Any procedures recommended by the system manufacturer or their distributor **must** be followed when **retrofitting** is to be carried out.

11.2 **Retrofitting** a system with an **alternative refrigerant** and/or lubricant **must** only be carried out based on written advice from the equipment and/or component manufacturers.

11.3 If the equipment and/or component manufacturers cannot be contacted and written advice from them is not available, written advice from a suitably qualified refrigeration or air conditioning engineer **must** be obtained prior to the **retrofit.**

11.4 High pressure, flammable or toxic **refrigerants must not** be used in systems where they will pose a safety risk.

11.5 **Alternative refrigerants must** be **compatible** with all parts of the system.

11.6 Correct lubricants **must** be used with **alternative refrigerants** (check with the **refrigerant** supplier if in doubt).

11.7 When an **alternative refrigerant** has been **retrofitted** to a system, the system's labelling, colour coding (if applicable) and nameplates **must** be changed to permanently identify the **refrigerant** contained and the type of lubricant.

11.8 A new filter drier appropriate for the new **refrigerant must** be fitted.

11.9 Where it is technically and economically feasible, **alternative refrigerants** with a lower **ozone depletion** and **global warming potential** than the original **refrigerant should** be used.

2.2.3 The Australia and New Zealand Refrigerant Handling Code of Practice 2007, Part 2 — Systems other than self-contained low charge systems

The following clause provides the procedure to change the refrigerant type which MUST be followed.

Clause 12 Retrofitting

12.1 Any procedures recommended by the system manufacturer or their distributor **must** be followed when **retrofitting** is to be carried out.

12.2 **Retrofitting** a system with an **alternative refrigerant** and/or lubricant **must** only be carried out based on written advice from the equipment and/or component manufacturers.

12.3 If the equipment and/or component manufacturers cannot be contacted and written advice from them is not available, written advice from a suitably qualified refrigeration or air conditioning engineer **must** be obtained prior to the **retrofit.**

12.4 High pressure, flammable or toxic **refrigerants** **must not** be used in systems where they will pose a safety risk.

12.5 **Alternative refrigerants** **must** be **compatible** with all parts of the system.

12.6 Correct lubricants **must** be used with **alternative refrigerants** (check with the **refrigerant** supplier if in doubt).

12.7 When an **alternative refrigerant** has been **retrofitted** to a system, the system's labelling, colour coding (if applicable) and nameplates **must** be changed to permanently identify the **refrigerant** contained and the type of lubricant.

12.8 A new filter drier appropriate for the new **refrigerant** **must** be fitted.

12.9 Where it is technically and economically feasible, **alternative refrigerants** with a lower **ozone depletion** and **global warming potential** than the original **refrigerant should** be used.

3. Other Relevant Documents

3.1 Heads of Workplace Safety Authorities (HWSA) Flammable refrigerant gases – position paper

The following sections provide the requirements for changing the refrigerant type.

4. Issues

a) Compatibility of refrigerant gases with the refrigeration system – refrigerant gases must be compatible with the refrigeration system. This determination must be made by a competent person, who has experience in this matter and who may have undertaken relevant formal training. A competent person is one who has acquired through training, qualifications or experience the knowledge and skills to conduct the task safely.

Converting a refrigerant system to use an alternative refrigerant must only be conducted in accordance with advice from the original equipment manufacturer or a competent person. A refrigerant should only be used in equipment that is designed or re-designed for its use.

5.5. Refrigeration technicians, engineers and businesses that install or maintain workplace refrigeration systems.

c) Where an alternative refrigerant is being considered, the compatibility of this refrigerant with the system must be assessed and documented by a competent person prior to the substitution. A person changing a refrigerant to a more flammable refrigerant takes on a role similar to that of a designer of a refrigeration system. For example, for a fixed system a refrigeration engineer must assess the suitability of the system for use with the alternative refrigerant, and ensure compliance with relevant standards including AS/NZS 5149, and the AS/NZS 3000 and other electrical standards.

d) Where the system falls under the scope of AS/NZS 3000 (the 'Wiring Rules') generally and specifically Clause 7.7 'Hazardous Areas (Explosive Gas or Combustible Dusts)' and compliance with AS/NZS 3000 is mandatory via the applicable jurisdiction's electrical regulations, the person in control of the installation must classify the hazardous areas in accordance with Clause 7.7 (which invokes the hazardous area

standard AN/NZS 60079.10.1). As a guide, most large fixed systems using flammable refrigerants in most jurisdictions must comply with these requirements.

f) The business operating the workplace or vehicle should also be consulted prior to a refrigerant substitution and should approve the substitution prior to it proceeding. In the absence of written confirmation from a competent person on the suitability of an alternative refrigerant, the alternative refrigerant must not be used.

5.6. People conducting a business or undertaking (PCBU), employers and people with management or control of workplaces where flammable refrigerant gases are used in refrigeration or air-conditioning systems:

e) Before using flammable refrigerants as a substitute to re-gas a refrigeration system designed for less flammable refrigerants, the PCBU must obtain written advice from a competent person (preferably the system's designer, manufacturer or supplier) on the suitability of the specific refrigerant for the system and the safety controls or system modifications required.

3.2 AIRAH Flammable Refrigerant Safety Guide

This online resource will help refrigeration technicians, apprentices and other stakeholders understand the range of skills and knowledge required to work safely with flammable refrigerants.

Module 6 Video on system conversion rules provides information to raise awareness about the critical aspects of the issues surrounding changing the refrigerant in an existing system, under the following topic headings:

- Replacing refrigerants in existing systems
- Difference between 'Drop-in replacement' and 'system conversion'
- Regulations for system conversions
- Changing refrigerant flammability classification
- Competence and responsibilities to undertake a conversion
- System suitability assessment
- Conversion Standards - AS/NZS 5149 parts 1 to 3
- Conversion Procedures - AS/NZS 5149.

3.3 ARC 32 Refrigerant information for technicians

Can I convert an existing R410A system to R32?

No. R32 is not suitable as a drop-in replacement for R410A and must only be used in systems specifically designed for R32.

R410A systems are not designed to operate using a flammable refrigerant and would require extensive modification and laboratory validation to confirm that the safety level has been increased to a level that satisfies the requirements of international standards set for systems that use R32.

It is not just the electrical components that must be compliant with the mandatory safety requirements (i.e. AS/NZS 60335.2.40) for the refrigerant used, it is the whole air conditioner. This includes surface temperatures, operating and installation instructions, markings and warning labels, mechanical strength etc. Anyone doing a conversion or modification takes on the responsibilities of the designer/manufacturer and therefore must certify that the modified product is compliant with all applicable codes and standards.

Compliance with AS/NZS 60335.2.40 can only be ascertained by physical testing in a laboratory and AS/NZS 5149.1:2016 has refrigerant charge limit requirements. As a result, it is difficult for any technician to confirm compliance.

3.4 Other Resources

Actrol - Drop-In-Refrigerant, Theory Vs Reality

Freon™- MO99 Refrigerant (R-438A) Retrofit Guidelines

Honeywell - Retrofit Guidelines, Solstice® N40, R-404A/R-507A to: R-448A

Linde - Refrigerants. General HCFC to HFC retrofit checklist