

Safe use of flammable refrigerants

This safety alert concerns Class 2.1 Flammable refrigerant gases and provides guidance to occupiers of premises on how to control the risk of fire and explosion from refrigeration and air-conditioning systems containing flammable refrigerants.

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Background

The extensive environmental damage caused by synthetic chemical refrigerants has given rise to the use of natural refrigerants, predominantly hydrocarbons, carbon dioxide and ammonia. Many of these refrigerants are flammable, toxic or both and have the potential to cause serious injury or death as well as property damage.

A recent incident involving flammable refrigerants resulted in death, injury and damage to property.

When hydrocarbon refrigerants containing mercaptan odourant are used in a refrigeration or air-conditioning system fitted with a filter-dryer, the mercaptan may be removed from the refrigerant during operation, meaning that if the refrigerant leaks out, it may not smell and the leak may be undetectable.

Duties

Occupiers of premises must identify all hazards and use appropriate risk controls to comply with the *Dangerous Goods Act 1985* and the *Dangerous Goods (Storage and Handling) Regulations 2012 (Regulations)*.

Under the Regulations occupiers must obtain material safety data sheets (MSDS) or safety data sheets (SDS) from the supplier of the refrigerant. Occupiers of premises should ensure personnel adhere to the safety requirements set out in the MSDS/SDS.

Marking and labelling

Service access points, refrigeration systems and entries into machinery rooms that contain flammable refrigerants need to be marked and labelled with warning signs that such systems contain class 2.1 flammable refrigerants. For further guidance, refer to *AS/NZ 5149 Refrigerating systems and heat pumps – Safety and environmental requirements* and the *Code of Practice for the Storage and Handling of Dangerous Goods*.

Flammable refrigerants in gas cylinders should be clearly marked with one of the Class 2.1 flammable gas labels.



Location of equipment containing flammable refrigerants

Refrigeration and air-conditioning equipment should be located outdoors and above ground in a well ventilated area. Locating these in enclosed spaces or below ground should be avoided. Where this is unavoidable, additional risk controls should be used to prevent the dangerous accumulation of leaked refrigerant in any space.

Where a refrigeration or air-conditioning system must be located within the confines of, or ducted into, a building or enclosed space, the quantity of flammable refrigerant in the system should be limited so that if it leaked into the space, it would not create a concentration in air above 20% of lower flammable limit (LFL).

Table: *Flammable refrigerant charge table*

Refrigerant	Charge Limit: Charge Limit g/m ³ of Net Room Volume ^[1] (based on 20% LFL)	Max allowable charge: Max allowable charge per system located in the enclosed space (kg)	Control measures: Can the Charge limit in either column be exceeded if control measures are used
R290	7.6	1.50	No
R600a	8.6	1.50	No
R1270	9.2	1.50	No
R32	61.4	11.97	Yes
R143a	56.4	11.00	Yes
R1234yf	57.8	11.27	Yes
R1234ze(E)	60.6	11.82	Yes
R142b	65.8	12.83	No
R152a	26.0	5.07	No

Flammable refrigerants should only be used to replace non-flammable refrigerants in existing refrigeration or air-conditioning systems when the system and components have been assessed as suitable to operate with the flammable refrigerant.

Manufacturers can advise whether refrigeration or air-conditioning systems are suitable for conversion from non-flammable to flammable refrigerants.

Alternatively, an engineering assessment can be undertaken to ensure that the system is suitable to be converted for use with flammable refrigerant. Such an assessment should be undertaken by a qualified and experienced engineer, for example, one registered on the National Engineers Register or an equivalent recognised body.

Air conditioning equipment using flammable refrigerants should use a flammable gas detector alarm system for the air leaving the cooling coil.

Risk Control Measures

If the quantity of refrigerant in one independent/separate refrigeration or air-conditioning system, is such that it would create a concentration in air above 20% of the LFL and the refrigerant has a "yes" beside it in the control measures column in the table above, additional control measures should be put in place to reduce the risk of fire and explosion. Suggested risk controls include:

1. The use of suitably located flammable gas detectors inside the space being air-conditioned. Gas detectors should be alarmed and interlocked to ensure a failsafe isolation shutdown of the air-conditioning system, in the event of a flammable gas leak.
2. Where refrigeration equipment is located within the confines of a building, the use of floor level flammable gas detectors interlocked with a floor level mechanical extraction system, with an alarm that will activate once a gas leak is detected. The detection and extraction system should be at floor level because most flammable refrigerants are heavier than air. If no gas detectors are installed the mechanical extraction system should operate continuously.
3. Elimination of ignition sources where possible.
4. Emergency procedures in the event of a leak.
5. Keeping records of maintenance and repair to the equipment, including date, contractor's details and other relevant information.

Refrigeration engineers, technicians, service persons and emergency responders must be vigilant as to the hazards associated with flammable refrigerants, including the need to use appropriate gas detection equipment. Where there

is uncertainty as to what the system is charged with, proceed with extreme caution and identify the refrigerant, by testing if

necessary, prior to engaging with the system.

[1] *Net room volume means the gross room volume less the volume of any product, equipment, or objects located in the room.*

Further Information

AS/NZS 5149 Refrigerating systems and heat pumps – Safety and environmental requirements

Code of practice for the storage and handling of dangerous goods, WorkSafe, 2013

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