

Australian/New Zealand Standard™

Refrigerating systems

Part 1: Refrigerant classification

AS/NZS 1677.1:1998

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee ME-006, Refrigeration. It was approved on behalf of the Council of Standards Australia on 14 November 1997 and on behalf of the Council of Standards New Zealand on 3 November 1997. It was published on 5 January 1998..

The following are represented on Committee ME-006:

Air-conditioning & Refrigeration Wholesalers Association, Australia
Air-conditioning & Refrigeration Equipment Manufacturers Association of Australia
Association of Fluorocarbons Consumers and Manufacturers, Australia
Australasian Railway Association
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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME-006, Refrigeration. This Standard supersedes (in part) AS 1677—1986, *Refrigerating systems*, NZS 5235, *Code of practice for safety in mechanical refrigeration (Refrigeration code)*, Part 1:1991, *Refrigerating systems with a total refrigeration effect in excess of 30 kW* and Part 2:1988, *Refrigerating systems with a total refrigeration effect less than 30 kW*.

This Standard incorporates Amendment No. 1 (July 2002). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The objective of this document is to provide a standardized system whereby refrigerants may be classified according to their physical properties.

This Standard forms Part 1 of a three-part series of Standards to address refrigerating systems. Part 2 of the series covers system safety requirements for fixed applications and Part 3 addresses mobile applications. The classification system adopted in this Standard is based on BS 4434:1995, *Safety and environmental aspects in the design, construction and installation of refrigerating appliances and systems*, ANSI/ASHRAE 34:1992 (and Addenda), *Number designation and safety classification of refrigerants* and ISO 817, *Organic refrigerants—Number designation*.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which it applies. An ‘informative’ appendix is only for information and guidance.

Statements expressed in mandatory terms in Notes to Tables are deemed to be requirements of the Standard.

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Australian/New Zealand Standard Refrigerating systems

Part 1: Refrigerant classification

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies a simple means of referring to common refrigerants instead of using the chemical name, formula, or trade name. It also establishes a uniform system to be used in assigning the proper reference number and classification to refrigerants. The system for refrigerant classification is defined and physical data of common refrigerants listed.

NOTE: As new refrigerants are developed and grow in popular usage, they will be added to this Standard through revisions.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS/NZS

1677 Refrigerating systems

1677.2 Part 2: Safety requirements for fixed applications

ISO

817 Organic refrigerants—Number designation

1.3 DEFINITIONS

For the purposes of this Standard, the definitions below apply.

1.3.1 Azeotrope

A mixture of volatile substances which is characterized by remaining in the same proportions and boiling at a constant temperature as the mixture evaporates.

NOTE: The azeotropic proportions for a particular azeotrope apply strictly at a specific pressure but in practice azeotropic mixtures appear to evaporate and condense as if they were a single fluid, with properties different from their components, over a range of pressures.

1.3.2 Critical temperature

The highest temperature the refrigerant can have and still be condensable by the application of pressure. When above the critical temperature all liquid refrigerant within a system will revert to a vapour.

1.3.3 Exposure standard

A specified value which represents an airborne concentration of an individual chemical substance which should neither impair the health of, nor cause undue discomfort to, nearly all workers.

NOTES:

- 1 The effects of concern include, but are not limited to, those carcinogens, mutagens, poisons, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, neurotoxins and agents that act on the haematopoietic system and agents that damage the lungs, skin, eyes or mucous membranes.
- 2 Temporary discomfort at a level that is not impairing is excluded.

A1

1.3.4 Global warming

The effect whereby heat loss from the earth is reduced by the insulating effect of the atmosphere.

NOTE: Strictly speaking the term should be 'increased global warming' because concern is with man-made increases in global warming above the natural and beneficial global warming produced by water vapour and natural concentrations of other atmospheric constituents.

1.3.5 Global warming potential (GWP)

The time integrated commitment to climate forcing from the instantaneous release of 1 kg of refrigerant expressed relative to that of 1 kg of carbon dioxide. Carbon dioxide is taken as having a GWP of 1. In this Standard GWP, which depends on the absorption spectrum of the substance and on its atmospheric life, is measured on the basis of a 100 year time horizon.

1.3.6 Halocarbon/hydrocarbon

CFC	Fully-halogenated (no hydrogen remaining) halocarbon containing chlorine, fluorine and carbon;
HCFC	Halocarbon containing hydrogen, chlorine, fluorine and carbon;
HFC	Halocarbon containing only hydrogen, fluorine and carbon;
PFC	Perfluorinated carbon containing only fluorine and carbon;
HC	Hydrocarbon containing only hydrogen and carbon.

1.3.7 Lethal concentration fifty (LC_{50rat})

A1 | A calculated concentration of a substance in air, exposure to which, for a 4 h period of time, is expected to cause the death of 50% of the entire defined experimental rat population. It is determined from the exposure to the substance of a significant number from that rat population.

1.3.8 Lower explosive limit (LEL) [lower flammability limit (LFL)]

The minimum concentration of the refrigerant that is capable of propagating a flame through a homogeneous mixture of refrigerant and air measured at 21°C and 101 kPa, (see Table 3.1).

1.3.9 Ozone depleting potential (ODP)

The capacity to destroy stratospheric ozone. ODP is stated relative to the ODP of R11 (CC13F) which is taken as having an ODP of 1.

1.3.10 Refrigerant

A substance used to produce refrigeration by its vaporization.

NOTE: Typical refrigerants and their physical properties are given in Table 3.1.

1.3.11 Secondary refrigerant

A liquid used for the transmission of heat without a change in its state.

1.3.12 Total equivalent warming impact (TEWI)

The total warming effect of operating a refrigerating system for its entire life. This effect is made up from a 'direct' contribution due to emissions of refrigerant during and after the life of the system and an 'indirect' contribution caused by the emission of carbon dioxide resulting from the generation of power to drive the refrigerating system.

A1 | **Not applicable**

$$TEWI = (GWP \times L \times n) + (GWP \times m [1 - \alpha]) + (n \times E \times \beta)$$

where

GWP = global warming potential per kilogram (CO_2 related)

L = leakage rate per year, in kilograms

n = operating life, in years

m = working refrigerant charge, in kilograms

α = efficiency of refrigerant recovery (fractional)

E = energy consumption per year, in kilowatt hours

β = CO_2 emission per kWh generated, in kilograms

NOTES:

- 1 β will vary depending on the type of electricity generating system in use. β is low for hydro and nuclear power generation.
- 2 Where power is generated using fossil fuels the indirect warming ($n \times E \times \beta$) usually dominates.

1.3.13 Toxicity

Potential of a refrigerant to be harmful or lethal due to acute or chronic exposure by contact, inhalation or ingestion.

1.3.14 Zeotrope (non-azeotrope)

A mixture of volatile substances which changes in composition as it evaporates. As a consequence, the evaporating temperature changes as the more volatile component distils out of the less volatile component(s).