INTERNATIONAL STANDARD 817

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Organic refrigerants — Number designation

Fluides frigorigènes organiques — Désignation numérique

First edition — 1974-09-15

UDC 621.564 : 003.35

Ref. No. ISO 817-1974 (E)

Descriptors : refrigerants, classifying, designation, numbering.

Price based on 4 pages

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, Technical Committee ISO/TC 86 has reviewed ISO Recommendation R 817 and found it suitable for transformation. International Standard ISO 817 therefore replaces ISO Recommendation R 817-1968.

ISO Recommendation R 817 was approved by the Member Bodies of the following countries :

Argentina	Germany	Sweden
Australia	Greece	Switzerland
Belgium	Hungary	Thailand
Canada	Ireland	United Kingdom
Chile	Israel	U.S.A.
Czechoslovakia	Italy	U.S.S.R.
Denmark	Japan	Yugoslavia
Egypt, Arab Rep. of	New Zealand	
France	Poland	

No Member Body expressed disapproval of the Recommendation.

No Member Body disapproved the transformation of ISO/R 817 into an International Standard.

Printed in Switzerland

Organic refrigerants — Number designation

1 SCOPE AND FIELD OF APPLICATION

This International Standard establishes a simple system of referring to common organic refrigerants instead of using the chemical name, formula or trade name. Although the use of a number for each refrigerant covered is a concise and accurate way of designating the refrigerant, there is no intention of precluding the use of a chemical name or formula.

2 DEFINITIONS

2.1 refrigerant : As covered in this International Standard, the medium of heat transfer in a refrigerating system which absorbs heat on evaporating at a low temperature and a low pressure, and gives up heat on condensing at a higher temperature and pressure.

2.2 compound : A substance formed by the union of two or more elements in definite proportions by mass.

2.3 hydrocarbon : A compound containing only the elements hydrogen and carbon.

2.4 halocarbon : A halogenated hydrocarbon containing one or more of the following four halogens : fluorine, chlorine, bromine, and iodine.

2.5 isomer : One of a group of compounds having the same combination of elements, but arranged spatially in different ways.

2.6 mixture : A complex of two or more compounds which do not bear a fixed proportion to one another, and which, however thoroughly mixed together, retain a separate existence.

2.7 azeotrope : A mixture of refrigerants whose vapour and liquid phases have identical compositions at a given temperature.

3 CLASSIFICATION

Refrigerants are classified as indicated in the nomenclature given in the table. Other refrigerants will be added through subsequent revisions.

4 NUMBERING SYSTEM

4.1 An identifying number is assigned to each organic refrigerant within the scope of this International Standard.

The identifying numbers assigned to the hydrocarbons and halocarbons of the methane, ethane, propane, and cyclobutane series are such that the structure of the compounds may be deduced from the refrigerant numbers, and vice versa, without ambiguity. The rules of the fixed number systems are as follows :

4.1.1 The first digit on the right is the number of fluorine (F) atoms in the compound.

4.1.2 The second digit from the right is one more than the number of hydrogen (H) atoms in the compound.

4.1.3 The third digit from the right is one less than the number of carbon (C) atoms in the compound. When this digit is zero, it is omitted from the number.

4.1.4 The number of chlorine (Cl) atoms in the compound is found by substracting the sum of the fluorine (F) and hydrogen (H) atoms from the total number of atoms which can be connected to the carbon (C) atoms.

When only 1 carbon atom is present, the total number of attached atoms is 4. When 2 carbon atoms are present, the total number of attached atoms is 6, unless the compound is unsaturated; in this case, the total number of attached atoms is 4.

For saturated hydrocarbons, the total number of attached atoms is the following :

For 1 C, the total number of atoms is 4
For 2 C, the total number of atoms is 6
For 3 C, the total number of atoms is 8
For 4 C, the total number of atoms is 10, etc.
For n C, the total number of atoms is $2n + 2$.

For mono-unsaturated and cyclic saturated hydrocarbons, the total number of attached atoms is the following :

For 2 C, the total number of atoms is 4
For 3 C, the total number of atoms is 6
For 4 C, the total number of atoms is 8
For 5 C, the total number of atoms is 10, etc.
For n C, the total number of atoms is $2n$.

4.1.5 For cyclic derivatives the letter *C* is used before the identifying refrigerant number.

4.1.6 In those instances where bromine is present in place of part or all of the chlorine, the same rules apply except that the letter *B* after the designation for the parent chloro-fluoro compound shows the presence of bromine (Br). The number following the letter *B* shows the number of bromine atoms present.

4.1.7 In the case of isomers of the ethane series, each has the same number and the most symmetrical one is indicated by the number without any letter following it. As the isomers become more and more unsymmetrical, the letters a, b, c, etc., are appended. Symmetry is determined by adding the atomic masses of the groups of elements attached to each carbon atom and substracting one sum from the other. The smaller the difference, the more symmetrical the product.

4.1.8 In the case of the ethylene series, the above rules apply, except that the number 1 is used as the fourth digit from the right.

4.2 Mixtures are designated by their respective refrigerant numbers and mass proportions. Refrigerants are named in order of increasing boiling points. For example, a 90 % and 10 % mixture of refrigerants 22 and 12 will be indicated as R 22/12 (90/10), or R 22/R 12 (90/10), or Refrigerant 22/Refrigerant 12 (90/10).

4.3 Abritrary identifying numbers of the 500 series are assigned to azeotropes. Refrigerants should be named in increasing order of boiling points.

5 DESIGNATION

5.1 Form

5.1.1 The identifying number is preceded by the letter symbol "R" or used in combination with the word "Refrigerant" (or its equivalent translation), and shall be equally comprehensible in all cases.

The identifying number may also be preceded by the manufacturer's trademark or trade name.

Example : R 12, Refrigerant 12, or 12 Refrigerant,

(Trade name) R 12,

(Trade name) Refrigerant 12, or

(Trade name) 12 Refrigerant.

5.2 Use on nameplates and in textual matter

5.2.1 Designation of a refrigerant on a nameplate or in specifications shall be transcribed as R 12 or Refrigerant 12, R 22 or Refrigerant 22.

5.2.2 In text or manual writing, the following manner of expression is acceptable :

The compressor can be used with R 12 or R 22,

The compressor can be used with Refrigerants 12 or 22,

The compressor can be used with Refrigerant 12 or Refrigerant 22.

TABLE — **Organic refrigerant nomenclature**

Refrigerant numbering designation	Chemical name*	Chemical formula*	Molecular mass
Halocarbon compounds			
10	Carbon tetrachloride	CCl_4	153,8
11	Trichloro(mono)fluoromethane***	CCl_3F	137,4
12	Dichlorodifluoromethane	CCl_2F_2	120,9
13	(Mono)chlorotrifluoromethane***	$CClF_3$	104,5
13B1	(Mono)bromotrifluoromethane***	$CBrF_3$	148,9
14	Carbon tetrafluoride	CF_4	88,0
20	Chloroform	$CHCl_3$	119,4
21	Dichloromonofluoromethane	$CHCl_2F$	102,9
22	Monochlorodifluoromethane	$CHClF_2$	86,5
23	Trifluoromethane	CHF_3	70,0
30	Methylene chloride	CH_2Cl_2	84,9
31	Monochloromonofluoromethane	CH_2ClF	68,5
32	Methylene fluoride	CH_2F_2	52,0
40	Methyl chloride	CH_3Cl	50,5
41	Methyl fluoride	CH_3F	34,0
50	Methane**	CH_4	16,0
110	Hexachloroethane	CCl_3CCl_3	236,8
111	Pentachloro(mono)fluoroethane***	CCl_3CCl_2F	220,3
112	1,1,2,2-Tetrachlorodifluoroethane	CCl_2FCCl_2F	203,8
112a	1,1,1,2-Tetrachlorodifluoroethane	CCl_3CClF_2	203,8
113	1,1,2-Trichlorotrifluoroethane	CCl_2FCClF_2	187,4
113a	1,1,1-Trichlorotrifluoroethane	CCl_3CF_3	187,4
114	1,2-Dichlorotetrafluoroethane	$CClF_2CClF_2$	170,9
114a	1,1-Dichlorotetrafluoroethane	CCl_2FCF_3	170,9
114B2	1,2-Dibromotetrafluoroethane	$CBrF_2CBrF_2$	259,9
115	(Mono)chloropentafluoroethane***	$CClF_2CF_3$	154,5
116	Hexafluoroethane	CF_3CF_3	138,0
120	Pentachloroethane	$CHCl_2CCl_3$	202,3
123	2,2-Dichloro-1,1,1-trifluoroethane	$CHCl_2CF_3$	153
124	2-Chloro-1,1,1,2-tetrafluoroethane	$CHClFCF_3$	136,5
124a	1-Chloro-1,1,2,2-tetrafluoroethane	CHF_2CClF_2	136,5
125	Pentafluoroethane	CHF_2CF_3	120
133a	2-Chloro-1,1,1,-trifluoroethane	CH_2ClCF_3	118,5
140a	1,1,1-Trichloroethane	CH_3CCl_3	133,4
142b	1-Chloro-1,1-difluoroethane	CH_3CClF_2	100,5
143a	1,1,1-Trifluoroethane	CH_3CF_3	84
150a	1,1-Dichloroethane	CH_3CHCl_2	98,9
152a	1,1-Difluoroethane	CH_3CHF_2	66
160	Ethyl chloride (chloroethane)	CH_3CH_2Cl	64,5
170	Ethane**	CH_3CH_3	30
218	Octafluoropropane	$CF_3CF_2CF_3$	188
290	Propane**	$CH_3CH_2CH_3$	44

* This proposal is based on the systems used in the United States of America by *Chemical Abstracts*. Countries may use their own designations for chemical names or formulas.

** The compounds methane, ethane, and propane appear in the halocarbon section in their proper numerical positions, although these products are not halocarbons.

*** The use of *mono*, where enclosed by parentheses, is optional, since only one compound is possible based on the chemical name or formula.

TABLE — **Organic refrigerant nomenclature** (*concluded*)

Refrigerant numbering designation	Chemical name*	Chemical formula*	Molecular mass
Cyclic organic compounds			
C 316	1,2-Dichlorohexafluorocyclobutane	$C_4Cl_2F_2$	233
C 317	(Mono)chloroheptafluorocyclobutane***	C_4ClF_7	216,5
C 318	Octafluorocyclobutane	C_4F_8	200
Azeotropic mixtures (see 4.2)			
500	Refrigerants 12/152a 73,8/26,2 by mass %	CCl_2F_2/CH_3CHF_2	99,29
501	Refrigerants 22/12 75/25 by mass %	$CHClF_2/CCl_2F_2$	93,1
502	Refrigerants 22/115 48,8/51,2 by mass %	$CHClF_2/CClF_2CF_3$	112
Hydrocarbons			
50	Methane	CH_4	16,0
170	Ethane	CH_3CH_3	30
290	Propane	$CH_3CH_2CH_3$	44
600	*n*-Butane	$CH_3CH_2CH_2CH_3$	58,1
600a	*iso*Butane (2-methyl propane)	$CH(CH_3)_3$	58,1
1150	Ethylene**	$CH_2 = CH_2$	28,0
1270	Propylene**	$CH_3CH = CH_2$	42,1
Unsaturated organic compounds			
1112a	1,1-Dichlorodifluoroethylene	$CCl_2 = CF_2$	133
1113	(Mono)chlorotrifluoroethylene***	$CClF = CF_2$	116,5
1114	Tetrafluoroethylene	$CF_2 = CF_2$	100
1120	Trichloroethylene	$CHCl = CCl_2$	131,4
1130	1,2-Dichloroethylene	$CHCl = CHCl$	96,9
1132a	1,1-Difluoroethylene (vinylidene fluoride)	$CH_2 = CF_2$	64
1140	Vinyl chloride	$CH_2 = CHCl$	62,5
1141	Vinyl fluoride	$CH_2 = CHF$	46
1150	Ethylene	$CH_2 = CH_2$	28,0
1270	Propylene	$CH_3CH = CH_2$	42,1

* This proposal is based on the systems used in the United States of America by *Chemical Abstracts*. Countries may use their own designations for chemical names or formulas.

** The compounds ethylene and propylene appear in the hydrocarbon section in order to indicate that these compounds are hydrocarbons. Ethylene and propylene are properly identified under unsaturated organic compounds.

*** The use of *mono*, where enclosed by parentheses, is optional, since only one compound is possible based on the chemical name or formula.