

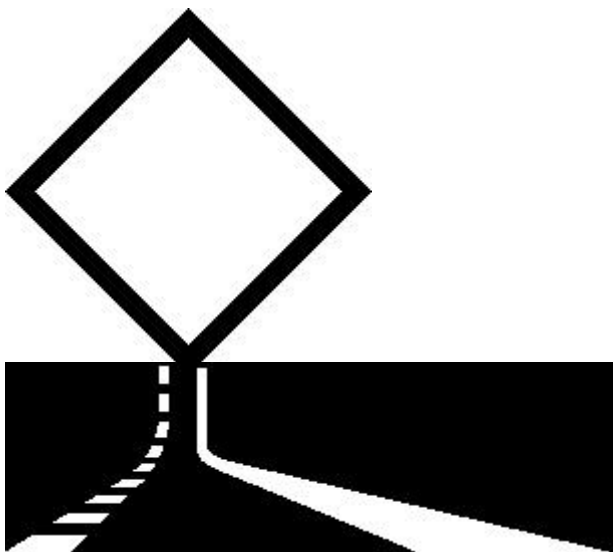
DG

**A Technical Publication
from the Co-ordination
and Information Centre**

Refrigerant Gases

November 2009

**Dangerous Goods
And Rail Safety**



**Government
of Alberta** ■
Transportation

This material is meant as a guide to certain parts of the Transportation of Dangerous Goods Regulations and is not meant to be a substitute for them. It is the responsibility of handlers, offerers and transporters of dangerous goods to consult the Regulations for the exact requirements. The Co-ordination and Information Centre of Alberta Transportation can provide accurate information regarding the Regulations 24 hours a day.

Co-ordination and Information Centre

**Alberta Transportation
Dangerous Goods and Rail Safety Branch
Main Floor, Twin Atria Building
4999 – 98 Avenue
Edmonton, Alberta, T6B 2X3**

**Tel. Edmonton: (780) 422 – 9600
Tel. Province-wide: 1 (800) 272 – 9600
Fax: (780) 427 – 1044**

These telephone lines are recorded to assist in responding to the emergency (natural/manmade) and/or inquiry regarding dangerous goods and to ensure that the information is accurate. Direct any questions regarding the recording to the Compliance Officer responding to your call or contact the Manager of the CIC at 780-427-8660. *Legal Authority: Dangerous Goods Transportation and Handling Act, Section 13(1).*

INTRODUCTION

Refrigerant gases are commercial gases that are used as a heat exchange material. Most of the early refrigerants which were toxic, corrosive, or flammable, have been replaced by chlorofluorocarbons, but even these have come under intense scrutiny in the 90's as suspected ozone destroyers. Some examples of early refrigerant gases/liquids are sulfur dioxide (SO₂) and ammonia (NH₃). Both are very noxious, irritating substances. They are no longer used in domestic refrigerators, though ammonia continues to be popular in large industrial applications.

The refrigeration industry has adopted a system of identifying refrigerant chemicals by assigning them "R" numbers. The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) created the system to help identify these gases without having to deal with their proper chemical names. However, the proper shipping name must be used when preparing a dangerous goods shipping document. Shipping names, classes and UN numbers for some common refrigerant gases can be found in Appendix 1.

EXEMPTIONS

Class 2, Gases, in Refrigerating Machines Exemption (Section 1.32)

This section of the Transportation and Dangerous Goods (TDG) Regulations provides an exemption from Part 3 (Documentation), Part 4 (Dangerous Goods Safety Marks), Part 5 (Means of Containment), Part 6 (Training), Part 7 (Emergency Response Assistance Plan), Part 8 (Accidental Release and Imminent Accidental Release Report Requirements), Part 9 (Road) and Part 10 (Rail) for UN2857, REFRIGERATION MACHINES, and refrigerating machine components, containing Class 2.2, Non-flammable, Non-toxic gases or UN2672, AMMONIA SOLUTIONS, if the quantity of gas has a mass that is less than or equal to 12 kg and the quantity of ammonia solutions is less than or equal to 12 L.

Refrigerating machines include air conditioning units and machines or other appliances designed for the specific purpose of keeping food or other items at a low temperature in an internal compartment.

150 kg Gross Mass Exemption (Section 1.15)

For some gases, this section provides a total exemption if all the requirements of the exemption are complied with.

Part 3 (Documentation), Part 4 (Dangerous Goods Safety Marks), Part 5 (Means of Containment), Part 6 (Training) and Part 8 (Accidental Release and Imminent Accidental Release Report Requirements) do not apply to the handling, offering for transport or transporting of dangerous goods on a road vehicle, a railway vehicle or a ship on a domestic voyage if:

- the dangerous goods are included in Class 2, Gases, and they are in one or more small means of containment in compliance with the requirements for transporting gases in Part 5, Means of Containment
- the gross mass of all dangerous goods
 - transported on the road vehicle or the railway vehicle is less than or equal to 150 kg, and
 - transported on the ship on a domestic voyage is less than or equal to 150 kg, excluding dangerous goods in a road vehicle or railway vehicle being transported on the ship.

This exemption does not apply to dangerous goods that:

- are in a quantity or concentration that requires an emergency response assistance plan;
- require a control or emergency temperature;
- are included in Class 2.1, Flammable Gases, and are in a cylinder with a capacity greater than 46 L;
- are included in Class 2.3, Toxic Gases;

500 kg Gross Mass Exemption (Section 1.16)

When refrigerant gases, solvents or propane torches are carried on refrigeration service vehicles or in a mixed load with other dangerous goods in small containers, this exemption might apply.

Part 3 (Documentation), Part 4 (Dangerous Goods Safety Marks) and Part 5 (Means of Containment) do not apply to the handling, offering for transport or transporting of dangerous goods on a road vehicle, a railway vehicle or a ship on a domestic voyage if:

- in the case of
 - dangerous goods included in Class 2, Gases, they are in one or more small means of containment in compliance with the requirements for transporting gases in Part 5, Means of Containment, or
- the gross mass of all dangerous goods
 - transported on the road vehicle or the railway vehicle is less than or equal to 500 kg, and
 - transported on the ship on a domestic voyage is less than or equal to 500 kg, excluding the dangerous goods in a road vehicle or railway vehicle being transported on the ship;

- each means of containment has displayed on one side, other than a side on which it is intended to rest or to be stacked during transport, the dangerous goods safety marks required by Part 4, Dangerous Goods Safety Marks.
- the dangerous goods are accompanied by a shipping document or document that is located, for a road or railway vehicle or a ship, in accordance with the requirements for location of a shipping document in sections 3.7 to 3.9 of Part 3, Documentation; and
- the shipping document or document referred to in paragraph (d) includes the following information in the following order:

the primary class of the dangerous goods, following the word “Class” or “Classe”, and

the total number of means of containment, on which a dangerous goods safety mark is required to be displayed, for each primary class, following the words “number of means of containment” or “nombre de contenants”.

For example,

Class 2.1, number of means of containment, 5

Class 2.2, number of means of containment, 10

The exemption does not apply to dangerous goods that:

- are in a quantity or concentration that requires an emergency response assistance plan;
- require a control or emergency temperature;
- are included in Class 2.1, Flammable Gases, and are in a cylinder with a capacity greater than 46 L;
- are included in Class 2.3, Toxic Gases;

DANGEROUS GOODS SHIPPING DOCUMENT

If the shipment of refrigerant gases does not fit into any of the above exemptions, a complete dangerous goods shipping document is required to accompany the shipment.

It is the responsibility of the consignor to prepare a shipping document when offering dangerous goods for transportation. The document is similar to a standard bill of lading but must contain information needed to describe the dangerous goods. The shipping document is handed over to the initial carrier and must accompany the consignment throughout its journey [Section 3.1]. The consignor and each carrier that transported shall retain a copy of the shipping document for a period of two years [Section 3.11].

The following table describes the minimum required information which must appear on a dangerous goods shipping document.

Shipping Document Information	When Required	Where in The Regulations
Date	Always	3.5(1)(b)
Name and address of consignor	Always	3.5(1)(a)
Description of goods in the following order		3.5(1)(c)
a. Shipping name	Always	3.5(1)(c)(i)
b. The technical name of the most dangerous substance related to the primary classification	If Provision 16 of Schedule 2 applies	3.5(1)(c)(i)(A)
c. The words "Not Odorized"	For liquefied petroleum gas that has not been odorized	3.5(1)(c)(i)(B)
d. Primary classification	Always	3.5(1)(c)(ii)
e. Subsidiary classifications	If Any	3.5(1)(c)(iv)
f. UN number	Always	3.5(1)(c)(v)
g. Packing group (none for compressed gases)	If Any	3.5(1)(c)(vi)
The quantity in the International System of Units (SI) ^{1, 2}	Always	3.5(1)(d)
The number of containers ²	For dangerous goods in small containers requiring safety labels	3.5(1)(e)
The words "24-Hour Number" followed by a telephone number where the consignor can be easily reached ³	Always	3.5(1)(f)
Emergency Response Assistance Plan (ERAP) number and telephone number to activate it	If Required	3.6(1)

1. If the quantity of dangerous goods is less than 10% of the container's capacity then the words "Residue – Last Contained" followed by the shipping name of the dangerous goods last contained in the means of containment may be used to describe the quantity. This does not apply to Class 2 gases in small containers [Section 3.5(4)].
2. If the quantity of dangerous goods or the number of small means of containment changes during transport, the carrier must show on the shipping document or on a document attached to the shipping document the change in the quantity of dangerous goods or the number of small containers [Section 3.5(5)].

3. A consignor can also use the telephone number of an agency that is competent to give the technical information on the shipment. For example, it is possible to use CANUTEC as a source of technical information provided that the consignor has received permission in writing from CANUTEC [Section 3.5(2)].

Location of Document During Transport

When a driver enters a power unit (for example, a tractor) he or she must place the shipping document in a pocket mounted on the driver's door, or within the driver's reach. If the driver leaves the power unit he or she must place the document in the door pocket, on the driver's seat or on a location visible to anyone entering the power unit through the driver's door [Section 3.7].

SAFETY MARKS

Safety marks are labels, placards, UN numbers and package markings. They are described in Part 4 of the TDG Regulations. The consignor is responsible for displaying safety marks on all means of containment carrying dangerous goods. The carrier is responsible for making sure that the safety marks remain displayed during transport. The carrier is also responsible for removing or changing the safety marks if the requirements for dangerous goods safety marks change during transport [Section 4.5(1)].

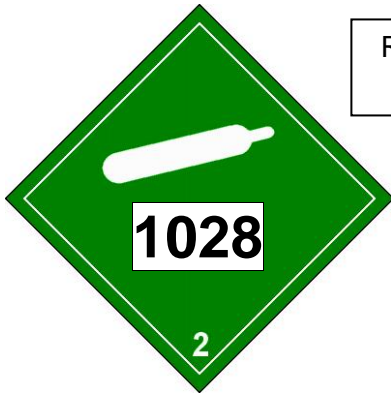
Small Means of Containment

A small means of containment has a capacity of 450 l or less. A small container must display the dangerous goods label(s), the shipping name and the UN number of the product [Sections 4.10 to 4.12]. The label is at least 100 mm on each side. If the container is too small or it has an irregular shape, the label can be reduced in size up to a dimension of 3.0 cm on each side [Section 4.7(2)]. If the label is reduced in size to 30 mm, the label may be displayed on a tag affixed to the means of containment [Section 4.10(4)]. If the label is displayed on a tag, the tag must also display the shipping name and UN number [Sections 4.11(3) and 4.12(2)].

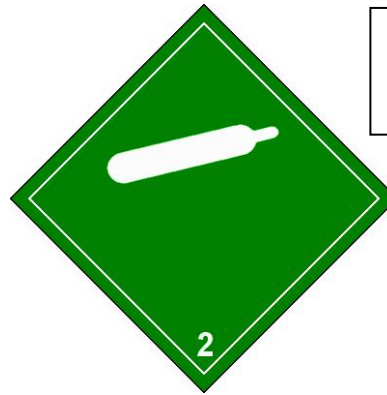
The UN number for a dangerous goods label can be placed inside the label or next to the label as shown below [Section 4.8(1)(b)]. If the UN number is inside the label the letters "UN" must be omitted.

Example of Safety Marks for a Small Means of Containment

In this case the product is REFRIGERANT GAS R12, Class 2.2



REFRIGERANT
GAS R12



UN 1028
REFRIGERANT
GAS R12

Class 2.2 label is green with a white cylinder symbol

Example of Safety Marks for a Small Means of Containment

In this case the product is , SULPHUR DIOXIDE, Class 2.3 (8)



SULPHUR
DIOXIDE



Class 2.3 label is white with a skull and crossbones symbol.
Class 8 label is black with a corrosive symbol on its top half.

Large Means of Containment

Placards representing the hazard class(es) of the dangerous goods being transported are placed on all four sides of a large means of containment (capacity greater than 450 l) or transport units.

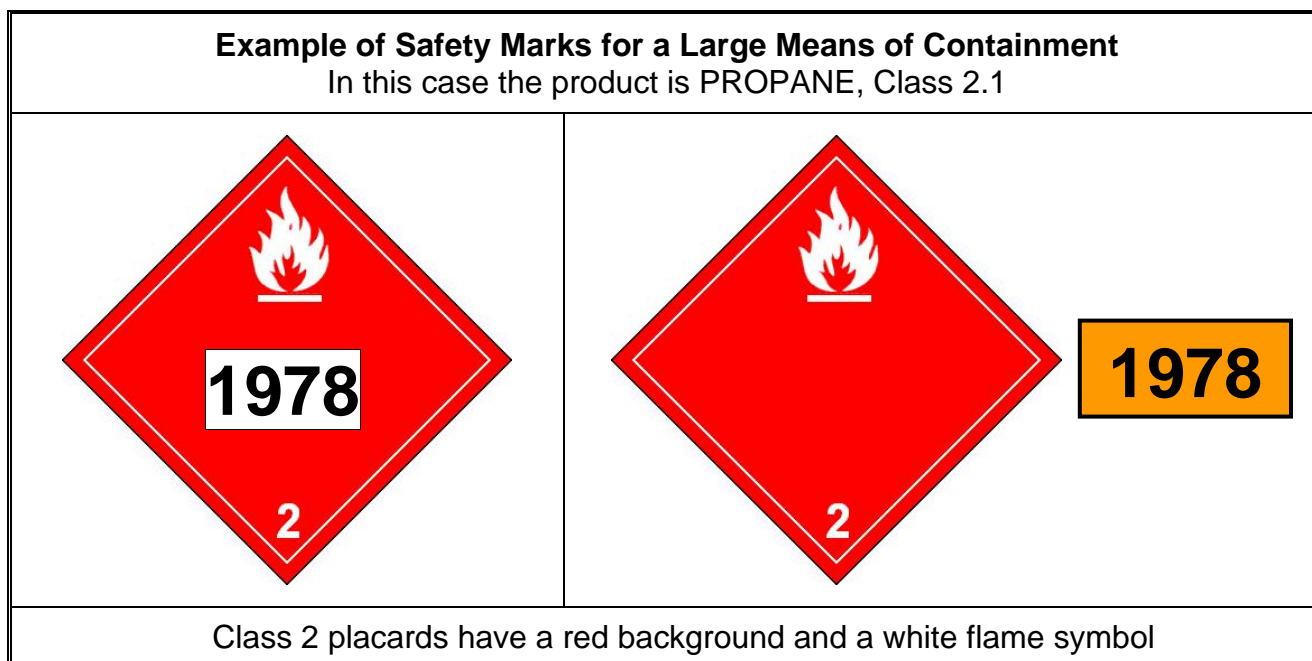
Each side of a placard must be at least 250 mm in length. Except for the DANGER placard, all placards have a line running 12.5mm inside the edge. If the large means of containment has an irregular shape or its size is too small, the placard can be reduced in size but the dimensions must never be less than 100 mm on each side [Section 4.7(3)].

Placards and UN numbers must be displayed in accordance with the table in Section 4.15 of the TDG Regulations if:

- the dangerous goods are in a quantity or concentration for which an Emergency Response Assistance Plan is Required;
- the dangerous goods are included in Class 7, Radioactive Materials, for which a Category III Yellow Label is required [Section 4.15(1)].
- the dangerous goods are a liquid or a gas in direct contact with the large means of containment;
- the dangerous goods have a total gross mass greater than 500 kg; or

Placards must be displayed on all four sides of a large means of containment; one on each side and one on each end. The placard can also be displayed on the frame for the means of transport or any other frame permanently attached to the large means of containment. A placard can also be placed at the front of a truck if the leading end of a highway tank is obstructed by the tractor [Section 4.15(3)].

The UN number of the dangerous goods being transported must be displayed inside the placard or on an orange panel next to the placard. The letters "UN" are always omitted [Section 4.8(2)].



Danger Placard

When gases are included in more than one division of Class 2, Gases, are transported together on the same road vehicle and the primary class placards or the UN numbers for those gases are required to be displayed by section 4.15, they may be replaced by the DANGER placard and the primary class placard of the most dangerous gas according to the following decreasing order and, if required by section 4.15, the UN number [Section 4.18]:

- Toxic Gas, Class 2.3;
- Flammable Gas, Class 2.1;
- Oxidizing Gas, Class 2.2 (5.1); and
- Any other Gas, Class 2.2

TRAINING

Unless there is an exemption under the TDG Regulations, anyone who handles, offers for transport or transports dangerous goods must have a valid Dangerous Goods Training Certificate or must be under the direct supervision of a trained person (Section 6.1).

The employer issues a training certificate when he/she has reasonable grounds to believe that an employee possesses adequate training. Self-employed people can issue training certificates for themselves. The employer must keep a record of the training that the employee has received and a copy of his/her training certificate (Section 6.6). The training certificate must be immediately presented to an inspector who requests for it (Section 6.8).

ACCIDENTAL RELEASE OF DANGEROUS GOODS

In case of an accidental release or imminent accidental release of dangerous goods of Class 2, the person who has possession of the dangerous goods must report this incident immediately. In the case of gases, an immediate report is required when the release involves **any quantity that could pose a danger to public safety or any sustained release of 10 minutes or more (Section 8.1) or if there is a possibility of an imminent accidental release.**

In Alberta, the report must be made to:

- the local police;
- Alberta Transportation, Dangerous Goods and Rail Safety Branch at 1-800-272-9600 (the provincial authority in Alberta);
- the person's employer;
- the consignor of the dangerous goods;
- the owner, lessee or charterer of the road vehicle involved; and
- for accidental release from a cylinder that has suffered a catastrophic failure, CANUTEC at (613) 996-6666.

For further information on accidental releases refer to the CIC bulletin entitled [Reporting an Accidental Release of Dangerous Goods](#).

APPENDIX 1

Table 1: Refrigerant Group I

Shipping Name	Class	PIN	"R" #
TRICHLOROFLUOROMETHANE	NR	-----	R-11
DICHLORODIFLUOROMETHANE; or REFRIGERANT GAS R 12	2.2	UN1028	R-12
CHLORODIFLUOROBROMOMETHANE; or REFRIGERANT GAS R 12B1	2.2	UN1974	R-12B1
CHLOROTRIFLUOROMETHANE; or REFRIGERANT GAS R 13	2.2	UN1022	R-13
BROMOTRIFLUOROMETHANE; or REFRIGERANT GAS R 13B1	2.2	UN1009	R-13B1
REFRIGERANT GAS R 14, COMPRESSED; or TETRAFLUOROMETHANE, COMPRESSED	2.2	UN1982	R-14
DICHLOROFLUOROMETHANE; or REFRIGERANT GAS R 21	2.2	UN1029	R-21
CHLORODIFLUOROMETHANE; or REFRIGERANT GAS R 22	2.2	UN1018	R-22
REFRIGERANT GAS R 23; or TRIFLUOROMETHANE	2.2	UN1984	R-23
TRICHLOROTRIFLUOROETHANE	NR	-----	R-113
1,2-DICHLORO-1,1,2,2-TETRAFLUOROETHANE; or REFRIGERANT GAS R 114	2.2	UN1958	R-114
CHLOROPENTAFLUOROETHANE; or REFRIGERANT GAS R 115	2.2	UN1020	R-115
HEXAFLUOROETHANE, COMPRESSED; or REFRIGERANT GAS R 116, COMPRESSED	2.2	UN2193	R-116
1-CHLORO-2,2,2-TRIFLUOROETHANE; or REFRIGERANT GAS R 133a	2.2	UN1983	R-133A
OCTAFLUOROCYCLOBUTANE; or REFRIGERANT GAS RC 318	2.2	UN1976	RC-318
DICHLORODIFLUOROMETHANE AND DIFLUOROETHANE AZEOTROPIC MIXTURE <i>with approximately 74 percent dichlorodifluoromethane; or REFRIGERANT GAS R 500</i>	2.2	UN2602	R-500
CHLORODIFLUOROMETHANE AND CHLOROPENTAFLUOROETHANE MIXTURE <i>with fixed boiling point, with approximately 40 percent chlorodifluoromethane; or REFRIGERANT GAS R 502</i>	2.2	UN1973	R-502
CHLORODIFLUOROMETHANE AND TRIFLUOROMETHANE AZEOTROPIC MIXTURE <i>with approximately 60 per cent chlorotrifluoromethane; or REFRIGERANT GAS R 503</i>	2.2	UN2599	R-503
CARBON DIOXIDE	2.2	UN1013	R-744
HEXAFLUOROPROPYLENE; or REFRIGERANT GAS R 1216	2.2	UN1858	R-1216

New Refrigerants

Shipping Name	Class	PIN	"R" #
DICHLOROTRIFLUOROETHANE	NR	-----	SUVA 123
1-CHLORO-1,2,2,2-TETRAFLUOROETHANE; or REFRIGERANT GAS R 124	2.2	UN1021	SUVA 124
REFRIGERANT GAS R 134a; or 1,1,1,2-TETRAFLUOROETHANE	2.2	UN3159	SUVA 134A
LIQUEFIED GAS N.O.S. (CHLORODIFLUOROMETHANE, CHLOROTETRAFLUOROETHANE AND DIFLUOROETHANE)	2.2	UN3163	SUVA MP39 or MP66
LIQUEFIED GAS N.O.S. (PENTAFLUOROETHANE, CHLORODIFLUOROMETHANE AND PROPANE)	2.2	UN3163	SUVA HP80 or HP81
LIQUEFIED GAS N.O.S. (PENTAFLUOROETHANE, TRIFLUOROETHANE AND TETRAFLUOROETHANE)	2.2	UN3163	SUVA HP62
LIQUEFIED GAS N.O.S. (DIFLUOROMETHANE, PENTAFLUOROETHANE AND TETRAFLUOROETHANE)	2.2	UN3163	SUVA 9000
LIQUEFIED GAS N.O.S. (DIFLUOROMETHANE AND PENTAFLUOROETHANE)	2.2	UN3163	SUVA 9100

Group I refrigerants are the least hazardous because they are not flammable or toxic, but these materials vaporize rapidly when spilled and can pose a significant hazard of asphyxiation if they are spilled in an enclosed space.

Table 2: Refrigerant Group II

Shipping Name	Class	PIN	"R" #
AMMONIA, ANHYDROUS	2.3 (8)	UN1005	R-717
1,2-DICHLOROETHYLENE	3	UN1150	R- 1130
1,1-DICHLOROETHYLENE; or REFRIGERANT GAS R 1132a	2.1	UN1959	R-1132A
METHYL CHLORIDE; or REFRIGERANT GAS R 40	2.1	UN1063	R-40
SULPHUR DIOXIDE	2.3(8)	UN1079	R-764

Group II refrigerants are toxic and somewhat flammable.

Table 3: Refrigerant Group III

Shipping Name	Class	PIN	“R” #
BUTANE	2.1	UN1011	R-600
ETHANE	2.1	UN1035	R-170
PROPANE	2.1	UN1978	R-290
REFRIGERANT GAS R 143a; or 1,1,1-TRIFLUOROETHANE	2.1	UN2035	R-143A
1,1-DIFLUOROETHANE; or REFRIGERANT GAS R 152a	2.1	UN1030	R-152A
VINYL CHLORIDE, STABILIZED	2.1	UN1086	R-1140
REFRIGERATING MACHINES, containing <i>flammable, non-toxic liquified gas</i>	2.1	UN3358	-----

Group III refrigerants are highly flammable gases or liquefied gases under pressure.

Table 4: Refrigerant Group IV

Shipping Name	Class	PIN	“R” #
REFRIGERANT GAS, N.O.S.	2.2	UN1078	-----
REFRIGERATING MACHINES, <i>containing non-flammable, non-toxic, liquefied gas or ammonia solutions (UN2672)</i>	2.2	UN2857	-----

Group IV refrigerants are mixtures of more than one gas.

Table 5: IATA Air Regulations

Shipping Name	CLASS	PIN
REFRIGERANT GAS, N.O.S.	2.2	UN1078
REFRIGERANT GAS R12	2.2	UN1028
REFRIGERANT GAS R12B1	2.2	UN1974
REFRIGERANT GAS R13	2.2	UN1022
REFRIGERANT GAS R13B1	2.2	UN1009
REFRIGERANT GAS R14	2.2	UN1982
REFRIGERANT GAS R 21	2.2	UN1029
REFRIGERANT GAS R 22	2.2	UN1018
REFRIGERANT GAS R 23	2.2	UN1984
REFRIGERANT GAS R 32	2.1	UN3252
REFRIGERANT GAS R 40	2.1	UN1063
REFRIGERANT GAS R 41	2.1	UN2454
REFRIGERANT GAS R 114	2.2	UN1958
REFRIGERANT GAS R 115	2.2	UN1020
REFRIGERANT GAS R 116	2.2	UN2193
REFRIGERANT GAS R 124	2.2	UN1021
REFRIGERANT GAS R 125	2.2	UN3220
REFRIGERANT GAS R 133a	2.2	UN1983
REFRIGERANT GAS R 134a	2.2	UN3159
REFRIGERANT GAS R 142b	2.1	UN2517
REFRIGERANT GAS R 143a	2.1	UN2035
REFRIGERANT GAS R 152a	2.1	UN1030
REFRIGERANT GAS R 161	2.1	UN2453
REFRIGERANT GAS R 218	2.2	UN2424
REFRIGERANT GAS R 227	2.2	UN3296
REFRIGERANT GAS R C318	2.2	UN1976
REFRIGERANT GAS R 404A	2.2	UN3337
REFRIGERANT GAS R 407A	2.2	UN3338
REFRIGERANT GAS R 407B	2.2	UN3339
REFRIGERANT GAS R 407C	2.2	UN3340
REFRIGERANT GAS R 500	2.2	UN2602
REFRIGERANT GAS R 502	2.2	UN1973
REFRIGERANT GAS R 503	2.2	UN2599
REFRIGERANT GAS R 1132a	2.1	UN1959
REFRIGERANT GAS R 1216	2.2	UN1858
REFRIGERANT GAS R 1318	2.2	UN2422
REFRIGERATING MACHINES, <i>containing flammable, non-toxic, liquefied gas</i>	2.1	UN3358
REFRIGERATING MACHINES, <i>containing non-flammable, non-toxic, liquefied gas or ammonia solution (UN2672);</i> REFRIGERATING MACHINES, <i>containing toxic liquefied gas or ammonia solution with more than 50% ammonia; or</i> REFRIGERATING MACHINES, <i>with less than 12 kg non-flammable, non-toxic, liquefied gas or containing less than 12 L ammonia solution with 35% or less ammonia</i>	2.2	UN2857