



FROGEN[®]

Refrigerants & Cooling Specialists

FROGEN[®]

is a **global leader**
in the supply of
environmentally
safer refrigerants.

Frogen has developed a broad line of premium refrigerant products to meet the needs of air conditioning and refrigeration professionals worldwide. Frogen refrigerants are one of the key substitutes for CFC's and HCFC's, providing a sustainable, environmentally safer, non-ozone depleting alternative that delivers comparable results in effectiveness as well as cost.

Frogen refrigeration specialists serve as long-term partners to client businesses, helping entities successfully make the transition to environmentally safer refrigeration and cooling products. The product line developed by Frogen ensures brand solutions for virtually every application in air conditioning and refrigeration, ranging from domestic to commercial and industrial uses.

Frogen products are developed under stringent quality control by our refrigerant specialists. We work with the world's leading equipment manufacturers and industry partners to ensure Frogen products

continue to surpass the highest effectiveness tests and safety standards, ensuring utmost reliability now and in the future.

Technical Expertise & Support

Reliability and after sale support is an important factor in refrigerant purchase. Frogen engineers and technicians provide support and share expertise with our clients, ensuring a smooth transition to Frogen powered refrigeration regardless of the size of the operation in question.

Retrofitting & Reclamation

Frogen can provide appropriate support in retrofitting existing systems to environmentally safer substitutes. Frogen encourages timely retrofitting to ensure smooth, sustainable, and economical long-term operation. In addition, Frogen encourages contractors and end-users to return used refrigerant for reclamation and eventual re-use.



Comfort Air Conditioning

Frogen Refrigerants are an essential substitute to ozone harming CFC's and HFC's in particular for home (comfort) Air conditioning systems. In existing systems most installations run on R-22 and do not require any conversion although the new systems are coming with Frogen blends like R407c. Due to the mandated phase out of CFC's and upcoming phase out of R22, Frogen R134a and Frogen Blends are used as replacements.



Vehicle Air Conditioning

Frogen R134a (HFC-134a) has been developed to serve as one of the key substitutes for CFC's and HCFC's. Frogen R134a is a long-term, environmentally safer, non-ozone depleting substitute. As a refrigerant, it possesses energy efficiency and has an intrinsically low toxicity. Frogen R134a is the alternative refrigerant of Choice in automobile air-conditioning and other Commercial applications.



Building Air Conditioning

Due to the mandated phase out plan of CFC's and upcoming phase out of R22, Frogen R134a and Blends are now being used as replacements. These refrigerants can be used effectively for new systems as well as retrofitted systems, providing safe and efficient cooling as well as value. For building Chiller applications HCFC-22, R 134 and other Frogen blends are used as Refrigerants.



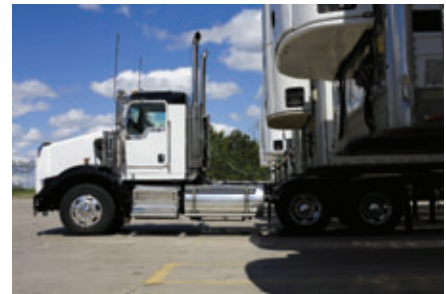
Domestic Refrigeration

For modern domestic refrigeration applications, Frogen R-134a is currently the preferred refrigerant for most manufacturers. In addition, Frogen offers a broad line of R-502 and R-22 replacement for low and medium-temperature refrigeration systems including Frogen R-507; an azeotropic HFC mixture of R-125 and R -143a. R-507 has been approved and is used worldwide in supermarkets and in industrial, food-service, and other applications.



Industrial Refrigeration

For Industrial and Commercial Refrigeration needs, Frogen has developed industry-grade Frogen R134a, Frogen R404A and Frogen R507. Frogen R134a is used primarily in medium temperature (> 35 deg F) applications such as cooling cases, vending machines, or ice cream servers. For lower temperature applications, we recommend Frogen R404A and Frogen R507 for efficient cooling in applications such as freezers, display cases and ice machines.



Transport Refrigeration

Commercial transport refrigeration produces unique challenges for the cooling professional. These applications require the use of a flexible, robust, and reliable refrigeration system able to operate in a wide variety of ambient conditions. For these applications, we recommend using Frogen R134a for medium temperature applications and Frogen R404A or Frogen R507 for lower temperature applications.

Product Guide

CFC

Trichlorotrifluoroethane
(C₂Cl₃F₃)

Used in low capacity centrifugal chiller packaged units. Operates with very low system pressures, high gas volumes.

HCFC

Dichlorotrifluoroethane
(CHCl₂CF₃)

A very low ozone depleting compound that serves as a replacement for CFC-11 in centrifugal chillers.

CFC

Trichlorotrifluoroethane
(CCl₃F)

Refrigerant for centrifugal chillers.

HFC

Pentafluoropropane
(CF₃CH₂CHF₂)

A non-ozone depleting candidate replacement for CFC-11 in centrifugal chillers.

CFC

Dichlorotrifluoroethane
(C₂Cl₂F₂)

Intermediate in pressure and displacement. Principally used with chillers for higher capacities or for lower evaporator temperature process type applications.

Selected Physical Data

Substitutes (See Legend Below)

	113	123	11	245fa	114
	R-113	R-123	R-11	R-245fa	R-114
Molecular Weight	187.4	152.9	137.4	134	170.9
Boiling Point @ 1 Atm, (°F)	117.7	82.1	74.7	58.8	38.5
Freezing Point @ 1 Atm, (°F)	-31	-160.6	-168	<-160	-137
Critical Temperature (°F)	417.31	362.63	388.33	309.29	294.22
Critical Pressure* (psia)	492.0	531.1	638.27	527.94	472.39
Saturated Liquid Density @ 86°F, (lb/ft ³)	96.8	90.6	91.4	82.7	89.8
Specific Heat of Liquid @ 86°F, (Btu/lb • °F)	0.22	0.25	0.21	0.32	0.24
Specific Heat of Vapor @ Constant Pressure* (Cp), @ 86°F and 1 Atm, (Btu/lb • °F)	0.16	0.15	0.13	0.20	0.16
Flammable range, %vol. in air (Based on ASHRAE Standard 34 with Match Ignition)	None	None	None	None	None
ANSI/ASHRAE Standard 34-1992 Safety Group Classification	A1	B1	A1	A1	A1

1 @ 0.2 Atm Pressure

Blend

Difluoromethane
Pentafluoroethane
Tetrafluoroethane
(CH₂F₂CF₃CHF₂CF₃CH₂F)

A long-term, non-ozone-depleting replacement for HCFC-22 in various air-conditioning applications, as well as in positive displacement refrigeration systems.

Blend

Pentafluoroethane
Trifluoroethane
Chlorodifluoromethane
(CF₃CHF₂CF₃CH₂CHClF₂)

An interim replacement for retrofitting low- and medium-temperature commercial refrigeration systems.

Azeotrope

Chlorodifluoromethane
Chloropentafluoroethane
(CHClF₂CClF₂CF₃)

An azeotropic mixture used in low- and medium-temperature refrigeration applications.

Blend

Pentafluoroethane
Trifluoroethane
Tetrafluoroethane
(CF₃CHF₂CF₃CH₂CF₃CH₂F)

A long-term, non-ozone-depleting replacement for R-502 in low- and medium-temperature commercial refrigeration systems.

Blend

Chlorodifluoromethane
Pentafluoroethane
Propane
(CHClF₂CF₃CHF₂C₃H₈)

An interim replacement for R-502 used mainly for ice machines and soft ice cream machines.

Selected Physical Data

Substitutes (See Legend Above)

	407C	408A	502	404A	402B
	R-407C	R-408A	R-502	R-404A	R-402B
Molecular Weight	86.2	87.7	111.6	97.6	94.7
Boiling Point @ 1 Atm, (°F)	-46.5↔	-48.2↔	-49.3	-51.2↔	-52.6↔
Freezing Point @ 1Atm, (°F)	-256	—	—	—	—
Critical Temperature* (°F)	186.86	181.65	176.28	161.68	181.2
Critical Pressure* (psia)	671.49	622.87	568.2	540.82	654.87
Saturated Liquid Density @ 86°F, (lb/ft ³)	69.6	64.8	74.4	63.6	70.4
Specific Heat of Liquid @ 86°F (Btu/lb • °F)	0.38	0.36	0.29	0.38	0.33
Specific Heat of Vapor @ Constant Pressure* (Cp), @ 86°F and 1 Atm, (Btu/lb•°F)	0.18	0.17	0.15	0.19	0.15
Flammable range, (Based on ASHRAE Standard 34 with Match Ignition)††	None	None	None	None	None
ANSI/ASHRAE Standard 34-1992 Safety Group Classification	A1	A1	A1	A1	A1

* NIST REFPROP 7, unless noted otherwise

↔ Bubble point temperature.

† Upper and lower vapor flammability (Vol.%).

†† ASTM E681-85 match ignition ambient conditions.

††† N.C. Not Classified.

Ω @ -30°F.

Contains HFC-32/
HFC-125/HFC-134a.

Contains HFC-125/
HFC-143a/HCFC-22

Contains HCFC-22/
CFC-115

Contains HFC-125/
HFC-143a/HFC-134a.

Contains HCFC-22/
HFC-125/HC-290

HCFC

Chlorotetrafluoroethane
(CHClF₂)

A medium pressure refrigerant for chiller applications.

HFC

Tetrafluoroethane
(CF₃CH₂F)

Replaces CFC-12 in auto air conditioning and in residential, commercial and industrial refrigeration systems.

CFC

Dichlorodifluoromethane
(CCl₂F₂)

A widely used refrigerant in reciprocating and rotary type equipment and in some centrifugal designs.

Blend

Chlorodifluoromethane
Difluoroethane
Chlorotetrafluoroethane
(CHClF₂/CHF₂/CF₃CHClF₂)

An interim replacement for CFC-12 in medium-temperature commercial refrigeration systems.

Azeotrope

Dichlorodifluoromethane
Difluoroethane
(CCl₂F₂/CHF₂/CH₂)

An azeotropic mixture which has slightly higher vapor pressures and provides higher capacities from the same compressor displacement.

Blend

Chlorodifluoromethane
Difluoroethane
Chlorotetrafluoroethane
(CHClF₂/CHF₂/CF₃CHClF₂)

An interim replacement for CFC-12 in low-temperature commercial refrigeration systems.

Blend

Chlorodifluoromethane
Chlorotetrafluoroethane
Chlorodifluoroethane
(CHClF₂/CHClF₂/CF₃CHClF₂)

An interim replacement for CFC-12 in refrigeration systems.

HCFC

Chlorodifluoromethane
(CHClF₂)

As a refrigerant, operates with higher system pressures but low compressor displacement. Popular in residential, commercial and industrial applications.

124



R-124

136.5

-326.0

525.66

0.27

None

134a



R-134a

102.0

-141.9

588.75

0.35

None

12



R-12

120.9

-252

599.89

0.24

None

401A



R-401A

94.4

—

668.3

0.31

None

Contains HCFC-22/
HFC-152a/HCFC-124.

500



R-500

99.3

-254

604.6

0.30

None

Contains CFC-12/
HFC-152a.

401B



R-401B

92.9

—

681.66

0.31

None

Contains HCFC-22/
HFC-152a/HCFC-124.

409A



R-409A

97.4

—

682.66

0.30

None

Contains HCFC-22/
HCFC-124/ HCFC-142b.

22



R-22

86.5

-256

723.74

0.31

None

Azeotrope

Pentafluoroethane
Trifluoroethane
(CF₃CHF₂/CF₃CH₃)

A non-ozone depleting azeotropic mixture of HFC-125 and HFC-143a. It has been primarily designed to replace R-502 in low- and medium-temperature commercial refrigeration applications such as supermarket display cases and ice machines.

Blend

Chlorodifluoromethane
Pentafluoroethane
Propane
(CHClF₂/CF₃CHF₂/C₃H₈)

An interim replacement for retrofitting low- and medium-temperature commercial refrigeration systems.

Azeotropic Mixture

Difluoromethane
Pentafluoroethane
(CH₂F₂/CF₃CHF₂)

Widely accepted to replace HCFC-22 in air conditioning and refrigeration applications.

CFC

Chlorotrifluoromethane
(CClF₃)

A specialty low temperature refrigerant used in the low stage of cascade systems to provide evaporator temperatures in the range of -75°C.

HFC

Trifluoromethane
(CHF₃)

A specialty low temperature refrigerant that may be used to replace CFC-13 and R-503 in the low stage of cascade systems.

Azeotrope

Trifluoromethane
Chlorotrifluoromethane
(CHF₃/CClF₃)

An azeotropic mixture which is used in the low stage of cascade type systems where it provides gains in compressor capacity and in low temperature capability.

Azeotrope

Trifluoromethane
Hexafluoroethane
(CHF₃/C₂F₆)

A non-ozone depleting azeotrope of HFC-23 and FC-116 used to replace CFC-13 and R-503 in the low stage of cascade systems.

507



98.9

-178

537.37

0.38

None

Contains HFC-125/HFC-143a.

402B



101.6

-153

611.97

0.34

None

Contains HCFC-22/
HFC-125/HC-290.

410A



72.6

-247

711.07

0.42

None

Contains HFC-32/HFC-125.

13



104.5

-294

562.6

0.24 Ω

None

None

23



70.0

-247

700.82

0.34 Ω

None

None

503



87.5

—

620.83

0.29 Ω

None

Contains HFC-23/CFC-13.

508B



95.4

—

549.54

0.30 Ω

None

Contains HFC-23/FC-116.

