

# FRCGEN®

# 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.



# 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.



# 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.



# 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 (C<sub>2</sub>Cl<sub>3</sub>F<sub>3</sub>)

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

**HCFC** Dichlorotrifluoroethane (CHCl,CF3)

compound that serves as a replacement for CFC-11 in centrifugal chillers.

chillers.

Trichlorotrifluoroethane (CCl<sub>3</sub>F) Refrigerant for centrifugal

**HFC** Pentafluoropropane (CF<sub>3</sub>CH<sub>2</sub>CHF<sub>2</sub>)

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

**CFC** Dichlorotrifluoroethane  $(C_2Cl_2F_4)$ 

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

### Selected Physical Data

Molecular Weight
Boiling Point @ 1 Atm, (°F)
Freezing Point @ 1 Atm, (°F)
Critical Temperature (°F)
Critical Pressure* (psia)
Saturated Liquid Density @ 86°F, (lb/ft3)
Specific Heat of Liquid @ 86°F, (Btu/lb •°F)
Specific Heat of Vapor @ Constant Pressure* (Cp), @ 86°F and 1 Atm, (Btu/lb •°F)
Flammable range, %vol. in air (Based on ASHRAE Standard 34 with Match Ignition)
ANSI/ASHRAE Standard 34-1992 Safety Group Classification

113

123

245fa

114

Substitutes (See Legend Below)					
	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 <b>.</b> 8	38.5
Freezing Point @ 1 Atm, (°F)	-31	-160.6	<del>-</del> 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/ft3)	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

<sup>1 @ 0.2</sup> Atm Pressure

#### **Blend**

Difluoromethane Pentafluoroethane Tetrafluoroethane (CH<sub>2</sub>F<sub>2</sub>/CF<sub>3</sub>CHF<sub>2</sub>/CF<sub>3</sub>CH<sub>2</sub>F)

A long-term, non-ozonedepleting replacement for HCFC-22 in various airconditioning applications. as well as in positive displacement refrigeration systems.

407C

Contains HFC-32/

HFC-125/HFC-134a.

#### Blend

Pentafluoroethane Trifluoroethane Chlorodifluoromethane (CF<sub>3</sub>CHF<sub>2</sub>/CF<sub>3</sub>CH<sub>3</sub>/CHCIF<sub>2</sub>)

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

408A

R-408A

-48 2**→** 

181.65

622.87

64.8

0.36

0.17

None

Contains HFC-125/

HFC-143a/HCFC-22

Α1

### Azeotrope

Chlorodifluoromethane Chloropentafluoroethane (CHCIF<sub>2</sub>/CCIF<sub>2</sub>CF<sub>3</sub>) An azeotropic mixture used in

502

R-502

111.6

-49.3

176.28

568.2

74.4

0.29

0.15

None

CFC-115

Contains HCFC-22/

Α1

low- and medium-temperature refrigeration applications.

#### Blend

Pentafluoroethane Trifluoroethane Tetrafluoroethane

(CF<sub>3</sub>CHF<sub>2</sub>/CF<sub>3</sub>CH<sub>3</sub>/CF<sub>3</sub>CH<sub>2</sub>F) A long-term, non-ozone depleting replacement for R-502 in low- and mediumtemperature commercial efrigeration systems.

404A

R-404A

-51.2**→** 

161.68

540.82

63.6

0.38

0.19

None

Contains HFC-125/

HFC-143a/HFC-134a.

Α1

97.6

#### Blend

Chlorodifluoromethane Pentafluoroethane Propane

(CHCIF<sub>2</sub>/CF<sub>3</sub>CHF<sub>2</sub>/C<sub>3</sub>H<sub>8</sub>) An interim replacement for

R-502 used mainly for ice machines and soft ice cream machines

402B

R-402B

-52.6→

181.2

654.87

70.4

0.33

0.15

None

Contains HCFC-22/

HFC-125/HC-290

Α1

94.7

### Selected Physical Data

Substitutes (See Legend Above)	
ASHRAE Number	R-407C
Molecular Weight	86.2
Boiling Point @ 1 Atm, (°F)	-46.5→
Freezing Point @ 1Atm, (°F)	-256
Critical Temperature* (°F)	186.86
Critical Pressure* (psia)	671.49
Saturated Liquid Density @ 86°F, (lb/ft3)	69.6
Specific Heat of Liquid @ 86°F (Btu/lb• °F)	0.38
Specific Heat of Vapor @ Constant Pressure* (Cp), @ 86°F and 1 Atm, (Btu/lb•°F)	0.18
Flammable range, (Based on ASHRAE Standard 34 with Match Ignition)††	None
ANSI/ASHRAE Standard 34-1992 Safety Group Classification	A1

- → Bubble point temperature.
- † Upper and lower vapor flammability (Vol.%).
- ttt N.C. Not Classified.
- \* NIST REFPROP 7, unless noted otherwise
- †† ASTM E681-85 match ignition ambient conditions.
- Ω @ -30°F.

Chlorotetrafluoroethane (CHCIFCF<sub>3</sub>)

A medium pressure refrigerant for chiller applications.

Tetrafluoroethane (CF<sub>3</sub>CH<sub>2</sub>F)

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

**CFC** 

Dichlorodifluoromethane (CCI<sub>2</sub>F<sub>2</sub>) A widely used refrigerant in

reciprocating and rotary type equipment and in some centrifugal designs.

Blend

Chlorodifluoromethane Difluoroethane Chlorotetrafluoroethane (CHCIF<sub>2</sub>/CHF<sub>2</sub>CH<sub>3</sub>/CHCIFCF<sub>3</sub>) An interim replacement for

CFC-12 in mediumtemperature commercial refrigeration systems.

Azeotrope

Dichlorodifluoromethane Difluoroethane (CCI<sub>2</sub>F<sub>2</sub>/CHF<sub>2</sub>CH<sub>3</sub>)

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

Blend

Chlorodifluoromethane Difluoroethane Chlorotetrafluoroethane (CHCIF<sub>2</sub>/CHF<sub>2</sub>CH<sub>3</sub>/CHCIFCF<sub>3</sub>) An interim replacement for

CFC-12 in low-temperature commercial refrigeration systems.

Blend

Chlorodifluoromethane Chlorotetrafluoroethane Chlorodifluoroethane (CHCIF<sub>2</sub>/CHCIFCF<sub>3</sub>/CCIF<sub>2</sub>CH<sub>3</sub>

. An interim replacement for CFC-12 in refrigeration systems.

**HCFC** 

Chlorodifluoromethane (CHCIF<sub>2</sub>)

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

<b>124</b>	134a	12	401A	<b>500</b>	401B	409A	22
R-124	R-134a	R-12	R-401A	R-500	R-401B	R-409A	R-22
136.5	102.0	120.9	94.4	99.3	92.9	97.4	86.5
-326.0	-141.9	-252	_	-254	_	_	-256
525.66	588.75	599.89	668.3	604.6	681.66	682.66	723.74
0.27	0.35	0.24	0.31	0.30	0.31	0.30	0.31
None	None	None	None	None	None	None	None

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

Contains CFC-12/ HFC-152a.

Contains HCFC-22/ HFC-152a/HCFC-124. Contains HCFC-22/ HCFC-124/ HCFC-142b.

Azeotrope Pentafluoroethane Trifluoroethane

(CF<sub>3</sub>CHF<sub>2</sub>/CF<sub>3</sub>CH<sub>3</sub>) A non-ozone depleting azentropic mixture of HFC-125 and HFC-143a. It has been primarily designed to replace R-502 in low- and mediumtemperature commercial refrigeration applications such as supermarket display cases and ice machines.

Blend

Chlorodifluoromethane Pentafluoroethane (CHCIF<sub>2</sub>/CF<sub>3</sub>CHF<sub>2</sub>/C<sub>3</sub>H<sub>8</sub>)

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

**Azeotropic Mixture** 

Difluoromethane Pentafluoroethane (CH<sub>2</sub>F<sub>2</sub>/CF<sub>3</sub>CHF<sub>2</sub>)

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

**CFC** 

Chlorotrifluoromethane (CCIF<sub>3</sub>)

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

**HFC** 

Trifluoromethane (CHF<sub>3</sub>)

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

Azeotrope

Trifluoromethane Chlorotrifluoromethane (CHF<sub>3</sub>/CCIF<sub>3</sub>)

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 (CHF<sub>3</sub>/C<sub>2</sub>F<sub>6</sub>)

of cascade systems

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

507

None

None

**503** 

508B

98.9 101.6 72.6 104.5 70.0 87.5 95.4 -178 -153 -247 -294 -247 549.54 537.37 611.97 711.07 562.6 700.82 620.83 0.42 0.38 0.34  $0.24 \Omega$  $0.34 \Omega$  $0.29 \Omega$  $0.30 \Omega$ 

Contains HFC-125/HFC-143a.

None

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

None

Contains HFC-32/HFC-125

None

Contains HFC-23/CFC-13. Contains HFC-23/FC-116.

None

None

# **Vapor Pressures**

Temp °F	124	134a	12	Bubble (liq) 401A	(vap)	500	Bubble (liq) 401B	Dew (vap) 401B	Bubble (liq) 409A	Dew (vap) 409A	22	Bubble (liq) 407C	(vap) 407C	Bubble (liq) 408A	Power (vap) 408A	502	Bubble (liq) 404A	Dew (vap) 404A	Bubble (liq) 402B	Dew (vap) 402B	507A	Bubble (liq) 402 A	Dew (vap) 402 A	410A
-40	22.1 *	14.8	* 11.0		* 13.8	* 7.6	* 6.7	* 12.4		* 14.8	* 0.6	2.7	4.6	* 3.5	3.1	3.7	4.9	4.3	5.6	3.7	5.4	7.4	5.7	10.7
-35	20.9 *	12.5	* 8.4	* 5.3	* 11.4	* 4.5	* 3.4	* 9.7	* 3.5	* 12.5	* 2.6	5.1	0.9	* 5.8	5.5	6.1	7.5	6.8	8.2	6.2	8.1	10.2	8.4	14.0
-30	19.4 *	9.8	* 5.5	* 2.0	* 8.7	* 1.1	* 0.1	6.8	* 0.0	9.9	* 4.9	7.7	1.6	8.5	8.0	8.7	10.3	9.6	11.1	8.9	11.0	13.3	11.4	17.7
-25	17.8 *	6.9	* 2.4	* 0.8	5.6	* 1.3	2.0	3.5	* 1.9	7.0	* 7.4	10.6	3.9	11.3	10.9	11.6	13.4	12.7	14.2	11.9	14.1	16.7	14.6	21.8
-20	16.0 *	3.7	* 0.5	2.9	2.2	* 3.3	4.1	0.1	4.0	3.8	* 10.2	13.7	6.5	14.5	14.0	14.7	16.8	16.0	17.6	15.1	17.6	20.4	18.2	26.2
-15	14.0 *	0.1 '	* 2.4	5.1	0.7	5.5	6.5	2.0	6.3	0.2	* 13.2	17.2	9.3	17.9	17.4	18.2	20.5	19.7	21.4	18.7	21.4	24.5	22.0	31.0
-10	11.8 *	1.9	4.5	7.5	2.8	7.9	9.1	4.2	8.8	1.8	16.5	20.9	12.3	21.7	21.1	21.9	24.6	23.6	25.4	22.6	25.5	28.8	26.3	36.3
-5	9.3 *	4.1	6.7	10.1	5.0	10.6	11.9	6.6	11.6	4.0	20.1	25.0	15.7	25.7	25.1	25.9	28.9	27.9	29.8	26.8	30.0	33.6	30.8	42.0
0	6.6 *	6.5	9.1	13.0	7.4	13.4	14.9	9.2	14.6	6.3	24.0	29.5	19.4	30.1	29.5	30.2	33.7	32.6	34.6	31.4	34.8	38.7	35.8	48.2
5	3.6 *		11.7	16.1	10.1	16.5	18.2	12.1	17.8	8.8	28.3	34.3	23.5	34.9	34.2	34.9	38.8	37.7	39.8	36.3	40.0		41.2	
10	0.3 *	11.9	14.6	19.5	13.0	19.9	21.8	15.2	21.3	11.6	32.8	39.5	27.9	40.0	39.3	40.0	44.3	43.1	45.3	41.6	45.7	50.1	46.9	62.2
15	1.6	15.0	17.7	23.1	16.2	23.5	25.7	18.6	25.1	14.7	37.8	45.2	32.7	45.5	44.8	45.4	50.2	49.0	51.3	47.4	51.7	56.5	53.2	70.0
20	3.6	18.4	21.0	27.1	19.6	27.4	29.9	22.3	29.2	18.0	43.1	51.2	37.9	51.5	50.7	51.2	56.6	55.3	57.6	53.6	58.2	63.4	59.8	78.4
25	5.7	22.1	24.6	31.4	23.4	31.7	34.4	26.3	33.6	21.6	48.8	57.7	43.5	57.8	57.0	57.5	63.4	62.1	64.5	60.2	65.2	70.7	67.0	87.4
30	8.0	26.1	28.4	36.0	27.4	36.2	39.3	30.6	38.4	25.5	55.0	64.7	49.6	64.6	63.7	64.2	70.7	69.3	71.8	67.3	72.7		74.7	
35	10.5	30.4	32.5	40.9	31.8	41.0	44.5	35.2	43.4	29.7	61.5	72.2	56.1	71.9	71.0	71.3	78.6	77.1	79.6	74.9	80.7		82.9	
40	13.2	35.0	36.9	46.2	36.5	46.2	50.1	40.2	48.9	34.2	68.6	80.2	63.2	79.7	78.7	78.9	86.9	85.4	88.0	83.1	89.2		91.6	
45	16.1	40.1	41.6	51.8	41.6	51.8	56.0	45.6	54.7	39.1	76.1	88.8	70.7	88.0	87.0	87.0	95.8	94.2	96.9	91.7		105.3		
50	19.3	45.4	46.6	57.9	47.0	57.7	62.4	51.4	60.9	44.3	84.1	97.9	78.8	96.8	95.7				106.3					
55	22.7	51.2	51.9	64.3	52.8	64.0	69.2	57.5	67.5	49.9	92.6	107.6							116.3					
60 65	26.3	57.4 64.0	57.6 63.7	71.2 78.5	59.0 65.7	70.7 77.8	76.5 84.2	64.1 71.2	74.5 81.9	55.9 62.3	101.6	117.9 128.9							127.0 138.2					
70	34.4	71.1	70.1	86.3	72.8	85.4	92.3	78.7	89.8										150.2					
75	38.9	78.7	76.8	94.5	80.3		101.0	86.7	98.2										162.7					
80	43.7	86.7		103.2					107.0			165.8												
85	48.8	95.2		112.4		110.8						179.6												
90	54.3											194.1												
95												209.4												
100												225.5												
105												242.4												
110	79.6	146.4	136.1	166.8	147.8	163.5	176.9	158.0	171.2	141.8	226.4	260.3	229.0	252.3	250.7	246.3	272.5	270.4	271.6	264.1	278.6	291.62	285.6	365.4
115												279.0												
120												298.6												
125												319.2												
130	111.3	198.7	180.5	221.2	199.7	216.2	233.9	212.6	225.8	192.2	296.9	340.7	306.6	329.2	327.4	320.2	355.6	353.5	352.7	344.7	363.5	378.1	372.0	476.8
135	120.4 2	213.6	193.0	236.5	214.5	231.0	250.0	228.1	241.1	206.5	316.7	363.3	328.8	350.7	349.0	340.9	379.1	377.0	375.4	367.4	387.5	402.4	396.4	508.3
140	129.9 2	229.2	206.0	252.5	229.9	246.5	266.7	244.3	257.1	221.5	337.4	387.0	352.1	373.3	371.5	362.6	403.7	401.7	399.2	391.2	412.7	427.8	121.9	541.4
145	139.9 2	245.7	219.7	269.3	246.2	262.7	284.3	261.4	273.8	237.3	359.0	411.7	376.6	397.0	395.2	385.3	429.6	427.7	424.0	416.1	439.2	454.4	148.7	576.3
150	150.4 2	262.9	233.9	286.8	263.2	279.7	302.6	279.3	291.2	253.9	381.7	437.5	402.5	421.7	419.9	409.0	456.8	455.1	450.0	442.2	467.2	482.3	176.9	613.0

### **High Boiling Temperature**

TEMP					
°F	113	123	11	245fa	114
35	25.1	* 19.5 *	17.2 *	12.9 *	2.1 *
40	24.4	* 18.2 *	15.6 *	10.6 *	0.5
45	23.7	* 16.6 *	13.9 *	8.1 *	2.1
50	22.9	* 15.0 '	12.0 *	5.4 *	4.0
55	21.9	* 13.2 *	9.9 *	2.5 *	5.9
60	20.9	* 11.2 *	7.7 *	0.4	8.0
65	19.8	* 9.0 '	5.3 *	2.1	10.3
70	18.6	* 6.6	2.7 *	4.0	12.7
75	17.3	* 4.0 '	0.1	6.1	15.3
80	15.8	* 1.2 '	1.6	8.3	18.1
85	14.2	* 0.9	3.2	10.8	21.1
90	12.5	* 2.5	5	13.4	24.3
95	10.6	* 4.2	6.9	16.2	27.7
100	8.6	* 6.1	8.9	19.2	31.3
110	4.0	* 10.3	13.4	26.0	39.3
120	0.6	15.1	18.5	33.7	48.2
130	3.6	20.6	24.2	42.5	58.2

### **Low Boiling Temperature**

TEMP				
°F	13	23	503	508B
-120	4.5	* 4.0	* 3	2.6
-110	2.1	2.9	9	8.7
-100	7.6	9.0	16.5	16.2
-95	10.8	12.6	20.9	20.6
-90	14.3	16.7	25.7	25.4
-85	18.1	21.2	31.1	30.8
-80	22.4	26.2	36.9	36.7
-75	27.0	31.7	43.3	43.1
-70	32.1	37.7	50.3	50.1
-65	37.6	44.4	57.8	57.8
-60	43.6	51.7	66.1	66.1
-55	50.1	59.6	75.0	75.1
-50	57.1	68.2	84.6	84.9
-45	64.7	77.6	94.9	95.4
-40	72.9	87.8	106.1	106.7
-35	81.6	98.8	118.0	118.9
-30	91.0	110.6	130.9	132.0
-25	101.0	123.3	144.6	146.0
-20	111.7	137.0	159.2	161.0



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