



ATOFINA



PREPARING *for* R-22 PHASEOUT

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Forane®

The Past, Present, and Future R-410A and R-407C

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Refrigerants

Production of R-22 is scheduled to be phased out for air conditioning and refrigeration applications by 2020. ATOFINA Chemicals, Inc. is committed to helping the industry through this transition. The following information will help the users of R-22 understand the choices for retrofit and replacement through the short and long term. As always, questions and concerns with these products can be directed to technical experts at ATOFINA Chemicals, Inc.

The Past

In the past, R-22 (chlorodifluoromethane) has provided the refrigeration and air conditioning industry with a reliable and efficient refrigerating fluid. Its thermodynamic properties are suited to most air conditioning and some refrigeration applications. It is also completely non-flammable and non-toxic.

PROPERTIES	Forane 22
Appearance	Colorless, liquified gas
Odor	Faint, ether-like odor
Molecular Mass (g/mole)	86.5
Boiling Point at 1 atm	-41.3°F
Flammable Limits (LFL, UFL), vol% (1 atm, 25°C)	NA/NA
Density of Saturated Vapor at bp, lb/ft ³	0.29
Ozone Depletion Potential (ODP) (CFC-11 = 1.0)	0.05
Global Warming Potential (GWP) (CO ₂ = 1.0)	1,700

The Present

Due to regulations imposed by the Montreal Protocol, production and use of R-22 for air conditioning and refrigeration applications will gradually be phased out. The phase-out schedule which is currently in place is the following.

2010

R-22 is scheduled for phaseout in all new equipment by 2010. This means that all original equipment manufacturers must begin using R-22 alternatives. All new equipment

built after this date will need to use R-22 replacement refrigerants, such as R-410A, R-407C or 134a.

2020

After 2020, there will no longer be any new R-22 produced for refrigeration and air conditioning service, although sales may continue. Reclaimed refrigerant will still be permissible, however R-22 supply may be limited.

Those involved in the sales, service, or support of equipment which



currently uses HCFCs will need to develop strategies for phaseout of HCFC-22. This includes understanding the phaseout schedule and switching over to new HFC refrigerants.

Currently, HCFC-22 is being manufactured by ATOFINA Chemicals, Inc. for use and sale in the air conditioning and refrigeration marketplace. For continued sales and support in the transition, please contact your local ATOFINA Chemicals, Inc. representative.

The Future

Due to the phaseout of R-22, several new refrigerating fluids have been developed to support the transition from HCFCs to HFCs. The leading fluids in this transition are R-410A and R-407C.



Forane[®] 410A

The R-22 Replacement

Forane 410A was developed to be used as a high efficiency refrigerating fluid used in applications which were serviced primarily by R-22. Due to the higher capacity and pressure of Forane 410A, it is not recommended

as a retrofit to existing R-22 systems. Mandatory changes would need to be made to existing equipment to accommodate the higher capacity and pressures of Forane 410A. Included in these changes would be expansion

valves, compressors, condensers, and other high side components. In situations where a retrofit would need to be performed, R-407C would be recommended due to its similarity to R-22.

Lubrication

R-410A should be used only with Polyolester (POE) oil. The HFC refrigerant components in R-410A will not be compatible with the mineral oil or alkylbenzene lubricants. New R-410A systems will be charged with the OEM recommended lubricant, ready for use with R-410A.

Charging

Due to the zeotropic nature of R-410A, it should be charged as a liquid. In situations where vapor is normally charged into a system, a valve should be installed in the charging line to flash the liquid to vapor while charging.

Retrofitting

Due to the different operating pressures and temperatures of R-410A, it should never be used as a retrofit for R-22 or any other HCFC refrigerant. R-410A should only be used with equipment designed specifically for use with R-410A.



PROPERTIES	Forane 410A
Appearance	Colorless, liquified gas
Odor	Faint, ether-like odor
Molecular Mass (g/mole)	72.6
Boiling Point at 1 atm	-61.6°F
Flammable Limits (LFL, UFL), vol% (1 atm, 25°C)	NA/NA
Density of Saturated Vapor at bp, lb/ft³	0.26
Ozone Depletion Potential (ODP) (CFC-11 = 1.0)	0
Global Warming Potential (GWP) (CO₂ = 1.0)	1,890

Forane[®] 407C

The R-22 Retrofit

Forane 407C is a zero ozone depletion blend of HFC refrigerants R-32, R-125, and R-134a. It has been developed to closely match the properties of

R-22, and will be used for many air conditioning and refrigeration applications in either new equipment or in retrofitting existing R-22 installations.



Lubrication

R-407C must be used with Polyolester (POE) oil. R-407C will not work with the mineral oil or alkylbenzene lubricants. When retrofitting an old R-22 system, it will be necessary to flush out the mineral or alkylbenzene lubricant in the system. New equipment designed for R-407C will be charged with the recommended OEM lubricant, ready to use with R-407C.

Charging

R-407C should be charged as a liquid. Due to the zeotropic nature of the product, R-407C will fractionate if charged as a vapor causing poor system performance and possible system failure. In situations where vapor is normally fed to the system, a valve should be installed in the charging line to flash the liquid to vapor while charging.

Retrofitting

Although R-407C closely matches the properties of R-22, R-407C is not suitable for use in all R-22 systems. Please consult the equipment manufacturer's guidelines for help when deciding if a retrofit is appropriate for the system.

PROPERTIES	Forane 407C
Appearance	Colorless, liquified gas
Odor	Faint, ether-like odor
Molecular Mass (g/mole)	86.2
Boiling Point at 1 atm	-46.1°F
Flammable Limits (LFL, UFL), vol% (1 atm, 25°C)	NA/NA
Density of Saturated Vapor at bp, lb/ft³	0.29
Ozone Depletion Potential (ODP) (CFC-11 = 1.0)	0
Global Warming Potential (GWP) (CO₂ = 1.0)	1,600
Temperature Glide	10.5°F

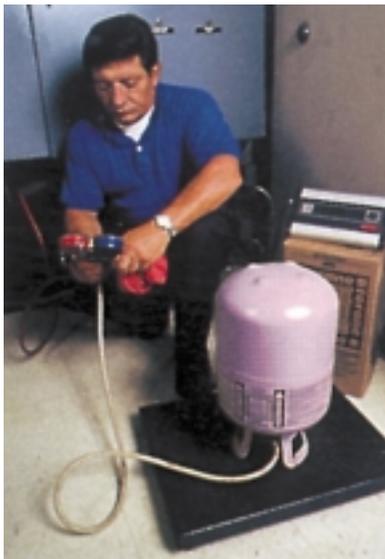
Properties Summary

Packaging

Product	Cylinder Sizes (lbs.)	Working Pressure Capacity (psig)	Test Pressure Capacity (psig)
Forane 22	30, 125, others*	260	325
Forane 407C	25, 115, others*	260	325
Forane 410A	25, 100, others*	400	500

*1/2 Ton, 1 Ton, bulk - please check with ATOFINA Chemicals, Inc. for specifications

Pressure/Temperature Properties



Temp (°F)	Pressure (psig)			
	Forane 22	Forane 407C Liquid	Forane 407C Vapor	Forane 410A Liquid
-40	0.5	2.5	5.2	11.6
-35	2.6	4.8	1.5	14.9
-30	4.9	7.3	1.3	18.5
-25	7.4	10.1	3.6	22.5
-20	10.1	13.1	6.1	26.9
-15	13.2	16.5	8.8	31.7
-10	16.5	20.1	11.9	36.8
-5	20.0	24.0	15.2	42.5
0	23.9	28.3	18.9	48.6
5	28.2	33.0	22.9	55.2
10	32.8	38.0	27.3	62.3
15	37.7	43.5	32.0	70.0
20	43.0	49.3	37.2	78.3
25	48.7	55.7	42.7	87.3
30	54.9	62.5	48.7	96.8
35	61.5	69.8	55.2	107.0
40	68.5	77.6	62.1	118.0
45	76.0	86.0	69.5	129.7
50	84.0	94.9	77.5	142.2
55	92.5	104.5	86.0	155.5
60	101.6	114.6	95.1	169.6
65	111.2	125.4	104.8	184.6
70	121.4	136.9	115.2	200.6
75	132.2	149.1	126.2	217.4
80	143.6	162.1	137.8	235.3
85	155.7	175.8	150.2	254.1
90	168.4	190.2	163.4	274.1
95	181.8	205.5	177.4	295.1
100	195.9	221.6	192.1	317.2
105	210.7	238.5	207.8	340.5
110	226.3	256.4	224.4	365.0
115	242.7	275.1	241.9	390.7
120	259.9	294.7	260.5	417.7
125	277.9	315.2	280.1	445.9
130	296.8	336.7	300.9	475.6
135	316.5	359.2	322.9	506.5
140	337.2	382.6	346.2	539.0
145	358.8	407.0	370.8	572.8
150	381.5	432.4	396.9	608.1

Red numerals=inches Hg. below 1 atm.

Common Questions

1. Will R-22 be available after 2010?

Yes, there is currently no sales restriction deadline for R-22. Manufacturers are allowed to produce R-22 for refrigeration and air conditioning applications until 2020; after that time sales can continue, but supply may be a problem.

2. Can R-22 equipment still be purchased?

R-22 equipment can be purchased until 2010 when it will be phased out for use in new equipment.

3. What are the alternatives to R-22?

ATOFINA Chemicals, Inc. recommends using R-407C for retrofit of R-22 systems. For new systems, R-410A is recommended for most unitary applications.

4. Will my existing equipment be able to handle the pressures associated with R-410A?

Most hose and gauge manufacturers have equipment which can accommodate the pressures of R-410A. Check with your equipment manufacturer for specific details.

5. Will R-410A and R-407C need to be reclaimed?

Yes, all refrigerants should be reclaimed. Check with your ATOFINA Chemicals, Inc. authorized

dealer for details on reclaiming.

6. What about the pressure of R-410A? Is there any safety consideration when leaving it in a hot truck?

The cylinders which are used to contain R-410A have been specifically designed to accommodate the pressure of R-410A. These cylinders are pressure tested to 500 psig, which should accommodate R-410A up to temperatures of at least 120 deg F. In cases where the user knows the temperature will be higher, special care should be taken to reduce the temperature. Like any other refrigerant, ATOFINA Chemicals, Inc. recommends storing cylinders in a cool, dry location.

7. What if the pressure exceeds the capacity of the cylinder?

R-410A cylinders are designed with a burst disk. In extreme cases when the actual cylinder pressure exceeds the cylinder test pressure, a burst disk would open and release the excess pressure in the cylinder.

8. Is R-410A a blend, and if so, do I need to be concerned with fractionation?

Yes, R-410A is a blend. Fractionation is not a concern because of the low amount of glide

(< 1 deg F) found in R-410A. The only concern a contractor would have is to make sure the refrigerant is charged as a liquid into the system.

9. Are there any special techniques which need to be performed with regards to using Polyolester (POE) oil in the system?

Yes, it is very important to keep the system free of moisture. POE oil is extremely hygroscopic and can be easily contaminated if moisture gets into the system.

10. Are R-410A and R-407C available?

Yes, contact any local ATOFINA Chemicals, Inc. distributor for information on availability and price.

To Receive:

Technical Information • P-T Charts • Retrofitting Instructions
Seminar Dates • Free Software

Visit us on the Web
www.forane.com



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