FORANE® REFRIGERANTS BY ARKEMA

CASE STUDY

Arkema's Forane® 427A Refrigerant – The Easy Retrofit™

Kazema Supply & Parts KSCC, Kuwait

BACKGROUND

As the HVACR industry continues to move away from R-22 due to regulatory pressures, Arkema's Forane® 427A refrigerant (R-427A) has proven itself as an excellent, easy-to-use, non-ozone depleting HFC refrigerant for air conditioning, heat pump, and refrigeration applications. Forane® 427A refrigerant is a better match to R-22 than other retrofits over a wide range of applications, offering close capacity and pressures to R-22, with no oil change required in many installations.

Kuwait City is located in a desert climate, where summer temperatures regularly exceed 45°C (113°F), and temperatures over 52°C (126°F) are not uncommon. Air-conditioning and refrigeration are not luxuries but necessities there. As an Article 5 country, Kuwait is following the phase-out of R-22, according to the timeline set forth by the Montreal Protocol. Its allocation of this refrigerant is scheduled to drop to 65% of the baseline in 2020. Thus, there is a growing need for an R-22 retrofit refrigerant that is both environmentally friendly and can perform in a hot desert climate.

Kazema Supply and Parts KSCC is a leading HVACR distributor serving three countries – Kuwait, Bahrain, and Qatar. Headquartered in Kuwait City, they have twelve sales outlets locations. Senior management at Kazema was planning to transition their customers away from R-22 but was concerned as to what retrofit refrigerant would perform well in their high ambient temperature environment.

RETROFIT APPLICATION

Based on the performance characteristics, such as capacity, COP, pressures, and discharge temperature, Forane® 427A – The Easy Retrofit™ – was a better match to R-22 than other retrofits, over a wide range of applications. To confirm these characteristics, Kazema agreed to a retrofit trial, with live testing in Kuwait. In the summer of 2018, Arkema retrofitted two units from R-22 to Forane® 427A – The Easy Retrofit™. The first was an 8-ton Goodman rooftop package unit, cooling a (72 sq. meter) Kazema distribution and showroom. The second was a 3.5-ton ducted split system, cooling two (60 – 65 sq.meter) apartments. The mineral oil was not changed in either systems, since the distance from the compressor to the evaporators was relatively close with only minimal elevation change (< 2 meters). The results of the trial are recorded in table 2 (on back).

Project
Kazema Supply & Parts KSCC

Location
Kuwait City, Kuwait

Application
Air Conditioning (AC)

Refrigerant
Forane® 427A (R-427A)

Lubricant
Mineral Oil (MO)

CLASSIFIED UL®

RESULTS

Both units continue to operate with no noticeable difference in cooling with Forane® 427A – The Easy Retrofit™. As expected, discharge pressures were elevated with R-22 and still elevated with R-427A, due to the high ambient and dusty conditions. Once the condensers were cleaned, discharge pressures reduced to a more manageable level. Suction pressures and discharge temperatures were lower with R-427A, as expected. The temperature in Kuwait during the retrofit exceeded 51°C. The return air temperature verses air supply temperature exceeded 17°C (30°F) for some parts of the day during the retrofit, which shows the challenging conditions.

In use since 2005, Forane® 427A – The Easy Retrofit™ – is a proven R-22 retrofit option, in both temperate and high ambient temperature climates as well as many different applications. As the availability of virgin R-22 becomes more difficult to obtain, users in the Middle East will continue to look for affordable and sustainable options available, like Forane® 427A – The Easy Retrofit™.

For answers to your refrigerant related questions or retrofit concerns, please contact Arkema's Technical Service Team at info.forane@arkema.com. More information on R-427A and our other retrofit solutions is available through our website, www.r22retrofits.com.

TABLE 1

FORANE® REFRIGERANT BASIC PROPERTY DATA	R-22	R-427A
Average Molecular Weight (g/mol)	86.5	90.4
Normal Boiling Point (NBP) (°F)	-41.5	-45.3
Latent Heat of Vaporization at NBP (BTU/lb)	100.6	101.8
Critical Temperature (°F)	205.1	185.6
Critical Pressure (psia)	723.7	637.0
Density of Saturated Vapor @ NBP (lb/ft^3)	0.29	0.30
Density of Saturated Liquid @ NBP (lb/ft^3)	74.3	70.5
Specific Heat of Saturated Vapor at NBP (BTU/lb °R)	0.14	0.19
Specific Heat of Saturated Liquid at 77°F (BTU/lb °R)	0.30	0.36
Ozone Depletion Potential (ODP) (CFC-11 = 1)	0.055	0
Global Warming Potential (GWP) (100-yr)	1,760	2,024
ASHRAE Safety Group Classification	A1	A1
Occupational Exposure Limits (8 hr time/wt. Avg.) (ppm)	1,000	1,000

TABLE 2

RETROFIT RESULTS	R-22	R-427A
Ambient	52	52
Head Pressure	309	319
Suction Pressure	104	100
Discharge Temperature	133	111
Suction Temperature	52	46
Supply Air	21	21
Return Air	26	26

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