R-22 has been used for decades mostly in air-conditioning applications due to its excellent thermodynamic properties; however, like all HCFCs (hydrochlorofluorocarbons), R-22 is subject to the regulations of the Montreal Protocol and its subsequent amendments. In Europe in particular R-22 is due to be phased out by 2010. In these countries therefore, the industry is looking for a zero-ODP* solution to replace R-22 in existing equipment.

A non-toxic, non-flammable and zero-ODP refrigerant, Forane® 427A requires just one drainage of the system’s oil followed by its replacement by a POE lubricant. Optimum performance similar to R-22 can be achieved without the need for a long and costly rinse of the circuit thanks to high tolerance to the residual original oil (mineral or alkylbenzene). No modification of the installation is required.

Forane® 427A is a simplified retrofit solution for existing R-22 direct expansion installations in a large range of applications.

Forane® 427A can be used to retrofit low temperature refrigeration equipment as well as air-conditioning installations.

Safety
Forane® 427A is non-toxic and non-flammable. All required toxicity and flammability tests have been performed in-house, and show that the product complies with the requirements of the A1 classification (non-toxic, non-flammable).

Material Compatibility
Forane® 427A is a 100% HFC blend. It is consequently compatible with elastomers or with plastics normally compatible with R-407C and R-404A.

Lubricants
Forane® 427A is a 100% HFC blend. It is consequently compatible with PolyOilEster (POE) lubricants. However, one specificity of Forane® 427A is its ability to tolerate a high residual amount of original oil in the POE lubricant (good oil return up to 10-15% residual AB or mineral oil) which makes for a simplified retrofit procedure.

Retrofit Procedure
1. Recovery of the whole R-22 charge.
2. Drainage of the original oil from the system**
   • An analysis of the original oil is recommended to ensure the R-22 installation is in a good state of repair.
3. POE lubricant charge
   • In most cases, no rinsing process is required. Only one oil drainage required.
4. Change of the filter drier.
5. Vacuum pumping of the installation and recharge with Forane® 427A. Afrox recommends to first fill the installation with a Forane® 427A charge, equal to 95% wt of the nominal R-22 charge, and top up to 100% if necessary.

* Ozone Depleting Potential
**Afrox does not recommend mixing Forane® 427A with R-22
Highly satisfactory operating conditions were reached immediately during the field tests, and several months later, still fulfill the customers’ requirements:

- Discharge temperatures can be up to 10°C lower than with Forane® 427A which improves equipment lifetime
- Required temperature levels are reached easily and remain stable
- Oil return is good despite a high level of residual mineral or alkylbenzene oil
- Energy consumption is equivalent or lower.

### Results of Field Tests

Forane® 427A has successfully been tested on several kinds of commercial equipment - including the conversion of:

- Air-cooled centralised refrigeration units in a supermarket in Italy
- Water-cooled water chiller installation in France
- A twin-stage compression water-cooled liquid chiller in France.

#### Comparative Data of the Field Tests

<table>
<thead>
<tr>
<th>Properties</th>
<th>Units</th>
<th>R-427A</th>
<th>R-22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molecular Weight</td>
<td>g/mol</td>
<td>90,4</td>
<td>86,5</td>
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<tr>
<td>Bubble Point (at 1,013 bar)</td>
<td>°C</td>
<td>-42,7</td>
<td>-40,7</td>
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<tr>
<td>Temperature Glide (at 1,013 bar)</td>
<td>K</td>
<td>7,1</td>
<td>-</td>
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<tr>
<td>Critical Temperature</td>
<td>°C</td>
<td>86,8</td>
<td>96</td>
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<tr>
<td>Critical Pressure</td>
<td>bar</td>
<td>44,0</td>
<td>49,8</td>
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<tr>
<td>Bubble Pressure (at 25°C)</td>
<td>bar</td>
<td>11,2</td>
<td>10,4</td>
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<tr>
<td>Bubble Pressure (at 50°C)</td>
<td>bar</td>
<td>20,8</td>
<td>19,7</td>
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<tr>
<td>Saturated Liquid Density (at 25°C)</td>
<td>kg/dm³</td>
<td>1,151</td>
<td>1,194</td>
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<tr>
<td>Density Of Saturated Vapour (at 1,013 bar)</td>
<td>kg/m³</td>
<td>4,78</td>
<td>4,70</td>
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<tr>
<td>Liquid Thermal Conductivity (at 25°C)</td>
<td>W/(m.K)</td>
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<td>0,083</td>
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<tr>
<td>Vapour Thermal Conductivity (at 25°C and 1,013 bar)</td>
<td>W/(m.K)</td>
<td>0,014</td>
<td>0,012</td>
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<tr>
<td>Surface Tension (at 25°C)</td>
<td>mN/m</td>
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<td>8,1</td>
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<tr>
<td>Liquid Viscosity (at 25°C)</td>
<td>mPa.s</td>
<td>0,15</td>
<td>0,17</td>
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<td>Vapour Viscosity (at 25°C and 1,013 bar)</td>
<td>mPa.s</td>
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<td>Liquid Specific Heat</td>
<td>kJ/(kg.K)</td>
<td>1,58</td>
<td>1,26</td>
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<tr>
<td>Vapour Specific Heat (at 25°C and 1,013 bar)</td>
<td>kJ/(kg.K)</td>
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<td>0,662</td>
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<tr>
<td>ODP*</td>
<td></td>
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<td>0,055</td>
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<tr>
<td>GWP**</td>
<td></td>
<td>2,000</td>
<td>1,700</td>
</tr>
</tbody>
</table>

* Ozone Depleting Potential **Global Warming Potential
Head Office
Afrox House
23 Webber Street
Selby
2001
PO Box 5404
Johannesburg
2000
Tel: 011 490 0400

Managing director: Tjaart Kruger
Fax: 011 490 1572
E-mail: tjaart.kruger@afrox.linde.com

Finance director: Frederick Kotzee
Fax: 011 490 1572
E-mail: frederick.kotzee@afrox.linde.com

Acting company secretary: Ay’esha Meer-Seedat
Fax: 011 490 0521
E-mail: ayesha.seedat@afrox.linde.com

National Customer Service Centre
1 Smits Street
Industries West
1401
PO Box 207
Germiston
1401
Tel: 0860 020202
E-mail: customer.service@afrox.linde.com

General manager: Jan Storm
Tel: 011 255 5000
Fax: 011 821 3284
E-mail: jan.storm@afrox.linde.com

Sales
Gate C Signal Road
Industries West
Germiston
1401

General manager: Gerhardt Schnackenberg
Tel: 011 876 1000
Fax: 011 873 5902
E-mail: gerhardt.schnackenberg@afrox.linde.com

Merchant & Packaged Gases
Afrox head office

General manager: Jaco Wiese
Tel: 011 490 0400
Fax: 011 490 0505
E-mail: jaco.wiese@afrox.linde.com

LPG
Afrox head office

General manager: Herbert Ngwenya
Tel: 011 490 0400
Fax: 011 490 0460
E-mail: herbert.ngwenya@afrox.linde.com

Healthcare
Afrox head office

General manager: Lerato Mosiah
Tel: 011 490 0400
Fax: 011 490 3704
E-mail: lerato.mosiah@afrox.linde.com

African Operations
Afrox head office

General manager: Willie Coetzee
Tel: 011 490 0400
Fax: 011 490 0585
E-mail: willie.coetzee@afrox.linde.com

MPG Operations
Afrox head office

General manager: Jonathan Narayadoo
Tel: 011 490 0400
Fax: 011 490 0585
E-mail: jonathan.narayadoo@afrox.linde.com

Communications
Afrox head office

General manager: Johann Cilliers
Tel: 011 490 0400
Fax: 011 490 0463
E-mail: johann.cilliers@afrox.linde.com

SHEQ
GOC – Gate 2
Barlow Street
Industries West
Germiston
1401

General manager: Karen Swatton
Tel: 011 255 5000
Fax: 011 825 1131
E-mail: karen.swatton@afrox.linde.com

Tonnage
16 Kings Road
Bedfordview
2008
Gauteng

General manager: Donal Mackinnon
Tel: 011 456 3864
Fax: 011 456 3728
E-mail: donal.mackinnon@afrox.linde.com

HPO
Afrox head office

General manager: Patrick Dunseith
Tel: 011 490 0400
Fax: 011 490 0428
E-mail: patrick.dunseith@afrox.linde.com

Human Resources
Afrox head office

General manager: Francis Graham
Tel: 011 490 0400
Fax: 011 490 0428
E-mail: francis.graham@afrox.linde.com

Information Services
16 Kings Road
Bedfordview
2008
Gauteng

General manager: Jenni Beard
Tel: 011 456 3999
Fax: 011 455 2482
E-mail: jenni.beard@afrox.linde.com