R-404A Replacement Refrigerants

DuPont™ SUVA® 407A
Properties and Applications
DuPont Refrigerants Vision

We will use our science and technology, market knowledge and global reach to provide sustainable materials and solutions to enhance personal comfort, enable preservation of perishable items and improve industrial processing while reducing environmental footprints.

We are a leader in environmental business advocacy and sustainable innovation (ISCEON® and Next Gen HFOs)
85 years of innovation and development in fluorine science

CFCs Invented Freon®
1928
Thomas Midgley, Jr. and Charles Franklin Kettering invent FREON® chlorofluorocarbons (CFCs).

Dr. Roy Plunkett Discovers the First Fluoropolymer
1938
“World’s most slippery surface” - extremely slippery and inert to virtually all chemicals, including highly corrosive acids.

Trademarked as Teflon®
1945
First used by the military in artillery shell fuses. After WWII DuPont found a wide range of uses for Teflon® such as electrical cable insulation, and soil & stain repellant for fabrics.

HFCs Introduced
1990
Hydrofluorocarbons (HFCs) commercialized in early 1990s to replace CFCs and HCFCs. National Medal of Technology in 2003 for policy and technology leadership.

Next Generation Refrigeration & Fluoropolymer 75th Anniversary
2013
Low global warming hydrofluoro-olefin (HFO) refrigerants commercialized. 75th anniversary of the discovery of the first Fluoropolymer.
HFC Alternatives for LT/MT Refrigeration Systems

*DuPont™ Suva® 407A*

Near Term Alternatives for 404A New Systems

*DuPont™ Opteon®*

Longer term alternatives for 404A retrofits

2012 2020
Near Term Alternatives for 404A
New Refrigeration Systems

DuPont™ Suva® 407A
Suva® 407A – The Basics

HFC Blend: R32/R125/R134a (20/40/40wt%)
Applications: Low and Medium Temp Refrigeration
Lubricant: Polyol Ester (POE)

Boiling Point: -45°C
Ozone Depletion Potential: 0
Global Warming Potential: 2110
ASHRAE Safety Classification: A1
Temperature Glide: ~4°C
R-407A – Where Does it Make Sense?

**New Systems:** A good choice when designing and installing new low/med temp refrigeration systems desiring a lower GWP option than R404A/R507

**Existing Systems:** Not recommended to replace R404A/R507; Requires engineering changes to manage reduced capacity, mass flow, and PT differences. May replace R-22 but will require complete change-out of lubricant to POE.
Condenser Pressure vs Condenser Temperature
(based on -6.7°C Evaporator, 5.5K subcooling from avg cond T)
Evaporator Pressure vs Evaporator Temperature
(based on 40.5°C Avg Condenser, subcool liquid to 35°C)

Average Evaporator Temperature (°C)
Evaporator Pressure (kPa)

- MR438A
- R-22
- R-407A
- R-404A
Evaporator Pressure vs Evaporator Temperature
(based on 105°F Condenser, subcool liquid to 95°F)
Condenser Pressure vs Condenser Temperature
(based on 20°F Evaporator, 10°F subcooling)
DuPont Suva® 407A – Benefits

- GWP reduction (46% vs. R-404A), Zero Ozone Depletion Potential
- Wide availability, multiple sourcing options
- Years of proven performance
- Specified by leading retailers for new stores
- Uses traditional POE lubricants (same as R404A)
- Comparable performance to R404A / R507 in new equipment
- Similar energy performance to R404A and R407F
- Can be combined with CO2 in cascading systems to achieve lower carbon footprint
- Compatible with common materials of construction/components
## Laboratory Calorimeter Data – New Systems

Relative Performance R-407A vs. R-407F

<table>
<thead>
<tr>
<th></th>
<th>Refr</th>
<th>GWP</th>
<th>Eff</th>
<th>Cap</th>
<th>Disch T</th>
<th>Mass Flow</th>
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<tr>
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<td></td>
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<tr>
<td>R-407A</td>
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<td>1.0</td>
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<tr>
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<td>+2F</td>
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<td>same</td>
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<tr>
<td>R-407A</td>
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<td>1.0</td>
<td>1.0</td>
<td>---</td>
<td>----</td>
<td>----</td>
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<tr>
<td>R-407F</td>
<td>1825</td>
<td>0%</td>
<td>+6%</td>
<td>+6F</td>
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</tr>
</tbody>
</table>

**Good Performance Match Possible in New Systems**
### Laboratory Calorimeter Data
Relative Performance R-407A & R-407F
R-404A Retrofit Conditions

<table>
<thead>
<tr>
<th></th>
<th>Refrg</th>
<th>GWP</th>
<th>Eff</th>
<th>Cap</th>
<th>Disch T</th>
<th>Mass Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>LT</td>
<td>R-407A</td>
<td>-46%</td>
<td>-5%</td>
<td>-12%</td>
<td>+27F</td>
<td>-30%</td>
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<tr>
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<td>-5%</td>
<td>-14%</td>
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<td>-30%</td>
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<tr>
<td>MT</td>
<td>R-407A</td>
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<td>-2%</td>
<td>-3%</td>
<td>+22F</td>
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<tr>
<td></td>
<td>R-407F</td>
<td>-53%</td>
<td>-2%</td>
<td>0%</td>
<td>+28F</td>
<td>-30%</td>
</tr>
</tbody>
</table>

**Engineering Concerns if Attempting Retrofits**
Summary- Alternatives for 404A

Opteon® Low GWP HFO’s in development (3-5 yrs)

Specify R-407A instead of R-404A for new systems
  - ~50% reduction in GWP
  - Equivalent Performance Achievable
  - Proven Technology
  - Widely Available

Retrofit of Existing R-404A systems
  - Not generally recommended
  - Engineering Assessment Required
  - R-407A performance similar to R-407F
For more information

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