Refrigerant Choices and Their Impact
THE NEXT TRANSITION
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Tonight’s Agenda

1. Pressures on refrigerants – why the transition?
2. The current state of HVAC refrigerants
3. Industry response – what are our options?
4. Compressor choices/technologies for the various refrigerant classifications
Refrigerant Message

Balanced approach minimizes overall environmental impact:
- Energy efficiency
- Refrigerant emissions
- Ozone depletion
- Global warming
- Atmospheric life
Today’s Regulatory Environment for Refrigerants

The Pressure on HFCs is Not New
- Higher GWP fluids will be phased down first
- The cap and phase down will not apply to HFOs

EU F-Gas Regulation (EC 842/2006)
- HFC cap and phase down begins 2015

US Legislators & Regulators Begin with Presidential Push & Global Agreements

Refrigerant Manufactures Bringing New Solutions to Market

US, Canada & Mexico
- HFC Phase Down Proposal

Auto Industry Already Shipping Cars with R-1234yf

Increasing pressure on all refrigerants in all regions
Phase down versus phase out

HRAI forwards comments to Environment Canada on Notice of Intent to regulate HFCs.

2015-01-29

The Heating, Refrigeration and Air Conditioning Association submitted comments to Environment Canada's Publication of Notice of Intent to regulate hydrofluorocarbons, which was released on Tuesday. The association agreed to provide consistent comments on both sides of the border because of Canada’s regulations being proposed by the United States Environmental Protection Agency (EPA).

The comments address the approach being taken for commercial refrigeration equipment and the potential negative impact on the equipment and the industry that services it. Of particular concern is Environment Canada's intent to adopt the path the EPA has proposed, which is to restrict the use of certain HFC refrigerants. The proposed regulation includes prohibition of the manufacture and import of specific HFCs (134a and those with a higher global warming potential, i.e. 507 series and 404a) with use being phased out in condensing units and supermarket systems, stand-alone units and vending machines. Another measure in the notice is the prohibition of the manufacture and import of R-410A for use in most foam end uses.

Watch the papers… new information is emerging daily
Options For HVAC Refrigerants

Fluorocarbons

Ozone Depleters
(Montreal Protocol)

- Class 1
  - High ODP
  - CFC’s
    - R-11
    - R-12
    - R-113

- Class 2
  - Low ODP
  - HCFC’s
    - R-22
    - R-123

Non- Ozone Depleters
(Kyoto Protocol)

- Higher GWP
  - R-134a
  - R-410A
  - R-407C

- Lower GWP
  - R-32
  - R-152a

“Natural” Refrigerants

- Propane
- Butane
- CO₂
- Ammonia
- Water

-ODP Concerns
-GWP Concerns
-Flammable

-Toxicity Concerns
-Efficiency Concerns
-Cost Concerns
Refrigerant Safety Classifications
ASHRAE 34 & Proposed ISO 817

- **Flammability**
  - Class 1, non-flammable: most refrigerants used today, like R-134a, R123, 410a
  - Class 2L, new class slightly flammable refrigerants: <10 cm/sec burning velocity, most new HFO’s, R32
  - Class 2, more flammable, R152
  - Class 3, explosive, like propane
How is the industry responding?

- Refrigerant producers are developing new refrigerants:
  - Near zero ODP, very low GWP, energy efficient & safe
  - Expected availability – 0-5 years
- Equipment manufacturers are analyzing new refrigerants:
  - Energy efficient, safe & low emissions
  - Equipment availability by 2015 - 2018
September 2014


In total, 22 companies have already committed to cutting HFC emissions by 2020.

“Close to $2 billion has been spent … since 2009 … and over the next 10 years, the HVACR industry will invest an additional $5 billion … to develop and commercialize low-GWP technologies.”

- AHRI president & CEO Stephen Yurek

Industry commitments and available options are increasing

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HFO Development

High Pressure (R-22/R-410) Replacement

R-32 (GWP=716) Moderate
- GWP is a concern
- 2L flammable
HFO/R-32 blends (GWP=400/600/)
- 2L flammable

Medium Pressure (R-134a) Replacements

R-1234yf (GWP<10) - Automobile
- Expensive, significant efficiency loss
- 2L flammable
R-1234ze (GWP<10) - Chillers
- Moderate price
- 2L flammable

Low Pressure (R-123) Replacements

R-1233 zd (GWP<10) - Chillers
- Moderate price
- Non-flammable
Refrigerant Operating Pressure

- evaporator (38°F)
- off line (72°F)
- condenser (100°F)

Operating pressure (psig)

Refrigerant:
- R-123
- R-1233zd
- R-245fa
- R-1234ze
- R-513A
- R-134a
- R-1234yf
- R-22
- R-410A
- R-32
What’s the compressor’s job?

1. Move refrigerant through the system (volumetric flow rate)
2. Create pressure rise (and in close systems, temperature rise in turn)

1. Volumetric flow rate = tons
2. Pressure = condensing and evaporating temperatures
Scroll Compressor

intake phase

compression phase

discharge phase
Helical-Rotary Compressor

meshing point

discharge port
Centrifugal Compressor

- Motor
- Inlet vanes
- Suction
- Impeller
Key takeaways on compressor/refrigerant combos:

1. The tonnage and compressor technology define the refrigerant, not the other way around
2. Variable speed means different things for different compressor technologies