

# A PERSPECTIVE ON FUTURE REFRIGERANT SELECTIONS

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## ABSTRACT

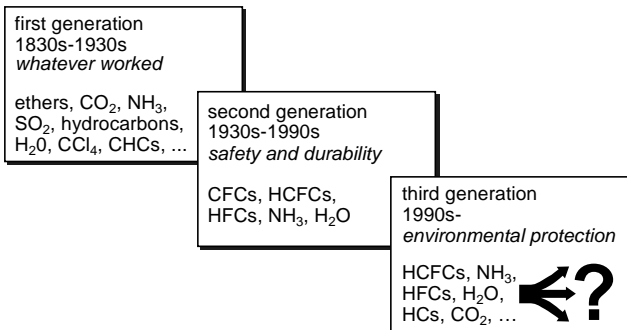
Owing to recognition of environmental concerns with ozone depleting substances and greenhouse gases as well as to international and national responses to address these issues, the most common refrigerants have been or are being phased out and replaced with environmentally safer alternatives. This paper briefly reviews the progression in refrigerants, from historical selections through current options, and offers projections for the future. It discusses candidate refrigerants in the context of future availability (or phaseout) based on controls for environmental protection, efficiency, toxicity, and flammability. It also addresses the importance of emission reductions, both for environmental protection and for performance improvement. The paper tabulates the alternative refrigerants for those phased out or being phased out both for service and/or retrofit of existing equipment and for new equipment applications. It also offers projections of those likely to survive the transition, as long-term replacements, based on present awareness.

**Keywords:** refrigerants, alternatives, projections, service fluids, new equipment, long-term replacements

**Table 1 Alternative Refrigerants**

| CFC or HCFC  | existing equipment<br>may require conversion  | new equipment<br>others or NIKs also  |
|--------------|---|---------------------------------------|
| R-11         | R-123   | R-123 R-245fa                         |
| R-12, R-500  | R-134a R-401A R-401B R-401C<br>R-405A R-406A R-407D R-409B<br>R-412A R-413A R-414A R-414B<br>R-415A R-416A R-418A | R-134a R-227ea                        |
| R-22         | R-407C R-411A R-411C R-417A<br>R-419A   | R-407C R-407E<br>R-410A R-410B<br>??? |
| R-113        | none  | any replacement                       |
| R-114, R-400 | R-124 R-236fa E245cb1 R-401A  | R-236fa E245cb1                       |
| R-502        | R-402A R-402B R-403A R-403B<br>R-404A R-407A R-407B R-408A<br>R-409A R-411B R-411C R-507A                         | R-404A R-407A<br>R-507A R-509A        |
| R-13B1       | R-410A R-410B   | R-410A R-410B                         |
| R-13, R-503  | R-23 R-508B   | R-23 R-170<br>R-508A R-508B           |

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**Fig. 1 Refrigerant Progression**

## PAPER AVAILABILITY

This paper was accepted after the submission deadline, and therefore was not ready for inclusion in the proceedings. Copies may be obtained by e-mail request to the author at [jmc@JamesMCalm.com](mailto:jmc@JamesMCalm.com).