

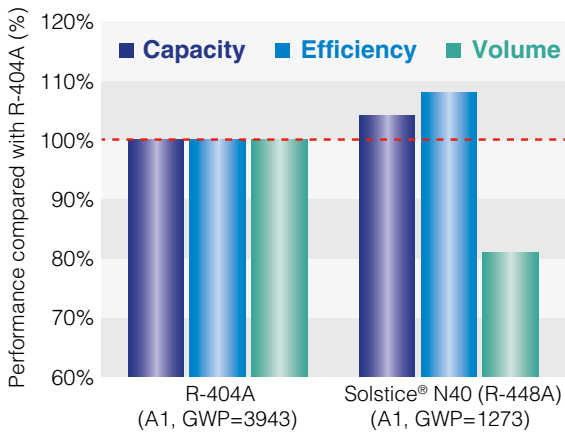


LOWEST GWP, NON FLAMMABLE (A1) REPLACEMENT FOR R-404A FOR
LOW AND MEDIUM TEMPERATURE REFRIGERATION EQUIPMENT

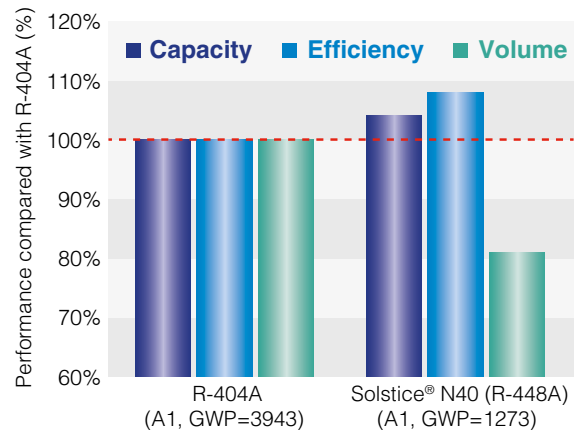
References

Honeywell Laboratory tests: comparison with R-404A

Medium Temperature (2°C / Room temp 35°C)



Low Temperature (-26°C / Room temp 35°C)



System description

- 1.5 tonne, fully instrumented, semi-hermetic condensing unit with evaporator for chiller and freezer cold rooms
- Long connector tubes (typical of supermarkets) to simulate the effects of a drop in suction pressure and an increase in temperature.

The performance of Solstice N40 (R-448A) is on a par with R-404A with 8% higher efficiency.

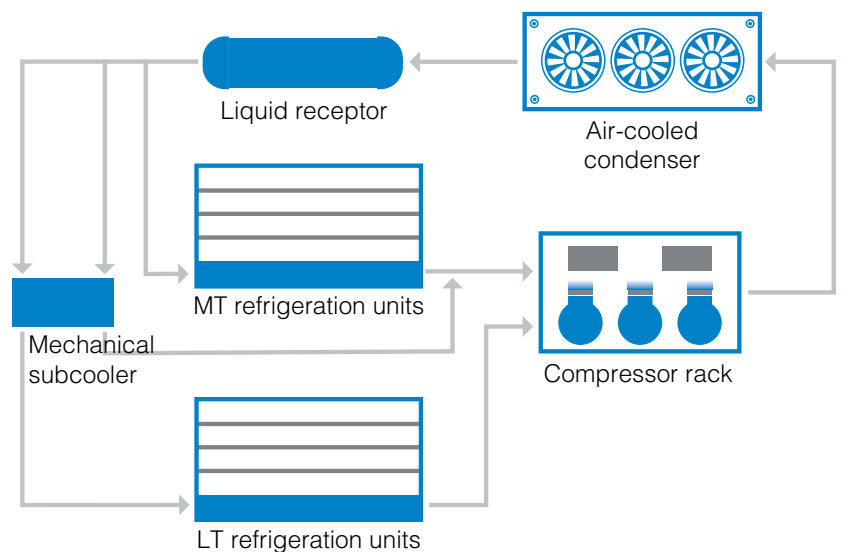
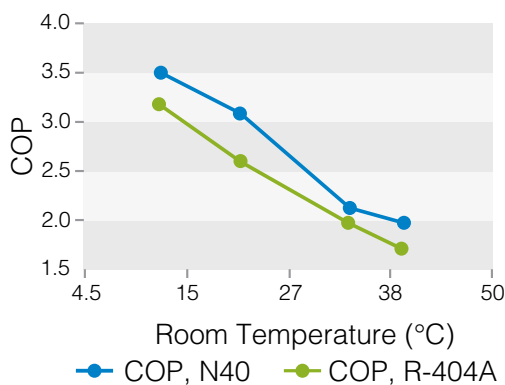
- Discharge temperature: approximately 4% lower than R-404A, below the compressor limits. Liquid injection is not required during the tests*.
- Environment: GWP reduction of 68% compared with R-404A.
- Same thermostatic expansion valves: a small adjustment was made to improve performance.

*Check with your compressor supplier

Oak Ridge National Laboratory in the US

US Government Department of Energy trial in an experimental, life-size supermarket. Comparison with R-404A.

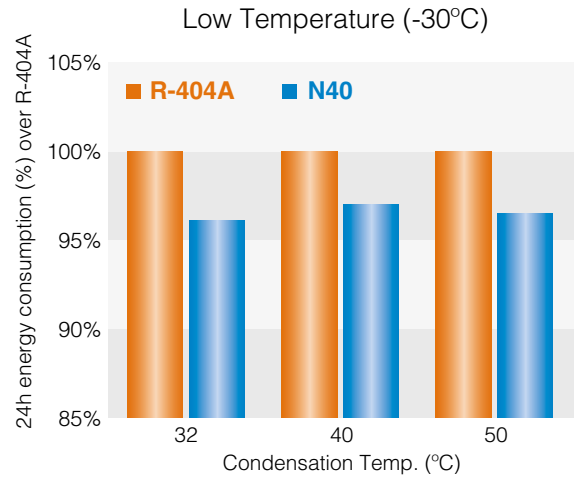
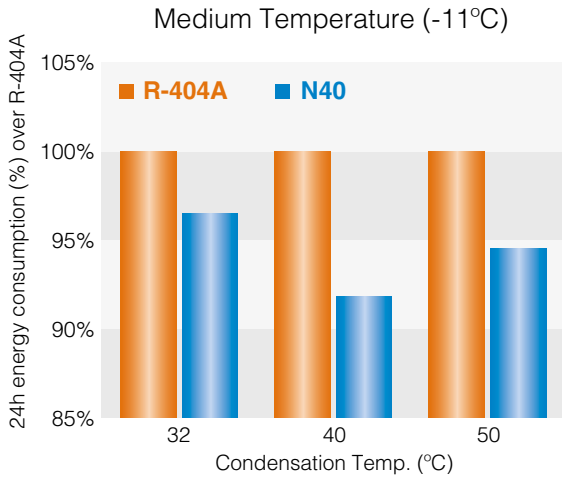
- Compressor power reduced by 3.7%
- Refrigerating capacity increased by 7.5%
- System's CoP improved by 11.6%



Solstice N40 qualified in its Centre of Excellence supermarket

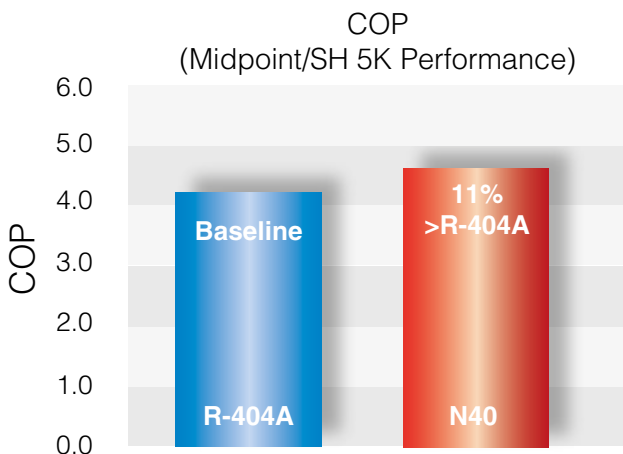
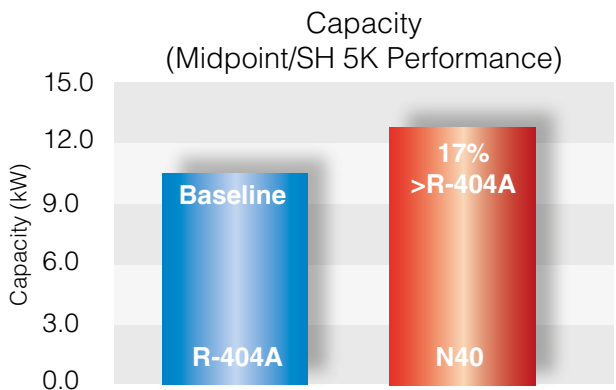
Emerson Climate Technologies, a leading global supplier of refrigerant, heating, ventilation and air conditioning solutions for residential, industrial and commercial applications, is actively engaged in the validation of new Honeywell HFO blends.

- Direct expansion with charged refrigerators and air condensers
- At MT, Solstice N40 showed 3% to 8% less energy consumption than R-404A
- At LT, Solstice N40 showed approximately 3% less energy consumption than R-404A

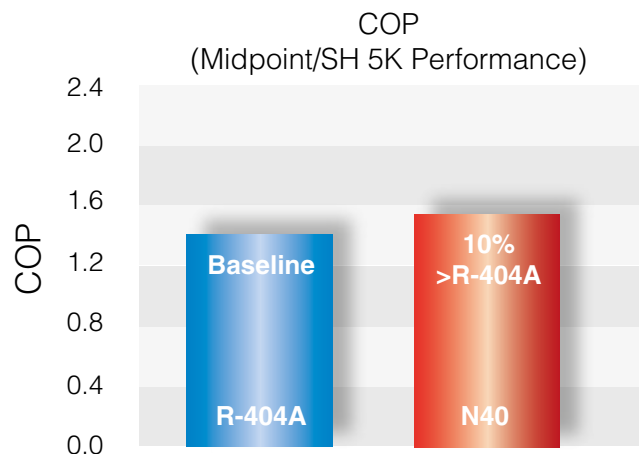
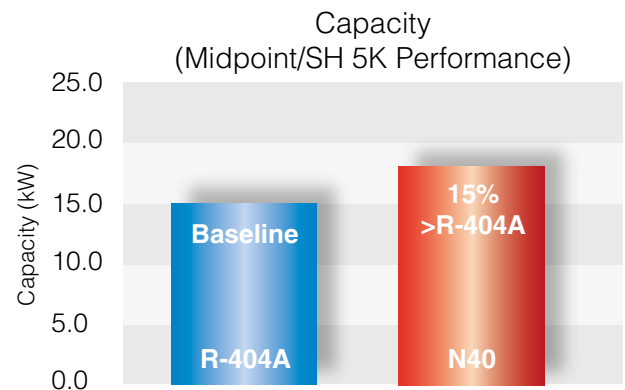


Qualified for use (medium and low temperature)

Copeland Liquid and EVI Scroll
Scroll System Analysis @ -6.7°C / 48.9°C



Copeland semi-hermetic reciprocating
Semi-Hermetic System Analysis @ -31.6°C / 43.3°C



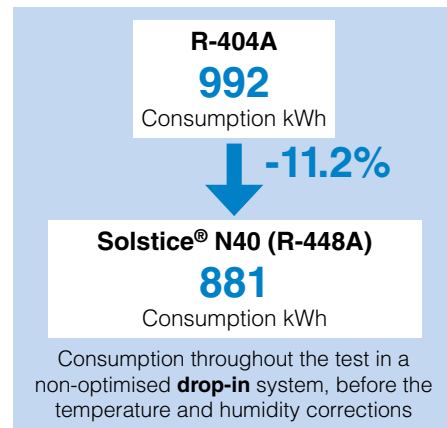
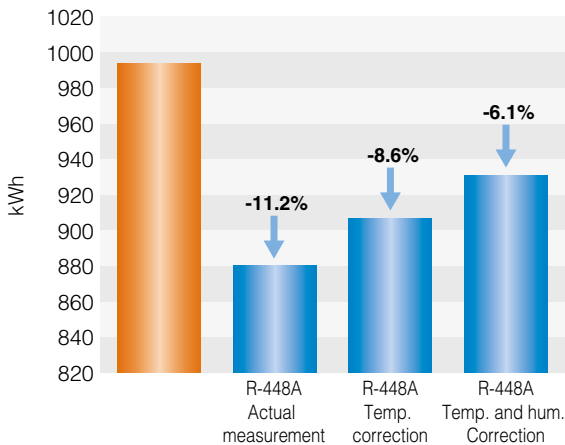


Energy consumption comparison of Solstice N40 (R448A) vs. R404A

Comparative study of Solstice N40 with 404A regarding energy saving. Tests conducted in August – September 2014. The system was charged with 80kg at 404A and, after the trials, it was loaded with Solstice N40 (R-448A). Measurements were taken on consecutive weeks so that temperature conditions were virtually the same. Corrections were made to the temperature since there was a slight variation.

The setting conditions and set-point were as follows for both tests (without optimisation or overheating improvement for R-448A):

- Compressor suction set-point: -10°C
- Condensation set-point: 40°C
- Temperature set-point in the units: 2°C
- Unit load: without products



Refrigerant	Consumption (kW)	Relative humidity	Laboratory temp.	Unit temp.
R-404A	991.8	61.95	26.58	4.10
R-448A	881.0	57.42	25.70	3.85

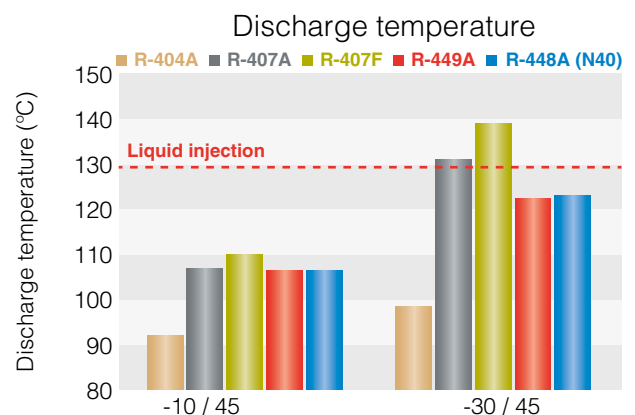
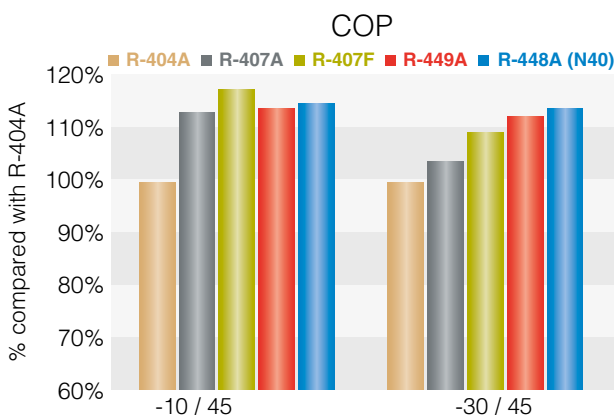
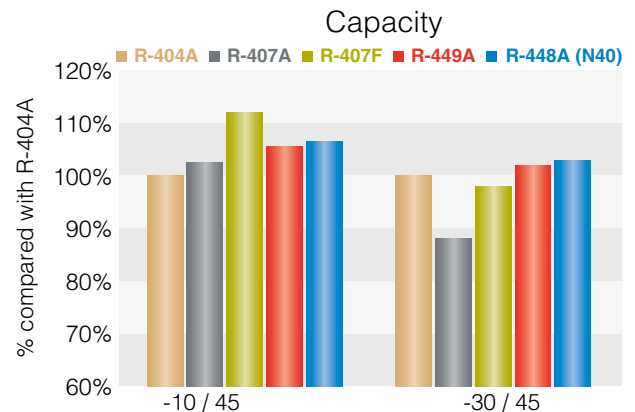


Solstice N40 qualified for use

Range of semi-hermetic reciprocating compressors and screw-type compressors, for medium and low temperature.

Comparison of the Bitzer calculation programme

- Version 6.4.3 (February 2015), system comparison
- Improvement in both capacity and efficiency compared with R-404A
- The lower discharge temperature allows for use in low-temperature applications without liquid injection



TOSHIBA

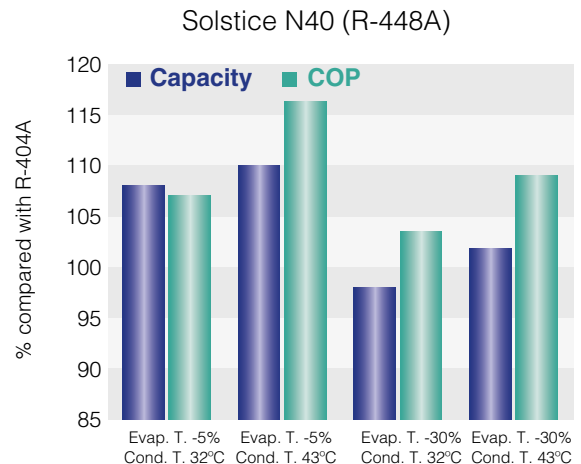
Carrier

(Japan): Solstice N40 in condensing unit

- Condensing unit performance test
- Trials* in accordance with the JIS 8623 standard at 32°C and 43°C
- Solstice® N40 (R-448A) showed a 4%-16% higher COP and excellent equality in capacity

*Performance evaluation of condensing unit using low GWP refrigerants. Atsushi BABA, Hiroichi YAMAGUCHI, Toshiba Carrier Corporation, Fuji-shi, Shizuoka-ken, 416-8521, Japan

“Solstice N40 is a refrigerant that is well-designed to meet the requirements for replacing R-404A.”



ASDA

(Walmart UK): Solstice N40 successfully running in supermarkets since 2013

More than 14 months of testing R-448A in comparison with R-404A at Asda supermarket trials (Leeds, United Kingdom) resulted in:

- Improved capacity and efficiency compared with R-404A
- Simple conversion with minimal system adjustments
- Discharge temperature close to the R-404A level: no liquid injection was used at low temperature



(United Kingdom): Solstice N40 (R448A) selected as replacement for R-404A

The manufacturer of catering and restaurant equipment, Precision Refrigeration, has announced that it will stop using R-404A and replace it with the new refrigerant R-448A with lower GWP. The change was decided following an extensive series of tests conducted over the past two years.

In tests conducted two and a half years ago, under class 4 climate conditions (30°C, 55% R.H.) in its three-door under-counter freezer, LCU323, Solstice N40 was compared with R-404A and with R-290 (propane).

The equipment was assigned to achieve temperature class L1 (frozen products), and energy consumption and temperature performance were measured in accordance with EN153 for periods of 24 hours, in a closed-door vacuum unit. Equipment was not optimised with expansion valve adjustments.



Solstice N40 exceeds the refrigeration performance of R-404A, improves energy consumption and produces a similar discharge temperature to R-290. R-448A also exhibits a lower recovery time after defrosting and a significantly better chilling time (the lower it is, the greater the energy saving and, therefore, the lower the operating costs).

“We are seeing an average of 4% energy savings in the units we have tested so far. The largest savings come from blast chiller applications.”

	Abatement (min)	Recovery after defrosting (min)	Max. Dis. T.	kWh in 24 hours
R-404A	78.0	29.0	85.0	11.44
Solstice N40 (R-448A)	65.0	24.0	75.0	10.40
R-290	82.0	25.0	73.0	9.80
% compared with R-404A				
Solstice N40 (R-448A)	83%	83%	88%	88%
R-290	105%	86%	86%	53%



(Spain) Solstice N40 (R-448A) with Solstice® N13 (R-450A) in BM supermarket

The 1,000m² supermarket, BM Ercoreca Atxukarro, located in Bilbao, in November 2014 carried out a full reversion of its system originally based on R-404A.

The system enabled optimisation by replacing R-404A with R-450A at medium temperature. Additionally, in order to reduce the indirect impact of energy consumption due to its better COP, on being more environmentally-friendly (its GWP is 86% lower than that of R-404A: 547 compared with 3,784), R-450A helps to reduce the direct impact and also the effect of tax on fluorinated gases (TFG) is significantly lower. The power of the selected compressor was adjusted to the lower capacity of R-450A, offset by installing doors in the units.

At low temperature, R-448A (Solstice® N40) was used as a direct replacement for R-404A. With a discharge temperature in the range of R-404A, in addition to the improved energy efficiency, a lower environmental and tax cost is achieved.

The results obtained so far are satisfactory:

- Lower energy consumption than the original configuration
- Technical simplicity
- Problem-free conversion



(Spain) Eroski: leader in energy management using Solstice N40

The 5000m² Eroski hipermarket in Berango (Spain), was remodelled end of April 2015 by energy consultant Tewis and technology pioneer contractor Iparfrío, using Solstice N40 (R-448A) as direct replacement of R-404A.

- Solstice N40 allowed an easy, fast, efficient and problem-free retrofit, with Bitzer compressors and Eliwell controls incorporating Solstice N40.
- Solstice N40 possesses a GWP 66% lower than R-404A, delivering lower emissions and also lower cost of maintenance due to preferential taxes
- Online, real-time energy monitoring shows reduced consumption according to the expected results
- A small adjustment of the expansion valves resulted in improved performance

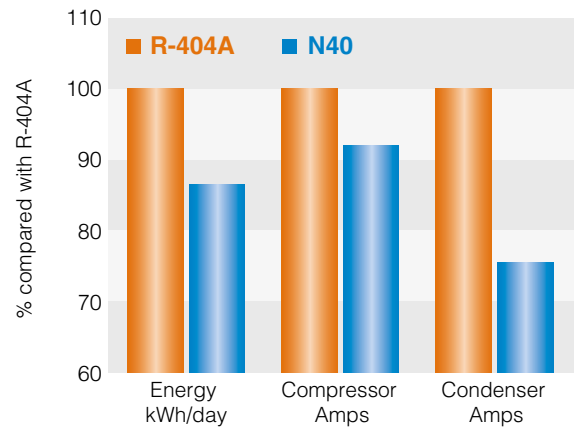


HUSSMANN® (USA) Solstice N40 in a real supermarket

Original Hussmann system distributed with R-404A with Scroll medium and low compressors. The same POE oil was used for R-448A and a small valve adjustment was made.

The integrated energy data over 3 months at a stable room temperature of 20°C show that R-448A has a 14%* lower energy consumption rate than R-404A (8% lower amperage).

*Results may vary, as they depend on multiple variables of the system



Major US Supermarket Chain Environmental impact (LCCP*): lower for Solstice N40

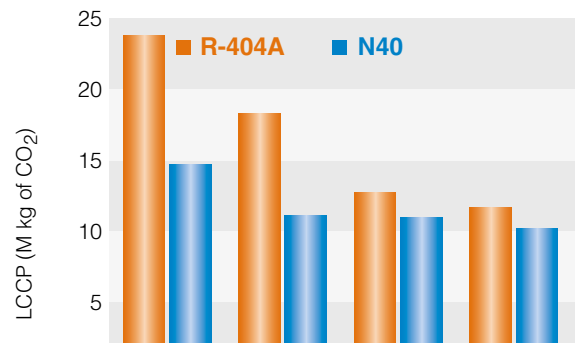
Assumptions:

- Annual calculation for establishment in Atlanta (USA)
- 4,200m² (36% LT, 64% MT), 1,450kg of R-404A
- Leakage ration of 15% per year in a direct expansion system

Results:

- R-448A reduces total emissions by 50%
- The environmental impact of R-448A in direct expansion is similar to CO₂ technologies.

* LCCP: Life Cycle Climate



HIPER SIMPLY (Spain) Simply: Improving Energy Efficiency and Reducing Environmental Impact

Solstice® N40 has been incorporated into the latest new 3,500 m² Simply store near Zaragoza, Spain by system designers Ebrofio, a company renowned for its forward-thinking and innovative approach.

- Solstice N40 is shown to offer better refrigeration performance than R-404A
- Monitored energy consumption shows a reduction in line with preliminary estimations
- Solstice N40 possesses a GWP 66% lower than R-404A, delivering lower emissions and also lower cost of maintenance due to preferential taxes.

Retrofitting of Solstice N40 was problem-free thanks to its drop-in replacement capability for R-404A, making it safe, easy and time-efficient for the technicians to perform the work.

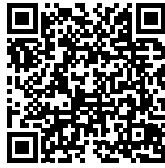


Available tools

Simulation software

Honeywell's Genetron Software – for refrigerants modelling – allows you to simulate your system with the right refrigerant and export the results to Excel. It has recently been updated to include both N40 and N13, so you can compare performance of multiple refrigerants, learn the line sizing and many more – all for free. It is available in English, German, Spanish, Portuguese and Italian.

Download the software from <http://www.honeywell-refrigerants.com/europe>



Download the brochure or scan the QR code

<http://www.honeywell-refrigerants.com/europe/product/solstice-n40/>



Download the Genetron Software or scan the QR code

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Solstice® Low GWP Refrigerants:
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The safety of our employees
The quality of our products
Being responsible stewards for the protection of the environment, the communities in which we operate and our customers

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