Honeywell | Refrigerants

SOLSTICE® ze – THE LOW CARBON, HIGH EFFICIENT COOLING SYSTEM SOLUTION FOR A LEADING RETAILER

"Honeywell's Solstice ze was ideal for this project. Its GWP of <1 and efficiency characteristics were matched with CO_2 in an integrated system that met the performance and environmental needs of the end user perfectly."

Radim Břečka, Sinop

Solstice® ze

Sinop CB is a leading manufacturer and supplier of industrial cooling technologies, air-conditioning systems and tapped beverage cooling and dispensing equipment in the Czech Republic. The company supplies a wide range of products and components, ranging from small beer cooling systems through to large-scale cooling racks for major commercial organisations, such as supermarkets and oil platforms.

When a major cash & carry wholesale hypermarket issued a tender for a retro-fit refrigeration and heat recovery system for a 9,700m^2 store in Brno to be completed in May 2016, Sinop was approached by main contractor Zdenek Danek - Chlazení to supply refrigeration racks, with CTS Engineering engaged to provide design services.

The customer requirement was for a low GWP (Global Warming Potential) and low carbon solution as a retrofit replacement for an R-404A-based system, so Sinop specified Honeywell's Solstice ze® – a new generation, high efficiency refrigerant ideally suited to air-conditioning and medium temperature (MT) applications, and CO_2 cascade configurations.

The Need

For this project, the end user specified that the solution benefit from:

- Refrigerant technology with a GWP lower than 150 and an ODP (Ozone Depletion Potential) rating of zero
- Refrigerant with classification "A1" for direct cooling, and "A1/A2L" (according to EN 378-1 A2:2012 and ASHRAE 34) for indirect cooling
- High operational efficiency to optimise performance
- Integration of air-conditioning, cooling and heat recovery systems to optimise energy efficiency

The Solution

The retrofit design includes air conditioning (AC) and medium temperature (MT) chiller systems charged with Solstice ze – with ethylene glycol as the cooling fluid - integrated with heat recovery technology, together with an independent low temperature (freezer) CO_2 system. Performance is verified through flow and temperature meters.

The Benefits

The system was retrofitted over a four month period, with the main contractor working during night-time hours to avoid unnecessary disruption to the end user.

The new cooling system is working problem free and to date has delivered the following benefits:

- Energy consumption has been reduced by an estimated 20-30% through the efficiency of Solstice ze and the integration of the cooling, air conditioning and heat recovery systems
- The compact system design has reduced the space required in the machine room
- The refrigerant chiller charge is lower than an equivalent conventional 404A DX system
- The ultra-low GWP facilitates a significant CO_2e reduction
- Lower maintenance requirements and lower leakage levels are reducing operating costs

Solstice ze® optimizes the benefits of an Integrated Cooling System

Wholesale cash & carry businesses are heavy users of refrigeration systems and many of the world's leading brands are focused on mitigating the impact of refrigerants on the environment. In this project, the customer required a technical solution utilising a refrigerant with ultra-low GWP, zero ODP and energy efficiency at its core.

	HT (AIR CONDITIONING)	MT	LT
Nª OF CIRCUITS	1	2	2
NUMBER OF COMPRESSORS	2 (2 x 1 rack)	4 (2 x 2 racks)	6 (3 per circuit)
COMPRESSOR TYPE	Danfoss Turbocor Oilfree	Bitzer screw	Copeland scroll
COMPRESSOR MODEL	TG310	CSH8573-110Y	ZOD104KCE + ZO104KCE
COOLING CAPACITY	440kW	533 kW	135kW
COP	4.58	3.66	4.02
Tª EVAP	-1.5ºC	-11ºC	-35ºC
Tª COND	+34ºC	+34ºC	-5ºC
REFRIGERANT	R-1234ze	R-1234ze	R-744
CHARGE	240 kg	2 x 130 kg	
CONDENSER	Shell and tube heat exchanger	Shell and tube heat exchanger	Plate heat exchanger
EVAPORATOR	Shell and tube flooded heat exchanger	Shell and tuber flooded heat exchanger	Direct expansion
SUBCOOLER	--	Plate heat exchanger	--
ARCHITECTURE	Indirect cooling	Indirect cooling	DX
HEAT TRANSFER FLUID	Freezium 30%	Freezium 30%	
INLET Tª	+0ºC	-8ºC	--
OUTLET Tª	+5ºC	-4ºC	--
COOLING MEDIA	MEG 30% (+26ºC / +31ºC)	MEG 30% (+26ºC / +31ºC)	--

MEG: mono-etylene-glycol

System characteristics

The rack manufactured by Sinop is located outside the supermarket in a ventilated machine room accommodating refrigeration equipment (MT and LT), along with integrated air conditioning (ventilation, cooling, heating) technology that ensures a constant internal temperature of 15 to 28°C.

Solstice ze is contained in the primary circuit of the integrated refrigeration unit, with CO_2 cascaded to the independent LT system via another auxiliary source in order to ensure operational safety.

De-superheating and condensation heat from AC and MT systems is routed to a mono-ethylene glycol (MEG) system, which is cooled in a hybrid dry-cooler that operates in dry mode below 16.3°C ambient, and as a cooling tower above that threshold. An antifreeze water solution of sodium-tetraborate–pentahydrate with freezing point of -15°C transfers the heat from the cabinets to the primary circuit.

System heating is provided through two heat pumps with a total capacity of 490 kW, delivering water temperature gradient at heatsink +58°C to 65°C and COP>4.1 for heating and >4.6 for cooling with 0°C ambient.

Solstice ze (HFO-1234ze)

Honeywell's Solstice ze refrigerant is the best medium pressure, low GWP refrigerant on the market when considering the balance of all properties.

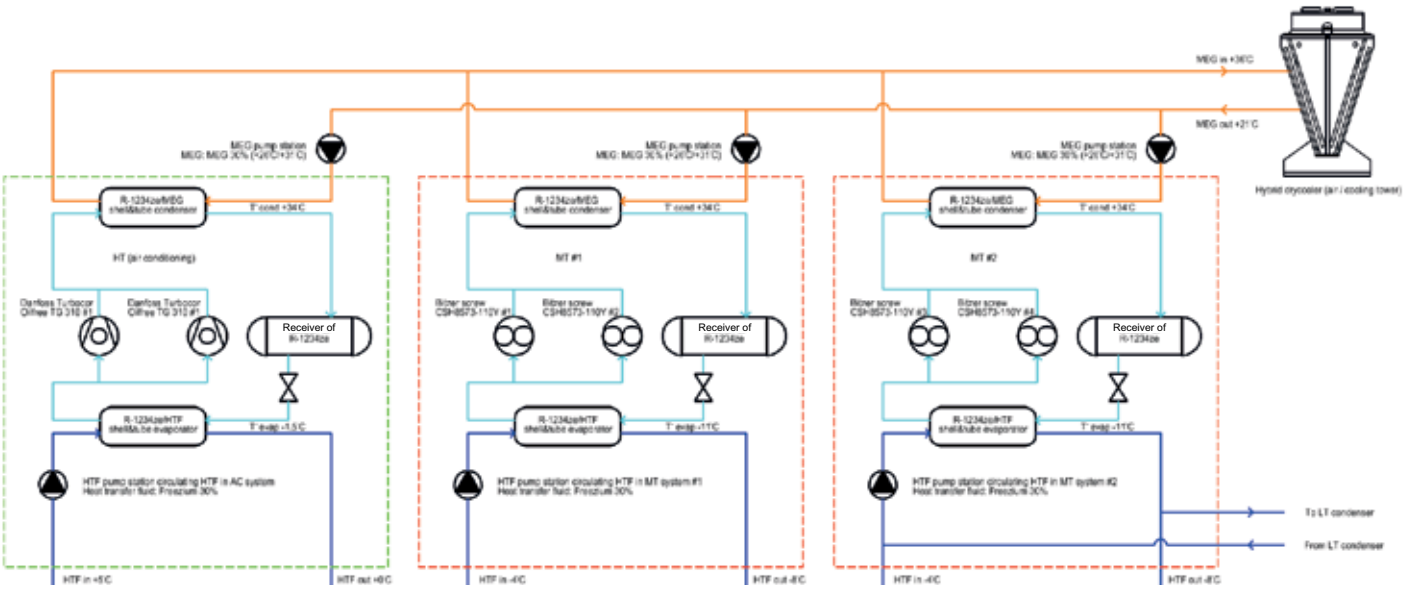
It is an energy-efficient alternative to traditional refrigerants in different medium temperature uses and has been selected by a number of equipment manufacturers for applications with a capacity range from several kW to 20MW and charges varying from 300g to 13mT. It is ideally suited to:

- **Water-cooled chillers**
- **District heating and cooling**
- **Heat pumps**
- **Refrigerators**
- **Vending machines**
- **Beverage dispensers**
- **Air dryers**
- **CO_2 cascade systems, etc.**

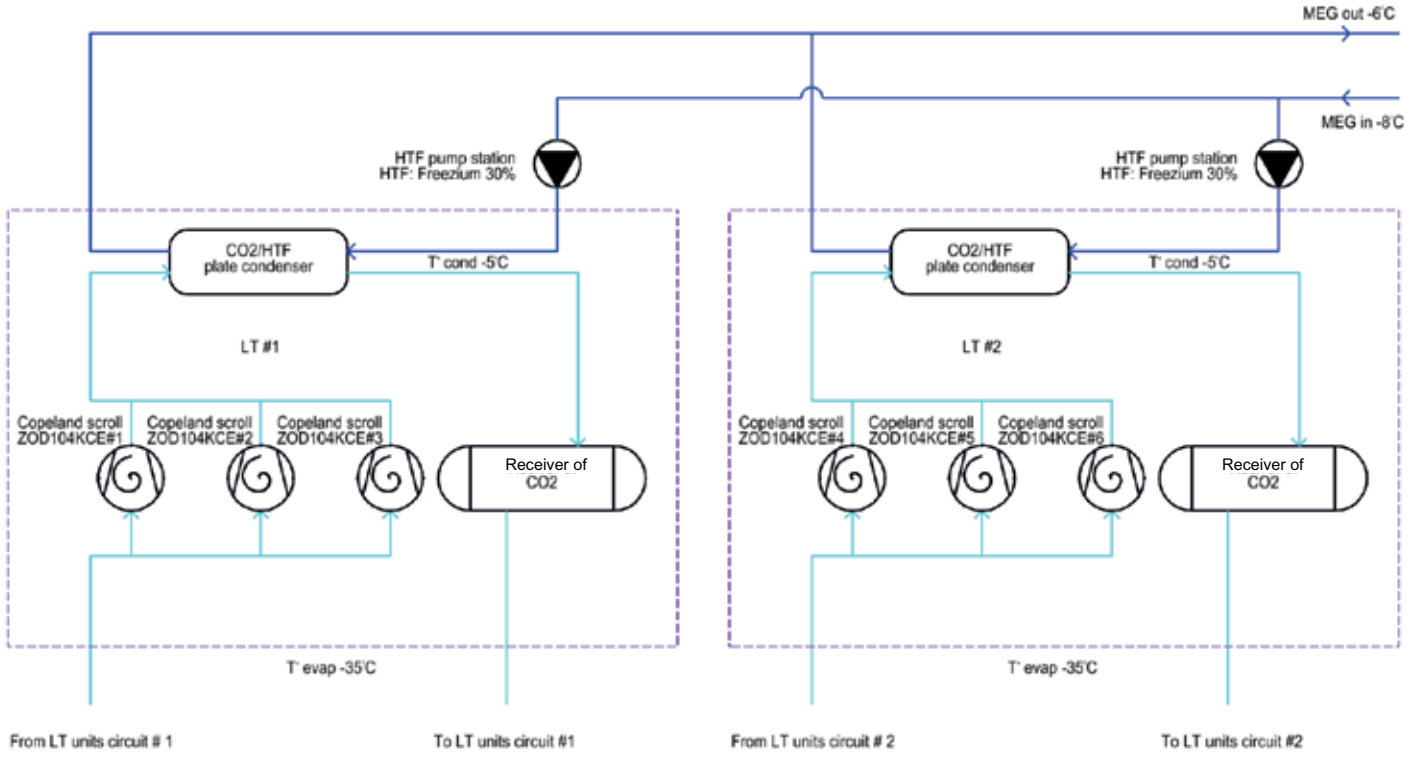
Solstice ze meets the criteria that are most important to refrigerants users: performance, cost effectiveness, environmental impact and safety.

System architecture

MT system



LT system



Sector Perspectives

> "The retailer customer is satisfied because we provided a solution that complies with all the tender requirements. Sinop has supported this project with a unit customized to the precise musts."

Mr. Zdeněk Daněk, Cooling Daněk

> "The fact that an A2L was accepted in the specifications made Solstice ze ideal for this project. Its GWP of <1 and efficiency were matched with CO_2 for the integrated unit. Understanding the A2L characteristics was uncomplicated, so meeting the safety demands was not difficult."

Radim Břečka & Michal Pavlíček, Sinop

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OUR COMMITMENT TO SUSTAINABILITY

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Simulation Software

Honeywell's refrigerant free-download modelling software allows to run refrigerants and cycles simulations based on actual data. Download the software from http://www.honeywell-refrigerants.com/europe

Smart phones apps

Download **Honeywell PT calculation applications for iOS and Android** free

Available on the App Store
ANDROID APP ON Google play

Literature

Honeywell has a wide range of literature available on Solstice® ze including case studies, customers references, etc. Visit www.honeywell-refrigerants.com/europe/resources/customer-case-studies

Information and contact

For information and support on new applications, and a list of authorised dealers contact your local Honeywell representative, visit **www.honeywell-refrigerants.com/europe**
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