

Natural Refrigerants: Solutions for HVAC

ATMOsphere America
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Jan Dusek

Business Development Manager APAC, shecco

CHINA: LIST OF RECOMMENDED SUBSTITUTES FOR R22



Natural Refrigerants recommended by MEP/FECO China in majority of targeted HVAC&R segments

- R290 Room air conditioner, Heat pump water heater, Stand-alone refrigeration system
- **R600a** Stand-alone refrigeration system
- CO₂ Domestic heat pump water heaters, industrial or commercial heat pump water heaters, Industrial or commercial refrigeration system (refrigerant or secondary refrigerant)
- NH₃ Cold storage, condensing unit, industrial refrigeration system



R290 AIR-CONDITIONING, IS IT COMING?











Foreign Economic Cooperation Office / Ministry of Environmental Protection of China (MEP/FECO) &

China house Household Electrical Appliances Association (CHEAA)
In Cooperation with

United Nations Industrial Development Organization (UNIDO) & United Nations Environment (UNEP)
Organize

International Workshop & Field Trip On

Designing, Production and Installation with R-290 in Air-conditioning Industry

10-12 April 2017, Ningbo-China

R290 AIR-CONDITIONING, IS IT COMING?





R290 AIR-CONDITIONING, IS IT COMING?













INDIA - GODREJ APPLIANCES



Godrej Appliances

- Replaced CFC, HFC and HCFC as early as 2002
- Efficient and green ACs using R290; first in the world
- India's first ACs with 7-star performance
- 300,000+ units sold since launch
- Earliest brand to opt for voluntary energy labelling of its refrigerators



JAPAN - RESEARCH - LOW-GWP HIGH EFFICIENCY AC



- Japanese Government (METI) & New Energy Development Organisation (NEDO)
 - 4 companies participating in the research projects to develop technologies for high energy efficiency low-GWP based small and mid-size air-conditioning systems
 - DENSO development of CO₂ (R744) AC system with high efficiency ejector
 - MITSUBISHI ELECTRIC development of HC based room air-conditioning system

高効率低GWP冷媒を使用した中小型空調機器技術の開発

三菱電機株式会社	自然冷媒を適用したルームエアコンの研究
株式会社デンソー	高効率エジェクタを使用したCO2冷媒空調システムの開発

HC&NH BASED HEAT PUMPS & WATER CHILLERS



- HC based water chillers introduced by several companies targeting commercial air-conditioning and process cooling applications
- RSA Cooling water chiller for outdoor installations, and are available with cooling capacity from 3,0 to 15,0 kW
- HC water chillers in Australia, reliable performance at 110+F days this summer



R718 WATER CHILLER







The world's first water-refrigerant turbo chiller

Kawasaki Heavy Industries (IGH) is ready to launch the world's first commercially available water-refrigerant contrifugal chiller for use in air-conditioning applications. Accelerate Japan reports.

Services complex solutions come from simple questions.

As global memerium continues to encoded towards finding alternative refrigerants to HPCs, some companies are retainly of their entire approach by asking very

Heyest Sakamoto is assistant manager in the Machinery Division of Eawaski Heavy Industries (CII). When be and his bear own the ylotal market star, to shift towards using more envisormentally friendly refigerants, they asked themselves the cuestion:

"It there an ultimate retrigorant that does not heat the planet, deplets the paper layer or present the risk of combession

"The snever is yet - water."

After several years of drivilopment and testing. CH is now maky tomerize the world stirst commercially available waterrefrigeral

Accelerate fuscialis B HZ / Autuma 2017

"For the air-conditioning industry, systems using water as a refrigerant have been an estimal thems. Although there were other manufacturers who worked on development, ne-one could invent a feasible product, because their subdicts were acvarid times larger than existing systems with the same refrigeration paparity' says Takahro Hirao, seniormanager in the Aerofynamic Machinery Department Machinery Division.

KHI, however has never been the type of company to stry away from engineering challenges — especially little workleads to breakthroughs that have the potential to charge the world.

Covolopment of the water-refrigerant turbo chiller

Kawanaki Heavy Industries has had a long history of salving trotrical challenges by leveraging knowledge acrees different. trotrical fields

KHI deet this through what it calls matrix management — a corporate manufacturing philosophy which encourages his eaches to internally share issues with experts in other fields to look for the best technical solutions, taker than having dipart trents westing incepted only from one another.

One of the best technical solutions, taker than having oundations, it has a meet larger volume than HFC gases. This conditions, it has a meet larger volume than HFC gases. This conditions, it has a meet larger volume than HFC gases. This conditions, it has a meet larger volume than HFC gases. This conditions, it has a meet larger volume than HFC gases. This conditions, it has a meet larger volume than HFC gases. This conditions, it has a meet larger volume than HFC gases. This conditions, it has a meet larger volume than HFC gases. This conditions, it has a meet larger volume than HFC gases. This conditions, it has a meet larger volume than HFC gases. This conditions, it has a meet larger volume than HFC gases. This conditions, it has a meet larger volume than HFC gases. This conditions, it has a meet larger volume than HFC gases. This conditions, it has a meet larger volume than HFC gases. This conditions, it has a meet larger volume than HFC gases. This conditions is not present than HFC gases. This conditions is not present that it is not present to the harmonic present than HFC gases. This conditions is not present that the harmonic present that the harmonic present than HFC gases. This conditions is not present that the harmonic present that the har

One of the most steered examples of this is the release of Kawasabi's new hints HGHUH2 recountly. The motorcycle has been able to achieve the company's legitlest performance

Artumn 2013 / Ascelerate Australia & NZ

benchmarks to date. This was achieved by incorporation industrial technology - Yorn KHTs York with gas ruiblines in the motorcycle's revenuch and denelopment process.

was the same source of inspiration that led to overcoming the challenges of working with water as a refrigerant. Rayato Sakameto told Accelerate Japan how KHI overcome those

Two-stage compression, high speed motor

Using water as a refrigerant presents two main challenges. First, the use of water receives the achievement of a significantly higher-pressure ratio lectwish the condenser and the evaporate, compared with standard FMC chillens.

"Indiae HFCs, which exist in the form of gas writer normal streamphoris conditions, water is a liquid, and its pressure needs to be reduced in order to change phases from liquid to gust."

Second, Decause water crists as a liquid in normal atmospheric

"Using water exit infriorrant," Sakamoto says, "multiplies the splanetic flow rate 100 fold, necessitating the use of a large

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