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## Air Conditioning: Leading Green Innovation



### Applications

- Light Rail Vehicles
- Metros
- Regional and Commuter Trains

# Green technology inside

As part of its environmental policy, Merak has designed and manufactured an HVAC unit that uses the new, environmentally friendly refrigerant HFO1234yf – putting the company one step ahead on the environmental protection front.

## MERAK ENVIRONMENTAL CARE

Merak has always been committed to protecting the environment. From the very outset, the company has looked for alternative solutions to help reduce global warming and prevent depletion of the ozone layer. Reducing the power consumption and greenhouse gas emissions of its products has always been a priority. One example is the heat pump that was firstly designed and manufactured by Merak in railway air conditioning systems in 1981.

Now, following further research and development work in this field, Merak presents its first HVAC unit using the HFO1234yf refrigerant. The use of this new refrigerant, whose global warming potential is much lower than ones in current use (4 compared with 1,300 for the R134a) represents a revolutionary change in air conditioning systems for railway vehicles.

A wide range of tests on the unit have been carried out in Merak's thermodynamic laboratory, with more than satisfactory results.

## ENVIRONMENTAL ASPECTS

Indicators	R134a	R407C	HFO1234yf
GWP (Global Warming Potential) <sup>100 years</sup>	1,300	1,653	4
ODP (Ozone Depletion Potential)	0	0	0
Average lifetime in the atmosphere	13.8 years	6-40 years	11 days

Source: IPCC Third Assessment Report 2001



## CUSTOMER BENEFITS

- Environmentally friendly refrigerant in response to increasingly restrictive market demands in terms of environmental protection
- Reduction of greenhouse gas emissions due to low Global Warming Potential ( $GWP_{100\text{ years}} = 4$ )
- Weight, dimension and cooling circuit are similar to HVAC equipment using the R134a refrigerant
- Can be used with high efficiency in all climatic zones contrary to  $CO_2$  and air cooling systems
- The price of this new equipment is much lower than the ones using air and  $CO_2$  as cooling agents
- This technology can be used in all types of railway vehicles

## MAIN TECHNICAL CHARACTERISTICS

Roof-mounted compact HVAC unit with two independent cooling circuits.

- Refrigerant HF01234yf
- Cooling capacity: 35 kW
- Ambient temperature: 40°C
- Number of compressors: 2
- Voltage/frequency: 400V/50Hz
- Control panel mounted inside the HVAC unit
- Adaptable to all train communication networks

## GREEN INNOVATION DEVELOPMENT

- 1987** Montreal Protocol on substances that deplete the ozone layer. As a result, these substances (CFCs and HCFCs) have to be progressively eliminated.
- 1997** Kyoto Protocol to reduce greenhouse gases (GHG) emissions.
- 2006** European Directive 2006/40/EC. Prohibits mobile air conditioning systems (MACs) from using fluorinated greenhouse gases with a Global Warming Potential higher than 150. This directive applies to the automotive sector. It will be valid with effect from 01/01/2011 for new types of vehicles; and from 01/01/2017 for all new vehicles.
- 2007-2010** Several automotive builders analyse alternatives in order to comply with the directive. The HF01234yf is tested in car air conditioning systems. Merak investigates and compares alternative technologies ( $CO_2$ , air and HF01234yf cooling agents) and builds several prototypes. SAE International recommends HF01234yf as the refrigerant in air conditioning systems in cars to fulfill the EU requirements.
- July 2010** General Motors announces that it will introduce the HF01234yf refrigerant in some models by 2013.
- September 2010** Merak, as a pioneer in the railway industry, introduces the first HVAC unit with the environmentally friendly refrigerant HF01234yf.

## Rail Vehicle Systems

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