

MAC Refrigerant HFO-1234yf

Meeting the MAC Directive on 1
January 2013

ASA Fachbereichssitzung Klima-Service
19.12.2012
Wuerzburg

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Daimler Statement (25 September 2012)

- Up to now, the climate-friendly chemical was set to be used worldwide in the automotive industry and was previously classified to be safe. This was determined by numerous laboratory and crash tests carried out by international vehicle manufacturers and independent institutions.
- Despite multiple confirmations of non-critical results, Daimler carried out a series of additional tests on the new refrigerant as part of a new real-life test scenario developed in-house **which goes above and beyond the legally prescribed requirements.**
- Due to the new findings of this study and the high safety demands at Mercedes-Benz, this chemical will not be used in its products. The company therefore wishes to continue to use the proven and safe R134a refrigerant in its vehicles.

EU MAC DIRECTIVE (2006/40/EC)

- With effect from 1 January 2011 Member States shall no longer grant EC type-approval or national type-approval for a type of vehicle fitted with an air conditioning system designed to contain fluorinated greenhouse gases with a global warming potential higher than 150.
- Moratorium
 - Due to product availability issues, the European Commission declared a moratorium on enforcement
 - New Vehicle Types must comply with the MAC Directive, but can be charged with a fluid with a GWP > 150 until December 31st, 2012.
- Following the Daimler declaration, Commissioner Hedegaard has stated:
 - There will be no more delays, Industry has had sufficient time to prepare itself.

HFO-1234yf Succeeds in Three Key Areas

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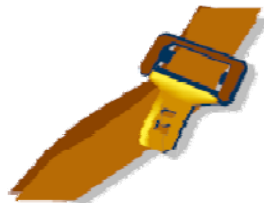
Energy Efficiency

- ✓ Highly energy-efficient refrigerant, meaning autos with HFO-1234yf use less fuel and have fewer emissions than those that use alternatives proposed to replace R 134a.
- ✓ Inefficient refrigerants – such as CO₂ – require more energy from the engine to operate, creating more emissions.



Climate Friendly

- ✓ Global Warming Potential (GWP) of 4 – well below the MAC Directive requirement of <150.
- ✓ Atmospheric lifetime of only 11 days, compared to 13 years for R-134a and more than 500 years for carbon dioxide.
- ✓ Converting Germany's car fleet to 1234yf (vs CO₂) reduces CO₂ equivalent car missions by 6,600,000 MT/yr.
- ✓ Full production has commenced and product is available today to meet the MAC Directive implementation on January 1, 2013.



Safety

- ✓ Extensively and rigorously tested by world-recognized, third-party organizations.
- ✓ Safe and effective for use in automobiles.

Vehicle Fluids Safety

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- Many flammable fluids commonly used in automobiles
- Gasoline, anti-freeze, brake fluid, automatic transmission fluid, lubricants **all burn**
- More than 5,000 times more energy is required to ignite HFO-1234yf than gasoline
- The auto industry has engineered appropriate, accepted methods to safely utilize flammable fluids
- The SAE CRP concluded:

“...From the evaluation and test results it has been concluded that HFO-1234yf can be safely accommodated through established industry standards and practices for vehicle design, engineering, manufacture, and service.”

Many fluids in a car ... ALL burn.



Gasoline



Automatic Transmission Fluid



Radiator Anti-freeze



Compressor Lubricant



Brake Fluid



Compressor Lubricant
(Electric /Hybrid Vehicle)

Gasoline much more flammable than 1234yf, and present at more than 100x volume of yf in cars. Standards allow safe use of all these fluids.

Auto OEMs Have Engineered A/Cs to Use HFO-1234yf Safely

Solutions Exist Today

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- **The Engine Compartment Requires Thermal Management**
 - Electronics, plastics, vehicle fluids and shrouding are close to high temperature surfaces
 - Solutions are available and in use today; many OEM's are using these to ensure MAC compliance on January 1, 2013
 - ISO and SAE standards recommend safe and proper engineering design standards for HFO-1234yf



SAE Cooperative Research Programs

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SAE Cooperative Research Programs Sponsors:

• Vehicle Makers:

Audi, BMW, Chrysler, Daimler, Fiat, Ford/Volvo, General Motors/Opel, Hyundai, Porsche, PSA, Renault, Shanghai Automotive, Tata, Jaguar Land Rover, Toyota, Volkswagen

• Tier One/Two Suppliers

DuPont, Honeywell, Conti Tech, Dayco, Delphi, Denso, Doowan, Dow, Freudenberg, Goodyear, Hutchinson, Maflow, Egelhof, Parker Hannifin, Sanden, Trelleborg, Valeo, Visteon

- SAE International carried out three Cooperative Research Programs (CRP) on HFO-1234yf
- 18 international, independent research institutes conducted tests:
 - Gradient
 - Creative Thermal Solutions
 - ILK
 - Ineris
 - Hughes Associates, Inc.
 - Exponent Scientific Engineering & Consulting
 - TNO Pharma
 - Hamner Institute
 - WIL Research Laboratories

Aspects Covered

- Safety and risk assessment
- Toxicity
- Flammability
- Air-conditioning system efficiency and performance
- Material compatibility

Overall Risk Assessment Conclusions

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“Use of HFO-1234yf in MAC systems poses an extremely low level of risk for both vehicle operators and service workers.”



“Use of HFO-1234yf in MAC systems will have a negligible impact on current risks associated with vehicle operation or service with current design practices.”

Honeywell Expects the New CRP to Confirm HFO-1234yf Is Safe for Use by January 1, 2013

SAE CRP1234-4 update 14.12.12

“To date, the majority of the OEMs involved in the new CRP do not believe that any of the new information reviewed will lead to a change in the overall risk assessment. Several OEMs have shared test results regarding their vehicles. **With the exception of Daimler, no OEM in the CRP has provided information that would suggest a concern for the safe use of R-1234yf in their vehicles.** R-1234yf is approved as an alternative refrigerant by the U.S. EPA and is REACH registered in Europe. Many new vehicles in Europe have received “type approval” to use this refrigerant. It is already in use in vehicles in North America and Europe.”

„The team includes 13 members: Audi, BMW, Chrysler/Fiat, Daimler, Ford, General Motors, Honda, Hyundai, Jaguar Land Rover, Mazda, PSA, Renault and Toyota. „

What We Are Hearing

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- HFO- 1234yf is Safe For Use in Automotive Systems Per SAE and ISO Standards
- EU Commission Continues to Affirm Enforcement of the MAC Directive January 1, 2013
- OEMs, Except Daimler, Acknowledge HFO-1234yf is Safe For Use in Automotive Systems
- ACEA Will Not Request A Moratorium
- KBA Will Type Approve Cars With HFO-1234yf If the Vehicle Meet the Safety Standards
- Honeywell Supplying Solstice™ yf to OEMs For - the MAC Directive and CAFÉ Credits
- CO₂ has Challenges with Safety, Performance and Cost

Regulators Affirming Product Is Safe

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Philippe Jean - Head Automotive Unit at DG Enterprise: From Letter to Neutronics (Equipment Supplier) – 10/31/2012

...of the Commission established that this would apply until the problems of supply were solved and that with the limit of 31 December 2012. After this date, the EU Member States can not allow registration of cars (those type-approved for the use of the new gas) that use the old gas 134a...

Antonio Tajani – VP of the Euro. Commission - DG Enterprise: Letter to Bernd Lange – 11/27/2012

... The Commission considers that the current body of regulation is adequate to provide for safe products on the EU market.

Dr. Lutz Knopek - Member of German Parliament – Note to Antonio Tajani – 11/26/2012

... I kindly ask that the European Commission makes sure that all member states take the necessary steps to ensure the compliance of their car-makers with the Mobile Air Condition Directive starting 01 January 2013.

Chris Davies (MEP -UK) - Note to the Commission Requesting Answers on The MAC Directive – 11/30/2012

...The Commission will also be aware that Daimler, after years of prevarication and obfuscation about how it intends to comply with the legislation on mobile air conditioning, has carried out a spurious test intended to demonstrate that under circumstances anticipated by no other manufacturer it is possible to ignite HFC1234yf at extremely high temperatures...

The Path Forward

- ✓ **Environmentally-Friendly, Energy-Efficient Refrigerant**
 - HFO-1234yf, with a GWP of 4, offers a 99.7 percent improvement in global warming potential compared with HFC-134a and far exceeds the EU Mobile Air Conditioning (MAC) Directive requirement.
- ✓ **Implement and Enforce the EU MAC Directive on January 1, 2013**
 - Adequacy of five years to plan, design, test and implement.
 - No product supply issues; full production of HFO-1234yf has commenced – Honeywell is fully committed to the full commercialisation of the product.
 - There is a cost to climate protection and a higher cost to delaying.
 - The EU Commission is fully intent on no further delays to the MAC Directive.
- ✓ **HFO-1234yf Is Safe**
 - Extensive, multi-year testing performed by globally-recognized experts confirm that the material is safe in application.
 - The Daimler testing, which represents an extreme set of conditions, adds no new data that has not been previously considered in the SAE CRP studies.
 - Other HFO solutions will exhibit similar flame characteristics at elevated temperatures; CO₂ creates risk related to asphyxiation.
- ✓ **Engineer Solutions for Individual Vehicle Types**
 - OEMs have solved engine compartment requirements for HFO-1234yf and will comply with the MAC Directive.
 - Other solutions such as CO₂ would need many years to develop and would be extremely costly compared to HFO-1234yf and not applicable on a global scale.

Solstice yf for the MAC aftermarket

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5 & 10kg packaging Solstice™ yf



Features:

- Liquid/Vapor phase
- Embedded Anti-filling valve
- Additional anti-tamper protection
- Lightweight, open handles for easy valve access
- Integrated safety relief valve

Valve

Outlet connection

CGA-166

0.500-16ACME-2G-LH-EXT

according to SAE J2844

More information

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www.1234fakten.de

www.1234facts.com