

Honeywell

Workshop

F-gases: Responsible Use, Environment and Energy

Athens, 29 September 2003

Safe Refrigerants Beyond Year 2004

Paris Vogdanos - Spray Pack Refrigerants

Cesare Soffientini - Honeywell Fluorine Products Italia

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Selection of Refrigerants

Parameters:

- Thermodynamic Performances
- Reliability
- Environment Friendship
- **Safety**

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Refrigerants Characteristics

Safety

- **Non-toxicity**
- **Non-flammability**

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Refrigerants Characteristics

- Refrigerants like HFCs are safe.
- All common gases are non-toxic but heavier than air.
- All common gases are non-flammable but, when leaking out, mixed with oil, they will become flammable in air.
- *Refrigerants are pressurized liquefied gases, to be treated with care* in any case.

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Material Safety

- The **Material Safety Data Sheet (MSDS)** is the most important documentation to accompany the product.
- Read the MSDS.
- Ask for clarification if you don't understand.
- Keep the MSDS in a prominent location near the product.
- If you distribute product you must provide with an MSDS.
- If you have an MSDS you must keep a written record of the parties to whom the MSDS has been given.
- Whenever there is a significant change in content all customers can be reached.

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Material Safety

Hazards Common to Most Halogenated Refrigerants:

- **Overexposure- dizziness, loss of concentration.**
- **At higher levels (Displacement of Oxygen to < 15%)**
 - Central nervous system depression**
 - Cardiac arrhythmia**
 - Loss of Coordination**
 - Increased Pulse Rate & Deeper Respiration**
 - Asphyxiation**

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Material Safety

Hazards Common to Most Halogenated Refrigerants: Inhalation

- Inhalation of high concentrations of refrigerant vapor can lead to cardiac arrhythmia.
- Because of possible disturbances of cardiac rhythm, heart stimulating drugs such as adrenaline (epinephrine) should be used with special caution only in situations of emergency life support.
- Treatment of overexposure should be directed at the control of symptoms and clinical conditions.

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Material Safety

Hazards Common to Most Halogenated Refrigerants: Inhalation

- Immediately remove to fresh air.
- If breathing has stopped, give artificial respiration.
- Use oxygen as required, provided a qualified operator is available.
- Call a physician.

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Material Safety

Hazards Common to Most Halogenated Refrigerants: Frostbite or “Cold Burns”

- Skin: Soak an affected limb in lukewarm water or cover with clean soft wool or similar covering if water is not available.

DO NOT RUB FROSTBITTEN SKIN

- Eyes: Flush with lukewarm water.
- Handling refrigerants, always wear protective clothing, safety goggles and/or gloves to prevent against incidental contacts.

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Material Safety

Toxicology

- The highest Exposure Limit for an individual - 40 Hour Workweek TLV-TWA (Threshold Limit Value on a Time-Weighted Average basis) is 1000 ppm.
- Workplaces should have adequate ventilation.
- The maximum allowable workplace concentration should be observed.
- Concentrated vapour or swallow liquid HFCs refrigerants must not be inhaled.

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Material Safety - Refrigerants and Open Flames

Thermal decomposition

- Refrigerants that contain *halogens* (chlorine, fluorine, bromine) should not be exposed to open flames or very hot metal surfaces.
- Thermal decomposition of *halogenated hydrocarbons* (CFCs, HCFCs and HFCs) generates toxic and corrosive materials.
- Possible thermal decomposition products include the acids HCl & HF, and carbonyl halides (carbonyl chloride or phosgene, carbonyl fluoride, carbonyl chlorofluoride).

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Material Safety - Refrigerants and Open Flames

Exposure Levels of Decomposition Products

Hydrochloric acid, HCl	5 ppm TLV, ceiling*
Hydrofluoric acid, HF	3 ppm TLV, ceiling*
Carbonyl fluoride	2 ppm TLV
Carbonyl Chloride (phosgene)	0.1 ppm TLV
R134a/R404A/R507/R410A/R407C	1000 ppm ** (Honeywell)

TLV (Threshold Limit Value) - The amount of material an individual can be exposed to for 8-hours daily on a time-weighted average basis.

*Ceiling- concentration should not be exceeded during any part of working exposure

** Occupational Exposure Limit, 8-hour time-weighted average

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Material Safety - Refrigerants and Open Flames

Protection Against Exposure

- Halogen acids and carbonyl halides are toxic and/or corrosive.
- Use ventilation and personal protective equipment including properly selected gloves, goggles and respirator. Filter masks are not recommended.
- Venting into the workspace, ie, using a fan is not preferred. Other persons, fixtures, etc., can be affected.
- Chemically resistant duct and an exhaust blower should be used whenever possible. Watch for condensed acid residues in ducts.

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Storage and Handling

Product Storage

- Store Cylinders in a cool, dry, properly ventilated area away from heat sources, flames, corrosive chemicals or fumes, explosives.
- Store out of direct sunlight.
- NEVER allow a cylinder to get warmer than 50°C.
- Keep cylinders above dirt or damp floors.
- Do not damage cylinders. Rack, chain, or rope cylinders so that they cannot tip, roll, or strike each other or any other object.

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Storage and Handling

Product Storage and Handling

- Always wear recommended personal protective equipment.
- All storage containers, equipment and components, cylinders, tanks, manifolds and hoses must have a design pressure rating acceptable for use with refrigerants.
- All product transfers should be liquid, not vapor, in order to minimize changes in composition.
- Regularly inspect hand trucks, carts, forklifts, pumps, hoses, regulators, valves, and vessels.

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Storage and Handling

Leak and Leak detection

- Check cylinders for leaks regularly.
- Check storage and transfer equipment for leaks.
- Check refrigeration systems for leaks regularly.
- HFC refrigerants require the use of a leak detector designed specifically for HFCs - detectors designed for CFCs and HCFCs will not be sensitive enough while halide torches will not work.

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Storage and Handling

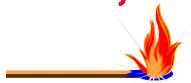
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- Never place any body part on the source of or in the path of a leaking pressurized gas no matter the leak rate is.

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Storage and Handling

Leak and Leak detection

- Detection and location of refrigerant leaks should be conducted using either the refrigerant, dry nitrogen or a mixture of the two as the tracer.
- *Nitrogen is a high pressure gas. To avoid serious personal injury, never connect directly to the cylinder. Always use a regulator approved for nitrogen service.*
- **Never use air to detect or locate a leak. Mixtures of air and hydrogen-containing refrigerant (HCFCs, HFCs) become flammable at elevated pressures.** 

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Handling Issues

- If a Fluorinated refrigerant is mixed with air and pressurized, the mixtures can become combustible. Never use mixtures of *HCFCs or HFCs and air as leak test gas. Always use dry nitrogen or other inert gases instead of air.*
- Refrigerants are under pressure in a system. *Never braze on a system containing refrigerant.*

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Conclusions

- MAINTAIN SAFETY AS A PRIMARY CONSIDERATION.
- MINIMIZEING ACCIDENTS AND HEALTH RISKS.
- KNOW HOW IN FACING EMERGENCIES, FIRES, LEAKS.
- LET REFRIGERANT HANDLING BE PERFORMED PROFESSIONALLY BY SKILLED, SHREWD AND SPECIAL TRAINED TECHNICIANS.

Improve your SAFETY PROGRAM !