

## Safety Information for COLD Hydrocarbon Refrigerants

In many respects the hazards of Hydrocarbon refrigerants are similar to those for CFC, HFC, HCFC. In addition to this, Hydrocarbon refrigerants are flammable. This section covers:

- General safe refrigerant handling;
- Flammability;
- Simple workplace precautions;
- Handling Hydrocarbon refrigerants cylinders;
- Design of Hydrocarbon refrigerants appliances.

### General safe refrigerant handling

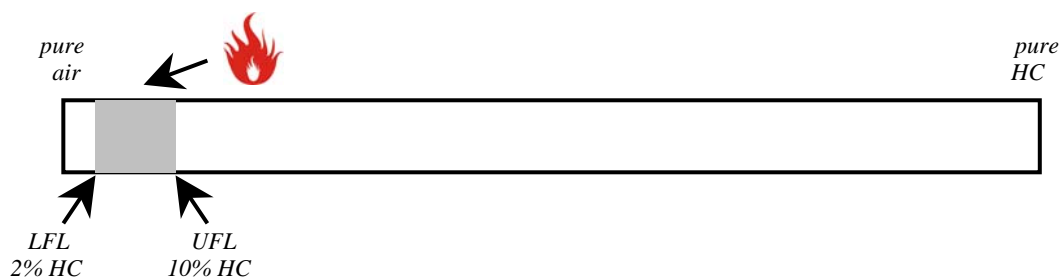
All refrigerant are hazardous. The following safe handling guidelines apply to all refrigerants, including CFCs (e.g. R12), HFCs (e.g. R134a) and HCs.

- ✚ **Contact with liquid refrigerant will cause a freeze burn** (similar to frostbite). You must wear gloves and goggles and clothing which covers your body when handling all refrigerants (e.g. when charging or recovering refrigerant). Bathing the area with cold water should treat a freeze burn. Medical attention may be necessary.
- ✚ **Refrigerants do not smell and are heavier than air** and will therefore tend to collect in chest freezers / chillers, pits, trenches and basements. You should ventilate these areas to disperse leaking refrigerant.
- ✚ **Refrigerants displace air and are asphyxiates** – they will suffocate you if you breathe in high concentrations. An affected person should be removed to an uncontaminated area (e.g. outside a building) and kept warm and still. Artificial respiration or oxygen may be needed. Medical attention may be necessary.

*Most refrigerants, including CFCs, HCFCs, HFCs and HCs (e.g. those which propane, isobutane and / or ethane) are not toxic.*

### Flammability

Hydrocarbons are flammable when mixed with air and ignited. The concentration of the HC in air must be between the lower and upper flammable levels as shown below.



If the concentration is below the lower flammability level (LFL) of approximately 2%, there is not enough HC for combustion. If the concentration is above the upper flammability level (UFL) of approximately 10% there is insufficient oxygen for combustion

✚ The LFL is approximately equal to  $35 \text{ g/m}^3$  of HC refrigerants in air. **For safety reasons a practical limit of  $8 \text{ g/m}^3$  should not be exceeded in a closed space.**

For example, in room 3m by 3m by 2.5m high the practical limit for an HC charge is 180 g. If the total charge of 180 g. is released into the room, it will not be enough to produce a flammable mixture. The resulting concentration will be about 20% of the lower flammability level if the refrigerant was evenly dispersed in the entire room. But this may not be the case, and therefore the practical limit should never be exceeded.

For combustion there must be an ignition source. The ignition source must be hotter than  $460^\circ\text{C}$  to ignite the HCs commonly used as refrigerants. The following are potential ignition sources:



A flame, e.g. from a brazing torch, halide torch leak lamp, match or cigarette lighter;



A spark from an electrical component such as a switch, relay, overload protector, loose wiring connection;



Static electricity.

Combustion will not occur inside the system as there will not be enough air. Even if a system is not evacuated before charging, there will not be enough air for combustion.

✚ **However, combustion can occur if a leak of HC results in a flammable mixture and there is an ignition source.**

#### **Refrigerant leakage can be dangerous if:**

- Refrigerant leaks into a closed cabinet (or other sealed space) and there are sparking electrical components inside the cabinet;
- Refrigerant leaks into the air around the system and there are sparking electrical components on the system;
- Refrigerant is lost during servicing (e.g. when venting, flushing or charging a system), and there are sparking electrical switches and / or flames.

## Simple workplace precautions

✚ You must take these simple precaution when working with HC refrigerants:



Work in a **well ventilated area**, or outside.



**No smoking**



**No flames** within 2 m of the charging / venting area.



**Do not use switches** within 2 m of the charging / venting area.



Have a **fire extinguisher** (dry powder type).



Wear **gloves, goggles** and clothing which cover you.

**Do not store HCs inside**

**HCs can accumulate**, e.g. in chest cabinets and basements

## Handling HC cylinders

Cylinders containing HC refrigerants should be clearly labeled to show the type of refrigerant and that it is flammable. This label should not be removed.

The guidelines below are recommended good practice when handling HC cylinders they are very similar to the guidelines for any refrigerant cylinder (e.g. CFCs):

- The valve cap should be fitted when the cylinder is not being used.
- The cylinder should not be heated. Refrigerants cylinders can usually withstand temperatures up to 45 to 50°C. If a cylinder needs to be heated ( e.g. to remove refrigerant more easily) it should be placed in a container of water no hotter than 45 to 50°C.
- The cylinder and its valve should not be modified.
- The cylinder should not be re-filled unless it is designed for recovered refrigerant.

Some HC refrigerants are supplied in cylinders fitted with an excess flow valve as an additional safety device (e.g. COLD refrigerants in 100 g cylinders and larger). This valve closes if the flow of refrigerant suddenly increases, e.g. if the charging hose is removed before the cylinder valve is closed. The excess flow valve is re-set by closing the valve and opening it again slowly. The excess flow valve sometimes closes if the cylinder valve is opened too quickly.

 **HCs should not be decanted into smaller cylinders unless absolutely necessary.** In some countries law prohibits this.

### If HCs are required to be decanted

- This should be done outside or in a well-ventilated area.
- The cylinder that is being filled must be weighed. Note that **the weight of the same volume of HC refrigerant is 40% - 50% of the weight of other refrigerants**-the same volume of refrigerant will weigh 50% - 60% less (e.g. a cylinder which can safely contain 14 kg of R12, will only be able to contain approx 6 kg of HC).
- The transfer hose used should be as short as possible to minimize loss and risk.
- The transfer hose should be evacuated or carefully purged before transferring refrigerant.
- When decanting a blend, it must be removed from the supply cylinder as a liquid.
- Aerosol can type cylinders (sometimes used for servicing) should never be re filled.

Some cylinders (especially those that HC refrigerants are supplied in) have a non return valve-you must not re-fill these cylinders.

When you need to purge lines, e.g. before charging with HC refrigerant, you must take care. In many cases you will have to purge with liquid refrigerant, which can be dangerous. To do this safely:

1. Make sure the area is well ventilated.
2. Open, then close the cylinder valve.
3. Purge each line for a short time-1second should be long enough.

## **Transport of HCs**

Follow local regulations for the transport of flammable gases (e.g. LPG).

## **Storage of HCs**

Follow local regulations for the storage of flammable gases. Extremely flammable. Pressurized container: protect from sunlight and do not expose to temperatures exceeding 50 °C.

## **Design of HC appliances**

HC appliances usually have electrical components that are either.

- Sealed.
- Solid state.
- Enclosed in sealed box.
- Located remote from the refrigeration circuit.

This avoids the risk of combustion if HC refrigerant leaks from the circuit.

**✚ When replacing these components you must use the same type, and fit them in the same position. If you need to open a sealed enclosure, make sure you re-seal it correctly.**