ProDetec

Measure . Prevent . Protect . Control

Whether it be for the preservation of the stocks, for the compliance with the sanitary or nutritional food requirement or for the well-being purposes (air-conditioning), cooling has become essential to our society.

Currently, the majority of the cooling systems are based on the use of steam compression cycles and fluid refrigerant phase changes.

The selection of refrigerant fluids is based on their heat-absorption property (calories) while they pass from their liquid phase to their gas phase.

So far, the majority of the refrigerants used were halogenated hydrocarbons because of their low toxicity and their good thermodynamic performance: CFC (chlorofl uorocarbons), HCFC (hydro chlorofl uorocarbons).

However, the Montreal Protocol dated 16th September 1987 (an international agreement intended to reduce and completely eliminate the substances that deplete the Ozone Layer and increase the greenhouse effect), which was reinforced by the Kyoto protocol dated March 2007, required the elimination of CFCs and HFCs including:

- a ban on their use as propellants;
- a requirement for enhanced sealing of the refrigeration circuits;
- a requirement for new measures to prevent bleeding and discharges into the atmosphere;
- a systematic recovery of the refrigerants.

This has promoted the use of natural fluids that are more delicate to handle but more effective from a thermodynamic point of view, such as ammonia (mainly for agricultural/food industries), carbon dioxide and hydrocarbons (propane and butane).

Refrigerants for agricultural and food industry

Application Note

How do we produce cold?

Whether it's a refrigerator or an air-conditioned car, the principle is the same : pumping the heat out of the place you want cool and evacuate it.

Heat transfer is possible thanks to the following gas properties:

- compressing a gas raises its temperature

- condensation of a gas releases heat

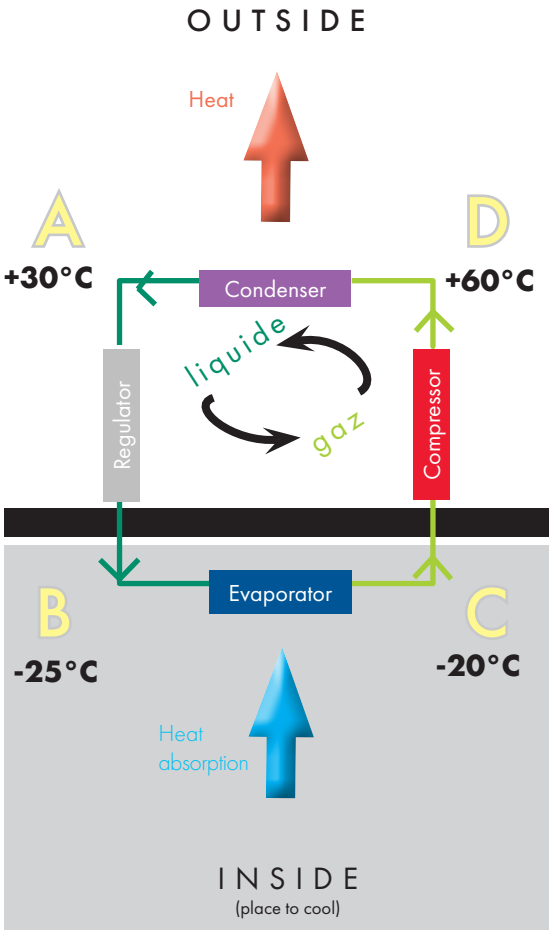
- the expansion of a gas lowers its temperature

- the evaporation of a liquid needs heat to be removed.

So, a compressor will compress a refrigerant fluid and therefore increase the gas temperature. The compressed refrigerant enters the condenser. The circulation of fluid in the gaseous state at high temperature in an environment with a lower temperature causes condensation of the latter.

Afterwards, the operator will lower the pressure of the fluid, that will cause a temperature drop (down to -20°C).

Cold fluid refrigerant is then sent into the evaporator.



Gas properties

Compounds	LEL (%vol)	LSE (%vol)	Density	VME (ppm)
Inorganic compounds				
Ammonia (R717)	15	28	0,59	25
Hydrocarbons				
Propane R290 (C3H8)	2,2	10	1,52	1000
Butane R600a (C4H10)	1,8	8,4	1,95	1000
HCFC				
R142b Chlorodifluoroethane	6	18	4,73	1000
HFC				
R32 Difluoroethane	12,7	33,4	1,79	-
R143a Trifluoroethane	7	16,1	1,05	-
R134a Tétrafluoroethane	-	-	3,52	1000
HFO 1234yf	6,2	12,3	3,9	-
HFO 1234ze	-	-	1,17	800

Refrigerants for agricultural and food industry

Application Note

Proposed solution :

MX32 controller

- 1 to 2 independent channels
- Up to 5 integrated relays
- Acoustic and luminous alarms
- LCD display

MX43 numeric controller

- 1 to 8 lines, up to 32 detectors
- Addressable relays
- Graphic display
- Mobile module (less wiring costs)

Fixed OLCT10 detector

- Freon detection
- 4-20 mA output
- Simple installation and use
- Anti-corrosion housing

Fixed CTX300 detector

- Detection of CO2, NH3 and Freon
- Set of interchangeable pre-wired sensor blocks
- Designed for secure areas
- Optional display (on the NH3 version)
- Anti-corrosion housing

Fixed OLCT100 detector

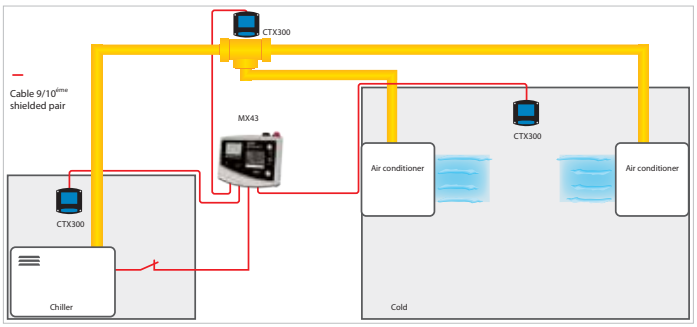
- Detection of CO2, NH3 and Freon (in the Atex zone)
- IP 66
- Anti-corrosion housing

* EN 14624 Standards on the metrological performance of halogenated refrigerant detectors

Installation

The installation rules depend on the configuration of your system, however, do not forget to take into account the density of the gases and the air flow when positioning your detectors.

Ammonia refrigeration



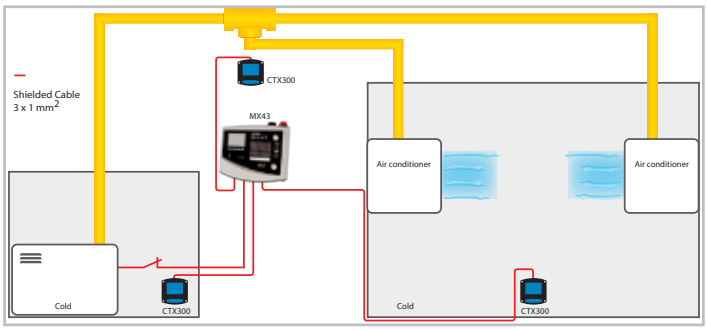
The sensors must be placed at a high level, usually in the attic, in order to protect people (engine room, technical room).

Areas to be monitored: compressor zone (1 sensor per compressor), condenser zone (1 sensor per condenser), valves (if there is a risk of leakage).

Cell type: Electrochemical

Wire to be used: 1 pair 9/10th shielded (use a third if the sensor has a display).

Refrigerant gases detection installation



The sensors are placed near the ground level (because of the Freon density) usually in the engine room or technical room.

Areas to be monitored (where there is a risk of leakage): compressor, condenser, valves.

Cell type: Semi-Conductor

Wire to be used: 3 x 1 mm2 shielded wires.

Refrigerants for agricultural and food industry

Application Note

Installation of at least 1.5 tons of NH_3

Order dated 19th November 2009 (abrogated 23/02/1998) for all new installations and existing cells according to the following deadlines

by April 24th, 2010:

Art. 2.1.2. Regulations specifi c to the use of ammonia... Pipes in and out of the condenser are protected by the enclosure of the compressor and equipped with a set of detectors to art. 4.3.1 ...

...By "enclosure" of the compressor we mean any structural arrangement aimed at ensuring the best containment of any leaked gas with the following minimal characteristics:

- the compressor enclosure is made of materials compatible with the use of ammonia,

- it shall retains its structural integrity, even in case of accidental leakage,

- it shall be made of solid panels, so as to form an envelope around the equipment or pipe network, all sides shall be dismountable to enable the checking the equipment and piping.

by September 1st, 2010:

Art. 4.3.1. Detection systems
I - Specifi c provisions for the storage or the use of containers with a capacity less than or equal to 50 kg

Gas detectors are implemented in the facility zones listed under point 4.1 where the greatest risk exists in case of leakage or significant accumulation of toxic gases or vapours. These zones must be equipped with detector systems whose sensibility levels must be suitable for the situation.

II - Specific provisions on the use of ammonia (refrigeration plant) at September 1st 2010

The installations that could pose a threat to the safety or health of persons must be provided with detection systems and alarms suitable to the possible risks and carefully arranged to promptly alert the staff in the event of any accident.

The location of detectors must be identifi ed by a preliminary study.

The operator shall list these detectors with their functionality and determine the maintenance schedule to ensure their effectiveness over time.

Gas detectors must be implemented in areas that are susceptible to be affected or likely to be impacted by ammonia leaks, more precisely engine rooms as well as technical rooms and halls.

The operator shall set at least two of the following safety thresholds:

- the exceeding of the fi rst threshold (500 ppm for manned places and 2000 ppm for unmanned places) resulting in the triggering of an acoustic or luminous alarm and putting into service the additional ventilation system in compliance with the regulations in force,

- the exceeding of the second threshold (1000 ppm for manned places and 4000 ppm for unmanned places) resulting in the previous case, the plant safety shutdown, an acoustic alarm in all areas of the building and if necessary, a remote transmission towards a technically competent person.

Installation of more than 1.5 tons of NH_3

Order dated July 16th, 1997

Chapter VIII: industrial risk during a malfunction of the installation – article 42

The installations that could pose a threat to the safety or health of persons must have an alarm and a detection system ...

The location of detectors must be identifi ed by a preliminary study.

The operator shall list these detectors with their functionality and determine the maintenance schedule to ensure their effectiveness over time.

Gas detectors must be implemented in areas at greatest risks in case of an important release or accumulation of gas or toxic fumes.

The safety zones must be equipped with detection systems whose sensibility levels are suitable to the situations.

These detectors must be of a toximeter type in permanently manned places or where people may be exposed, and an explosimeter type in other cases of compressed atmospheres.

The operator shall set at least two of the following safety thresholds:

- the exceeding of a fi rst threshold resulting in the triggering of an acoustic or luminous alarm and putting into service the additional ventilation system in compliance with the regulations in force

- the exceeding of a second threshold resulting in the previous case, the plant safety shutdown, an acoustic alarm in all areas of the building and if necessary, a remote transmission towards a technically competent person. (this threshold is more than double than the value chosen for the 1st threshold).

Fixed detectors must activate an acoustic or luminous alarm in the control room.

Order dated May 7th, 2007

Concerning the sealing control of refrigeration and air conditioning equipment (reduction of gas emission with greenhouse effects – Kyoto agreement)

Art. 2 – The tightness control is carried out by using a manual leakage detector if the equipment is located in a confi ned space, tightness can be checked with the use of a multi-probe room controller connected to an alarm.

Art. 4 – ...the room controllers have a sensitivity below 10 ppm. These sensitivities are measured according to EN 14624. The sensitivity will be checked at least once a year to ensure that it does not change more than 10%

Art. 5 – If the tightness control is done by means of a room controller... The frequency of inspection of the equipment with a load greater than 30Kg is reduced by half (once per year instead of twice per year => reduction of operating costs)

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