

The interest and the application for Hydrocarbons (HC) refrigerants is growing more and more, especially now that the impact of global warming refrigerants has acquired an important role in the industry of refrigeration and air conditioning.

It is widely recognized that these refrigerants classes are excellent in terms of performance, but also that they have negatives features for their environmental use in terms of flammability.

Airserco realizes specialized secure systems for testing, evacuation and charging with flammable refrigerants of the circuits, providing special commissioning of appropriate working areas equip-ped with auxiliary forced extraction systems and monitored by means of leak Gas sensors detec-ting leaks to safeguard the safety of the operator according to existing rules on the prevention of possible explosion.





Description of a typical HC Refrigerants treatment System

The equipment for the final vacuum and the charge of HC refrigerants are realized according to ATEX Directive 99/92 / EC, inside a proper workspace for refrigeration units to be loaded with flammable gas. Within that area flames or wells are not allowed, and smoking is prohibited. The area is delimited by walls and ventilation ducts. For security reasons, sources of potential danger to the fire ignition should be placed not less than 2-3 meters from the perimeter of the work area.

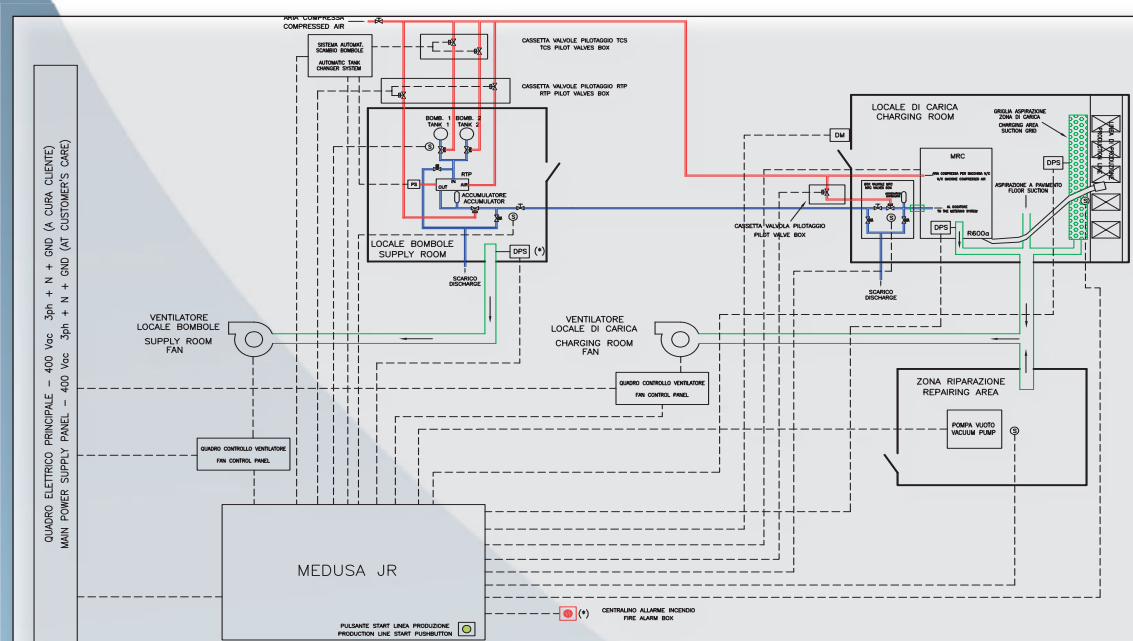
Usually a bounded working area is provided by an enclosure in which, the cooling units to be treated are moved inside through a sliding door. The same door is the access point to the work area by the staff engaged. The door can be controlled by a microswitch timed.

The size of the charging Area is approximately 20 m², with height of 1 meter from the floor and is enclosed by fireproof panels, which are also supplied by **Airserco**.

On the internal perimeter of the working area, an extraction system is installed, which provides for the necessary extraction of air, so as to keep under control the concentration of hazardous gas. Inside of this area is the HC vacuum and charging machine with one / two injectors.

The refrigerant tank in use, can be installed inside another area and it can deliver the refrigerant to the charging station by means of Refrigerant Transfer Pump systems.

The devices to check the environmental safety are installed in the vicinity of the outer walls of the charging area, while the ventilation unit with variable speed is located on the wall perimeter of the plant, in correspondence of the charging area.



Full layout example of a FT HC systems installation



System components for HC refrigerants treatment

Airserco can supply a full and customizable components package that realizes a full HC system.

Every **Airserco** component system is delivered with relevant test certification and user manual that describe the all the necessities steps to follow in order to work with high performances and security conditions during use and maintenance.

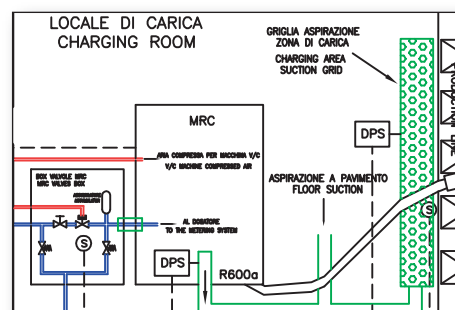
Every system has been tested according to standardized production and testing procedures . In this section there is a summary description of the functional characteristic of all the component system. For a more detailed description please look at the relevant technical table.

Vacuum and Charging Machine (iRockall HC)

iRockall HC Provides Automatic Evacuation, Decay/ Rise tests, and Refrigerant Charging.

iRockall HC is designed to work inside a potential dangerous Area classified as zone 2, according to the CEI EN 60079-10 normative.

iRockall HC has a special to internally protect and separate electronic components from potential contact with refrigerants.



Electrical Unit - it contains the all electrical components as relevant power supply, safety relays to limit over possible current shortcuts conditions. The electrical unit is also equipped with a door microswitch in order to cut the power supply to the unit when the door is opened.

Intermediate Empty space - this component separated the electrical unit from the hydraulic unit. In this case there is warranty of perfect insulation between the two sub units.

Hydraulic Unit - it is contained under the Electrical Unit and it is generally composed by:

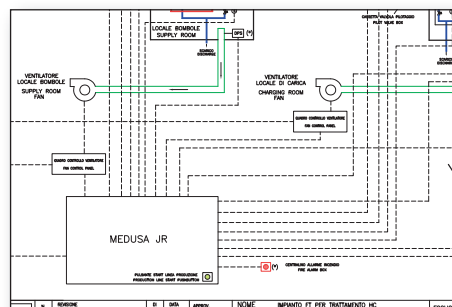
- Refrigerant supply line
- Refrigerant pipes
- Refrigerant metering system (Volumetric or by RTP automatic dosator)
- Injector refrigerant line
- Pneumatic vacuum pump for Injector internal vacuum
- Sensor to detect refrigerant leaks
- Sensor to detect internal forced ventilation

All components of each line of refrigerant charge are sectioned by type of quick couplings Hansen or Faster, which simplify the replacement procedure of every component, making it easier and safer.

Each line also sectioned by two normally closed valves, one on the injector, the other on the refrigerant metering system which limit the amount of refrigerant lost, in case of leakage or malfunction of the sealing devices to the outside.

Medusa Monitoring System

The monitoring system **Medusa** represents the general central control and command of the entire plant for the treatment of refrigerant gas. It is essentially composed by electrical panel with electronic control unit and gas concentration detection sensors installed inside the charging working area, one of which directly installed inside the station Vacuum and Charging. The **Medusa** system controls the forced ventilation system (see Eolo system) so to enhance the air flow rate in the presence of dangerous concentrations.



Medusa also controls the Vacuum and Charging unit power supply electrical permission and the relevant Refrigerant Transfer pumps connected to the delivery line.

The electrical permission is real time according to the continuous monitoring of the refrigerant concentration detected from the sensors and a ventilation level detected from relevant differential pressure switches installed on the charging area ventilation circuit.

Medusa provides to alert operators and supplies additional ventilation, when the gas concentration reaches 15% of the Lower Flammability. The system will cut power to the vacuum system and charge, putting it in a stand-by safety, if the concentration exceeds 30% of the Lower Flammability. The warning sound and lighting is available with a remote column to advise the operators to leave the working area as well as fire prevention devices that are running. In case of lowering the level of concentration below the threshold value, the system must be reset manually by the operator.

Medusa is also supplied with:

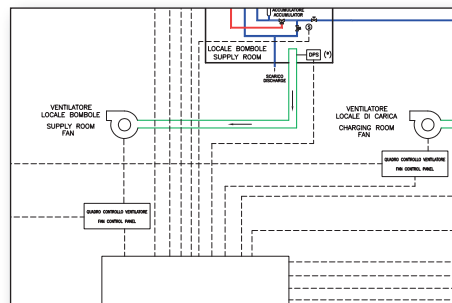
- control box valves placed inside the storage box, each essentially equipped with a valve of the barrier pneumatically operated with relevant pilot valve, manual valve, safety valve and accumulator
- safety valves for the refrigerant lines.
- valves control box placed in the supply room, each with sectioning valves, solenoid and manual, to stop, in case of need the power supply the power lines of the refrigerant
- Box fire alarm, placed in proximity of the two doors of the storage box.
- Differential pressure switch for continuous monitoring of the forced ventilation system.
- Column indicating abnormal concentration of hazardous gas.
- Alarm indicators door or fan, in addition to the microswitch control opening of the doors of the storage box.



Extraction System Eolo

Eolo extraction system consists of a fan soundproof / free multispeed in Ex execution, with rate capacity up to more than 3500 m³/h, controlled by smart inverter.

The control system is regulated by a special electrical panel, interfaced with the Medusa monitoring system and with the charging unit iRockall HC



The ventilation delivered by the Eolo system is routed in a pipe appropriately sized according to the factory layout. If the ventilation system ends to work (broken fan motor, accidental clogging ducts etc. ...) the Medusa system activates a procedure for disarming of the refrigerant pumping systems and the refrigerant charging machine as it no longer guaranteed safety.

The control of the operation takes place by means of differential pressure switches connected to the Medusa system that is dimensioned to detect the presence of air flow in the ventilation areas potentially more critical.

Operation Constraints of the Eolo System:

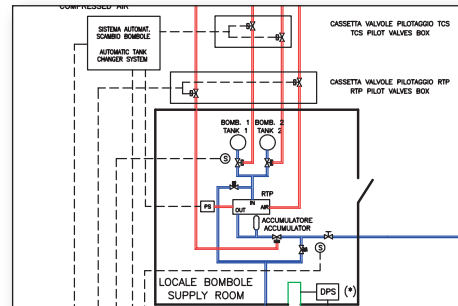
- The fan must be always in operation, the lower operating speed, when the machines are in operation, so as to maintain a continuous change of air in the working area
- the ventilation flow rate is set at the maximum speed, when one or more sensors detect a gas concentration greater than 15% of the Lower Flammability.
- The fan continues to run at full capacity even when, exceeded the threshold of 30% of the Lower Flammability, the power to the charging unit is cut and is given indication that you are in an emergency situation.





Refrigerant Transfer Pump (RTP)

The **Refrigerant Transfer Pumps** are volumetric pumps with cylindric movement designed to pressurize and transfer the refrigerant in liquid phase. The **RTP** runs on compressed air. They are installed close to a tank or storage systems from which they transfer the refrigerant fluid due to the cylinders moved by compressed air and proper pneumatic valves. The fluid is compressed in liquid phase and transferred to the refrigerant charging machine.



The **RTP** is equipped on the refrigerant sending line with a barrier realized by means of unidirectional valves that avoid the fluid return towards the pump. As all the Refrigerant fluids tend to increase their specific volume with the temperature increasing, some events of uncontrolled pressure increase can appear due to the incompressibility of the fluid itself. The **RTP** have a safety valve settled at 40 Bar that allows it to exhaust on the ventilation circuit if overpressure occurs on the delivery line.

Automatic Tank Changer System (TCS)

This system is used to automatically replace the supply of refrigerant gas to the transfer pump when the tank runs out of stock. The principle of operation is based on monitoring of the movement of the piston of the pump RTP that in case of lack of refrigerant in the cylinder, tends continuously to make extraction cycles at a frequency much higher than that of normal use. The monitoring takes place by means of electrical signals from the appropriate limit sensors which close an electrical contact shown on the electronic control unit.



The **TCS** automatically creates an alarm sound when the current tank is going to be empty and it must be replaced with a full tank. The alarm sound is also emitted with a red alarm light that (optionally) can be installed in a remote place.

As soon the **TCS** detects a empty tank status it provides to:

- close the pneumatic valve of the empty tank aspiration line and switch the suction line to the full tank by opening the relevant pneumatic valve
- indicates the relevant procedures to restart the suction process from the full tank.

