

# technical BOOK



## Side notes for designing air conditioning plants for **magnetic resonance departments**



# Air conditioning plants for magnetic resonance departments

## General characteristics

The air conditioning plant for a magnetic resonance department serves three separate areas all of which have different characteristics and requirements:

- examination room
- control room
- machine room

## Examination room

This area has a volume of roughly 100-120 m<sup>3</sup>, without a raised floor and therefore having upward air distribution. It is characterized by the presence of the scanner and the consequent dissipation of its heat, about 4 kW, and by its helium charge for cooling the magnet. It is this helium charge (about 100 kilos) which in the event of any leakages could create severe respiratory problems for the patient.

The characteristics of the air conditioning plant for this room are as follows:

- supply airflow (full fresh air), approx. 10 volumes per hour, therefore about 1,200 m<sup>3</sup>/h
- air filtration: standard F7, maximum F9, already guaranteed by the air conditioner, so without final air filtration;
- exhaust airflow: approx. 1,000 m<sup>3</sup>/h, 60% of which is from the magnet and the rest is re-

turned air expelled from the air conditioner;

- room conditions: temperature 24°C ± 2°C; humidity 50% ± 5%;
- sensible cooling: approx 5 kW;
- emergency functioning (helium leakage): an oxygen-quantity detector informs the air conditioner's microprocessor of any alarm condition due to the possible escape of helium. The microprocessor activates the emergency software, sets off an acoustic and visible alarm and doubles both the discharge and return/exhaust airflow in order to dilute the presence of helium and to guarantee the respiration of the patient and the health care workers.

## Control room

This area has a volume of approx. 70 m<sup>3</sup>.

Plant characteristics:

- supply airflow (full fresh air); 6 volumes/hour, so about 450 m<sup>3</sup>/h;
- air filtration: standard F7, maximum F9;
- exhaust airflow: about 400 m<sup>3</sup>/h;
- room conditions: temperature 22°C ± 2°C; humidity: 50% ± 5% ;
- sensible cooling: about 1.5 kW.

## Machine room

This area has a volume of approx. 70 m<sup>3</sup>. It usually has a raised floor and therefore the air conditioner, treating the recirculation air, discharges downwards.

Plant characteristics:

- supply airflow (full fresh air): 2 volumes/hour, therefore about 150 m<sup>3</sup>/h;
- recirculation airflow: about 4,000 m<sup>3</sup>/h;
- air filtration: F7, maximum F9 for the fresh air; G4 for the recirculation air;
- exhaust airflow: about 50 m<sup>3</sup>/h;
- room conditions: temperature 22°C ± 2°C; humidity: 50% ± 5%;
- sensible cooling: about 20 kW.



## Construction characteristics

### Plant

The plant, which is normally completely separate from the air conditioning system of the hospital, uses full fresh air with integrated local recirculation only in the machine room.

Temperature regulation is by fixed point with the sensor in the supply compartment and the humidity sensor in the return air compartment. The constancy of the supply airflow is guaranteed by a continuous measurement device and correction by an inverter on the fan.

### Air conditioning for fresh air

Air conditioner for the treatment of full fresh air, having the following characteristics, model OHU 3.600:

- mono-block unit complete with controls, electrical panel, microprocessor and specialized software, certified to UNI/EN 1886;
- the air conditioner normally has a chilled water coil; direct expansion coil available as an alternative;
- normally without a heat recovery system, due to both the low airflow and to the fact that part of the exhaust is from the mag-net and therefore is not returned to the air conditioner;
- motorised damper on the fresh air intake;
- G4 fresh air pre-filter;
- hot water heating coil with three way valve controlled by microprocessor functioning in mixing and the relative spill-back pump;
- chilled water cooling coil with three way valve controlled by microprocessor functioning in deviation;
- post-heating coil with three way valve controlled by microprocessor functioning in deviation;
- modulating steam humidifier with immersed electrodes controlled by microprocessor;
- Supply fan with inverter and airflow meter;
- F7 or F9 efficiency discharge air filter;
- F5 efficiency return air filter;
- return/exhaust fan with inverter to regulate the necessary depression in the ducting to permit the correct functioning of the VAV dampers;

- RS485 board to connect to the remote control system of the hospital.

## Return and discharge ducting and its accessories

Externally insulated galvanized sheet metal ducts, airtight to at least class B

- always fitted with a sound damper in the supply and return air ducts;
- the necessity to install a sound dampers in the fresh air intake and exhaust duct depends on the evaluation of the impact on the external surrounding area;
- post-heating coil on the supply duct to the examination and control rooms; it is not necessary on the duct to the machine room because that area always produces enough heat itself; normally a hot water coil is used, regulated by a three way modulating valve which is controlled by a sensor installed in the controlled room.

Alternatively an electric coil with TRIAC regulation can be used;

- manual dampers installed in the supply duct to the examination room and to the control zone, to regulate the air flow;
- motorised variable air volume (VAV) dampers to regulate the overpressure room by room using a differential pressure switch installed between the controlled room and a reference area.

## Air conditioning for the machine room

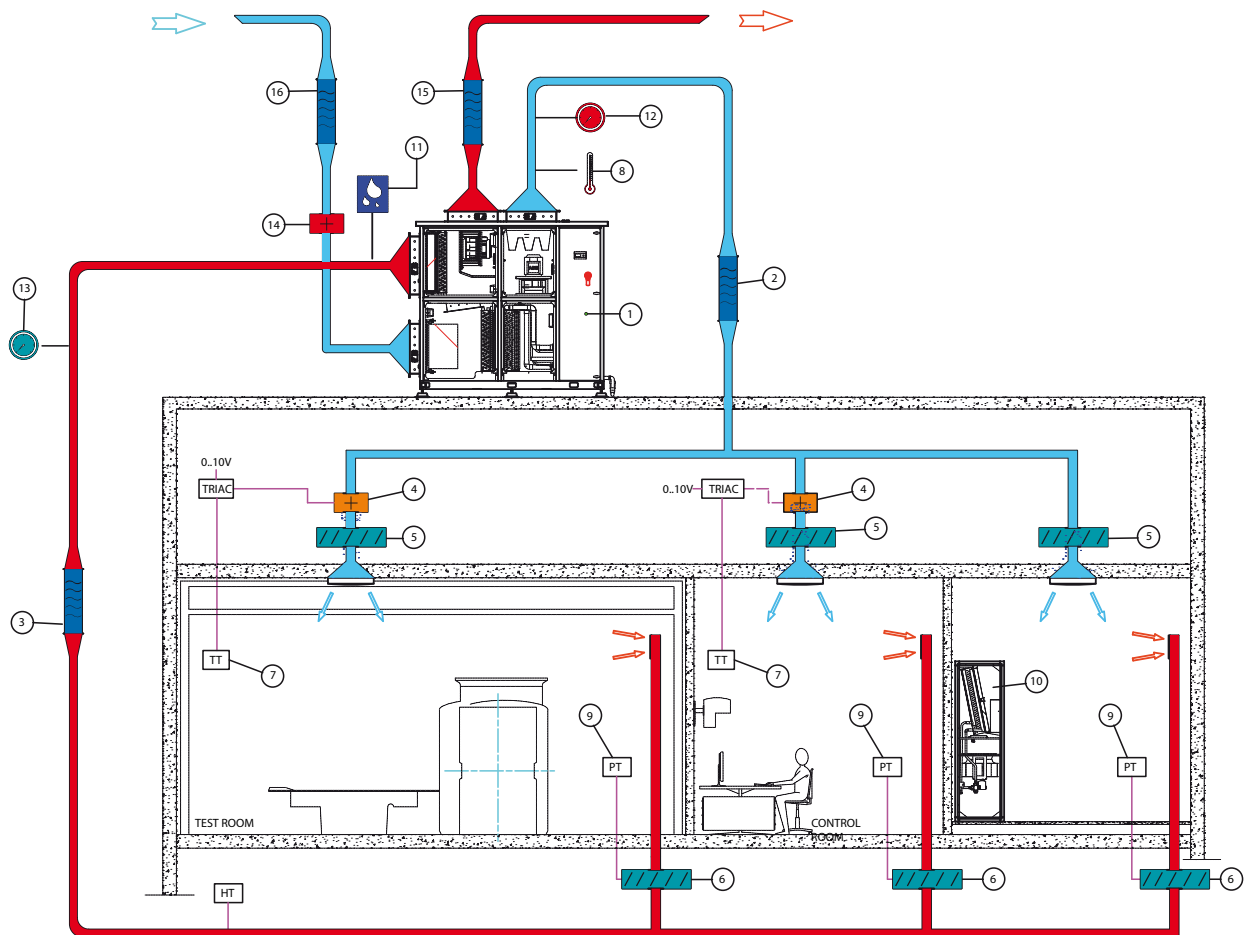
Chilled water with downward air discharge, model UPU 30.

The supply airflow is regulated automatically as a function of the power required by the electronic equipment.

A sensor in the air conditioner installed in the return duct regulates the temperature.

Post-heating and humidification is not necessary as these functions are already guaranteed by the treatment of the fresh air.

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# serie H

1. Air conditioner with chilled water coil for full fresh air treatment
2. Sound damper on supply air duct
3. Sound damper on return air duct
4. Electric or hot water reheating coil with room thermostat
5. Manual air flow regulating damper
6. Motorised damper to regulate the room overpressure; controlled by a pressostat installed between the controlled room and a reference one.
7. Room thermostat to regulate the reheating device
8. Thermostat to regulate the supply air temperature
9. Pressostat to regulate the room overpressure
10. Close control air conditioner with chilled water coil and downflow air supply: 25 kW cooling capacity: model UPU 30
11. Humidostat for humidity control
12. Pressostat to handle constant air flow through a constant pressure inside the supply duct.
13. Pressostat to handle constant depression inside the return air duct
14. Anti-freeze heater in the fresh air intake duct (only if very low temperatures are forecast)
15. Sound damper on exhaust air duct
16. Sound damper on fresh air intake duct



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