Travaglini

CLEAN ROOMS

Since 1950, **Travaglini S.p.A. has been a worldwide leader in the manufacturing of equipment for the production of sausages, hams and dairy products. Our company is a recognized and a qualified supplier of advanced conditioning and air treatment systems and clean rooms**.

Thanks to our knowledge and experience of technological processes and their relative hygienic challenges, we are able to design and produce advanced equipment and to supply the necessary know-how and assistance to answer our customers' production needs with adequate solutions.

Definition of clean room

A clean room is a room in which the concentration of airborne particles is controlled. These rooms are built for minimizing the introduction, generation, and retention of pollutant particles within.
The contamination of products due to dust, mold, and airborne particles reduces the quality and the shelf-life of the products themselves.

Cause of impurities

The following are the principal causes of air contamination:
- people that are the principal vehicle of contamination and with one small movement can release several million of particles of various sizes;
- products, especially when packaged or left in dust;
- production machinery and liquids (pneumatic equipment with open drains, lubricating oils, condensation drops, drains without traps, etc.);
- production, cleaning, and disinfection processes;
- biological contamination through mold, yeast and bacteria present in the air.

Product protection

Protecting products from contamination by harmful airborne particles means avoiding that they come into contact with the air itself. This is not possible during all stages of production and is extremely difficult at the same time.
However, the concept of protection can be interpreted in a different way: not to isolate the product from the surrounding ambient, but instead to place it in a high quality environment, with controlled hygienic conditions, and with particularly pure air to promote protection of the product.

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Classification of clean rooms

In the table below you can find a classification of air purity (filtration grade) in conditioned rooms according to the Federal Standard 209 E, Federal Standard 290 D and ISO 14644-1 that are taken as reference classifying rooms.
Moreover, since the introduction of Fed.Std.209D, it has been specified that the conditions that must be tested in order to establish environmental contamination classes are:
- as built clean room
- at rest clean room
- operational clean room

Filters

For each installation class, filters with different efficiency levels are used. Air filtration takes place progressively; lower-protection filters are placed before those that have a higher protection.
Progressive air filtration prevents damage to the higher-protection filters and their rapid contamination.

Working environment characteristics

- limited dimensions in order to guarantee a healthy work environment;
- work areas must be placed as far as possible from potential sources of contamination;
- the production cycle must flow from the least sterile to the most sterile room;
- elimination/reduction of turbulence within the clean rooms;
- easy access to all areas of the clean room for cleaning;
- accessories that comply with international safety and hygiene regulations.

Classification

ISO 14644-1	US. FED STD 209D	US. FED STD 209E
1		
2		
3	1	M1.5
4	10	M2.5
5	100	M3.5
6	1.000	M4.5
7	10.000	M5.5
8	100.000	M6.5
9		

Values indicate the highest level of allowable particles with a maximum diameter of 0,5 µm (0,5 µm = 0,0005 mm) per cubic foot (28,3 litres).

Example
There are not more than 10 particles per cubic foot (28,3 litres). That is, that corresponds more or less to the proportions of the head of a pin with respect to that of a soccer field. In comparison: a cubic meter regularly contains 1-5 million particles.

Structure and operation of a clean room

A basic feature of clean rooms is that they are often enclosed in areas of limited size which are optimized for production requirements. Air distribution inside a clean room can be implemented in different ways, and this, together with the different grades of filtration, determines the level of protection against product contamination.
Here you can find possible methods of air distribution:

1. unidirectional vertical flow, filters are placed in the ceiling and the air is recovered from the lower parts of the room or from the perforated flooring (figure 1a); in this case the clean working area is located in the upper part of the room;
2. unidirectional horizontal flow, the air enters from wall filters and is recovered by localized grates; in this case, the clean work area is located between the filters that generate the flow and the first source of contamination (figure 1b);
3. non-unidirectional flow, the clean working area is the whole room (figure 2a);
4. mixed flow, this is a situation in which unidirectional and non-unidirectional flows coexist (figure 2b).

Therefore, looking at this classification we understand how choosing and properly placing filters is fundamental in the design of a clean room.

Figure 1a

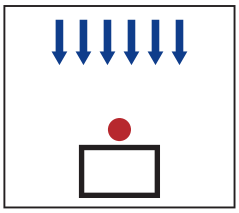


Figure 1b

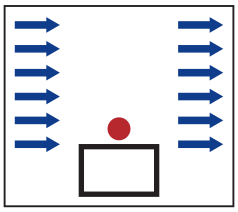


Figure 2a

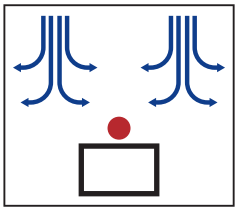
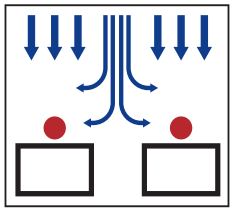


Figure 2b



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Environmental parameters in clean rooms

The most important environmental parameters are those that must be kept under control for the product's quality, packaging, and waste material, energy consumption, machine functionality, and last but not least, the workers' comfort. These parameters are:

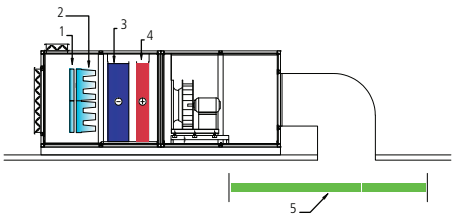
- temperature and humidity: humidity control, besides being fundamental for product quality, is also of great importance for problems in relation to corrosion, condensation on work surfaces, and the reduction of electrostatic charges;
- differential pressures: all rooms must be kept at static pressures that are sufficiently higher than atmospheric pressure in order to avoid any type of infiltration; any expulsion of air from the room must be counterbalanced by new air input in order to maintain the environmental pressure value;
- lighting: the level of lighting, its uniformity, and the colour of the light must be controlled;
- noise and vibration: can be dangerous both for the workers and for the equipment itself.

Connection between different working areas

- openings between the various environments with controlled atmosphere must be limited as much as possible;
- entries and exits must be made using "Air locks" in order to minimize contamination, and furthermore, to maintain the differential pressures between the various environments.

Air treatment systems

Systems Class 100

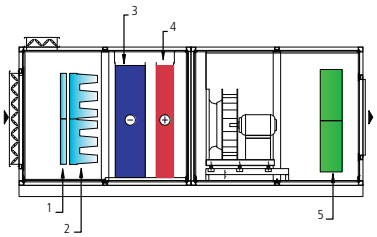


Filter:
- EU3/EU4 level filters
- EU9 pocket filters at the entrance.

Distribution from the ceiling:
- with EU14 box filtering

Air departure from the environment:
- suction through wall grilles

Systems Class 10.000

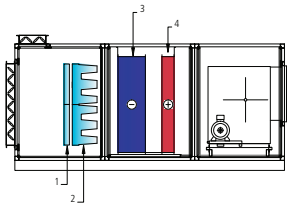


Filter:
- EU3/EU4 level filters
- EU8 pocket filters at the entrance
- EU13 absolute filters at the exit

Distribution from the ceiling:
- with finely permeable fabric channels

Air departure from the environment:
- through ceiling grilles

Systems Class 100.000



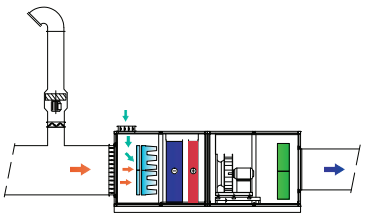
Filter:
- EU9 poket filter
- EU3/EU4 level filter

Distribution from the ceiling:
- with ceiling socket
- with fabric channels

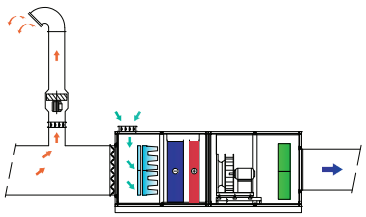
Air departure from the environment:
- through ceiling grilles

Working phases

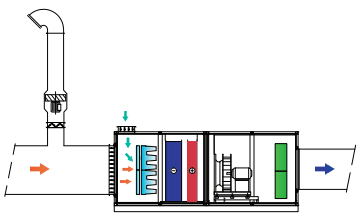
The equipment, besides its normal function as an air conditioning unit, provides the expulsion of humid air generated while the work environment is being washed. The air treatment unit in this phase provides the introduction of hot air to facilitate the drying of surfaces and equipment.
The equipment is designed for working in four distinct phases:



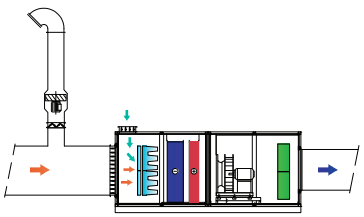
1. Production phase:
temperature and ambient humidity is checked



2. Cleaning phase:
at the end of the working phase, the necessary cleaning operations are carried out in the room



3. Drying phase:
after washing, the room is dried



4. Maintenance phase:
the period following the drying phase and preceding a new working phase

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