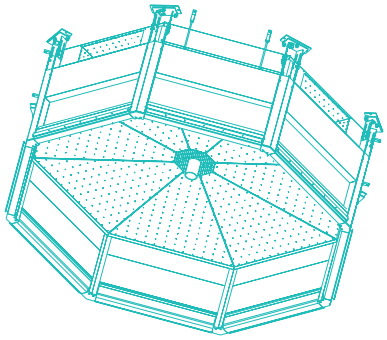
TECNAIR LB
CLOSE CONTROL AIR CONDITIONERS



TECNAIR LB
CLOSE CONTROL AIR CONDITIONERS

Lifeline

Air Ceiling
Unidirectional Filtered Ceiling

TECNAIR LB Sr.r.l.
21040 Uboldo - Varese - Italia
Via Caduti della Liberazione, 53
Tel. 0039 02 9699111
Fax. 0039 02 96781570
E-mail: sales@tecnairlb.it
www.tecnairlb.it

Air Ceiling
Unidirectional Filtered Ceiling

Static or ventilated ceilings

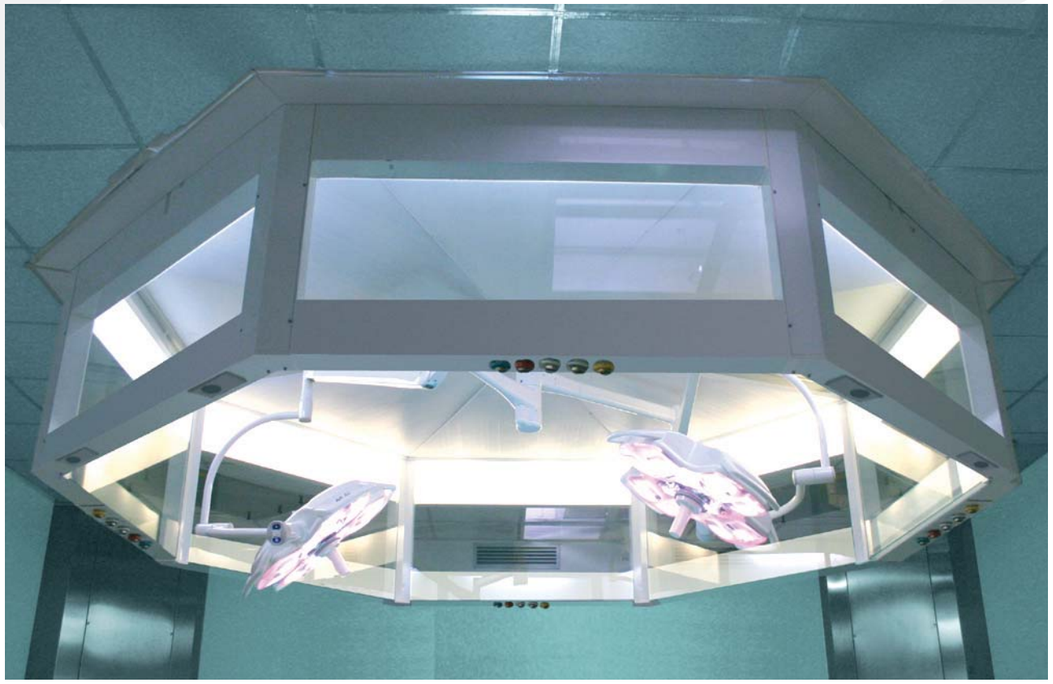
The Standards allow recirculation under 3 conditions:

1. Re-circulation must be done in one single room, it is therefore not allowed to mix air from different environments.

2. The re-circulated air must have, at least in the second stadium filter (F9) and the terminal one (H14), the same filtration efficiency of the external one.

3. The SPL at the centre of the room must not pass 48 dB(A)

The simplest solution is to bring back all air flow to the air conditioner and use a static laminar ceiling. This solution, interesting for brand new buildings, is extremely unrealistic with the reality of many Hospitals which foresees, especially for rooms to be restructured, areas for the ducts insufficient to bring back to the air conditioner all capacity: to clarify this we emphasis that for 8.000 m3/h the necessary ducts (two: supply and suction) have dimensions of approximately 800 x 500 each. For installations where these duct dimensions are not compatible, Tecnair LB proposes the octagonal ceiling even in it's ventilated version with fans, so to allow for an efficient recirculation inside the surgical room. Innovative characteristic is the installation of the four fans for recirculation in the corners of the room, with ducts which house F9 efficiency filters and two large sound dampers able to lower by about 20 dB(A) the sound pressure level. By sucking the air at floor level, unlike from the ceiling as many other laminar ceilings solutions on the marketdo, we do not disturb the unidirectional flow therefore reducing the protection on the patient.



Unidirectional ceilings : technical characteristics

All the Tecnair LB laminar ceilings have an octagonal shape and 3,2 m by 3,2 m; the number and type of filters: 8 efficiency H14: trapezoidal shape are equipped with a system to guaranty that any air leakage from the filtering section comes in a space around the filters. Keeping this place in depression the air which bypassed the HEPA filters is evacuated by using the re-suction fans. Above the filters a plenum in galvanised steal (as an accessory stainless steel AISI 304 is available) for an optimal air distribution of the primary air coming from the air conditioner and the re-circulated (secondary) air coming from the ceiling. The connections are riveted; it is not necessary to seal the angles. This sealing can be made as accessory, even if not necessary, in case air tightness is requested. Under the filters there is the lamination system in micro-holed sheet metal perfectly sterilisable.
At the centre of the octagon the scialitc lamp connection is foreseen.

Two models are foreseen:

- Static ceiling with crystal curtain and lights
The curtains are needed for the containment of the air flow and go down to a height of up to 2.1 meters from the ground. The curtains can have a lighting of the lamination system which gives a magnificent indirect light effect.

-Ventilated ceiling with curtains and lights
The recirculation fans are installed in the corners of the surgical room and are connected by ducts, downstream an F9 suction filtered grill installed in the lower part of room and upstream the unidirectional ceiling. The fans have an air flow of approximately 2000 m3/h each. Upstream and downstream the fans sound dampers are installed which can guaranty that at a height of 1,7 m at the centre of the room the sound pressure level does not rise above 48 dB(A).

Air Ceiling
Unidirectional Filtered Ceiling

Main design criterias:

The impossibility to use the same system to carry 12 times more air is obvious and does not need a follow-up. Whilst generic surgery is dealt with by normal systems with the over mentioned parameters, for specific surgery, and especially for orthopedics, the following need to be considered:

- Due to the high air flow requested: 250 ac/h, it is necessary to reduce the super controlled area for obvious needs of comfort and energy saving. An “aseptic nucleus” is therefore normally seen as of only 2,8 meters by 2,8 inside of which the surgical bed, the surgeon, and the tools tray are all inside. This is maintained in class ISO5; outside of the nucleus a ISO7 class is accepted.

- To arrive to this ISO5 class it is necessary that the air follows a unidirectional flow. To obtain this type of air flow it is necessary that the air speed out from the terminal filter is between 0,30 and 0,40 m/s since beneath it we cannot be sure that the flow is unidirectional, whilst above it the operating costs would rise too much.
It is known that the main design criterias for designing surgical operating theatres air quality classes have the following characteristics:

Characteristics of surgical operating theatres

Operation type	Air qual. class	Necess. Air flow	Terminal filter	Distribution
Generic Surgery	ISO 7	20 vol/h	H13	Turbulent
Specific Surgery	ISO 5	250 vol/h	H14	Unidirectional

- It is mandatory that the inside of the ceiling over the aseptic nucleus is made up of absolute filters: this is the filtering ceiling. The aseptic nucleus is of 2,8 meters by 2,8. (dimensions at surgical bed height). To obtain this protection it is necessary that the filtering ceiling is of bigger dimensions; it has been therefore concluded that the optimal dimensions for the ceiling are of 3,2 m by 3,2 m (depending on specific design characteristics)

- According Swiss and German guidelines, the ceiling normally has a net area of no less then 9 m2 with 10 m2 as a good solution. With a speed of 0,30 m/s we obtain at least 3 m3/s. In one hour we have 3 x 3.600 = 10.800 m3/h.

- This huge air flow cannot be of totally fresh air and it is necessary to heavily use recirculation limiting the fresh air flow, necessary to dilute the chemical contamination from the anaesthetic gasses, by what is requested by the local rules, normally not more than 1.500-2.000 m3/h.

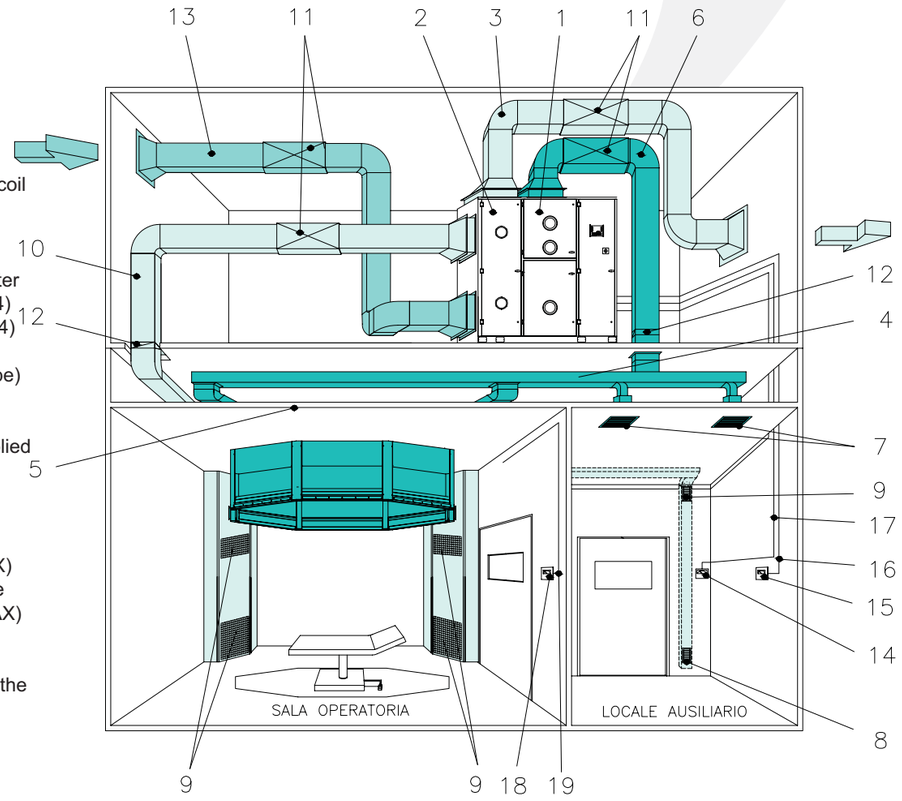
The Tecnair LB solution.

The costs of running a unidirectional flow is strongly related to the outside-air-flow directly proportionate to the re-circulated air, itself proportionate to the surface of the ceiling. Tecnair LB therefore proposes an octagonal ceiling instead of square, this to eliminate the protection on the angles where there is no need for it. The total surface of the ceiling therefore is smaller by approximately 20%; in regards to this the necessary air flow goes down, up to around 8.000 m3/h. In addition, in the cut off angles the pendants for the Surgeon and anaesthesia tools can be installed.

Octagonal ceilings

Allow, with the same area of filtering mass, a higher surface of approximately 20% from a traditional rectangular filter solution. The pressure loss absorbed by the fans, as well as the systems SPL therefore fall by approximately 30%

1 Suplpy fan
2 Exhaust fan
3 Exhaust duct
4 Electric or water reheating coil
5 Absolute filter: H12 or H14
6 Supply air duct (thermally insulated)
7 Air diffuser with absolute filter
8 Lower filtered air intake (G4)
9 Higher filtered air intake (G4)
10 Air suction duct
11 Sound damper (hospital type)
12 Cut fire damper
13 Fresh air intake duct
14 Differential pressostat supplied loose
15 Interface for remote control (accessory)
16 Shelded cable for remote pressostat (3x0.5 50m MAX)
17 Telephonic cable for remote interface (6 wires 100m MAX)
18 Temperature and humidity feeler (suplpied loose)
19 Connecting cable between the feeler and the unit (6x0.5 50m MAX)



Air Ceiling
Unidirectional Filtered Ceiling

Introduction

The manufacturers offer a wide range of choices for high quality air filters, designed to hold back particles of the smallest possible dimension which are possible sources and transports of viruses and bacteria and therefore protect the patient from nosocomial infections. This is anyway not sufficient to maintain the requested air quality. The real technical challenge is to avoid that airborne contamination can enter in the area which we want to keep sterile. According to the air quality requested it is therefore mandatory to make a correct choice in deciding how to direct the air flow coming from the absolute filters and keep away from the aseptic nucleus the contamination created by the surgical team.

Generalities: system solutions

The tendency of the installations for Surgical rooms sees more and more often used unidirectional filtered ceilings systems, customely called “laminar ceilings”.
The logic of this type of installation brings the necessity to raise by a lot the air flow to maintain the room as clean as possible and arrive to a level of the air quality itself as high as possible. Instead of a traditional dilution concept with big airflow rates, the new strategy is a dynamic protection focussing the “protected zone” which includes the OP-table, the cloths of the OP-team and all instrument- and sterile material tables. This creates a sterile “wall/piston” of perfectly sterile air which comes down from the unidirectional filter at low speed so not to create any turbulence. This therefore allows for the certainty that the air is free from any form of particulate, at least inside the aseptic nucleus.
The advantages of this solution are the following:

- Certainty that the particulate, possible source of virological or bacteriological contamination cannot arrive to be in contact with the wound or with the surgical instruments, and therefore gives a greater protection to the patient.

- Unlike ambient overpressure, which is forecasted by the traditional systems which depends from the closing of the doors, the dynamic overpressure of the aseptic nucleus is independent from the closing of the doors and therefore grants more certainty of the continuous protection of the aseptic nucleus.

- Faster “Recovery time” of the room. This means that the time period necessary after each operation in which the system dilutes the contamination present in the OT so to go back to the classes of air quality required becomes much shorter, therefore granting more possibilities to use the OT. The recovery time diminishes form approximately 15 minutes with turbulent air flow systems (ISO 7) to just a few seconds for OT with unidirectional distribution systems.