Supply air ceiling and recirculated air ceiling OP.... for operating rooms with low-turbulence displacement flow
For more than 20 years KRANTZ KOMPONENTEN has been developing and delivering high-quality HVAC products for hospitals. Here, particular attention is paid to thermal comfort and hygiene and with that to the protection of patients and staff.

As a result of constant contact and active exchange of ideas with engineering firms, physicians, operating staffs and hygienists, we are in the position to guarantee these demands with greatest possible quality, efficiency and operational liability. Regardless of what air distribution system you are planning, whether for an operating room, a space for sterile goods processing or for a custom-made design, as for example a hybrid operating room, we offer the suitable solution!
Systems to meet the highest demands
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Operating room
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Supply air ceiling
OP-Z-32/32
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Recirculated air ceiling
OP-U-32/32
Pages 10 – 11
Demanding requirements have to be complied with when designing and building a complete "operating room" system. An essential criterion is that the air flow in the operating field must guarantee a very high protective effect against infiltration of particles and germs.

The supply air and recirculated air ceilings of KRANTZ KOMPONENTEN reliably fulfill the required standards and guidelines for operating rooms, without neglecting the thermal comfort.

Because of the compact size and numerous unique selling points as light lead-through, mixing chamber system and recirculated air suction at the corners of the OR ceiling, they are the best solutions for the use in the complete system "operating room".

The OR ceilings have been developed in our ultra-modern research and development centre and external independent experts confirmed their efficiency.
A pleasant climate and reliable hygiene

Ventilation and hygiene requirements for operating rooms

The operating field with instrument table is the most sensible area in operating rooms with regard to ventilation and hygiene. The whole area of protection must be supplied reliably with low-germ air. This is guaranteed by a sufficiently large, vertical low-turbulence displacement flow above the operating field. The dimensions of the OR outlets (OP-Z and OP-U) made by KRANTZ KOMPONENTEN correspond to the DIN standard of 3 200 x 3 200 mm and are suited for room class Ia.

Air distribution systems in the OR

With a low-turbulence displacement flow (LTF), the pollution of the air with germs and particles in the operating field and on the instrument table is significantly lower in comparison to turbulent mixing air.

Low-turbulence displacement flow
- prevents from infiltration of germs and particles
- reliably displaces surgical smoke
- leads away thermal loads and hazardous substance emissions
- supports the thermal comfort in the room

Standards and guidelines

The ceiling systems are completely constructed and manufactured according to the latest standards and guidelines in the health care system. Participating actively in the standards committee and having a constant dialogue with physicians, hygienists and nursing personnel, KRANTZ KOMPONENTEN guarantees an accurate realization of the standards and guidelines.

The following standards and guidelines are fulfilled:
- DIN 1946-4 (2008-12)
- ISO EN 14644, class 5
- SWKI Guideline 99-3, 400/5/2003
- HTM 03-01

One-stop system solutions

KRANTZ KOMPONENTEN is in the position to offer and coordinate a complete ceiling system for operating rooms, because of its cooperation with well-known manufacturers in the field of medical products (e.g., media bridges, ceiling supply units), of lighting technology (perimeter lighting system) and the remaining ceiling installations (metal tile ceilings suited for cleanrooms).

Supply air ceiling OP-Z-32/32
Perimeter lighting system

Recirculated air ceiling OP-U-32/32
Recirculated air suction

Ceiling supply unit
Ceiling supply unit
Flow stabilizers

Perimeter flow stabilizers provide best guidance for the air flow. Our OR ceilings are equipped with flow stabilizers of various heights. They are made of heat-strengthened laminated safety glass (TVG), but are also available as transparent strip curtains or made of Plexiglas.

OR light lead-through

The supply air flows through a purpose-made fabric frame in the critical area surrounding the central flange tube for OR lights. Thus, the low-turbulence displacement flow is available over the full supply air ceiling area.

The optimum access to the connection flange of the OR light facilitates maintenance.
To generate low-turbulence displacement flow, the air is conducted through special fabric frames that are covered with monofilament polyamide from one side. Cleaning and disinfection is easy because of accessibility to the monofilament polyamide fabric from both sides.

Depending on the demands, it is possible to achieve different velocity profiles by using frames covered with different fabrics.

At the recirculated air ceiling OP-U-32/32 modules for low-noise intake, mixing and distribution of recirculated air and outdoor air rates are used. Each module is equipped with an EC fan, an innovative mixing chamber and two F7 pre-filters.
**Supply air ceiling OP-Z-32/32**

For operating rooms with low-turbulence displacement flow

The supply air ceiling for operating rooms made by KRANTZ KOMPONENTEN is used, if the total volume flow rate needed for the running of a ceiling for operating rooms is provided by a central HVAC system.

The supply air ceiling generates a vertical, homogenous low-turbulence displacement flow with low pressure drop.

Due to its modular design and the different types of air connection available, it is suited ideally for the installation in the ceiling plenum, even at low heights and cramped space conditions.

The complete supply air ceiling system is disinfectant-proof and has a surface of 3,200 mm x 3,200 mm conforming to DIN 1946. It is symmetrically arranged around the central OR light lead through. The construction consists of four units in modular design with filter housings and variable connection housings for the supply air.

Altogether, the supply-air ceiling is equipped with 16 HEPA filters, filter class H14 (pursuant to DIN 1822-1). The large coverage with filters and the very low initial pressure drop of the filters generates optimum operating conditions. Directly below the filters are four fabric frames that can be pulled-down individually. These are covered with monofilament polyamide and therefore produce the necessary low-turbulence displacement flow.

The supply air flows through a purpose-made fabric frame in the critical area surrounding the central flange tube for OR lights. Thus, the low-turbulence displacement flow is available over the full supply air ceiling area.

The optimum access to the connection flange of the OR light facilitates maintenance.

**Concept for air connection**

Because of its low height, the supply air ceiling can be utilized without problems in new buildings as well as for reconstruction. Due to its advanced connection concept, it is extremely variable regarding the connection to the existing air duct system.

**Connection type A**
Air supply through two rectangular ducts from one side

**Connection type B or C**
Air supply from two opposite sides

**Connection type D**
Four-sided air supply at a low installation height above the ceiling

**Connection type E**
Four-fold air supply from above

Views from above (further connection types are possible)
Features

- Pre-assembled units in modular design, consisting of connection housing and filter housing
- Easy, fast and flexible assembly of the single modules; no module larger than 1 600 x 1 600 x 550 mm
- Central active OR light lead-through, without interruption of the low-turbulence displacement flow. With airtight partition towards the ceiling and inspection opening for necessary maintenance of the OR flange tube.
- Horizontally arranged terminal HEPA filters H14 with grip protection on both sides; filter exchange from the unfiltered air side; filter tested and certified to EN 1822-1
- Fabric frames in modular design, divided into four parts and with minimum number of bars, can be individually pulled-down, covered with monofilament polyamide from one side, fast and easy to replace, fixed without screws
- Ceiling support brackets for connection to the false ceiling provided from the customer

Accessory

Mean value temperature probe
To measure the supply air temperature on the unfiltered air side

Differential pressure control device
For the monitoring of the HEPA filter H14

Material

Connection housing 1)
Sheet steel, galvanized

Filter housing 1)
Sheet steel with epoxy-polyester resin coating, disinfectant-proof, similar to RAL 9016

Optional

Shutoff dampers
Airtight shutoff dampers, leakage loss class 4 according to EN 1751, mounted to the connection housings, with electric spring-return motor 24 V and integrated limit switches

Technical data

<table>
<thead>
<tr>
<th>Total volume flow rate:</th>
<th>2 556 – 3 611 l/s</th>
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<tbody>
<tr>
<td>Dimensions 1):</td>
<td>3 200 x 3 200 mm</td>
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<tr>
<td>Construction height 1):</td>
<td>approx. 550 mm</td>
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<td>Mean air discharge velocity:</td>
<td>0.25 – 0.35 m/s</td>
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<tr>
<td>Number of fabric frames:</td>
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<tr>
<td>HEPA Filter</td>
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<tr>
<td>– Filter class:</td>
<td>H14 according to EN 1822-1</td>
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<tr>
<td>– Number:</td>
<td>16 pieces</td>
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<tr>
<td>– Initial pressure drop:</td>
<td>55 Pa</td>
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<td>Supply air duct connection:</td>
<td>according to requirements and type of connection</td>
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<tr>
<td>Total sound pressure level (measured at 1 800 mm above the floor, in the centre):</td>
<td>≤ 48 dB(A)</td>
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<tr>
<td>At basic noise level:</td>
<td>≤ 38 dB(A)</td>
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<td>Make:</td>
<td>KRANTZ KOMPONENTEN</td>
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<tr>
<td>Type:</td>
<td>OP-Z-32/32</td>
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</table>

1) Optionally available in stainless steel
2) Other dimensions on request
Recirculated air ceiling OP-U-32/32

Recirculated air module for installation in the ceiling plenum

In case that the necessary total volume flow rate to operate the OR ceiling is not completely provided by a central air handling unit, KRANTZ KOMPONENTEN offers the recirculated air ceiling OP-U-32/32. For this purpose, decentralised recirculated air modules are connected to the supply air ceiling OP-Z-32/32.

Here, the total volume flow rate is made up of a proportion of outside air, processed by a central HVAC system, and a proportion of recirculated air which was delivered and pre-filtered by circulation fans. The ventilation function of the recirculated air ceiling OP-U-32/32 is similar to the earlier described supply air ceiling.

Based on intensive measurements and years of project experience we have developed special recirculated air modules. Its special design and its placement in the four room corners achieve a uniform air distribution in the whole operating room. Lees and areas of uncontrolled air distribution, as they often appear at a two-sided recirculated air suction, are totally avoided. Medical ceiling supply units or media bridges as well as perimeter lighting can be easily integrated. Low energy consumption for the air delivery as well as more space for ventilation systems and air ducts are further advantages.

Mixing chamber system

Caused by persons, lights and technical devices, heating loads in operating rooms of 7 000 W or higher have to be removed. On many occasions, air-water heat exchangers are used for this purpose.

They work according to the principle of “dry cooling”. This requires a lot of control and monitoring to prevent from condensation. For operating room ceilings condensation means a very high hygiene risk and would lead to very long downtimes. On condition that there is a sufficient temperature difference between the proportion of recirculated air and the supplied outdoor air, it is possible to do completely without decentral coolers in the OR ceiling having our mixing chamber.

So with the required outdoor air of 333 l/s [1 200 m³/h] according to DIN 1946-4 (12/2008), fed in with 14 °C, a cooling capacity of about 3.2 kW is achieved. If you increase the proportion of outdoor air to 833 l/s [3 000 m³/h], at an equal temperature, it is possible to achieve cooling capacities of 8 kW.

A further, very important advantage of the mixing chamber is the homogenous mixing of outdoor air with the recirculated air to a temperature of ±0.3 °C, at a temperature difference of up to –12 K. This consequently avoids an uneven flow and a resulting entry of particles.

Functional principle of a decentralized recirculated air module with mixing chamber

1) Details on request
**Features**

- The ventilation function is similar to the earlier described supply air ceiling
- Special mixing chamber system for the removal of heating loads via the outdoor air proportion
- Homogenous mixing of outdoor air and recirculated air
- Decentralized recirculated coolers are completely unnecessary
- Recirculated air suction through fibre filter and two F7 pre-filters with the slightest pressure drop
- EC fans; automatic non-return damper on the pressure side
- Once adjusted, the total volume flow rate remains constant, even if one of the fans fails to function
- Connections for control and monitoring of the circulation fans

**Accessory**

**Mean value temperature probe**
To measure the supply air temperature on the pure-air side

**Differential pressure control device**
For the monitoring of the HEPA filter H14 and the F7 pre-filters

**Material**

**Recirculated air module 1)**
Galvanized sheet steel, faces with epoxy-polyester resin coating, disinfectant-proof, similar to RAL 9016

**Insulating material**
Mineral fibre, laminated with glass silk, flame-resistant

**Technical data**

<table>
<thead>
<tr>
<th>Outdoor air volume flow rate:</th>
<th>approx. 333 – 833 l/s</th>
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<tbody>
<tr>
<td>Total volume flow rate:</td>
<td>approx. 2,556 – 3,056 l/s</td>
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<tr>
<td>Recirculated air volume rate:</td>
<td>approx. 1,667 – 2,222 l/s</td>
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<td>Total sound pressure level (measured at 1,800 mm above floor level, in the centre):</td>
<td>≤ 48 dB(A)</td>
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<tr>
<td>At basic noise level:</td>
<td>≤ 38 dB(A)</td>
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</table>

<table>
<thead>
<tr>
<th>Data for one recirculated air module</th>
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<tbody>
<tr>
<td>Dimensions 2)</td>
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<tr>
<td>Filter housing:</td>
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<td>Fan housing:</td>
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<td>Pre-filter (F7 filter to EN 779):</td>
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<td>Air volume flow rate for each fan:</td>
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<td>Operation categories:</td>
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<td>Control by external relay:</td>
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<td>Fan monitoring:</td>
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<tr>
<td>Nominal voltage for each fan:</td>
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<tr>
<td>Control voltage:</td>
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<tr>
<td>Make:</td>
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<tr>
<td>Type:</td>
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</table>

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1) Optionally available in stainless steel
2) Other dimensions on request
Sales offices in Germany
- Aachen
- Dresden
- Frankfurt
- Hamburg
- Munich
- Stuttgart

Agencies worldwide

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- Switzerland
- Turkey
- South Africa

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- China
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- Japan
- Kuwait
- Qatar
- Singapore
- South Korea
- Taiwan
- Thailand
- United Arab Emirates
- Turkey

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- New Zealand