Source: ADAC

strulik gmbh

Reference
ADAC Main Office

„Safety and Exclusivity“

Fig. 1: ADAC Head Office, Munich

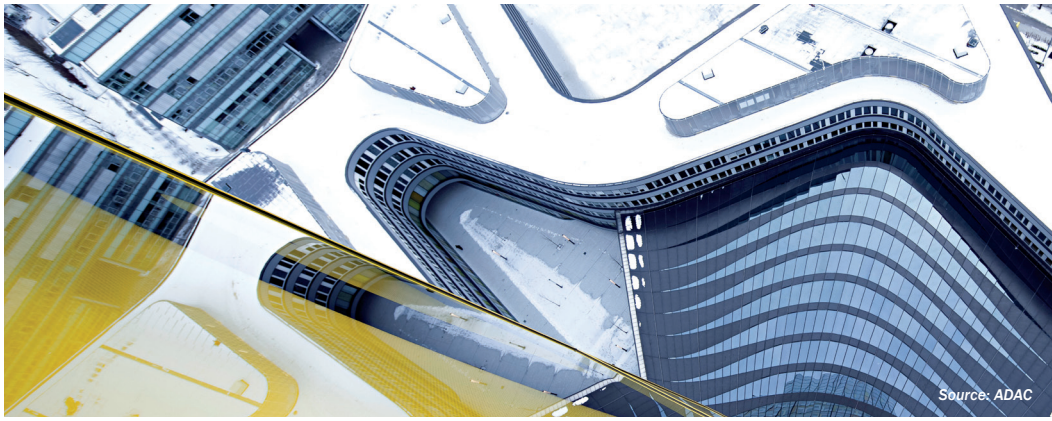

Fig. 2: "The Star of Sendling" - View from above

The Star of Sendling

New ADAC main building with innovative technology and protection-orientated concept for the differential pressure system

"The Star of Sendling", as the new ADAC building is now called, characterises the Munich cityscape with its unusual architecture. The 92 m high main building, with its over 1,000 windows in 22 different colours and the curved base construction is a new landmark of the Munich Westend.

The building designed by the architect team of Sauerbruch - Hutton from Berlin accommodates 2,400 employees of over 100 professions under a single roof. Until the relocation, the employees were distributed between seven locations. "We can now streamline the processes and create a consistent culture of member care", emphasises ADAC President Peter Meyer. "We wanted to construct a building which not only makes its mark on the skyline of Munich, but was also to be equipped with innovative technology and a special energy concept", explains Meyer.

One part of this innovative technology is reflected in the differential pressure system installed. Here, particular attention was paid to smoke extraction of the 92 m high office tower and the five flat-roofed structures, which are arranged amoeba-like around two courtyards, and also due to the fact that the building is occupied day-in and day-out by 2,400 employees.

Smoke extraction of escape and rescue routes

The smoke extraction of escape and rescue routes, particularly in the relevant stairwells, is an important requirement to allow evacuation of people and fire-fighting by the Fire Service. In escape and rescue routes and stairwells, the differential pressure system creates an over-pressure in comparison to adjoining areas, which prevents the ingress of smoke into the escape routes.

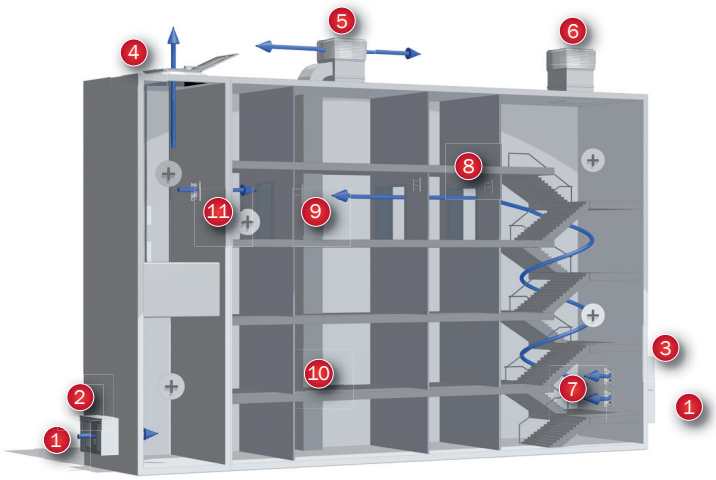

Fig. 3: Schematic view of a differential pressure system with components

1 | External air intake, weather-protection grille with louver flaps
2 | Inlet air fan
3 | Inlet air fans in redundant design
4 | Pressure relief unit with automatic regulating damper and roof dome
5 | Exhaust air unit with fan and intake-side automatic regulating damper
6 | Pressure relief unit with automatic regulating damper, insulating damper and slatted hood
7 | Inlet air grille
8 | Pressure equalisation opening
9 | Exhaust air opening with smoke extraction damper
10 | Exhaust air shaft
11 | Inlet air opening with smoke extraction damper

Requirements of the differential pressure system

At the ADAC in Munich, several regulations had to be taken into account in the planning. Prof. Kaellander of Kaellander Ingenieur GmbH was commissioned to develop an overall concept for the smoke extraction of the safety stairwells and the internal stairwells.

The following directives had to be observed:

- Bavarian building regulations
- Special construction regulations
- High-rise building directive
- Design of the fire safety concept with building approval classification
- DIN EN 13779 - Ventilation of buildings, performance requirements for technical air-conditioning requirement
- DIN EN 12101 Part 6 - Smoke and heat extraction specifications for differential pressure systems, construction sets

The system concept

In the 92 m high-rise building, the East and West safety stairwells were each planned with their own differential pressure system, although these work simultaneously when in operation. The inlet air is blown by fans on the ground floor into a separate shaft at the front wall of the stairwell. The stairwells of the flat-roofed buildings are also each equipped with a differential pressure system, where the inlet air in the 3rd basement floor is blown in. The building was classified in Building Class C to DIN EN 12101 Part 6. The design conditions for Class C systems are based on the assumption that all users of the building are evacuated in case of actuation of the fire alarm. Evacuation takes place simultaneously. In the definition of Class C, the air speed in the airlock door is also specified. The air speeds through the door opening between the over-pressure area (stairwell) and the area may not be less than 0.75m/s if:

a) on the floor of the fire the doors between the usage area and the force-ventilated stairwell and the vestibule are open, and

b) the path of the air extraction from the usage area on the floor of the fire where the air speeds are measured is open, and

c) it is assumed that all doors except for the doors on the floor of the fire are closed.

The stairwells are as a rule accessible via two air locks per floor. Both air locks are simultaneously protected against the penetration of smoke.

Safety exhaust air

As soon as a fire alarm on a floor is passed to the differential pressure system by the fire alarm system, the openings to the exhaust air shafts of the floor are released. Normally the openings to the exhaust air shafts are closed. This ensures a proper outflow from the floor of the fire.

Summer-winter convection

A fundamental requirement on the differential pressure system is safe and reliable operation even in the event of unfavourable outside air conditions. In particular, the temperature difference between the inside and outside in winter requires special consideration. The warm air in the building creates a thermal updraft, which must be compensated for by the differential pressure system → the compensation is increased in the event of a falling outside temperature.

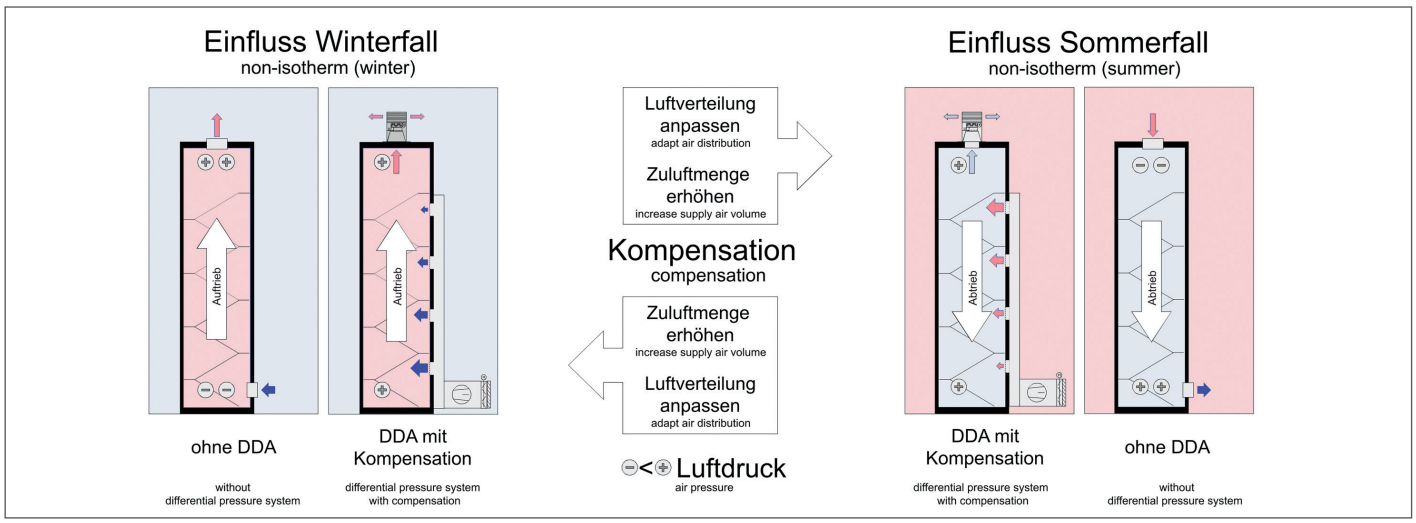

Fig. 4: Summer and winter situation

This means that in winter, more volumetric flow must be provided in the lower area of the building. In summer the case is exactly the reverse, and the airflow must be increased in the upper area of the building. In order to adjust the volumetric flow in accordance with the ambient temperatures, a damper motor with 15 adjustable intermediate settings was developed specially for this purpose. It is now possible with the aid of outside temperature measurements to ensure reliable operation of the system under any weather conditions.

Fig. 5: Special inlet air damper motor with 15 settings

Necessary extent of compensation must be taken into account in full in the course of the planning. Accurate and comprehensive calculations must be carried out for this purpose.

The firm of Strulik has many years of experience in this field, together with calculation programmes developed in-house, which even in the planning stage determine all the necessary parameter of the differential pressure system and take them into account accordingly in the design. In case of the problem of convection in the stairwell, there must be no uncertainty, and safety considerations are paramount.

The controls

All five flat-roofed buildings, the Fire Service lift and the two stairwells in the high-rise building were equipped with independent controls.

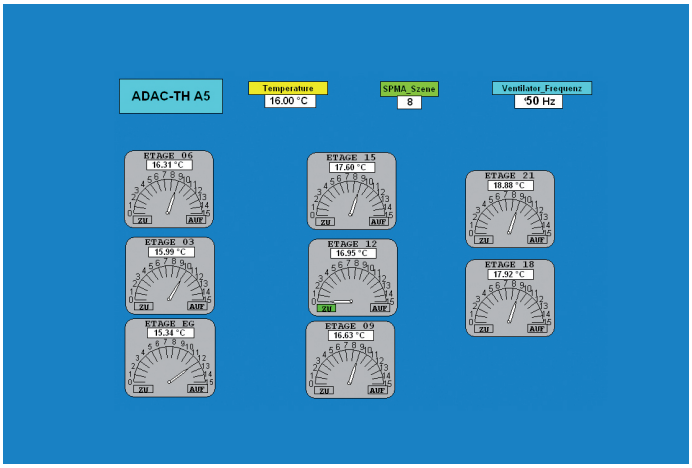

Fig. 6: Overview of the temperatures on the individual floors, outside temperature and setting of the damper motors for supply of air to the stairwell.

In the high-rise building, a decentral structure was implemented, with one master control and one slave control on every fourth floor. This decentral structure has the advantage that several processing units control the process and communicate with each other via a bus system. The communication takes place by means of a serial Modbus protocol.

The system therefore no longer uses one central control that controls everything, but several small units which are all in communication with each other. If one control now fails, the system still remains in operation, because the remaining controls continue to function, thereby increasing the system availability. All field elements - actuators and the sensors for temperature detection in summer and winter conditions - are monitored for wire breaks and short-circuits, and are designed in many cases with built-in redundancy.

Special monitoring of the outside air intake prevents smoke being drawn in and spreading into the stairwell. The status of all nine controls is transmitted to the building control equipment for visualisation by means of a TCP / IP protocol. This enables all events relating to the differential pressure system to be viewed on a PC-based system.

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