New hotel with future-oriented Hybrid VRF airconditioning technology

Air Conditioning

In the town of Blaustein near Ulm/Germany, a new hotel has been built with a modular wooden construction and façade. This modern, sustainable approach is also reflected in the air-conditioning and heating technology.

Case Study

Klingenstein Hotel, Blaustein, Germany

The Klingenstein comprises a hotel, inn and brewery and is located in the Klingenstein district of Blaustein.

It has a history as a lodging house, hostelry and brewhouse that stretches back 400 years.

A hybrid VRF air-conditioning system with heat recovery has been installed that requires no refrigerants in the building. It also enables excess heat from rooms that need cooling to be used for heating other areas. This solution saves energy and ensures maximum comfort and convenience when cooling and heating.

In 2017, the traditional ensemble of buildings was expanded to include a modern new hotel section, which was constructed entirely in wood and deliberately contrasts with the original, classified heritage structure.

The ground floor was designed as a classic shell construction in exposed concrete. Above this are three further floors built of solid wood in a modular design. The visually striking external facade is also completely constructed of wood.

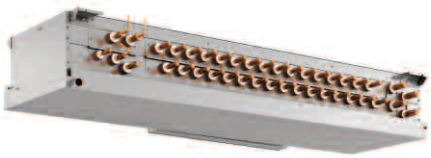
The reasons for choosing a wooden design were low weight, a pleasant interior climate, the use of sustainable raw materials and the short construction time due to the use of almost entirely pre-fabricated room modules. Each room (with bathroom) was to a large extent pre-fabricated and then installed in the modular system in a period of three weeks. This meant that only the technical supply infrastructure had to be connected on site.

This unusual building project also had to meet special requirements in terms of the use of wood, fire safety regulations and its modular construction.

Case Study

Klingenstein Hotel, Blaustein, Germany

The hotel comprises 63 single, double and family rooms on three storeys. The ground floor of the new building contains six meeting and conference rooms that can be used flexibly and provide a floor area of up to 104 m2.



Hybrid Branch Controller

The client and owner was looking to achieve the best possible air-conditioning comfort for guests, high energy efficiency of the air-conditioning systems, low operating costs and ease of use.

"The requirements for this building were very demanding. In particular, the solid wood design of the building poses special demands in terms of fire safety," explains Michael Leibinger, Managing Director of Klingenstein Gastronomie GmbH & Co.KG.

"There is currently only one system on the market that can meet all these requirements," states Daniel Hamann, Augsburg Branch Manager of refrigeration and air-conditioning wholesaler Robert Schiessl GmbH. The **City Multi Hybrid VRF system** (HVRF) from Mitsubishi Electric is the world's first 2-pipe system to provide simultaneous cooling and heating with heat recovery, combining the benefits of a direct evaporation system and those of a chilled water system. It was specially developed to meet the requirements of modern building architecture with its high demands in terms of efficiency and comfort. The technology is based on the City Multi VRF R2 heat pump system from Mitsubishi Electric and consists of a City Multi VRF outdoor unit, a Hybrid BC controller (HBC) and special indoor units equipped with a water coil.

The HBC controllers are responsible for heat exchange between the refrigerant-based outdoor circuits and the water-based indoor circuits to the indoor units. With this system, the HBC controller can be up to 60 metres from the last indoor unit. Refrigerant is only present in the pipes from the outdoor units to the HBC controllers. All pipes leading through the building and the guest rooms transport water. Each individual indoor unit can be operated independently in heating or cooling mode. Heat extracted from the rooms requiring cooling is used elsewhere in the building for heating other rooms and areas. Heat recovery enables energy savings of up to 40% compared to conventional units with two separate systems for heating and cooling.

Case Study

Klingenstein Hotel, Blaustein, Germany

> “The base load of the heat supply on the ground floor of the new building as well as all hotel rooms are heated and cooled with the Hybrid VRF system”

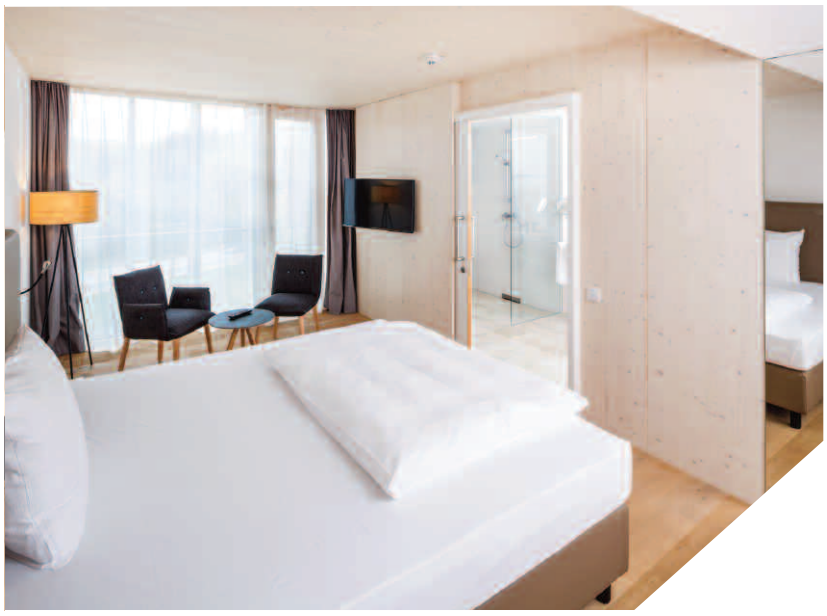
Roland Hammer
Project Manager
Walter GmbH

Only the windows of the corridors and seminar rooms on the ground floor of the hotel are additionally fitted with convectors for thermal comfort. The district heating network of the town of Blaustein supplies these radiators, the old building and the entire hot water supply.

A new gas boiler, which supplies the brewhouse with process heat, is coupled with the heat supply from the district heating network in order to cover peak loads.

The system design reflects the structure of the building and has been flexibly adapted to individual requirements. Three Hybrid VRF outdoor units with different outputs are installed on a side roof. They transport the refrigerant via pipe trains to a total of five HBC controllers, which are located in storage and technical rooms on the ground floor. From there, they supply the indoor units with the required heating or cooling output. Two pipes with a very small pipe cross-section run through the building to each indoor unit, so that the Hybrid VRF heating and cooling system requires very little space.

In order to simplify the installation process and reduce the number of ducts through different fire safety zones, the pipe trains were arranged vertically. This means that each pipe train connects to three indoor units in hotel rooms one above the other. Each of the 63 hotel rooms has a concealed unit installed in the suspended ceiling in the entrance area. On the ground floor, there are six conference and seminar rooms of different sizes, which are air-conditioned with 4-way ceiling cassettes. There is also a 4-way ceiling cassette in the entrance foyer and one in the beer store to maintain a uniform temperature there. A total of 73 indoor units have been installed in the new hotel building.



Case Study

Klingenstein Hotel, Blaustein, Germany

The client attached particular importance to a tailor-made and convenient operating concept.

This requirement was met using Mitsubishi Electric product solutions.

All indoor units can be controlled via PAC-YT52CRA compact cable remote controllers. This means that the temperature and desired fan speed can be set individually in each hotel room or conference room.

When guests are not in the rooms or they are not occupied, the indoor units are programmed for automatic temperature maintenance in order to heat or cool the respective room. In addition to functionality and quality, the manufacturer places particular emphasis on comfort and ease of use in its control technology to meet building-specific requirements.

The indoor units are connected to an AE-200E centralised controller for central control, monitoring and management of the air-conditioning systems. The AE-200E is housed in a small technical room and, in addition to a graphic touch display, offers the option of displaying the exact location of all indoor units on the floor plan of the building. Operating parameters and error messages can also be displayed, time programs set and trend data analysed.

In addition, the complete integration of the air-conditioning system into the multifunctional TG-2000A operating software offers further functionalities and additional energy-saving potential. One of the features of this control system is an optimise-starter function. This function specifies when the set room temperature is to be reached. Based on the outside temperature and the current room temperatures, the air-conditioning system automatically starts operation in advance in order to achieve the preset temperature at the desired time.

A cooling protection feature ensures that as soon as the temperature falls below a preset threshold value, the system automatically starts heating so that the individual hotel and conference rooms do not cool down too much.

Klingenstein Hotel, Blaustein, Germany

Conclusion:

In 2017, the traditional ensemble of buildings was expanded with the addition of a modern new hotel building,which was constructed entirely in a modular timber design with a high degree of pre-fabrication. This modern, sustainable approach is also reflected in the air-conditioning and heating system. The owner and operator were looking to achieve the best possible climate control and user-friendly operation, high energy efficiency, low operating costs and easy and clear usability.

A City Multi Hybrid VRF system from Mitsubishi Electric was installed as the heating and air-conditioning solution for simultaneous heating and cooling with heat recovery. The 2-pipe system combines the advantages of a directly evaporating system with those of a chilled water system in which water is used as the sole transport medium in the building itself instead of refrigerant.

It thus optimally meets the client's requirements and is particularly economical in operation and environmentally friendly thanks to significantly reduced refrigerant quantities. Ease of operation is achieved through the use of compact cable remote controllers and a central control system in combination with multifunctional operating software.

Installation Summary

CITY MULTI CONTROLS

R410A Outdoor Units

- x 3 PURY-EP400 Simultaneous Heating and Cooling with Heat Recovery Outdoor Unit

Master HBC Controllers R410A (HVRF)

- x 2 CMB-WP1016V-GA1
- x 2 CMB-WP108V-GA1

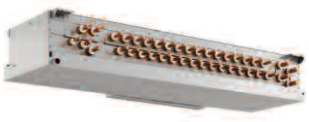
Indoor Units

- x 63 PEFY-P15VMS1-E Ultra Thin Ceiling Concealed Ducted Units
- x 6 PLFY-WP32VBM-E 4-Way Blow Ceiling Cassette Indoor Units

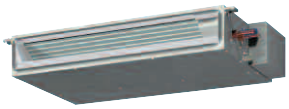
Controls

- x1 AE200 Centralised Controller
- x1 EW50E Centralised Controller
- x71 PAR-32MAA-J Remote Controllers

PURY-EP400YNW-A



CMB-WM1016V-AA



PEFY-WP15VMS1

PLFY-WP32VBM-E

AE-200E

EW50E

PAR-32MAA-J

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Note: The fuse rating is for guidance only. Please refer to the relevant databook for detailed specification. It is the responsibility of a qualified electrician/electrical engineer to select the correct cable size and fuse rating based on current regulation and site specific conditions. Mitsubishi Electric's air-conditioning equipment and heat pump systems contain a fluorinated greenhouse gas, R410A (GWP:2088), R32 (GWP:675), R407C (GWP:1774) or R134a (GWP:1430). *These GWP values are based on Regulation (EU) No.517/2014 from IPCC 4th edition. In case of Regulation (EU) No.626/2011 from IPCC 3rd edition, these are as follows. R410A (GWP:1975), R32 (GWP: 550), R407C (GWP:1650) or R134a (GWP:1300).

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