

# Separate Radiation and Convection to design an Optimal Radiation Panel

References: Performance Verification of Urban Environmental Building with Radiation Air Conditioning with Micro Airflow (6th Report)  
2009, Air-conditioning and Sanitation Engineering Meeting Competition

## Goal

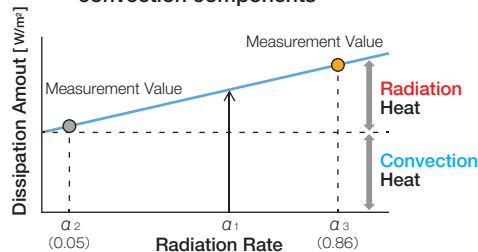
- ① Measure heat dissipation from the radiation panel by dividing it into convection and radiation heat dissipation.
- ② Find out the unit performance of the radiation panel and optimize design.

## Measurement Method

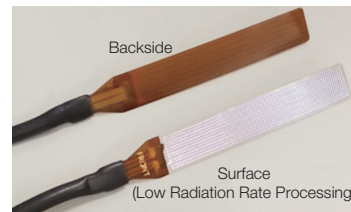
We would like to measure radiation dissipation emitted from the radiation panel and find out the performance of the panel itself. For that purpose, it is necessary to separate radiation and convection dissipation. The idea of separation between radiant heat dissipation and convective heat dissipation is as shown on Fig. 1. The slope of the zero radiation rate intercept is taken from the data obtained by measuring the radiation rate with two types of sensors that have different radiation rates. A 0.86 radiation rate standard type heat flux sensor (a3) and 0.05 low radiation rate convective heat radiation sensor (a2) are used for the measurement. The sensor appearance is shown on Fig.2.

As shown on Fig. 3, the above heat flux sensors were installed side by side on the radiation panel, and the radiation and convection heat dissipations (a1) on the indoor side and the ceiling side were obtained.

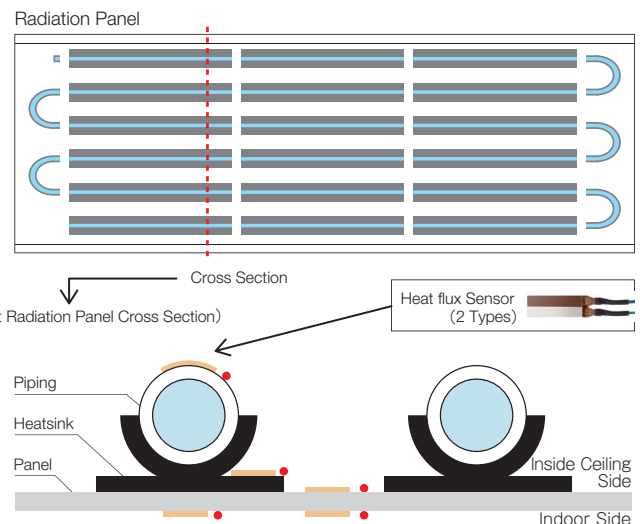
**Fig. 1** Differentiation between radiation and convection components



**Fig. 2** Convection Heat Dissipation Sensor



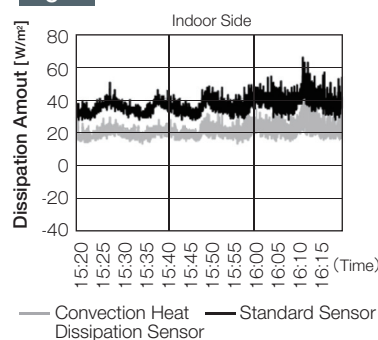
**Fig. 3** Heat flux Sensor Installation Location



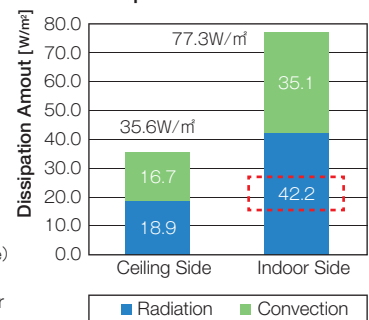
## Results

The results after the ball compression mechanism is operated are shown on the graph below: ①

**Fig. 4** Measurement Data



**Fig. 5** Radiation & Convection Separation Results



## Considerations

The heat flux sensor for convection heat dissipation used this time, can measure with high accuracy under stable radiation rate, so it was able to successfully separate radiation and convection heat dissipation. Moreover, we are confident that it is effective for energy saving and optimal design by grasping the individual performance of the radiation panel installed in the building.

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