

## Spot Cooling System for Data Centers

### Features

'Ref Assist' is a localized air conditioning solution for datacenters, which is installed above the IT cabinets. Its installation significantly reduces energy usage, expands available floorspace for server installation, and removes the use of the datacentre floorspace for the installation of cooling equipment.

### Basic Concept or Summary

Conventional floor mounted 'Computer Room Air Conditioning', CRAC, units (Figure 1) are typically installed either end of the server rows, within the datahall. The CRAC units draw in hot server exhaust air at high level, and supply cold air via a raised floor void. This conventional cooling solution requires considerable amount of motive force to provide the required air distribution.

However, the spot cooling system "Ref Assist" (Figure 2), comprised of an overhead suspended spot cooling unit above the servers, features the following characteristics:

- 1) The motive energy for driving the air conditioning fan is significantly reduced by a reduction in pressure loss arising from the circulation of air.
- 2) Since the floor space used for conventional floor standing type air conditioners can be used for installing server racks, the number of server racks installed at a facility can be increased.
- 3) Unlike conventional air conditioners no cold air passes under the floor, therefore the amount of space under the flooring can be reduced.

Furthermore, a cooling system that takes advantage of the natural circulation of a refrigerant (Figure 3) has been adopted for the spot cooling system "Ref Assist" (Figure 3).

The natural circulation of a refrigerant involves exhaust heat from servers heating and vaporizing the refrigerant inside the air conditioning unit. The vaporized refrigerant now has a lower specific gravity and rises through a vertical tube and reaches the chilled water refrigerant heat exchanger. The refrigerant is cooled by the chilled water in the chilled water refrigerant heat exchanger, then liquefied and once again returns to the air conditioning unit as gravity pulls the refrigerant, with gained specific gravity, down again. The refrigerant, therefore, can be circulated without any motive energy, by using such a cycle driven by natural circulation.

Furthermore, up to 60% energy savings can be obtained, in comparison with conventional systems, by combining the spot cooling system with highly efficient heat sources (Figure 4), such as an inverter turbo chiller or free cooling, etc.

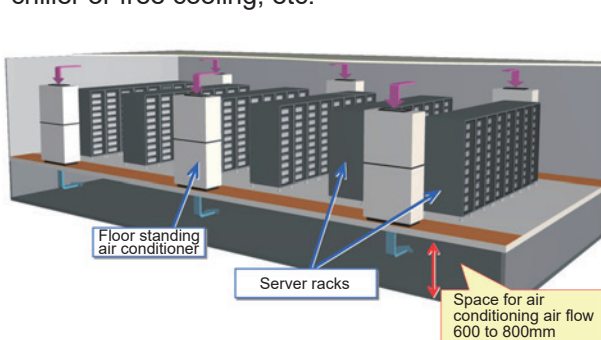


Figure 1: Conventional system (floor level blasting air conditioning system)

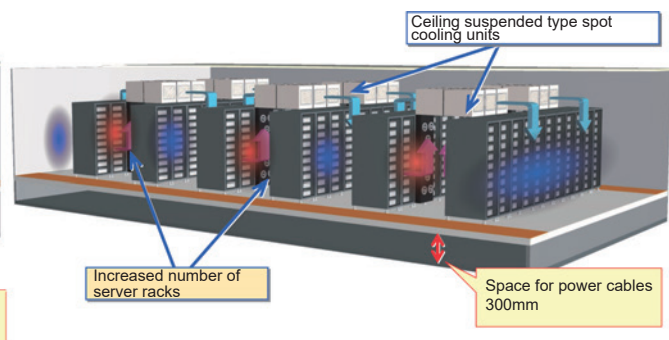


Figure 2: Ceiling suspended spot cooling unit system

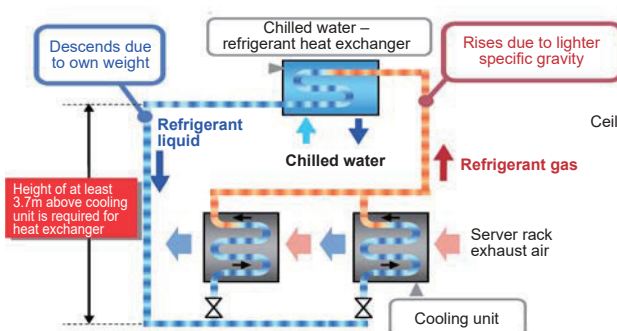


Figure 3: Principles of natural circulation of refrigerant

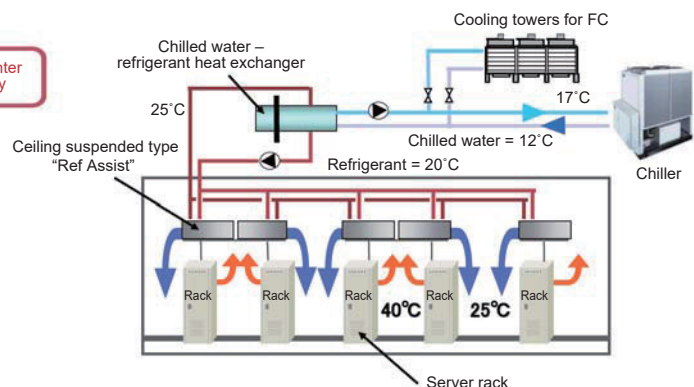
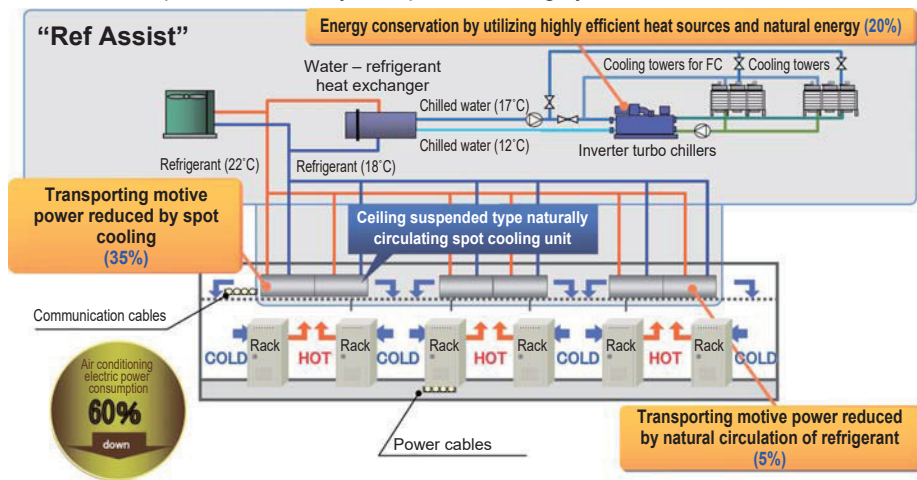


Figure 4: Combination of highly efficient heat sources

◆ **Energy conservation of spot cooling systems: Energy savings of 60%.**

[Breakdown of 60% energy saving] (comparison with conventional methods, according to our estimated figures)

- Air distribution motive power reduced by spot cooling : 35%
- Refrigerant distribution motive power reduced by natural circulation of refrigerant : 5%
- Heat source motive power reduced by incorporation of highly efficient heat sources and free cooling : 20%



Comparison against conventional computer system packages from 2004

◆ **The spot cooling system is featured as Best Practice by the ITU (International Telecommunication Union)\*1.**

[Details of "Spot Cooling System" featured by Best Practice of ITU]

1. Data centers accommodating highly integrated server racks (typically those having 5 to 8kW capacity per rack) should select "ceiling suspended spot cooling" when considering "space efficiency".
2. Data centers located in a region with high external wet bulb temperatures (for instance 15°C or higher) should select "ceiling suspended spot cooling" when considering "energy efficiency". Data centers located in a region with low external wet bulb temperatures (typically 15°C or higher) should select "outdoor air cooling" or "evaporative cooling".
3. Data centers located in a region with a mild climate (typically external wet bulb temperatures of 15°C or lower) should select "ceiling suspended spot cooling" when considering both "space efficiency" and "energy efficiency".

(Click on "ITU-T Recommendations" at the website of ITU-T: <http://www.itu.int/ITU-T>.)

\*1: **ITU: International Telecommunication Union**

ITU is one of the specialized organizations of the United Nations that has the objectives of promoting standardization activities in electrical and wireless communication fields, the development of telecommunication technologies and the management of communication frequencies, etc. Their headquarters are located in Geneva, Switzerland.

**Installation in Practice or Schedule**

<b>Domestic</b>	2014	186 units of ceiling suspended single blower type 15 kW were installed at a data center company
	2015	98 units of ceiling suspended single blower type 15 kW were installed at a data center company
	2016	31 units of ceiling suspended dual blower type 30 kW and 334 units of ceiling suspended single blower type 15 kW were installed at a data center company
	2017	30 units of rack type 20 kW were installed at a communications company
	2017	72 units of ceiling suspended single blower type 15 kW were installed at a data center company
<b>Overseas</b>	2010	UK: 4 units of rack type 22 kW and 11 units of door type 10 kW were installed
	2010	Netherlands: 4 units of rack type 14 kW and 4 units of door type 10 kW were installed
	2012	Singapore: 14 units of rack type 22 kW were installed at a communication company
	2014	China: 16 units of ceiling suspended single blower type 15 kW were installed at a financial institution
	2016	14 units of ceiling suspended dual blower type 30 kW and 117 units of rack type 20 kW were installed at a broadcasting company

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