Swirling Induction Type HVAC System
New HVAC system for the large-scale enclosure

**Merits of the SWIT**

- Comfort and Clean Environment
- Flexibility and Reduction of Installation Space
- Reduction of Installation Cost and Energy Consumption

**Mixing System**

- **Cooling**
  - Spread heat and contaminants
- **Heating**
  - Stay cold air within occupied zone

**Half of Installation Space by swirling supply air**
(comparison with general displacement ventilation)

- Fresh air is supplied to occupied zone
- Cool air spread
- Stay cold air within occupied zone

**New HV AC system for the large-scale enclosure**
Air Movement of Mixing System

- Cooling
- Heating

Supply air duct-work

Air conditioning zone

Spread heat and contaminants

Stay cold air at occupied zone

Occupied zone
Using combination swirling air flow, the amount of induced air is increased near the air supply unit for the SWIT. The air supply unit for the SWIT is compact and half of installation space as compared with the general DV.

By the induction effect, the SWIT can move the air within occupied zone slowly.

At the DV system, the supply air flow is moved only near the floor.
Comfort and Reduction of Energy Consumption

**SWIT Mixing System**

- Saving fan power by large difference of temperature
- It is not necessary too cooling supply air.
- Saving heat source energy because of high temperature of supply air

**Cooling by Mixing System**

- Low Temp. → Low Temp. (T=10)
- High Temp. → High Temp. (T=15)
- Warm air circulator without draft

**Heating by Mixing System**

- High Temp. → Low Temp.

*Merit of the SWIT*

- It is so ineffective that the higher area in which a person is not present is air-conditioned.
- Heat and contaminants are spread toward occupied zone.
- Since warm air does not arrive to occupied zone, colder air stay within occupied zone.
- Since air at occupied zone does not move, most contaminants can’t be diluted.

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It verified that SWIT was most comfortable than other systems by field Measurement.

Comparison in same conditions:
- Supply air temperature: 18 °C
- Supply air volume: 21 m³/h/m²
- Cooling load: 120 W/m²

Supply Air
Exhaust Air (FL+9m)
Machine tool (In Operation)

Machine work building 200m² □ 10mH

Cooling Load 120W/m²
Outdoor Air Temperature 30°C
It verified that SWIT was most comfortable than other systems by field measurement comparison in same conditions:

- Supply air temperature: 30 °C
- Supply air volume: 21 m³/h/m²
- Heating load: 50 W/m²

**Diagram Description:**
- **SWIT** and **Mixing System**
- Supply Air
- Exhaust Air (FL+9m)
- Machine tool (In Operation)
- Machine work building 200m² □ 10mH

Other System
- General DV

Heating Load
- 50W/m²

Outdoor Air Temperature
- 10°C

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SWIT can reduce annual energy consumption and installation cost.

**Annual Energy Consumption**

- **SWIT** can reduce annual energy consumption compared to a mixing system.

**Installation Cost**

- **SWIT** reduces installation cost compared to a mixing system.
Users of SWIT

- Printing factory
- Training room
- Assembly plant
- Gymnasium

Under operation 172,000 m²

Organic Solvents
- Heat
- Saving energy

Contribution to improvements of warm temperature environment and air quality

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References
Increase The Amount of Induction Air near The Supply Air Unit

It solve a problem by effect of induction and natural convection

- Air in occupied zone is moved slowly.
- Warm and duty air is lifted up from occupied zone.
- Cold air is removed from occupied zone.
SWIT can reduce energy consumption of room with large internal generation of heat and large fresh air load at maximum cooling load.

Left: Mixing system
(\(\Delta T=10^\circ C\) )
- Fresh air 50%
- Return air 50%

Right: SWIT (All fresh air)
Volume of fresh air is more than Mixing system
SWIT can dilute contaminants efficiently and keep the environment clean.

It is difficult to dilute, since only the air near the floor moves.

Ventilation efficiency comparison in case the generating point of contaminants differ.

- **Swit**: High efficiency of ventilation and clean area.
- **Displacement Ventilation**: It is the concentration when perfectly mixing and diluting by fresh air.
Air flow Pattern of Displacement Ventilation System

Mixing System

Displacement Ventilation System (DV)