Active Air Terminal Systems

- *For more comfortable and energy efficient air-conditioning applications*

Breeding a better environment into your building

Air T&D Ptd Ltd

Overview

The key components of Active Air Terminal (AAT) systems include Active Beamers (ABM) and Active Diffusers (ADF):

- ABM use typical air-water configuration consisting of two sub-systems: primary air system and secondary water system. The primary air system meets the ventilation requirement which handles the full latent load and a small portion of the sensible load, while the secondary water system handles major portion of the sensible load.
- Unlike ABM, ADF use conventional all air configuration and can simply be denoted as ABM without the secondary water system. The possibility of condensation is ruled out while the primary air handles all the ventilation, latent and sensible loads.

A high entrainment ABM with specially designed nozzles to create higher cooling/heating outputs

ABM installed in an office

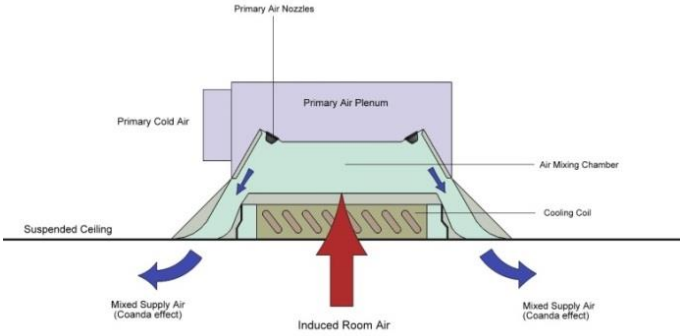
AAT systems can be arranged differently to suite different applications. They have been widely adopted in many western countries for different type of building applications including office, laboratory, factory etc. The growing interest is fueled by the characteristics of improved Indoor Environment Quality (IEQ), reduced space requirements, cost saving, etc.

ABM installed in a meeting room.

Working principle

Entrainment

ABM working principle



ABM supply cooling/heating to the space through the following mechanism:

1. The primary air plenum receives the pretreated and pressurized primary air from a Dedicated Outdoor Air System (DOAS).
2. This pressurized primary air is injected through a series of nozzles into the mixing chamber on its way to the conditioned space.
3. A low pressure kernel is created at the outlet of each nozzle due to the increase in air velocity.
4. The pressure is slightly negative compared to the environmental pressure, which induces the secondary room air into the mixing chamber.
5. A heat exchanger is imposed in the path of the secondary air; the secondary air is cooled/heated when it passes through the heat exchanger
6. The reconditioned secondary air then mixes with the primary air and is discharged into the space through a specially designed outlet to achieve coanda effect.

Primary Air System

The primary air is generally pre-conditioned to a particular temperature and humidity level. In cooling mode the temperature setting is 12-15 ℃, while in heating mode it is 30-40 ℃. The humidity level is defined based on the latent load and the primary air volume flow rate.

Secondary Water System

The secondary water system usually handles 65-75% sensible load of the unit. Due to the relatively large quantity of air passing through the secondary water heat exchanger, high chilled water temperature (13-17 ℃) or low hot water temperature (30-35 ℃) is normally sufficient to meet the load requirement. These temperature requirements for the secondary water loop provide some ease in configurations of secondary water supply according to the applications.

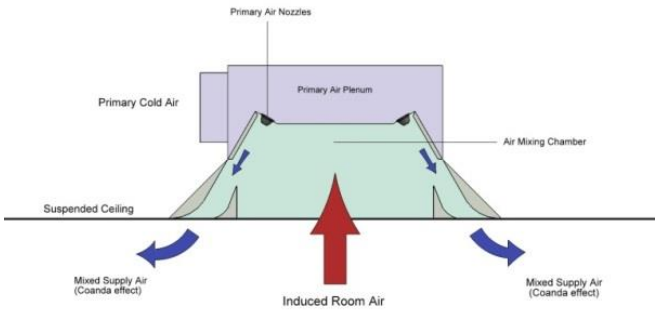
Control Strategy

ABM are usually operated in a constant air volume configuration with predetermined temperature and relative humidity. Control strategy of the primary air loop is simplified to be a time-based on-off scheme, leaving the relative humidity to find its own level. Space temperature control is accomplished by either varying the secondary water flow rate or its supply temperature to the terminal units without affecting the space ventilation and/or relative humidity. ABM do have the ability to turn down the primary air flow and they can be operated in a variable air volume configuration as well. In such cases, space temperature and relative humidity can be independently controlled via the primary air system and secondary water system.

ADF

ADF can be regarded as simplified ABM. The discharging air becomes warm by inducing the relatively high temperature secondary air into the primary air. That means ADF provide a solution for low temperature primary air (10-12 ℃). For a given sensible cooling load, the primary air quantity is smaller and humidity control is much improved. ADF combine the advantages of ABM and diffuser units with compact size, low noise and high energy efficiency.

ADF working principle



Benefits of AAT Based ACMV Systems

AAT based ACMV systems offer several advantages in residential and commercial applications.

IEQ Improvement

- Sound levels under 30 NC
- Flexible and independent indoor temperature and relative humidity setting
- Better air flow distribution
- Comfortable and consistent room temperatures gradient

Space Saving

- 25% savings in terms of ceiling space
- Small foot print of primary air handling unit

Energy Saving

- Reduced ventilation fan energy
- Less energy consumed to condition outdoor air
- 15% to 20% higher chiller efficiency
- Elimination of energy-intensive reheat devices

Cost Reduction

- Conventional equipment requirement
- Low electricity bill
- Less maintenance cost

Our Products

Our products are sufficient to cover most of the commercial and residential ACMV applications.

AAT Units

Four types of terminal units incorporated with nine types of nozzles for different applications:

- One way discharge ABM and ADF units: used in perimeter areas of large spaces.
- Two way discharge ABM and ADF units: the most commonly used type in the AAT based system applications for large spaces.
- Four way discharge ABM and ADF units: used in small offices and conference rooms.
- Horizontal discharge ABM and ADF units: used in hotel rooms and student dormitories.

½ or 1 inch insulation covers are used to reduce thermal loss and for acoustic attenuation.

The nozzles made from fire retardant material and designed to be leak proof.

Distributed Air Handling Units

A series of Distributed Air Handling Units (DAHU) with the capacity to deliver up to 5000m^3/h

- Low noise level due to dedicated silencers
- Reduced heights below 500mm
- Factory assembled, light weight and single point power connection, making it very easy to install
- Bottom access panels to facilitate easier, faster maintenance on the fan and coil
- Energy efficient EC Motor fans

Air Flow Control Station

A high accuracy Air Flow Control Station (AFCS) employs the specially designed Rapid Averaging Pitot Tube for air flow measurement and a dedicated controller for regulating the position of the damper blades. The AFCS can be used to monitor and control the outdoor air volume flow rate with less than 2% error.

Controllers

A series of controllers have been developed. With built in program logics, the controllers can be used to control almost all elements in the ACMV systems.

Our Integrated System Solutions

At Air T&D, we provide one stop solutions for energy efficient AAT based ACMV system applications

Condensation Avoidance

- An energy efficient Liquid Desiccant Dehumidification System (LDDS) (patent granted) which can reduce the water content of primary air as low as 3g/kg.
- A condensation avoidance and temperature control scheme for multi-zone ABM system (patent filed) to control the risk of condensation through independent adjustment of the secondary water temperature in multiple zones.
- A hybrid ABM and ADF implementation scheme which can independently control the ventilation, temperature and humidity in the space.

System Control

Integrated Intelligent Building Management System (I^2BMS) with the following features:

- Display, analysis and trending
- Controller auto-tuning
- System optimization
- Fault detection and diagnostic

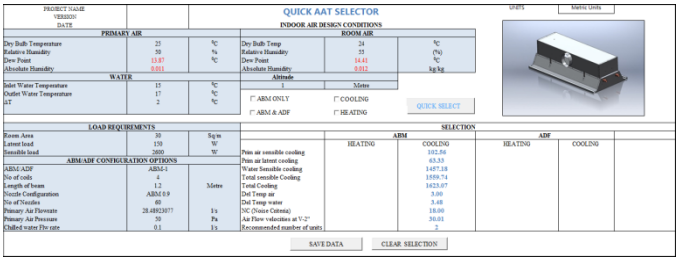
Integrated Intelligent Building Management System

System Design

In order to make AAT systems widely applicable in different climate conditions, we have developed:

- A unique design & simulation protocol with testing facilities to fast deliver AAT systems according to the customer needs, space limitation, load profile, etc.
- A performance evaluation program with experimentally validated models to simulate and predict different mechanical and control system performances under different scenarios.
- A quick AAT selector for end users to automatically and optimally determine the system layout, nozzle configuration and number of ABM and ADF with given external and internal design conditions.

Quick AAT Selector



Our Vision

While our R&D capacity continues to expand, our intention remains the same which is to act as a catalyst to build a more sustainable society and create value for our communities, partners, customers and investors alike. We sincerely hope that our products and services in research, consultancy, product development and education for green cooling and air-conditioning technologies will benefit you.