FORM 020.119 REV1704

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Therma-Fuser™ Systems

# HIGH PERFORMANCE AIR SYSTEMS USING LOW ENERGY AIR HANDLING UNITS
# Zoned with Therma-Fuser™ VAV Diffusers

## INTRODUCTION

High Performance Air Systems (HPAS) combine superior comfort with high efficiency. Comfort is achieved with the smallest possible zones of temperature control, uniform temperature distribution and indoor air quality. Efficienct HPAS have low energy fans, variable speed drives, low pressure drop filters, low pressure drop cooling and heating coils, low pressure drop ducts, low pressure drop Therma-Fuser VAV diffusers and free-cooling with outside air. HPAS are also low cost and provide sustainability with low maintenance and tenant flexibility.

## GOALS

1. Comfort: Individual temperature control
2. Low Energy: Small zones of control
3. Low Energy: VAV turndown pressure control
4. Low Energy: Supply air temperature (SAT) control
5. Low Energy: Low horsepower fan
6. Low Energy: Low pressure drop air system
7. Low Energy: Eliminate / reduce reheat

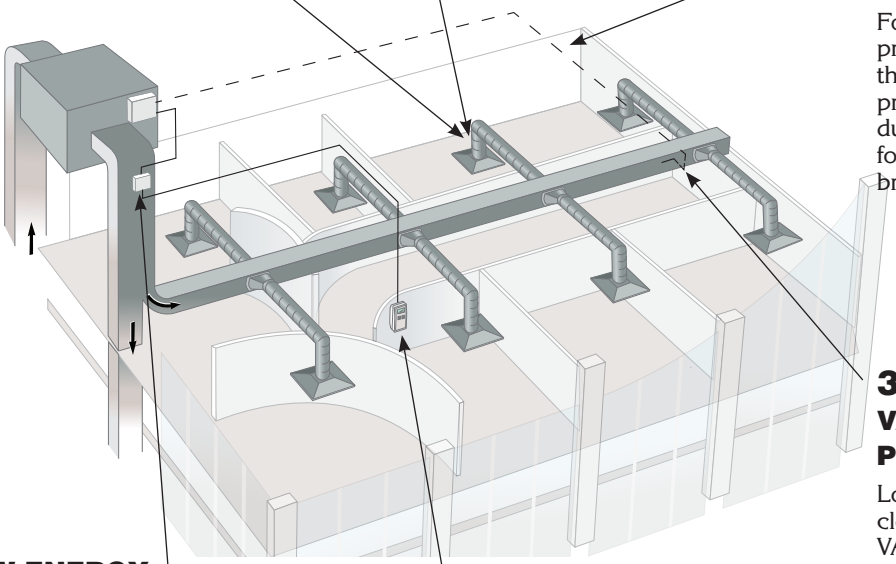
**Recommendations in accord with ASHRAE's *Advanced Energy Design Guide for Small to Medium Office Buildings – Achieving 50% Energy Savings Toward a Net Zero Energy Building.***

### 1. COMFORT: INDIVIDUAL TEMPERATURE CONTROL

Therma-Fuser™ VAV diffusers have separately adjustable heating and cooling setpoints. Thermostat and VAV damper are built-in.

### 2. LOW ENERGY: SMALL ZONES OF CONTROL

Each Therma-Fuser™ diffuser is a VAV zone of control. No energy is wasted by overcooling or overheating.



### 3a. LOW ENERGY: VAV TURNDOWN PRESURE CONTROL

For static pressure control and pressure independence, control the fan speed from a static pressure sensor located in the duct run. Use multiple sensors for duct work with multiple branches.

### 3b. LOW ENERGY: VAV TURNDOWN PRESSURE CONTROL

Locate the static pressure sensor closest to the last Therma-Fuser™ VAV diffuser in the duct run. As the system turns down static pressure is reset downward for all upstream diffusers.

### 4a. LOW ENERGY: SUPPLY AIR TEMPERATURE (SAT) CONTROL

Control cooling and heating with a discharge air thermostat for constant SAT. May be reset to another constant SAT.

Design cooling SAT at 50°F and reset to 58-61°F depending on climate zone. For SAT reset in humid climates use at least one zone humidity sensor to disable reset if humidity exceeds 60%.
The heating SAT must be as low as possible but no lower than 80°F.

### 4b. LOW ENERGY: SUPPLY AIR TEMPERATURE (SAT) CONTROL

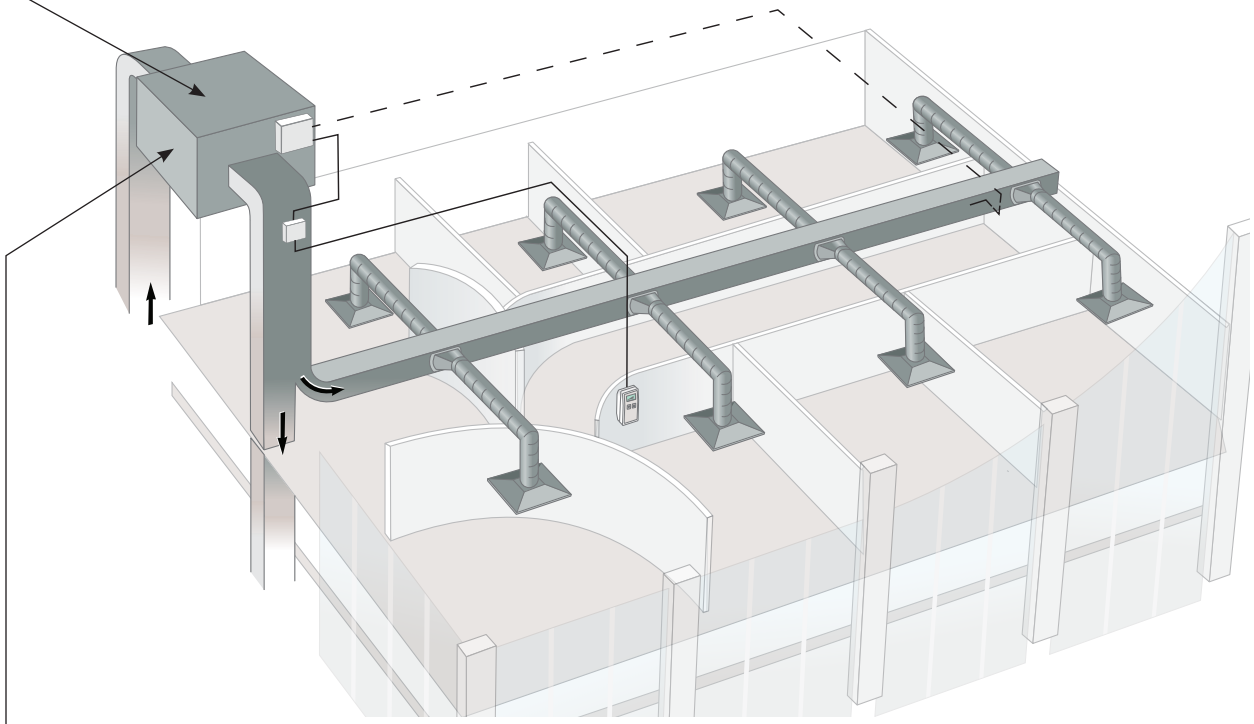
Changeover between heating and cooling may be manual, with a room thermostat (as shown), or multiple voting room sensors. Locate the room thermostat in the room of "greatest need" or maybe the most important room.

**SEE FOLLOWING PAGES FOR:**


5. **Low Energy: Low horsepower fan**
6. **Low Energy: Low pressure drop air systems**
7. **Low Energy: Eliminate / reduce reheat**

## 5. LOW ENERGY:
## SELECT THE LOWEST HORSEPOWER FAN AND CONTROL IT FOR LOW TURNDOWN HORSEPOWER

- Maximum fan power should not exceed 0.72 W/cfm.
- Use a more efficient scroll type airfoil centrifugal fan when noise and space limits allow.
- Use a variable speed drive (VSD) on the fan.
- Control the VSD from a static pressure sensor located close to the last VAV terminal in the duct run. Use multiple sensors for duct work with multiple branches.
- Use the lowest pressure drop air system possible. (See "Low Pressure Drop Air System" below.)
- Specify that no balancing damper shall be installed before the last Thera-Fuser VAV diffuser (alternatively that the balancing damper before the last Therma-Fuser VAV diffuser shall remain open) so that the system will be balanced at the lowest possible fan speed.



## 6. LOW ENERGY:
## LOW PRESSURE DROP AIR SYSTEM

### 6a. FILTERS

- Avoid pre-filters.
- Use the largest filter bank that can fit in the space.
- Select low pressure drop extended surface area filters.

### 6b. COILS

- Select the largest coil that can fit in the space. Coils should have a minimum water side delta T of 15° F and face velocities between 300 fpm and a maximum of 450 fpm.

### 6c. FAN

- Minimize the fan outlet effect with a straight run duct or an elbow in the direction of the fan rotation.
- Use duct liner only where necessary for sound attentuation. Use the minimum needed. Avoid sound traps.

### 6d. RISERS

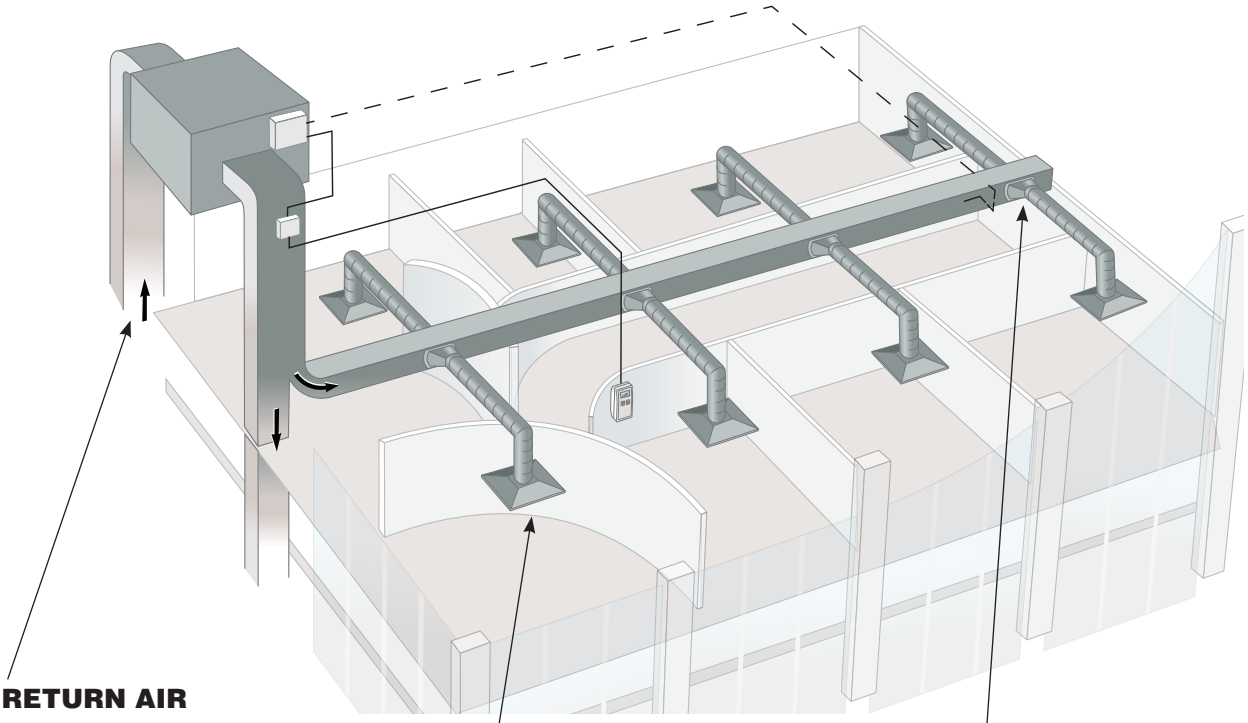
- Place the shafts close to the air handler but, for sound attenuation, not directly under it (except connect ducts to rooftop units through an insulated roof curb to avoid ducts outside the building envelope).
- Size for 800 to 1200 fpm at the floor closest to the air handler.
- Consider multiple air shafts for large floor plans.

**SEE NEXT PAGE FOR:**
6. **Low Energy: Low pressure drop air systems (continued)**
7. **Low Energy: Eliminate / reduce reheat**

## 6. LOW ENERGY: LOW PRESSURE DROP AIR SYSTEM (continued)

### 6e. SUPPLY AIR DUCTING

- Make as straight as possible with a minimum of transitions and joints.
- Use large radius elbows and low pressure drop fittings and takeoffs.
- Size for 1200 to 700 fpm or pressure drop no greater than 0.08”wg per 100ft.
- Limit use of flexible ducting to a maximum of 5ft at the diffusers.



### 6f. RETURN AIR

- Provide at least one return air grill for each VAV diffuser, more if the zone is large.
- Size return grills for pressure drop no greater than 0.08”wg.
- Use ceiling return air plenums (except in high humidity locations such as DOE climate zone 1). Seal ceiling plenums for minimum air infiltration.
- Size return ducts for pressure drop no greater than 0.04”wg per 100ft.

### 6g. SIZING THERMA-FUSER™ VAV DIFFUSERS

Size Therma-Fuser™ VAV diffusers for low static pressure drops — between 0.25”wg and 0.05”wg. Size the diffusers as large as possible, especially at the end of the duct run, for the lowest possible pressure drop at design air flow.

### 6h. LOW PRESSURE / LOW ENERGY BALANCING

Specify that no balancing damper shall be installed before the last VAV diffuser (alternatively that the balancing damper before the last VAV diffuser shall remain open) so that the system will be balanced at the lowest possible fan speed.

## 7. LOW ENERGY: ELIMINATE / REDUCE REHEAT

- Eliminate the need for reheat by adding enough inexpensive insulation to the building envelope until the heat loss through the envelope at outside temperature below winter design is less than the heat gain of the occupants and other internal loads in perimeter spaces. Warm-up heating may still be required.
- Eliminate the need for reheat by using separate air handling units for each heating zone such as one per exposure and one for the interior.
- Use the lowest possible minimum flow set point. Must be the higher of the minimum ventilation requirement **- or -** the minimum 10% of design air flow for Therma-Fuser VAV diffusers.
- Use a slightly higher supply air temperature. An increase in the supply air temperature will require a larger volume of air.
- Increasing the use of fan energy to lower use of refrigeration energy can seldom be justified except when also reducing reheat. One method is to reset supply air temperature during cool weather and size interior zones for 60° F or higher supply air. Supply air reset may not be beneficial in warm climates and in high humidity locations where alternate dehumidification may be required.

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