How Preservation Environments Use Energy

Charles E. Young Research Library, UCLA – Los Angeles, CA
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Sustainable Preservation Practices
for managing storage environments

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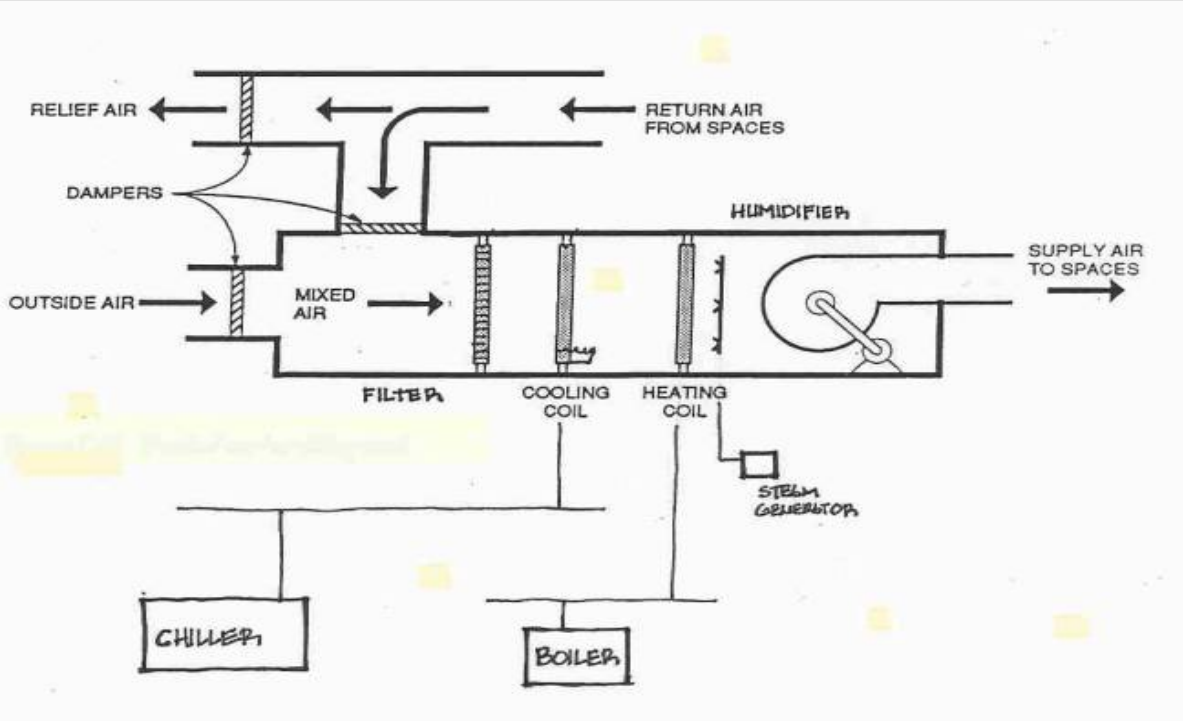
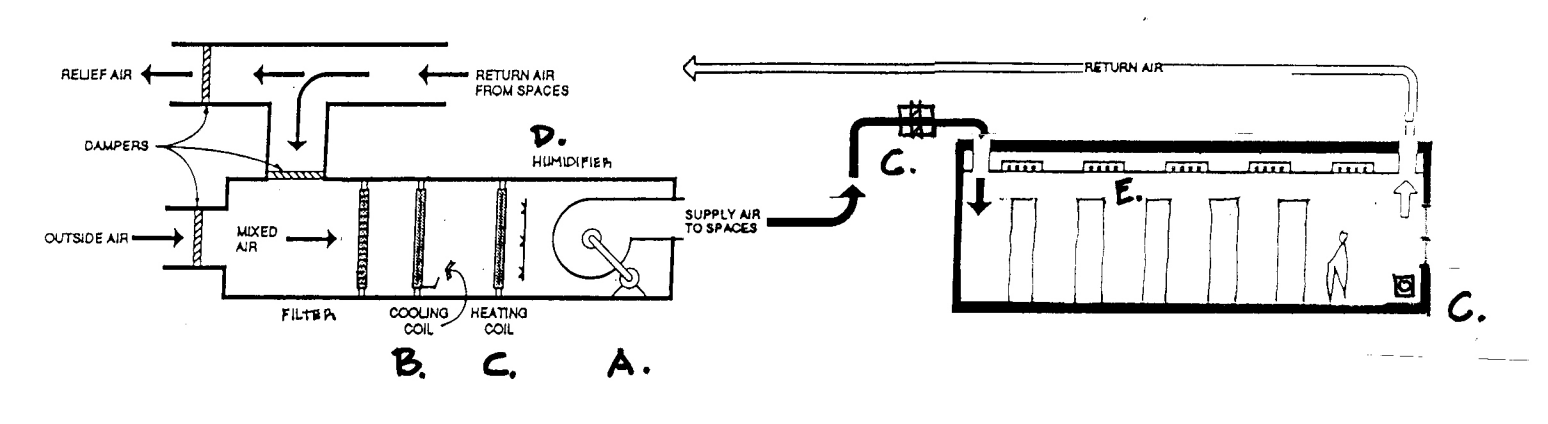
NATIONAL ENDOWMENT FOR THE HUMANITIES

Energy-Consuming Components of HVAC Systems

- Air Handling Unit and Sources of:
  Cooling / Heating / Humidification



Energy-Consuming Components of HVAC Systems

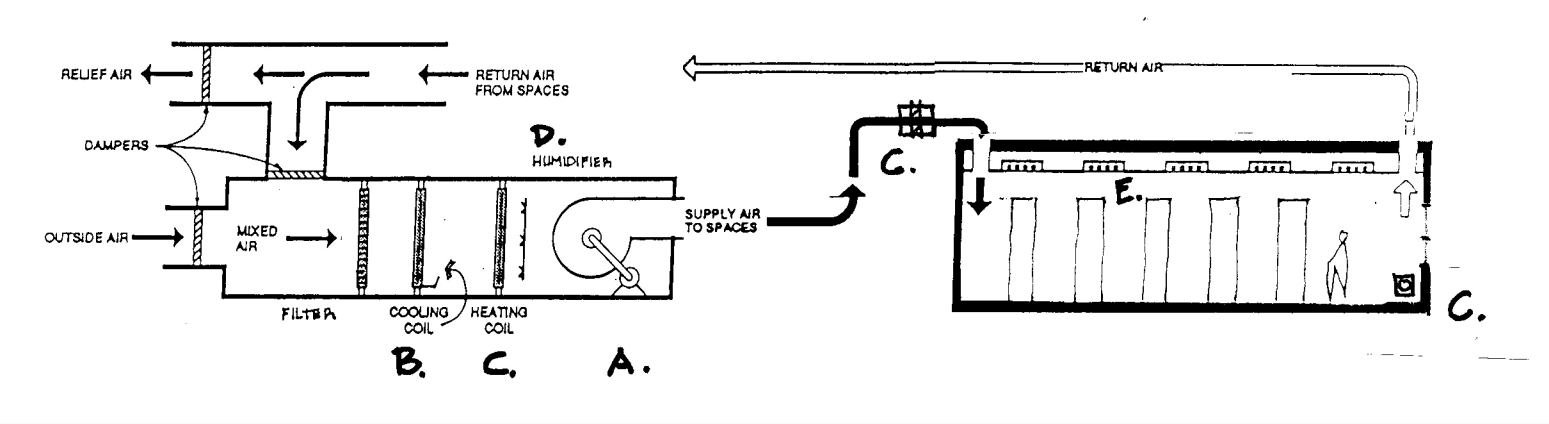


Components:

A. Air Handling Fans
B. Cooling/Dehumidification
C. Heating/Reheating
D. Humidification
E. Lights

Energy-Consuming Components of HVAC Systems

Operating Variables that Affect Energy Consumption



Energy = Rate of Consumption x Time of Operation

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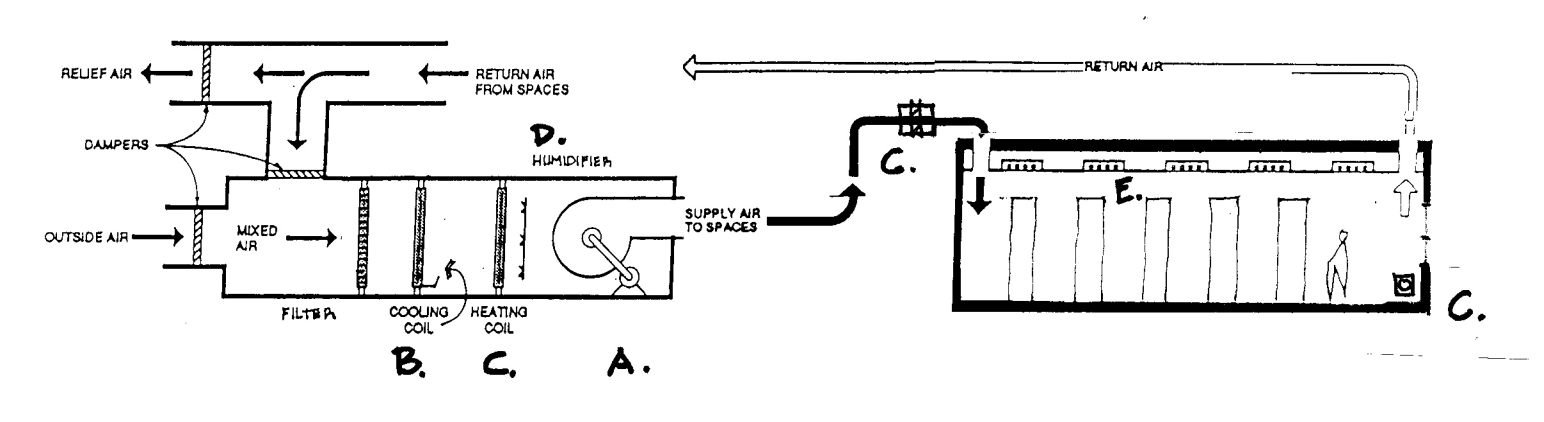
Energy-Consuming Components of HVAC Systems
Operating Variables



A Air Handling Fans – Operating Drivers

Total Air Flow (VAV)

Schedule of Air Flow

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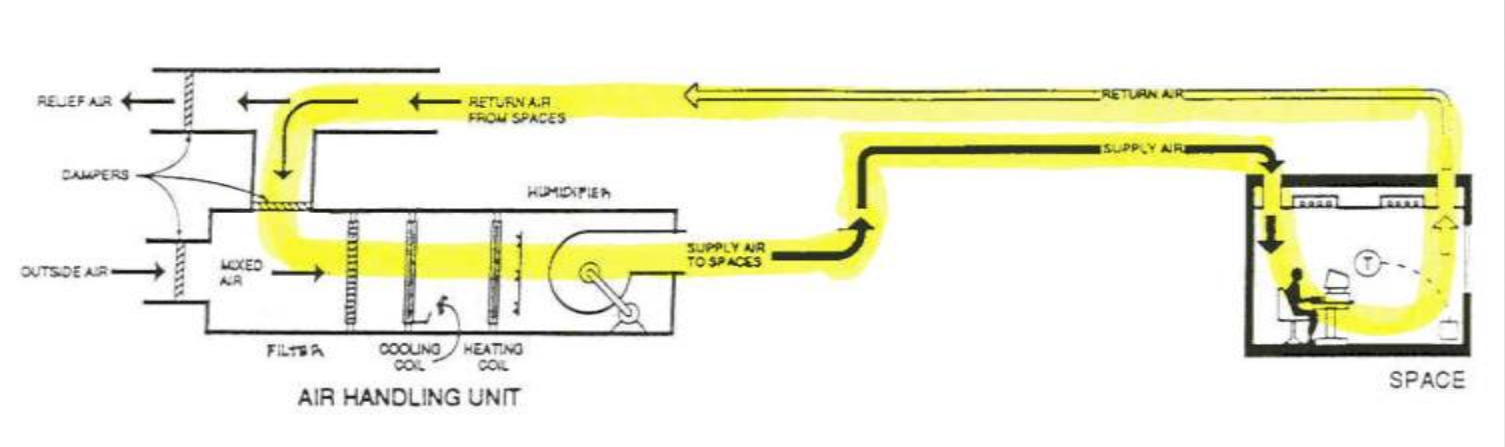
Operating Variable – Total Air Flow
Example Air Change Calculation



Storage space area = 5,000 SF

Storage space ceiling height = 8 FT

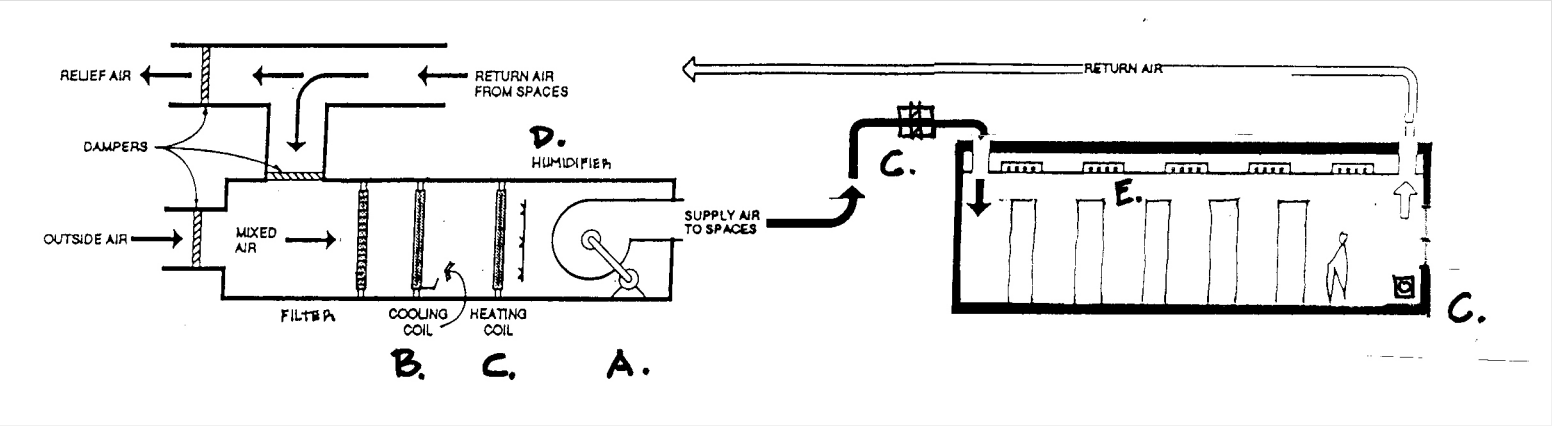
Storage space volume = 5000 SF x 8 FT = 40,000 Cubic Feet (CF)

Supply air is 5,000 CFM x 60 minutes = 300,000 CF per Hour

300,000 CFH divided by 40,000 CF = **7.5 Air Changes per Hour**

At 10% OA = 0.75 Air Changes/Hour = **1 Outside Air change every 1.3 Hours**

Energy-Consuming Components of HVAC Systems
Operating Variables



B Cooling/Dehumidifying – Operating Drivers

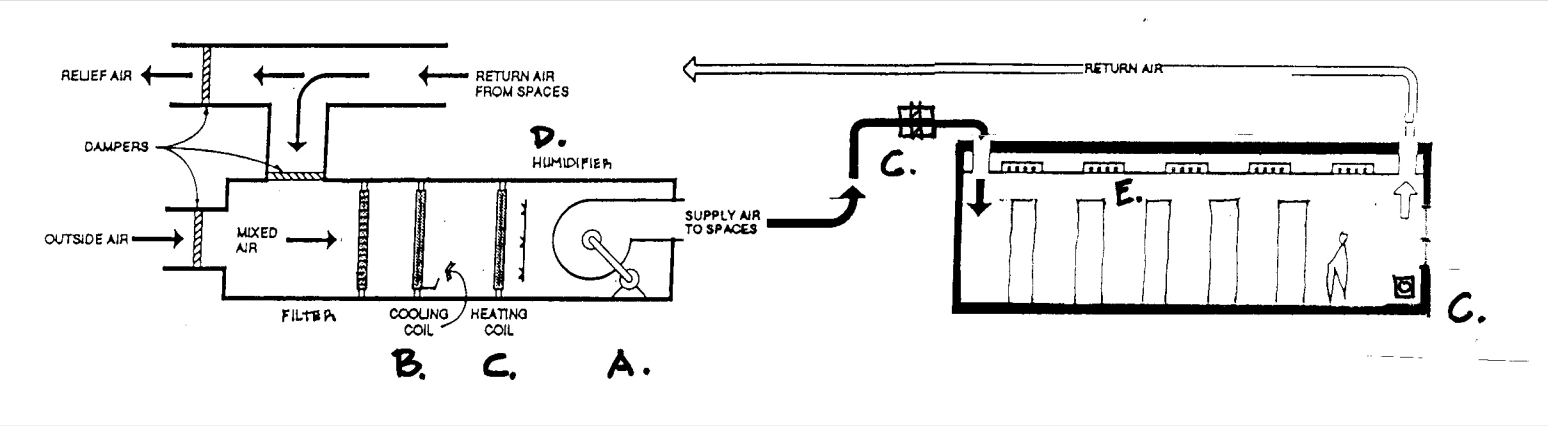
Temp. and RH Setpoints & Schedule

Quantity of Outside Air & Schedule

Space Loads (Lighting)

Total Air Flow

Energy-Consuming Components of HVAC Systems
Operating Variables



C Heating/Reheating – Operating Drivers

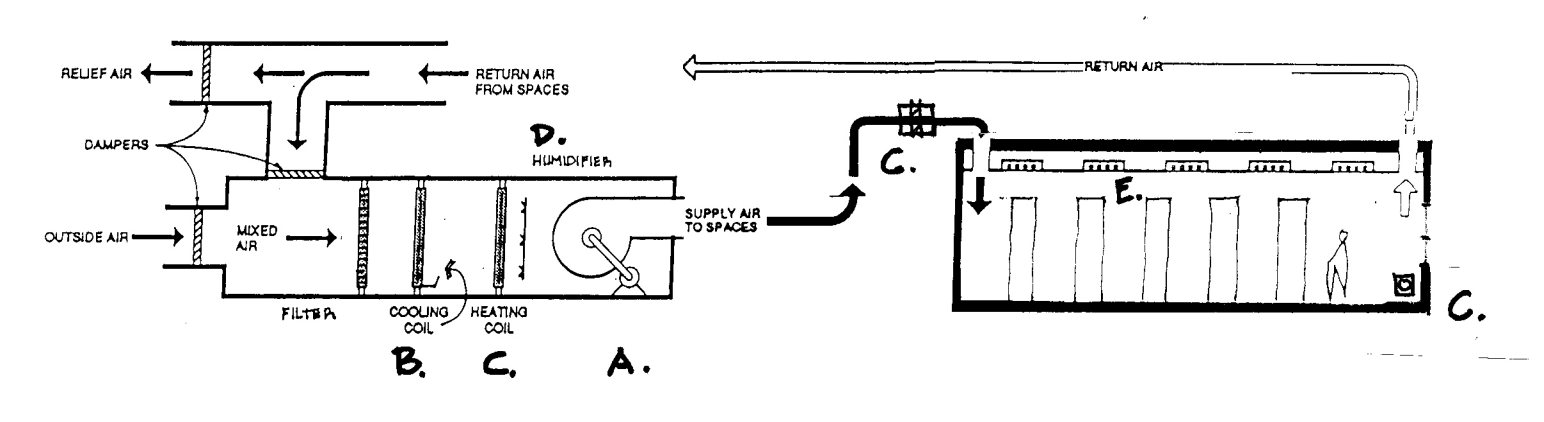
Temp. Setpoint & Schedule

Quantity of Outside Air & Schedule

Seasonal Control

Total Air Flow & Schedule

Energy-Consuming Components of HVAC Systems
Operating Variables

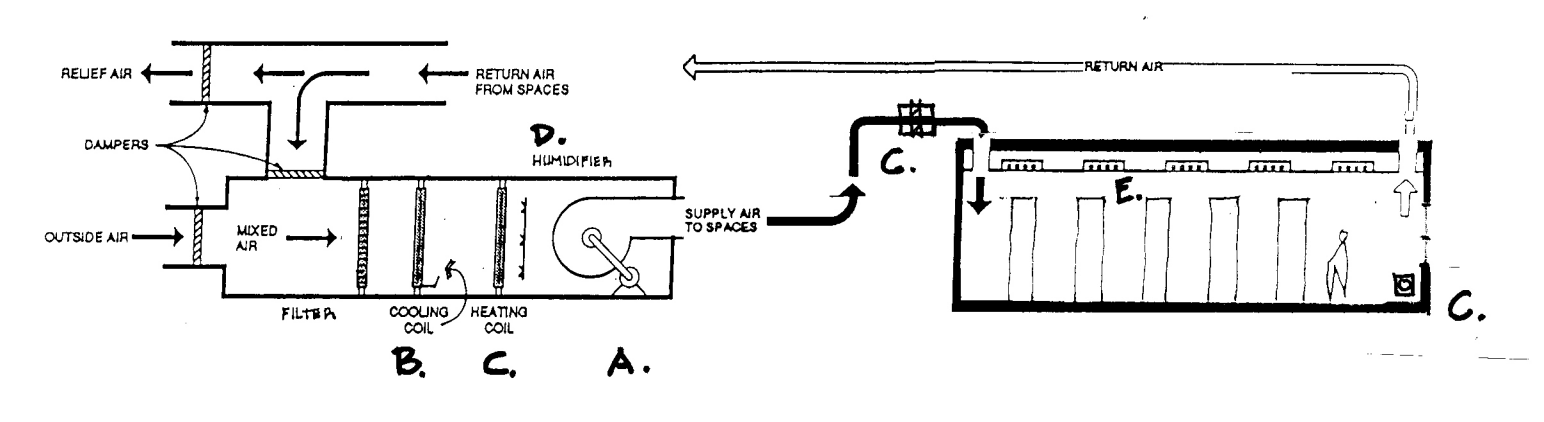


D Humidifying – Operating Drivers

RH Setpoint

Quantity of Outside Air & Schedule

Energy-Consuming Components of HVAC Systems
Operating Variables



E Lights – Operating Drivers

Schedule (hours of operation)

Example Allocation of Storage Area Annual Energy Cost

Component		% of Annual Energy Cost
A. Air Handling Fans		**19%**
B. Cooling Coil		**30%**
C. Heating Coil		**40%**
D. Humidifier		**5%**
E. Lighting		**6%**

Energy-Consuming Components of HVAC Systems
Operating Variables

Summary of Operating Variables:

- Total air flow and schedule
- Temperature and RH setpoints and schedule
- Quantity of outside air and schedule
- Space Loads (Lighting)