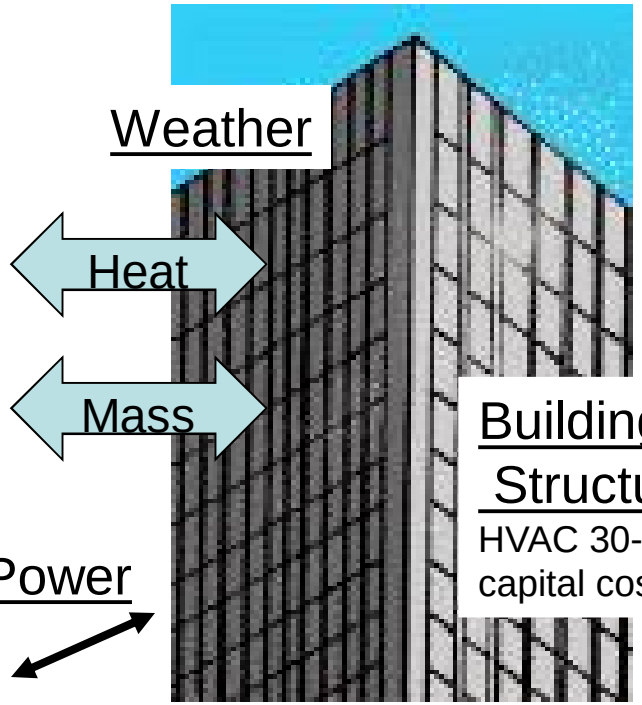
The Air Conditioning Problem



30-40% national energy use

Analysis-Design Process

Loads
Air Processes
Distribution
Refrigeration
System Specification
Simulation

Engineering Disciplines

Thermodynamics
Heat Transfer
Fluid Mechanics
Machinery
Physical Chemistry
Acoustics
Controls
Economics

Engineering Interests

Consulting Engineer - design, specification, simulation
OEM- equipment design, fabrication
Contractor- construction
Owner- operation, capital operating cost
Research- data, methods codes, (DOE, ASHRAE)

Course Outline

Introduction Chapter 1 and 2
- Airconditioning Systems
- Zoning

Conditioned Air Properties
- Psychometric properties Chapter 3
- Psychometric processes
- Combines processes
- Space design conditions Chapter 4

Building Loads
- Heat transfer modes
- Convection heat loads Chapter 5
- Solar heat gains Chapter 6
  - Structures
  - Windows

Building Loads
- Cooling loads Chapter 8
  - Heat Balance Method
  - Radiant Time Series
- Energy usage
  - Degree Day Method
  - Bin Method

Refrigeration
- Vapor Compression cycles Chapter 15
  - Positive displacement compressors
  - Centrifugal compressors
- Absorption cycles
- Cooling towers

Distribution (collection) Systems
- Fans and air systems Chapter 12
- Pumps and liquid systems Chapter 10

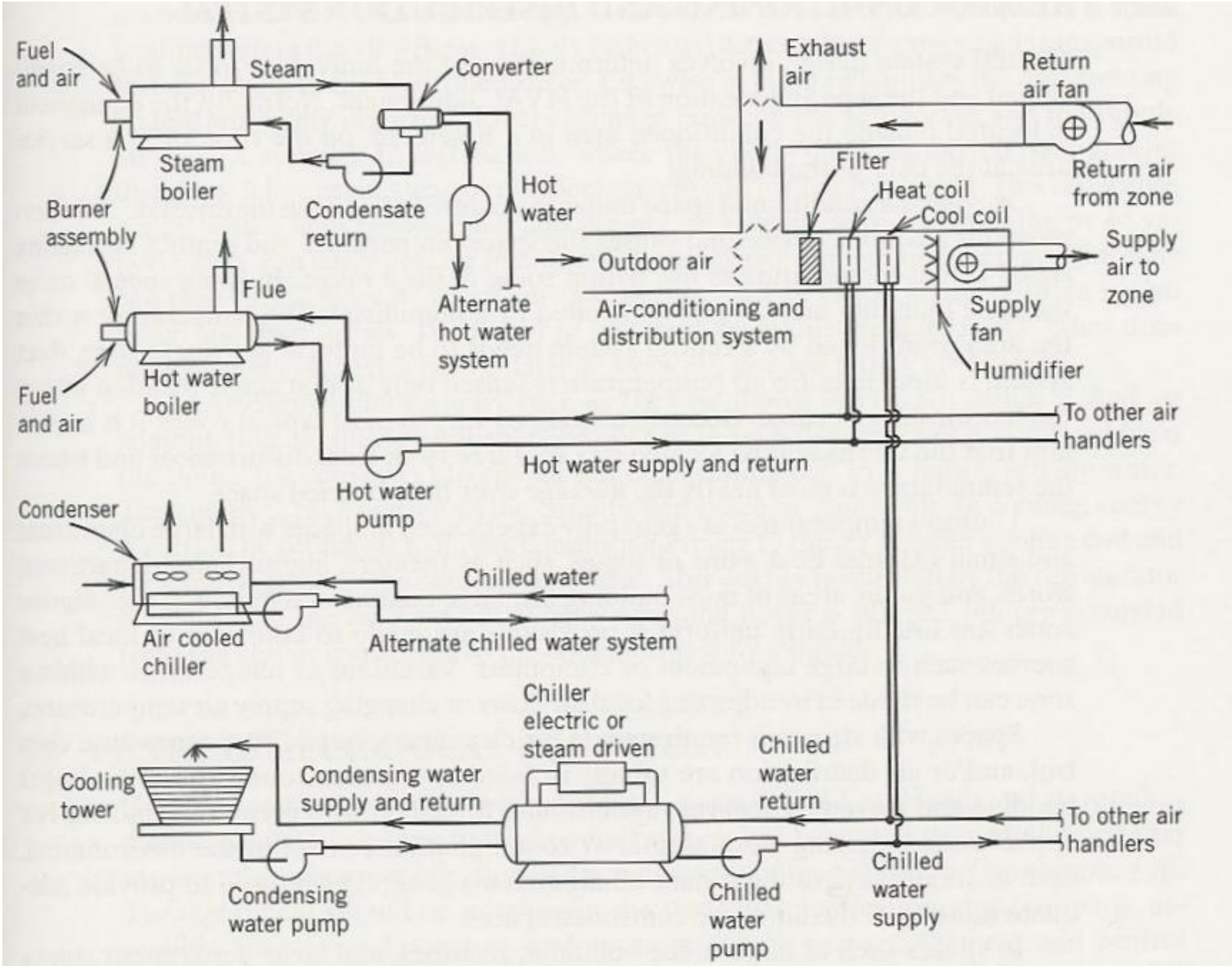
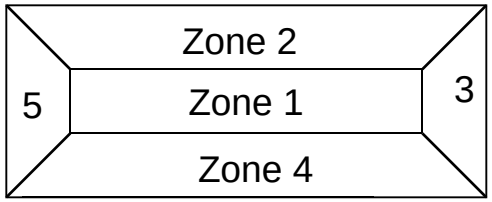
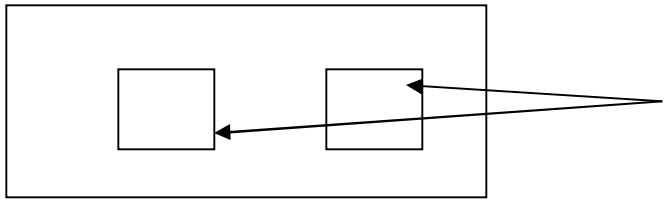


Figure 2-1 Schematic of a typical commercial air-conditioning system.

ZONE ï conditioned spaces controlled by a single thermostat



The rooms in a zone do not have to be adjacent



High load equipment
Or computer rooms

ZONE OPTIONS

conditioned spaces with similar load patterns (offices)
single zone for large open spaces (auditorium)
each room a zone (hotel)
Interior of the floor of a large office building

HAP Manual Zoning Example

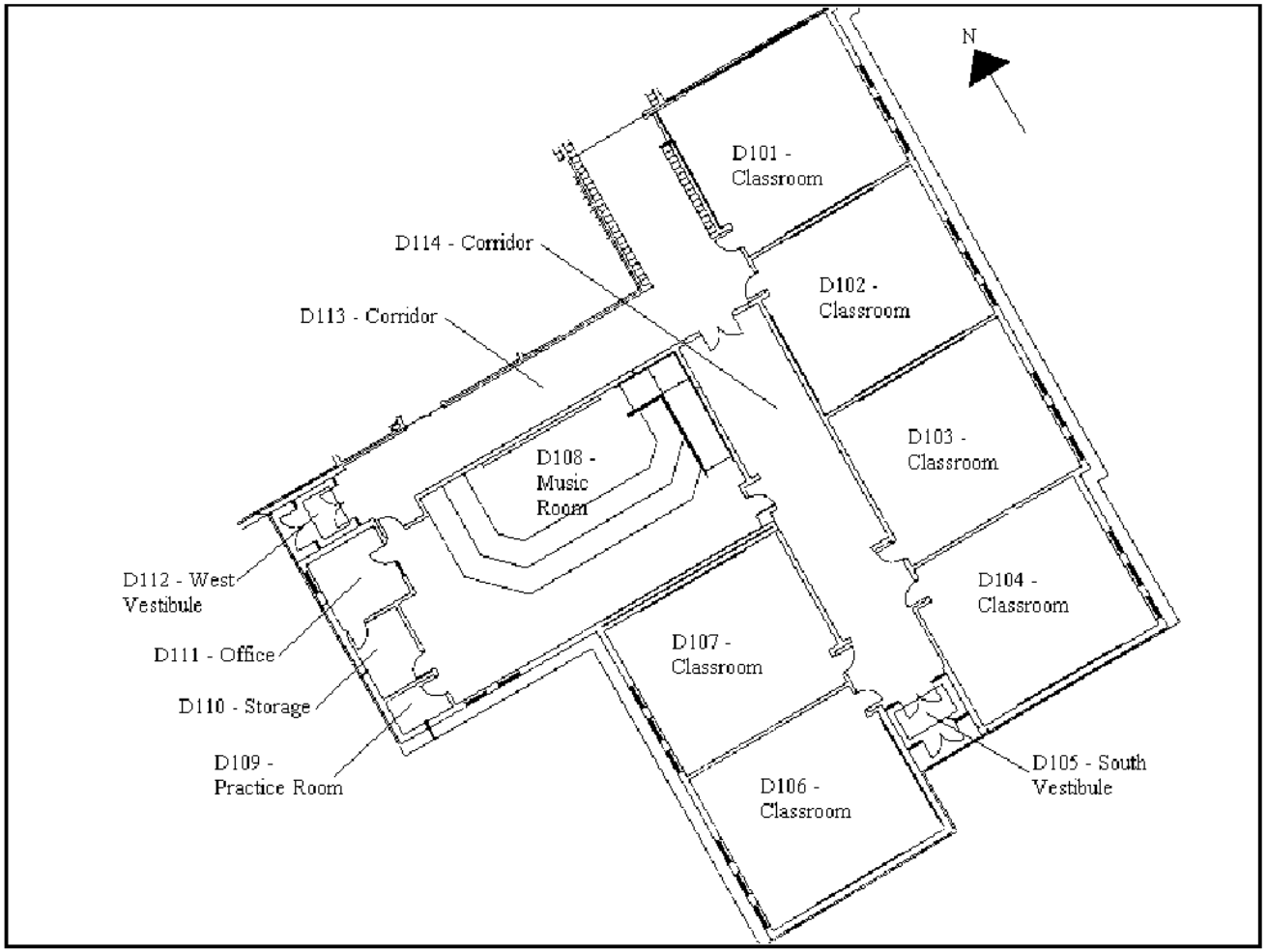
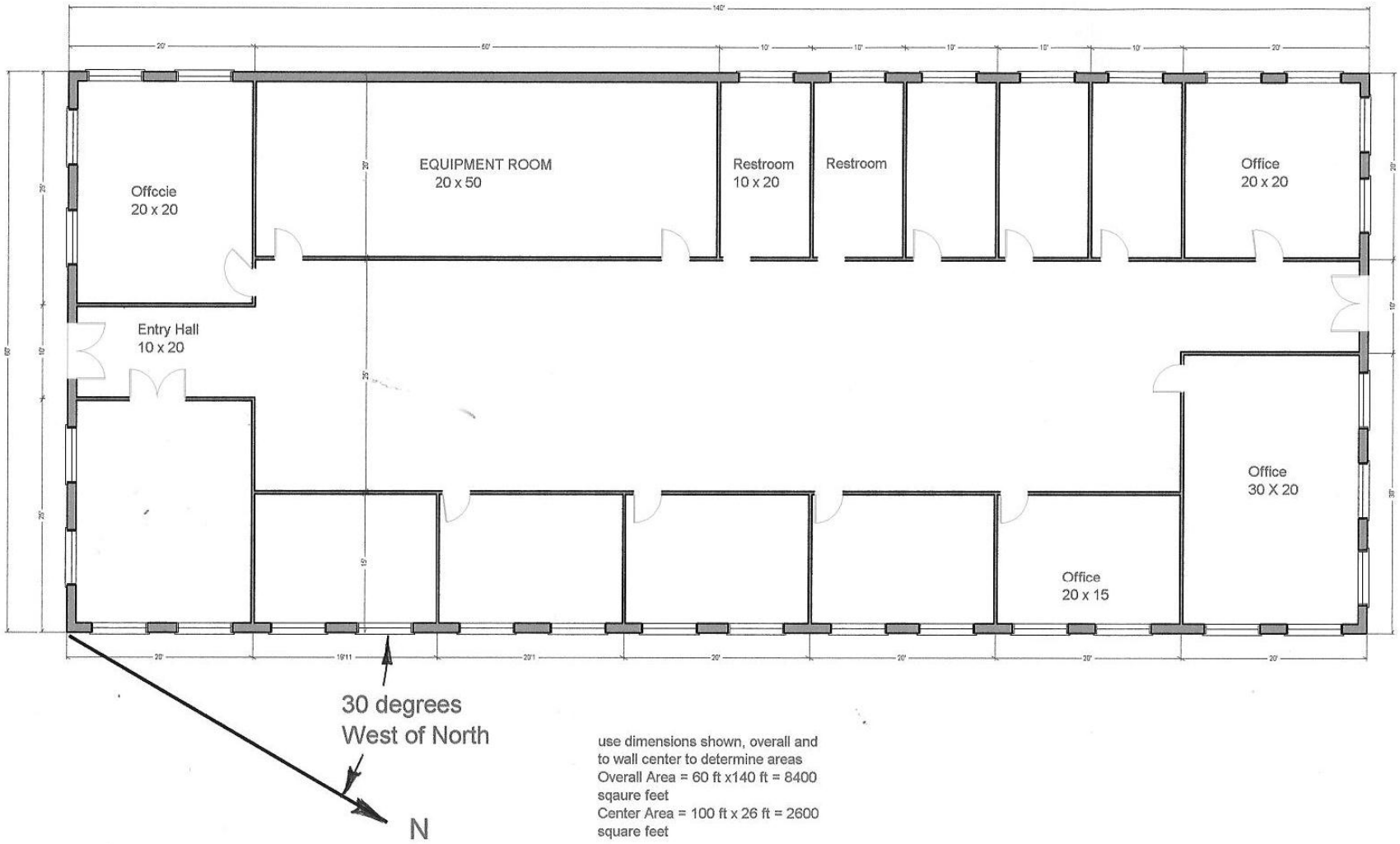


Figure 3.1 Floor Plan for School Building

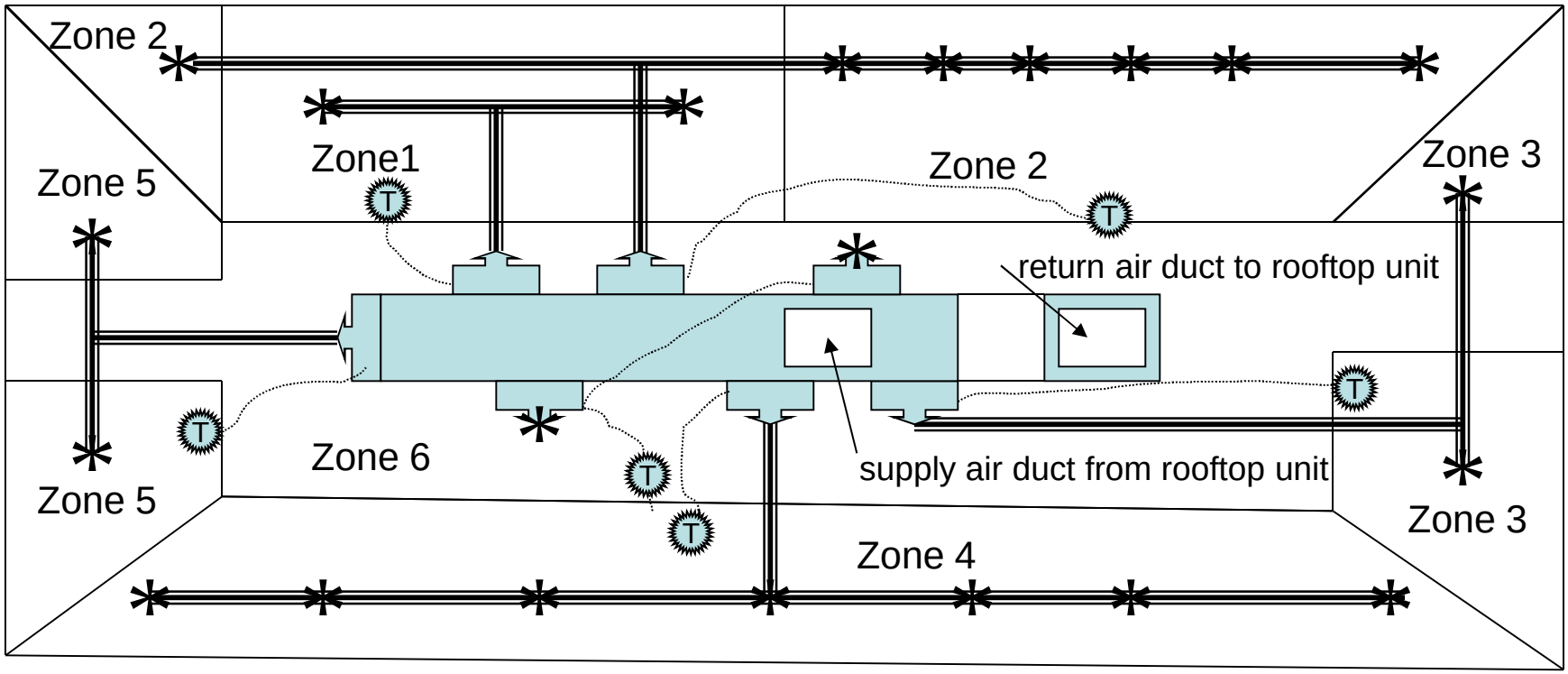
· **Zoning.** A zone is a region of the building with one thermostatic control. One zone will be created for each classroom. The music room and its adjacent office, storage room and practice room will all be part of a single zone. Each corridor and each vestibule will also be zone. Therefore, a total of 11 zones will be created: one each for the six classrooms, one for the music room, two for the corridors and two for the vestibules.



use dimensions shown, overall and to wall center to determine areas
Overall Area = 60 ft x140 ft = 8400 sqaure feet
Center Area = 100 ft x 26 ft = 2600 square feet

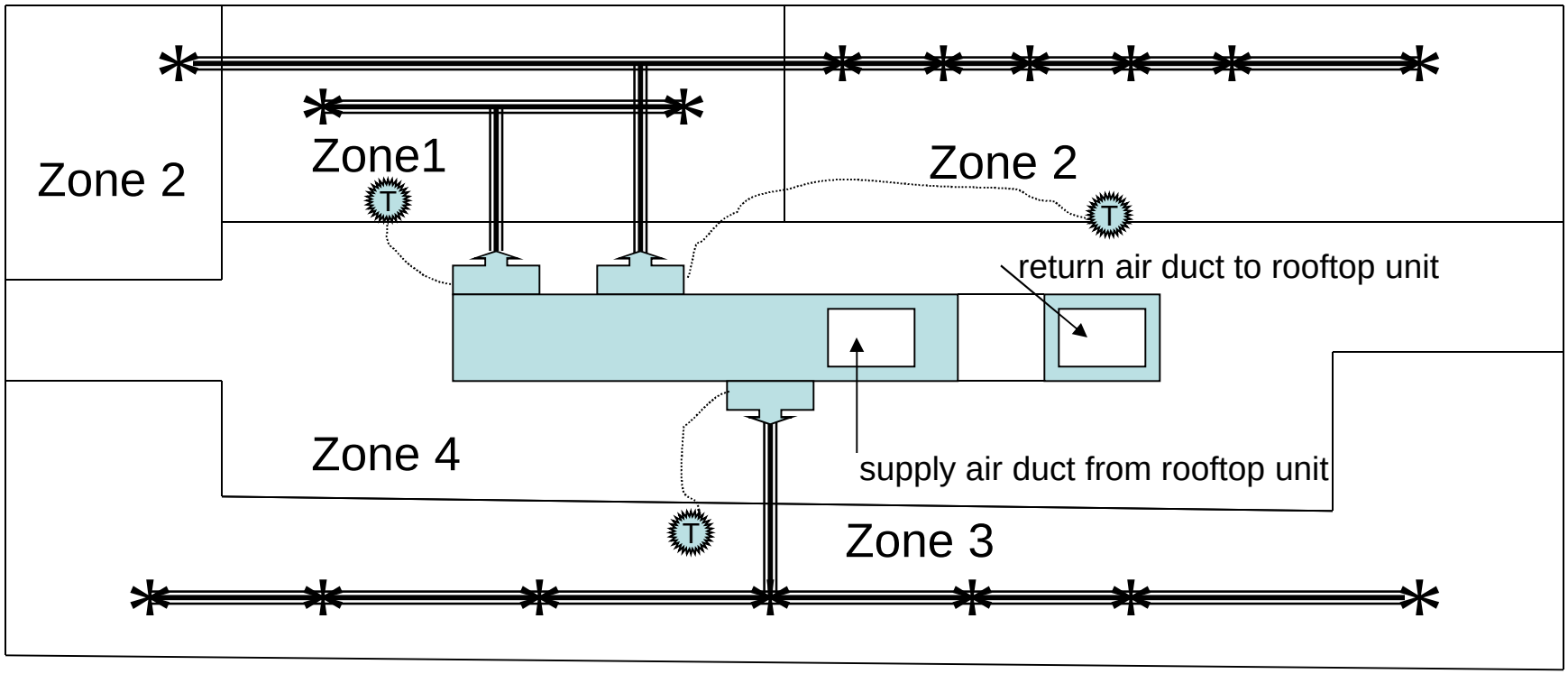
SYSTEM 1. VAV supply from a rooftop unit to 6 zones. Return only from zone 6. 6 terminal boxes controlled by 6 thermostats.

SYSTEM 2. Induction units in each office with unitary unit is Zone 6 and Zone 1



MINIMAL SYSTEM

East and west sides of the building are controlled as zones 2 and 3 . The equipment room is controlled as a zone 1. The central area, zone 4 is cooled by return air. 4 zones, 3 thermostats, 3 terminals.



T thermostat

* difffuser

VAV terminal box (page 389)

SYSTEM TYPES

Single zone - constant volume, variable coolant temperature Fig 2-8

VAV ï variable air flow, constant supply temperature Fig 2-10

Dual Duct - warm and cold streams are mixed at each zone or controlled space, constant air flow Figure 2-11.

Multizone - warm and cold streams are mixed at the central fan coil unit. constant air flow Figure 2-12.

Water Air Induction ï Figure 2-24

Fan Coil - Figure 2-14 (motel type)

Unitary - Figures 2-27, 2-28

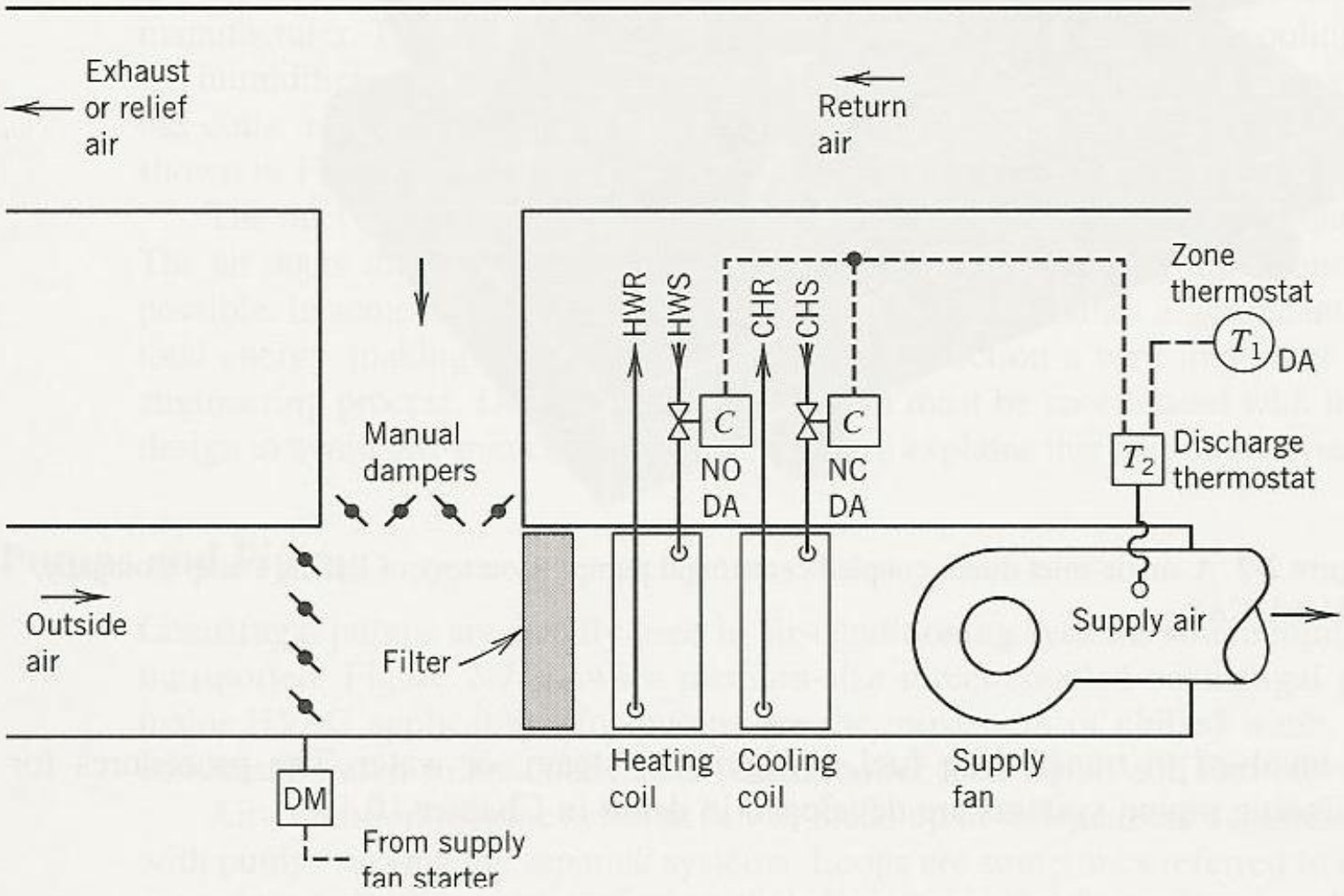


Figure 2-8 Air handler and associated controls for a simple single-zone constant-volume all-air system.

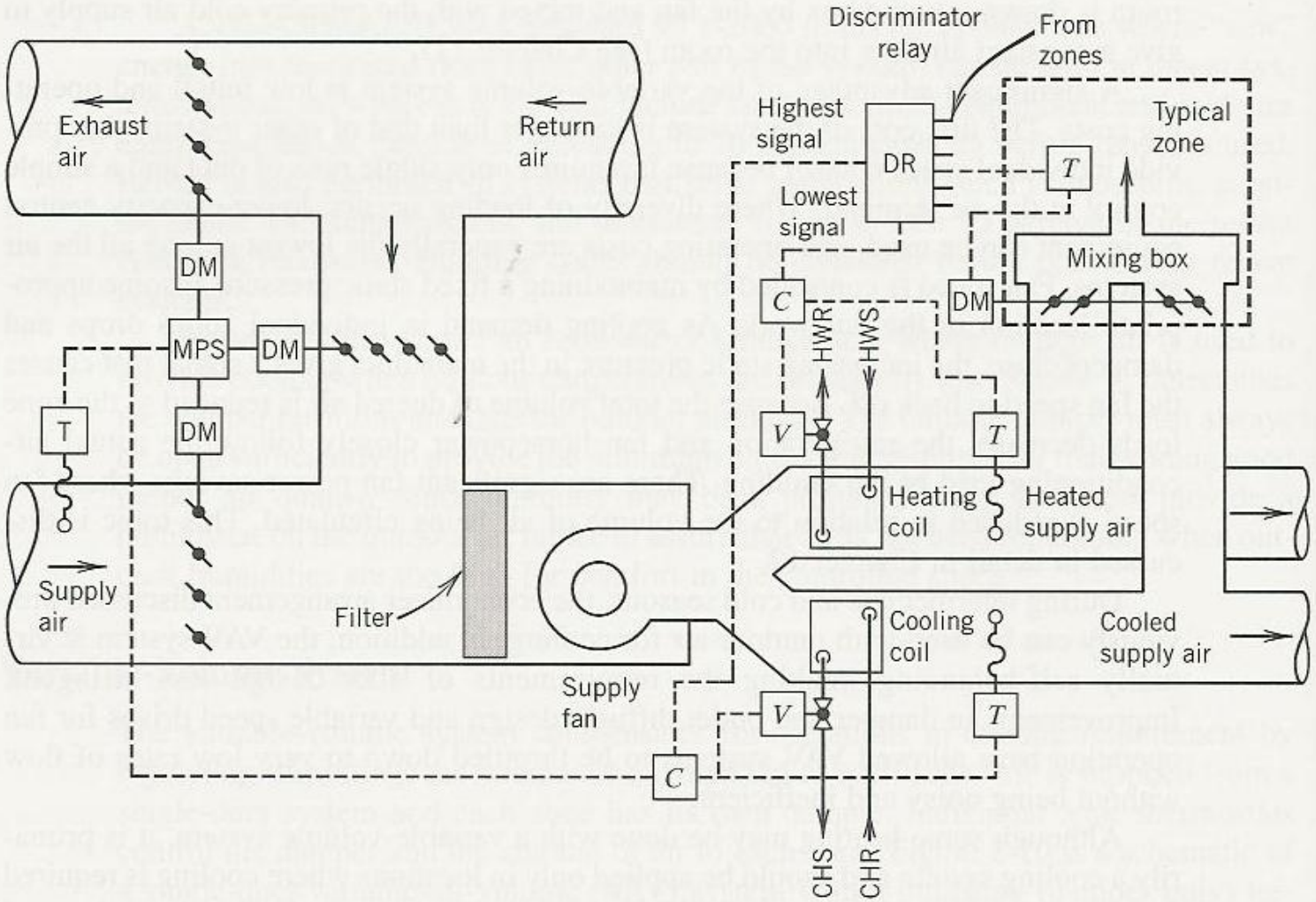


Figure 2-11 Simplified control schematic of a dual-duct system.

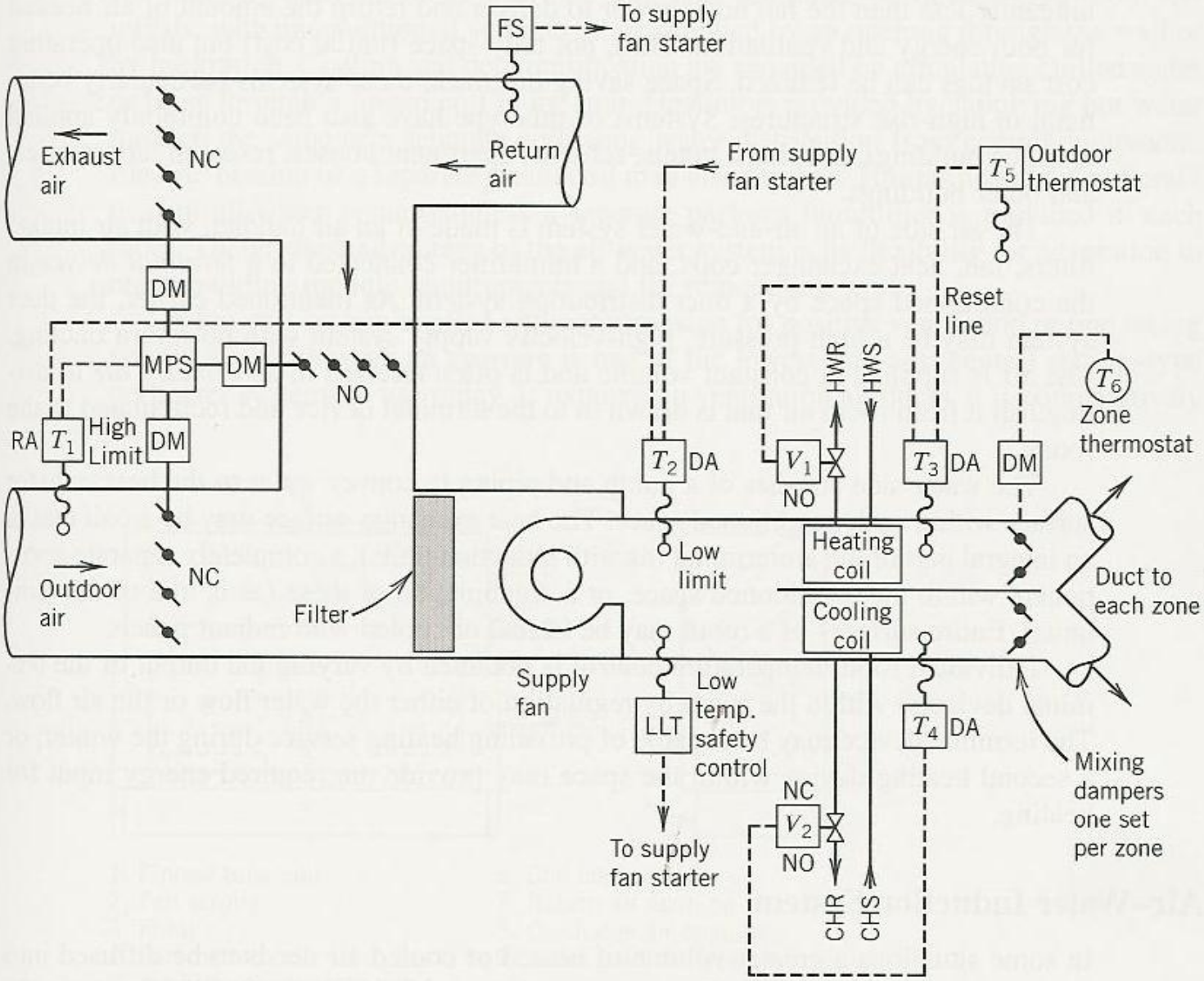


Figure 2-12 Simplified control schematic of a multizone system with hot and cold plenum reset.

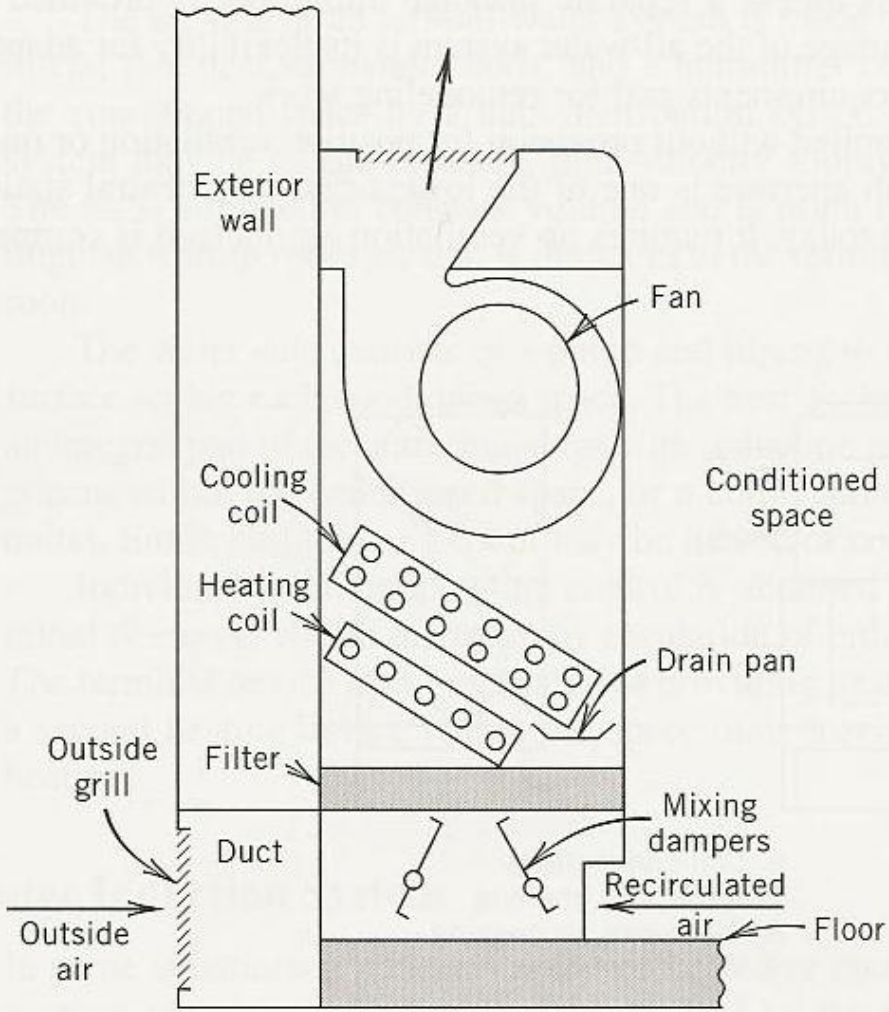


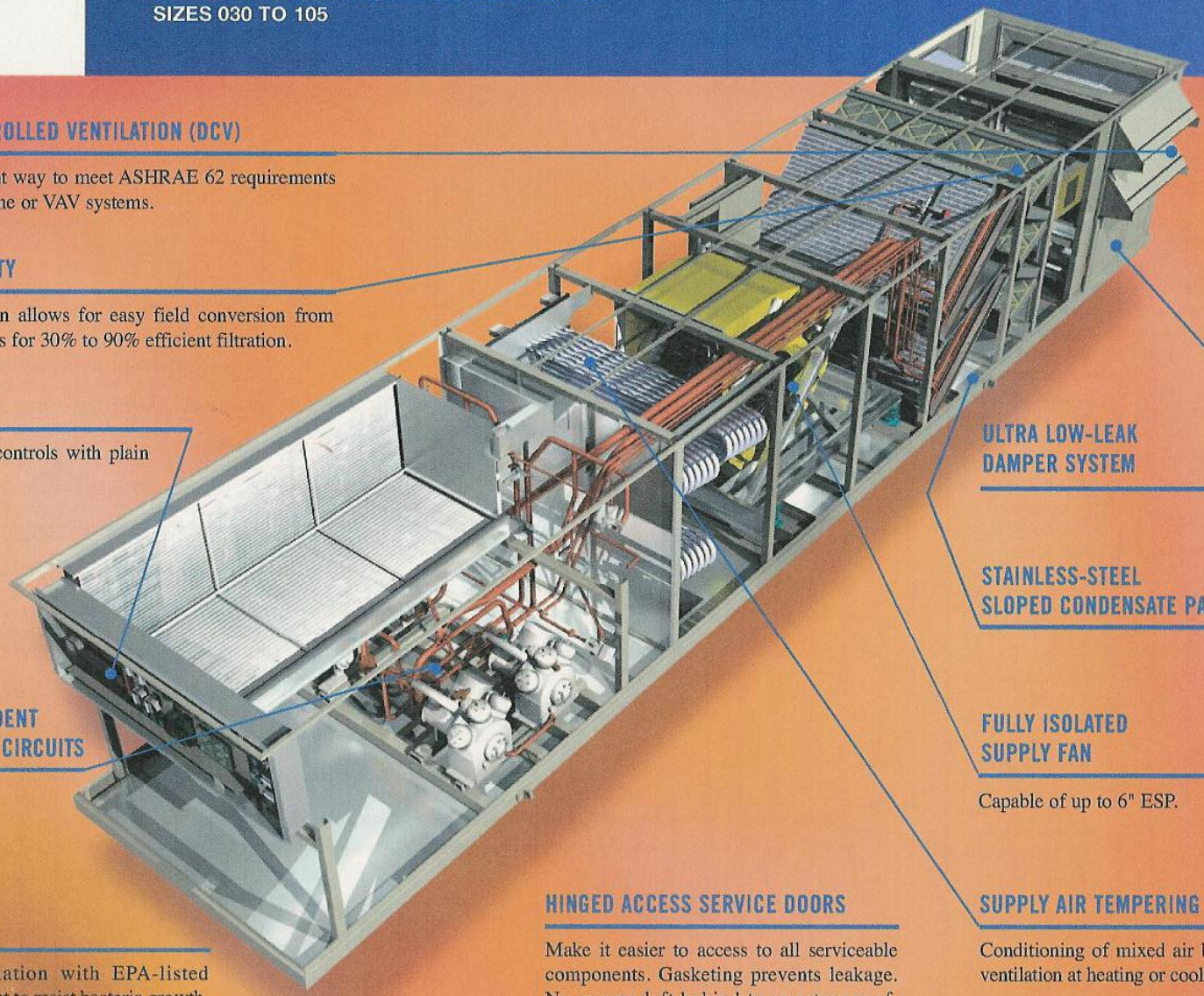
Figure 2-14 Typical air-conditioning unit ventilator with separate coils.

Carrier

48/50Z

Single-Package Rooftop Units

CONSTANT VOLUME OR VARIABLE VOLUME
SIZES 030 TO 105



DEMAND CONTROLLED VENTILATION (DCV)

The most efficient way to meet ASHRAE 62 requirements on constant volume or VAV systems.

FILTER CAPACITY

Filter track design allows for easy field conversion from 2" to 4" or options for 30% to 90% efficient filtration.

ComfortLINK™

Communicating controls with plain language display.

DUAL INDEPENDENT REFRIGERATION CIRCUITS

TUF-SKIN Rx™

Cleanable insulation with EPA-listed antimicrobial agent to resist bacteria growth.

HINGED ACCESS SERVICE DOORS

Make it easier to access to all serviceable components. Gasketing prevents leakage. No screws left behind to puncture roof.

SUPPLY AIR TEMPERING

Conditioning of mixed air below 50° F for ventilation at heating or cooling CFM.

ULTRA LOW-LEAK DAMPER SYSTEM

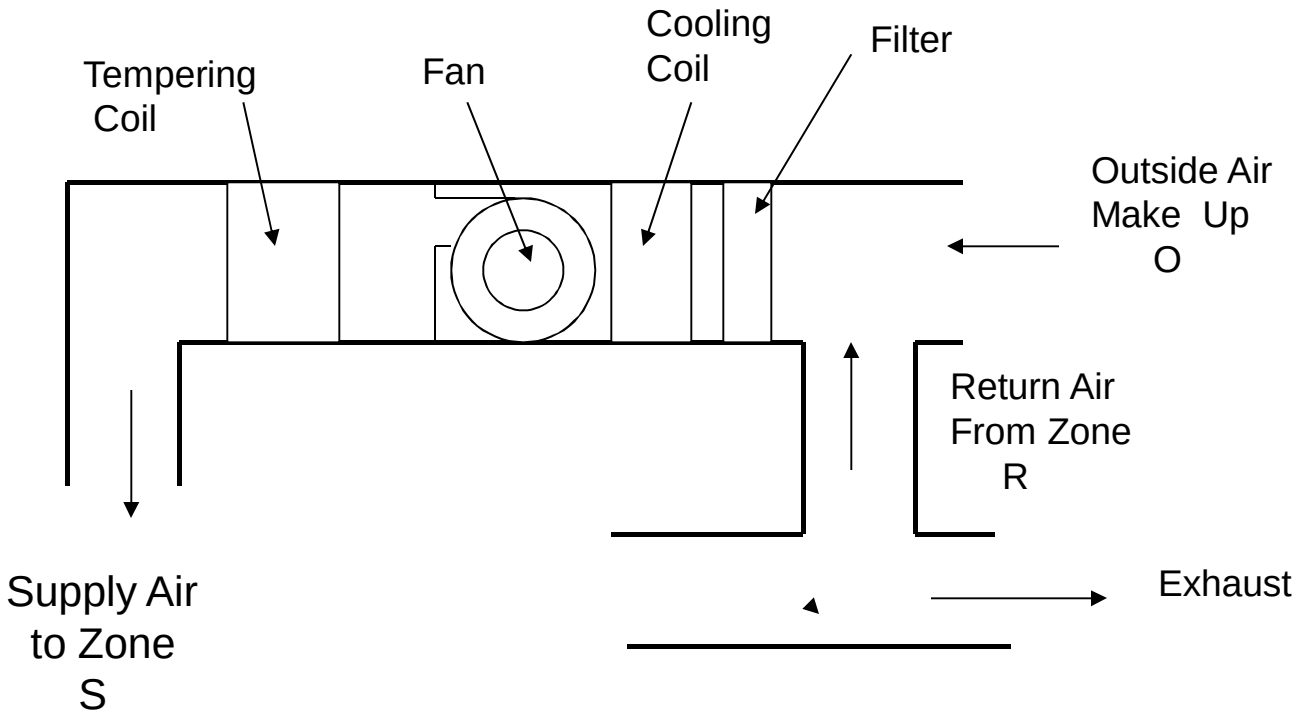
STAINLESS-STEEL SLOPED CONDENSATE PAN

FULLY ISOLATED SUPPLY FAN

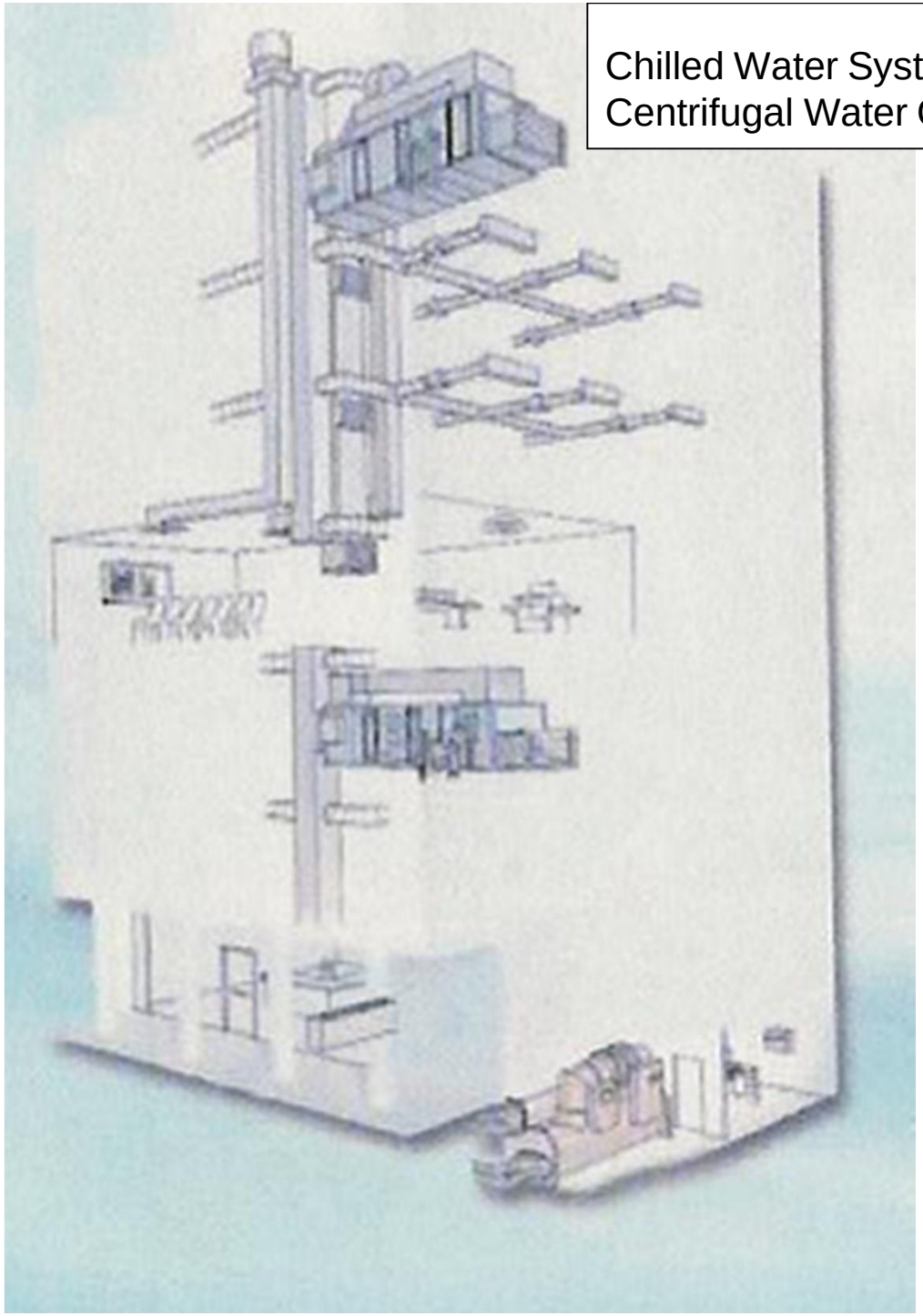
Capable of up to 6" ESP.

Carrier 48/50Z

Fan Coil Section



Chilled Water System
Centrifugal Water Chiller



Centrifugal Water Chiller