



WHEA Lunch & Learn

Room Pressurization

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Engineering Future Focused Solutions

Overview



- Importance of room pressurization
- Air Pressure Basics
- How is it created
- How is it monitored
- How is it controlled
- Codes & Guidelines
- Where required
- Levels of pressurization
- Building pressure
- Air exchange rates
- Filtration

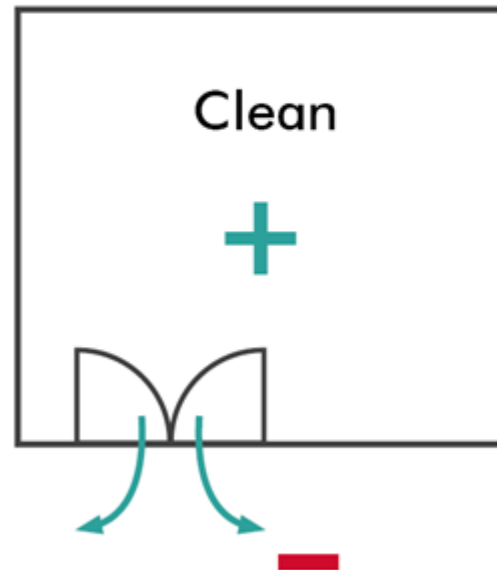


Importance

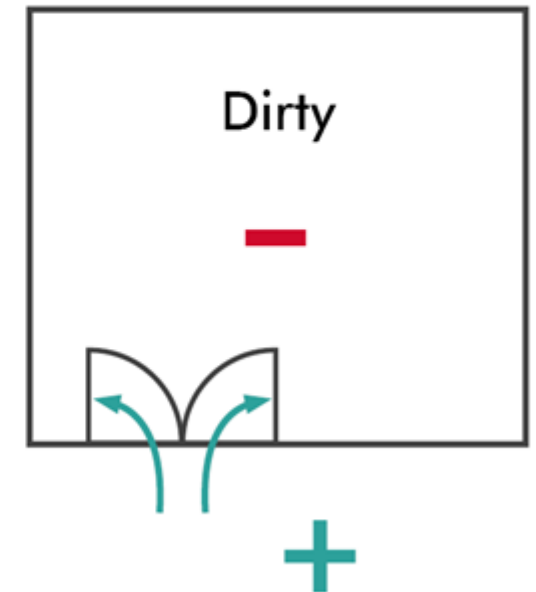


- Odor control
- Infection control
- Fume control
- Forces air to move from “clean” to “dirty” rooms
- Protects patients and staff

Positively
Pressured Room

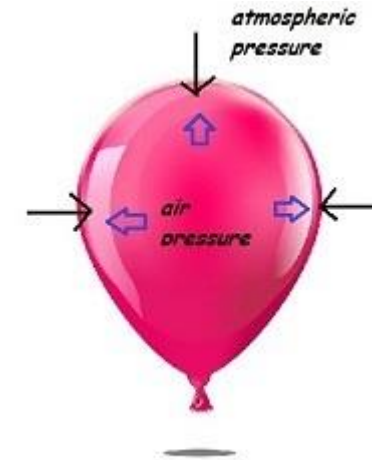
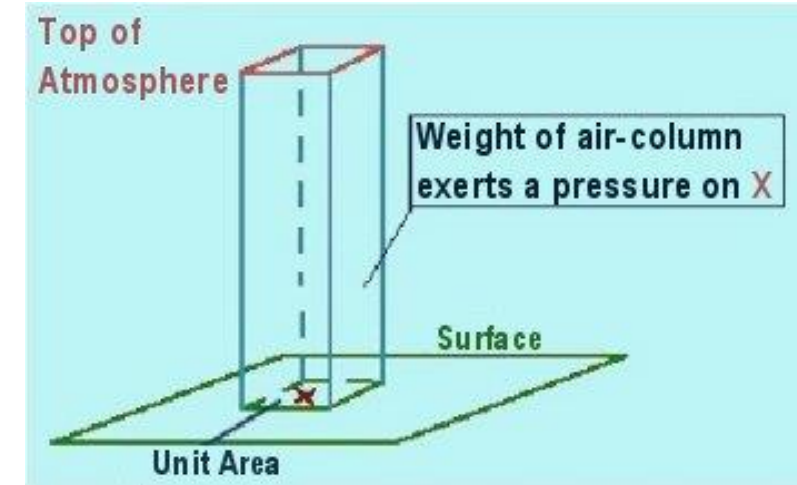


Negatively
Pressured Room



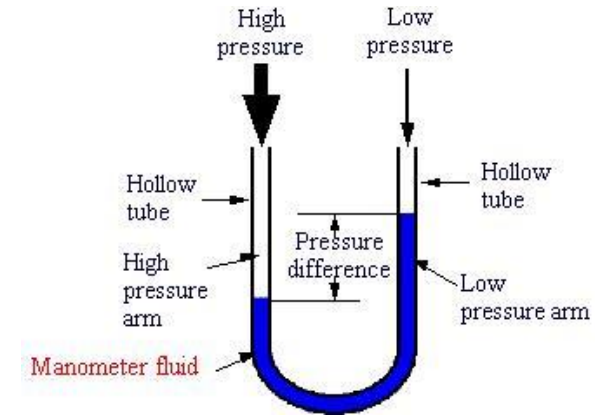
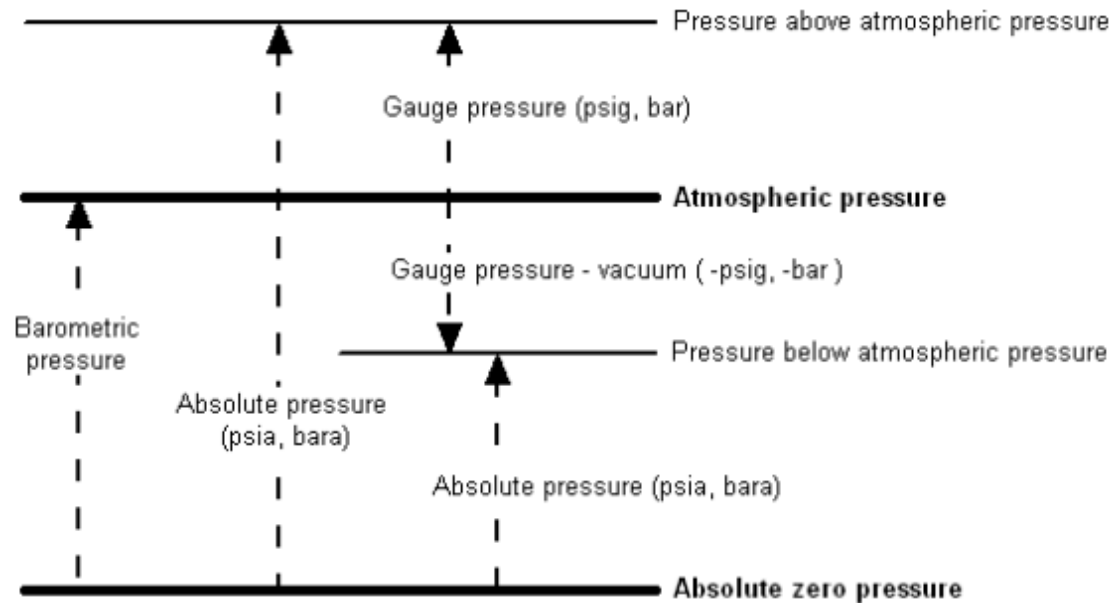
Air Pressure Basics

- Atmospheric Pressure
 - 14.7 psi at sea level
 - Pressure decreases as elevation increases
 - Does not affect pressure relationship between adjacent rooms in a building (the rooms are at the same elevation)
- Gauge Pressure
 - Pressure difference between a confined space and the surrounding atmosphere
 - Pressure difference between two confined spaces

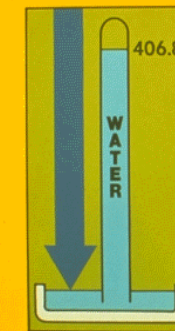


Air Pressure Basics

- Units of measure
 - Inches of water column (w.c.)
 - Pounds per square inch (psi)



ATMOSPHERIC PRESSURE VS INCHES OF WATER

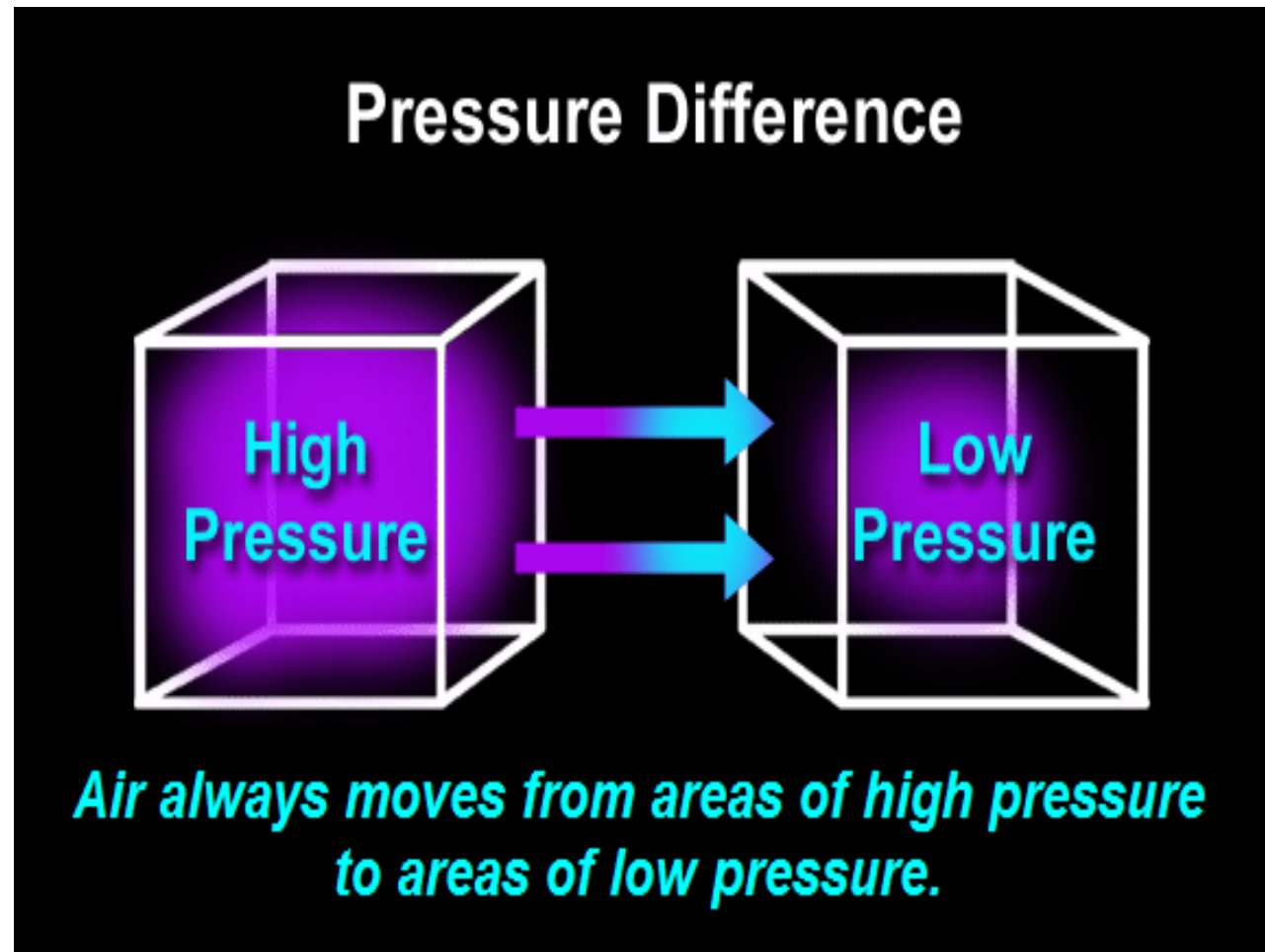


PER PSIA EQUIVALENT

$$1 \text{ PSIA} = \frac{406.8" \text{ WATER}}{14.696 \text{ PSIA}}$$

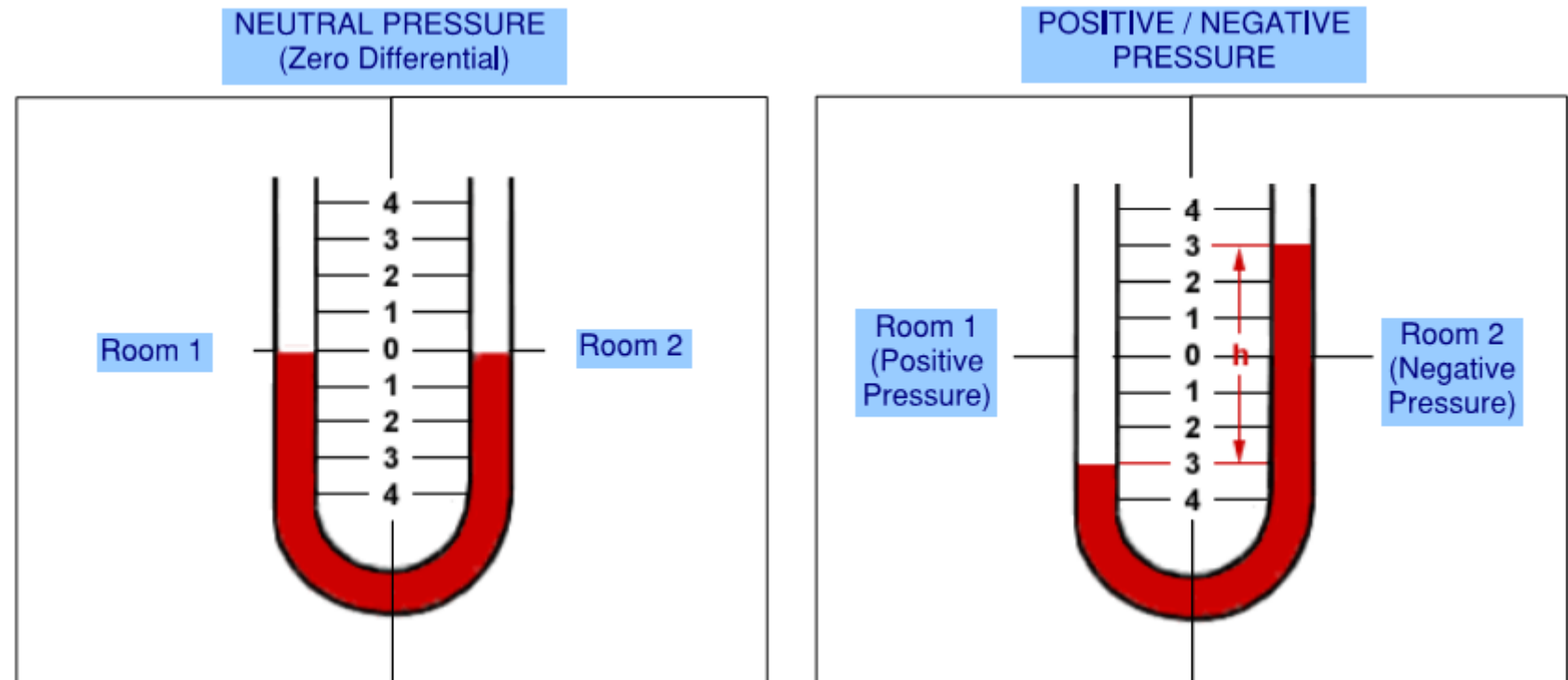
$$1 \text{ PSIA} = 27.68" \text{ WATER}$$

Air Pressure Basics



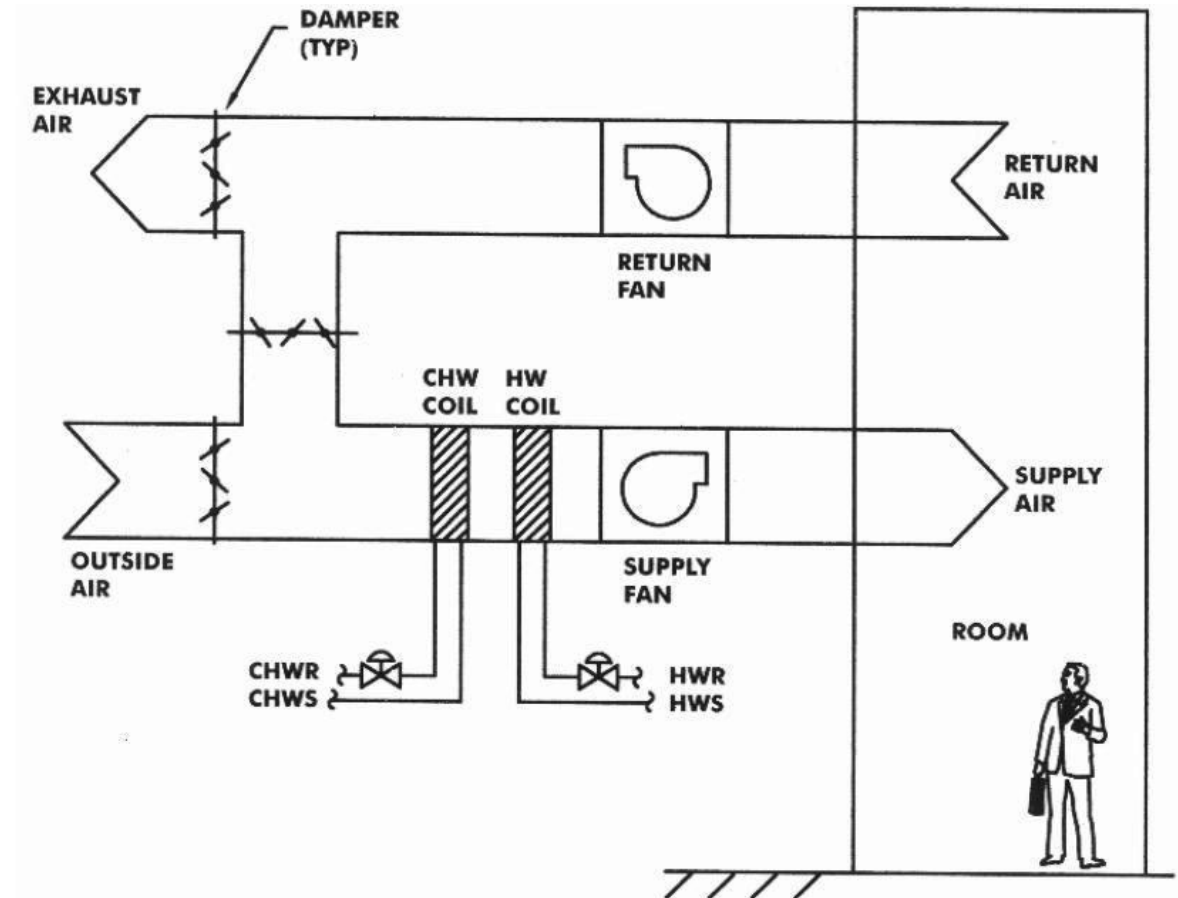
Air Pressure Basics

- Pressure differential (Gauge Pressure)
 - Positive
 - Neutral
 - Negative



What Creates Pressure Differential

- Mechanical devices, i.e. air handling system
 - Supply vs. Return/Exhaust
- Air balance
 - “Leaky balloon”
 - Holes = Air Transfer = Loss of Pressure
- Room construction



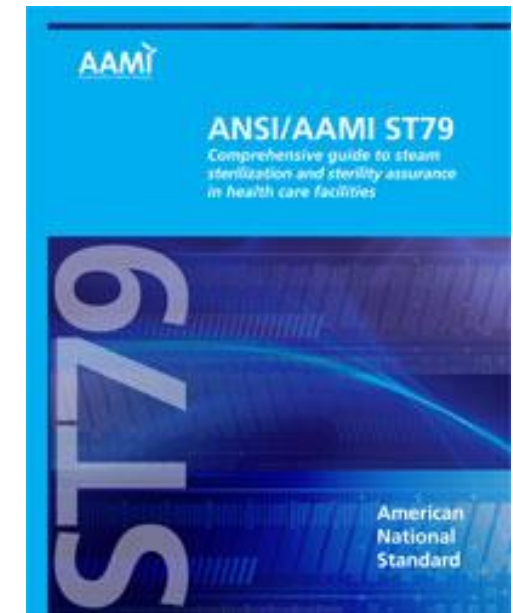
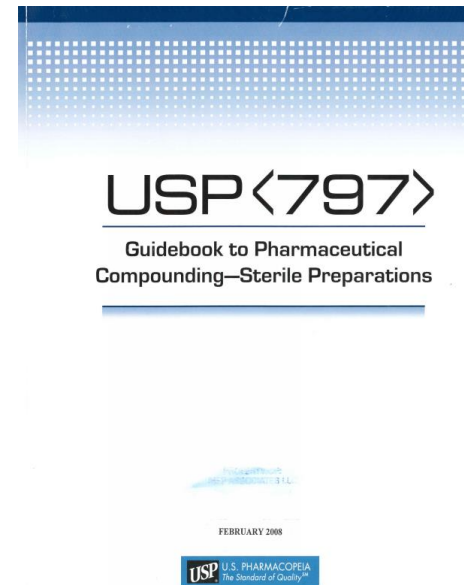
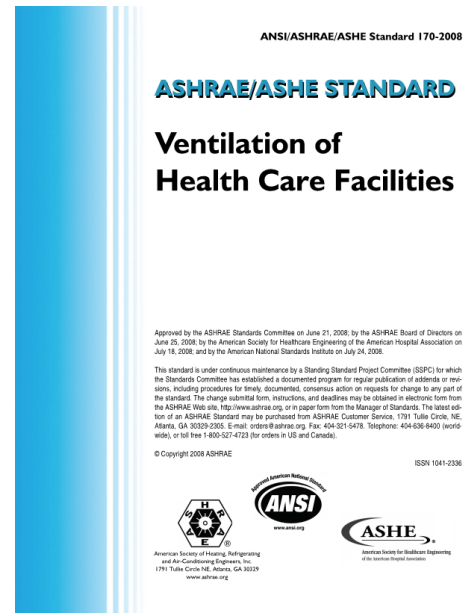
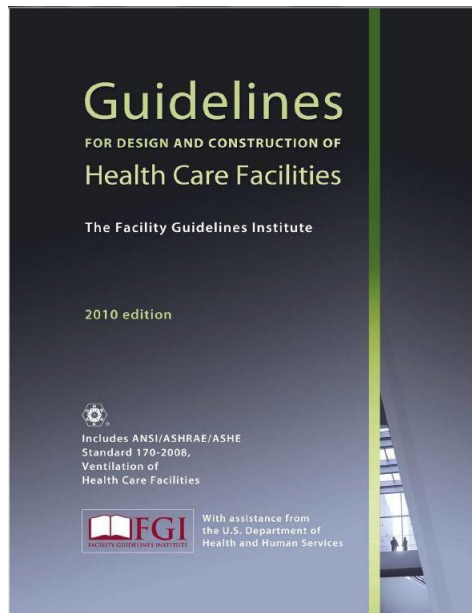
How To Monitor Pressure Differential

- Digital monitor
- Ball in the wall
- Analog Gauge
- Smoke test
- Tissue test
- Periodic Air Balance



Governing Codes & Guidelines

- FGI / ASHRAE 170
- USP 797
- AAMI ST79



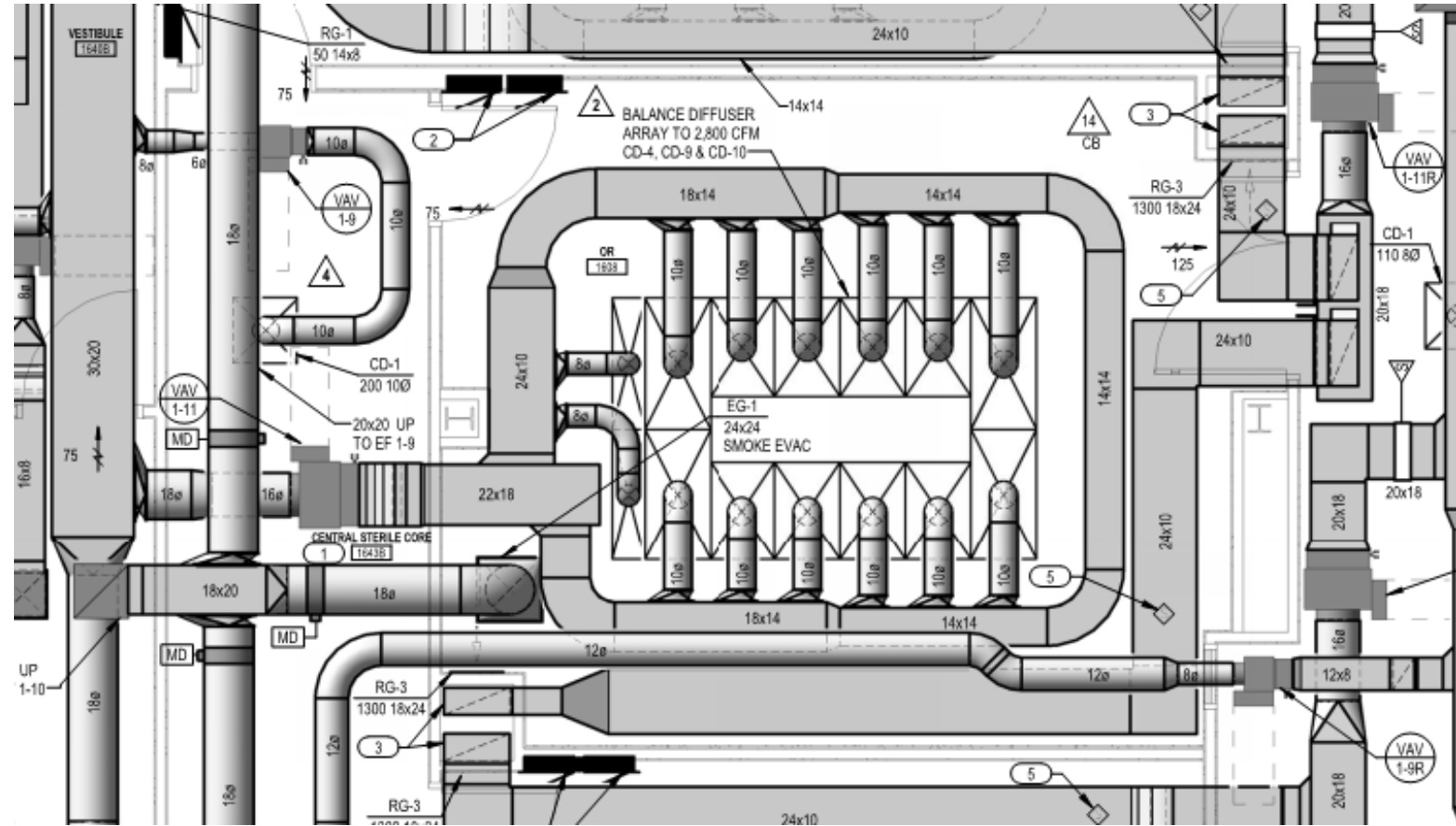
Positive Pressure Spaces



- Operating Room
- Cath Lab
- Critical and Intensive Care
- Newborn intensive Care
- Trauma
- Laser Eye Room
- Protective Environment Room
- Medication Room
- Pharmacy
- Endoscopy
- Central Supply Clean Work Rooms
- Central Supply Sterile Storage
- Clean Workrooms

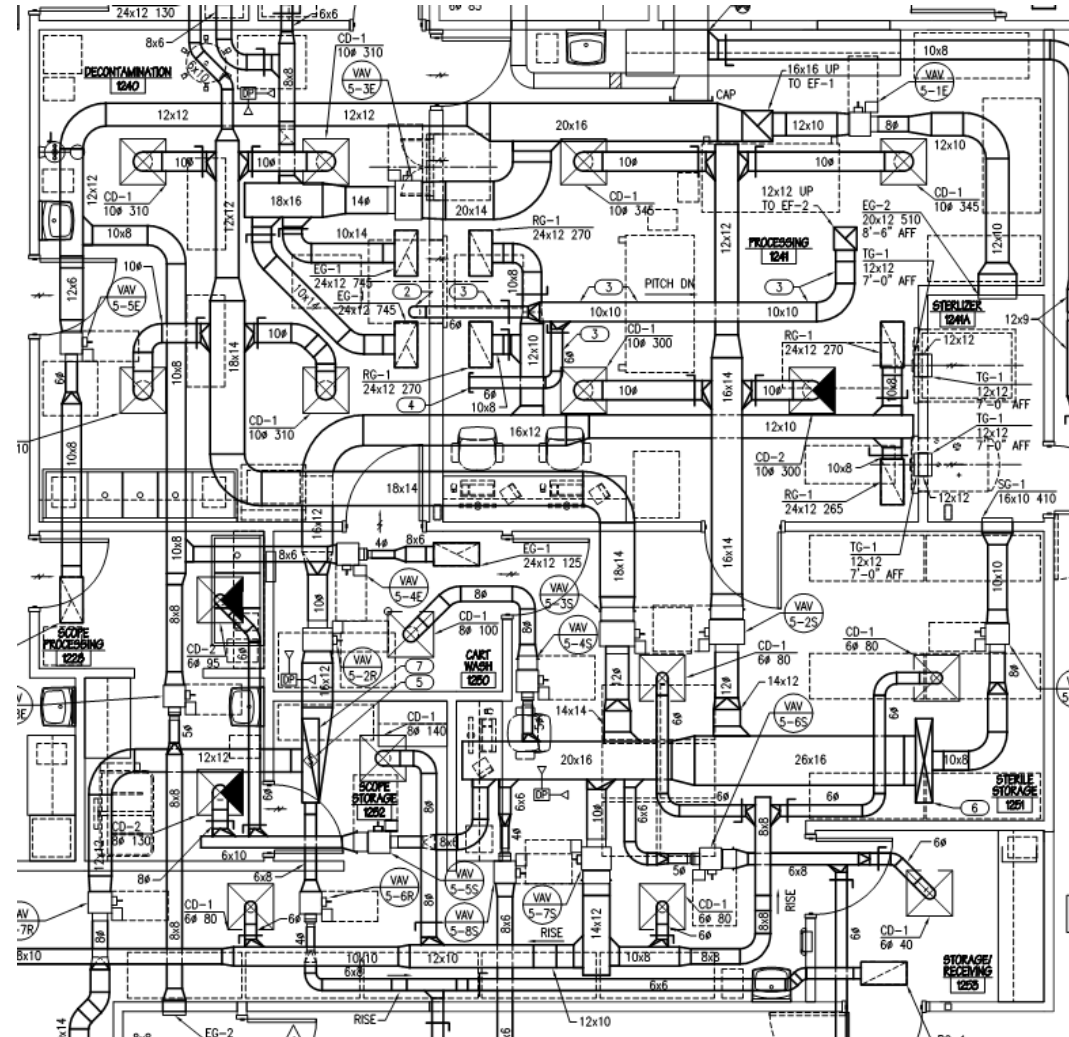
Positive Pressure Spaces

- Operating Room



Positive Pressure Spaces

- Central Processing

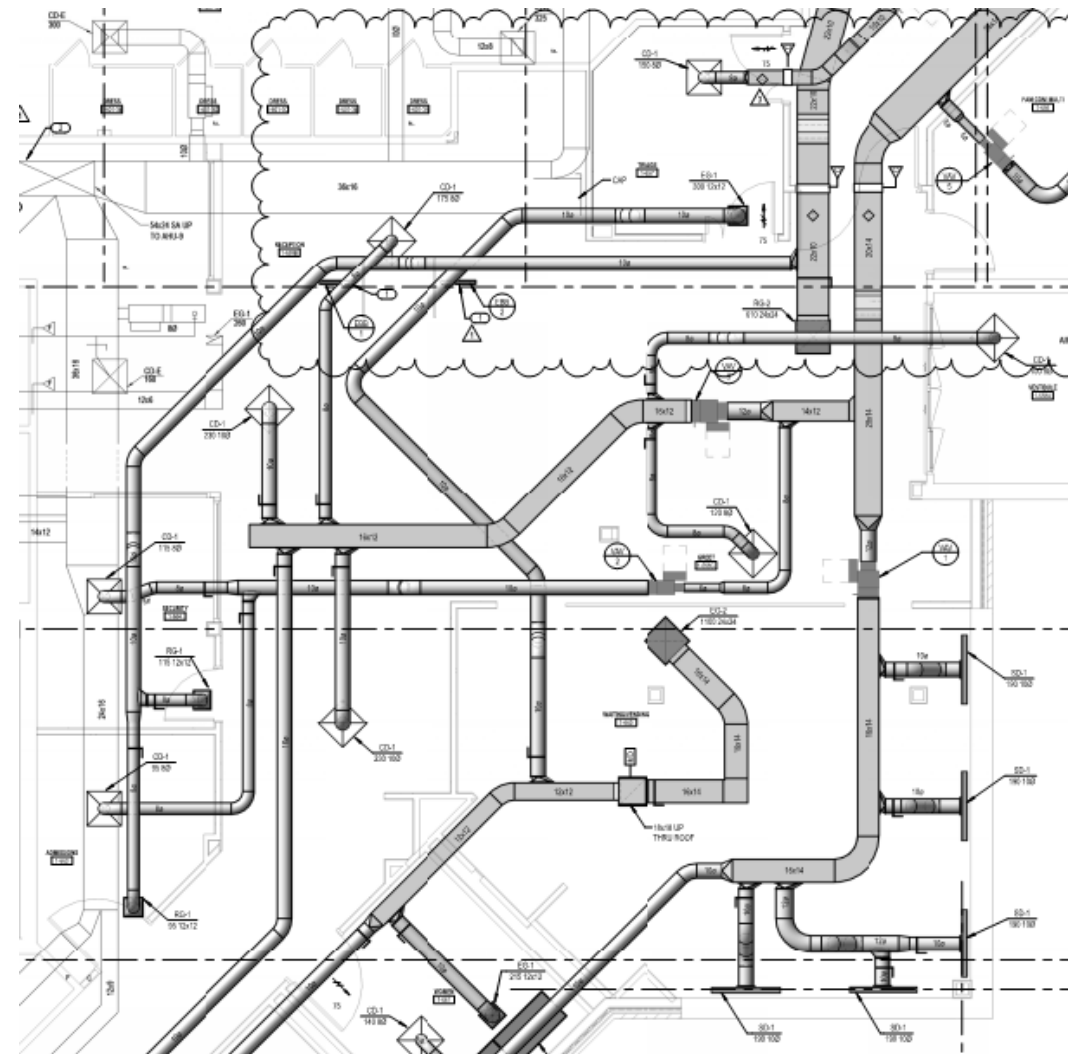


Negative Pressure Spaces

- Toilet Rooms
- Gas storage
- ER waiting
- Triage
- ER decontamination
- Radiology waiting
- Airborne Infection Isolation (AII) Rooms
- Central supply decontamination
- Sterilizer Equipment Rooms
- Laboratories
- Endoscope cleaning
- Hydrotherapy
- Physical Therapy
- Dishwashing
- Laundry
- Soiled linen
- Janitor's closets
- Soiled workrooms
- Hazardous material storage

Negative Pressure Spaces

- Emergency Waiting & Triage

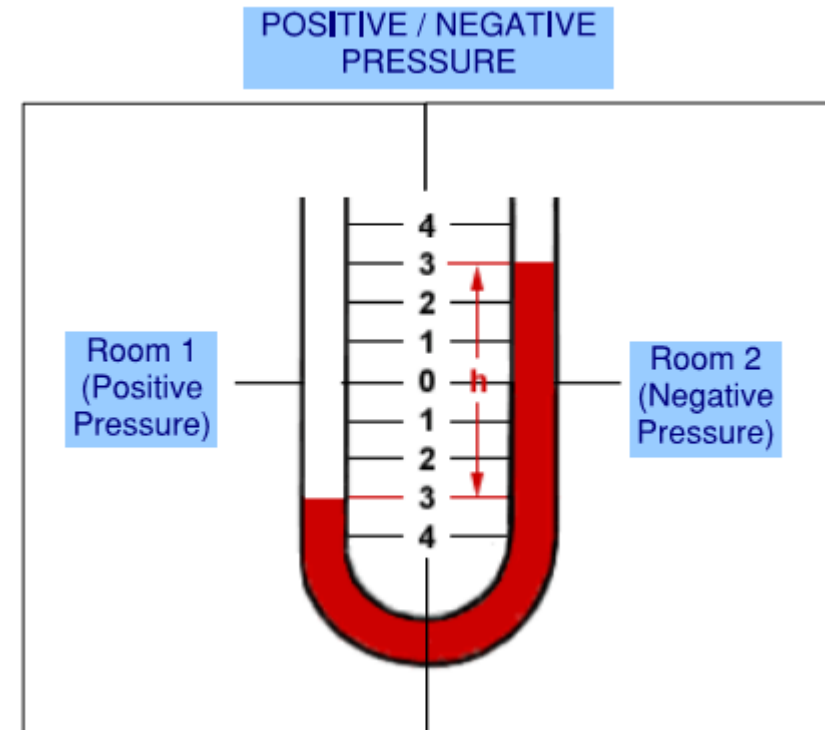


Skilled Nursing Facilities

- Physical Therapy – Negative Pressure
- Bathing Room – Negative Pressure
- Barber/Beauty Rooms – Negative Pressure

Pressurization Levels

- Airborne Infection Isolation Rooms:
 - -0.01" w.c. minimum differential
 - Permanent monitoring device required
- Protective Environment Rooms:
 - +0.01" w.c. minimum differential
 - Permanent monitoring device required
- USP 797 Compliant Pharmacy:
 - 0.02" - 0.05" w.c. range
 - Permanent monitoring device required
- Operating Rooms:
 - +0.01" w.c. minimum differential
 - Monitoring devices not required



Building Pressurization



- Slightly positive is preferred
- Difficult to control with multiple air handling systems
- Difficult to control with multiple floor levels

Air Exchange Rates

- ASHRAE 170 Examples:
 - Surgery: 20 ACH total, 4 ACH outside air
 - ER Waiting & Triage: 12 ACH exhaust air
 - Most patient care spaces: 6 ACH total, 2 ACH outside air
 - Toilet rooms and other “dirty” spaces: 10 ACH exhaust air
 - See ASHRAE 170 Table 7-1 for full listing of minimums
- USP 797
 - Generally 30 ACH with some exceptions
- AAMI ST79
 - Decontam: 10 ACH exhaust
 - Sterilizer Equipment: 10 ACH exhaust
 - Prep/Pack: 10 ACH supply
 - Sterile Storage: 4 ACH supply

Filtration



- ASHRAE 170 Examples:
 - Surgery and inpatient care: MERV 7 pre-filters, MERV 14 final filters
 - Protective environment rooms: MERV 7 pre-filters, HEPA final filters
 - Most other spaces: MERV 7 pre-filters
 - See ASHRAE 170 Table 6-1
- USP 797
 - HEPA filtered supply air



Questions?

Thank You

- Rooms not previously mentioned?
- Specific control issues?
- Non-pressure related questions?

