Cold Rooms – Basics and Health and Safety Challenges

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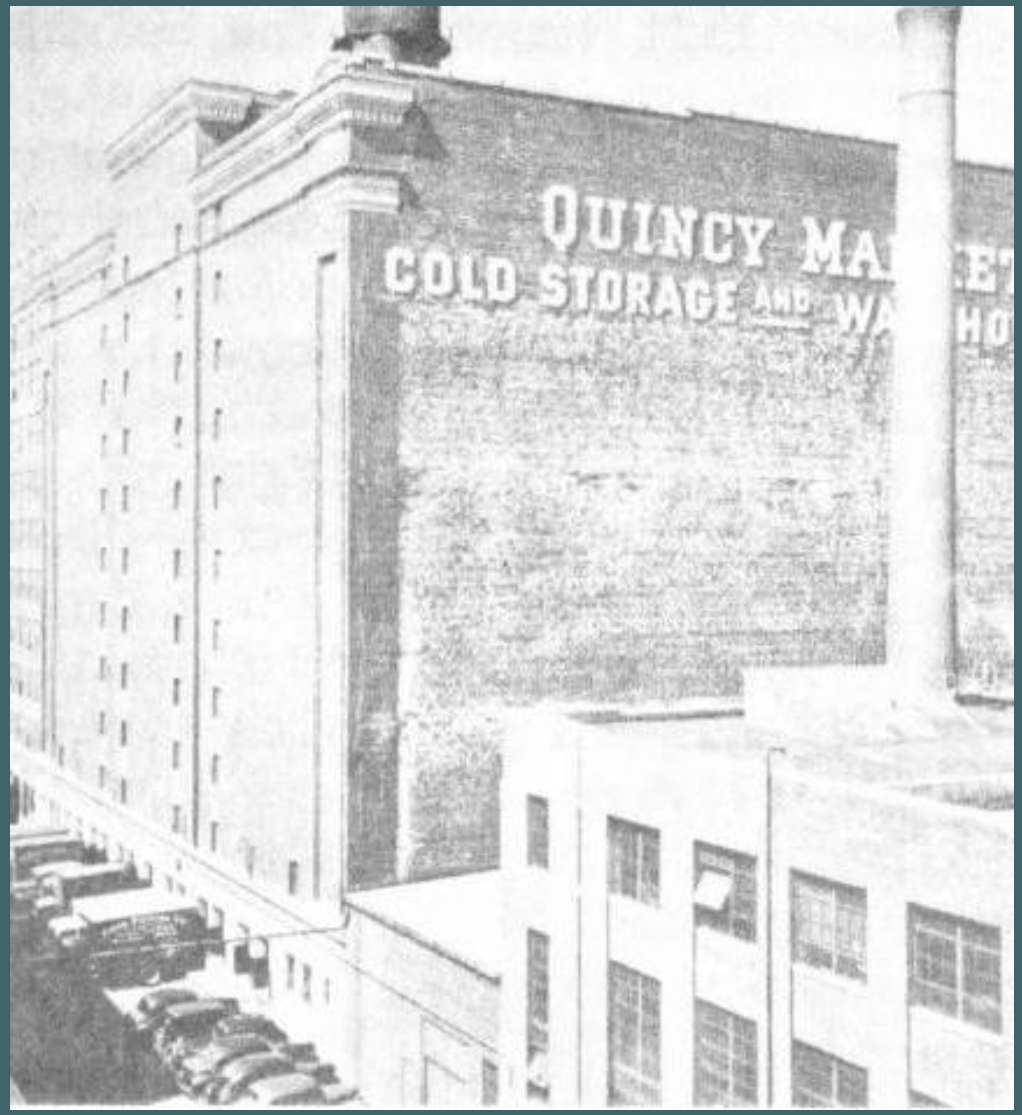
Agenda

- Cold rooms definition
- Cold rooms use
- Cold rooms classification and types
- Cold room refrigeration system
- How to choose a cold room
- Cold rooms hazards

What is a cold room?

A cold room is a climate-controlled space designed to maintain specific temperatures through refrigeration, enabling:

1. the storage
2. experimentation
3. preservation of food, equipment, and medical supplies.



A multistory warehouse. This warehouse is used **to** store meat and fishery products. (Photo **courtesy of** Quincy Market Cold Storage and Warehouse Co.)

Poll Q1- Do you currently have a cold room in your work place?
a. Yes
b. No
c. Planning to install one

Which industries use cold rooms?

Commercial Cold Rooms
Are designed for caterers, retail outlets, and small businesses

Vegetable and Fruit Cold Rooms
Vegetable and fruit cold rooms and freezers are among the most common applications for cold storage, designed to keep produce fresh and minimize losses

Florist Cold Rooms
Cold rooms for flowers are designed to be highly adaptable to meet the specific needs of different plant species.

Meat Freezer Cold Rooms
The meat industry relies heavily on cold rooms, starting from slaughterhouses and extending through storage, logistics, and sales.

Which industries use cold rooms?

Laboratory Cold Rooms
In research and experimentation, precise temperature control is crucial to prevent environmental factors from affecting results.

Pharmaceutical Cold Rooms
To ensure that vaccines and medicines maintain their efficacy, they must be stored under precise and stable temperature conditions.

Automobile Wind Tunnel Testing
A unique application of cold rooms is in wind tunnel testing for automobiles, where temperatures can drop to -30°C (-22°F) and wind speeds can reach 130 km/h (80 mph).

Poll Q2- What kind of cold rooms are you managing?
a. Commercial Cold Rooms
b. Meat Freezer Cold Rooms
c. Laboratory Cold Rooms
d. Other

Cold rooms classification

based on their:

1. temperature ranges -40°C to -2°C (-40°F to 28.4°F)

2. size (small walk-in units to large warehouse-sized facilities.

Cold rooms can be categorized into four types based on their temperature ranges:

1. storage rooms
2. freezing rooms
3. deep freezing tunnels, and
4. blast chillers

Positive Temperature Cold room aka Cold Storage rooms

0°C to 18°C (32°F to 64.4°F)

They are used for preserving the quality of fruits, vegetables, and medical samples such as tissue and medicines. These cold rooms ensure a stable environment for storing fresh food in bulk by maintaining a constant temperature and low humidity through effective insulating materials.

Negative Temperature Cold Room

0°C to -28°C (32°F to -18.4°F)

Achieving and maintaining these low temperatures requires high-quality insulation to minimize electricity usage and reduce the number of openings.

These cold rooms are commonly used for freezing and storing food, vaccines, and organic materials.

Deep Freezing Tunnel
-30°C to -40°C (-22°F to -40°F)

These tunnels use automatic displacement systems and cold air currents to freeze items as they pass through the tunnel.

Designed to rapidly freeze products, deep freezing tunnels consist of a sealed chamber through which food moves on a conveyor belt while being exposed to cold air that quickly freezes it.

In the deep freezing tunnel process, products are continuously transported by a series of conveyors.

Temperature Blast Chillers aka Blast Chillers

Are designed to rapidly cool food products to safeguard them from bacterial growth which can accelerate between 8°C and 68°C (46°F and 154°F).

Similar to deep freezing tunnels, blast chillers use a high-speed circulation of cold air to quickly lower the temperature of the food products.

Cold Room Size

Cold rooms come in various sizes depending on their intended use.

Small – up to 30 m^3 (1059.44 ft^3) – Catering, butchers, ice cream shops, florists, and grocery stores.

Medium – up to 200 m^3 (7065.93 ft^3) – Supermarkets, hotels, laboratories, research facilities, and clean rooms.

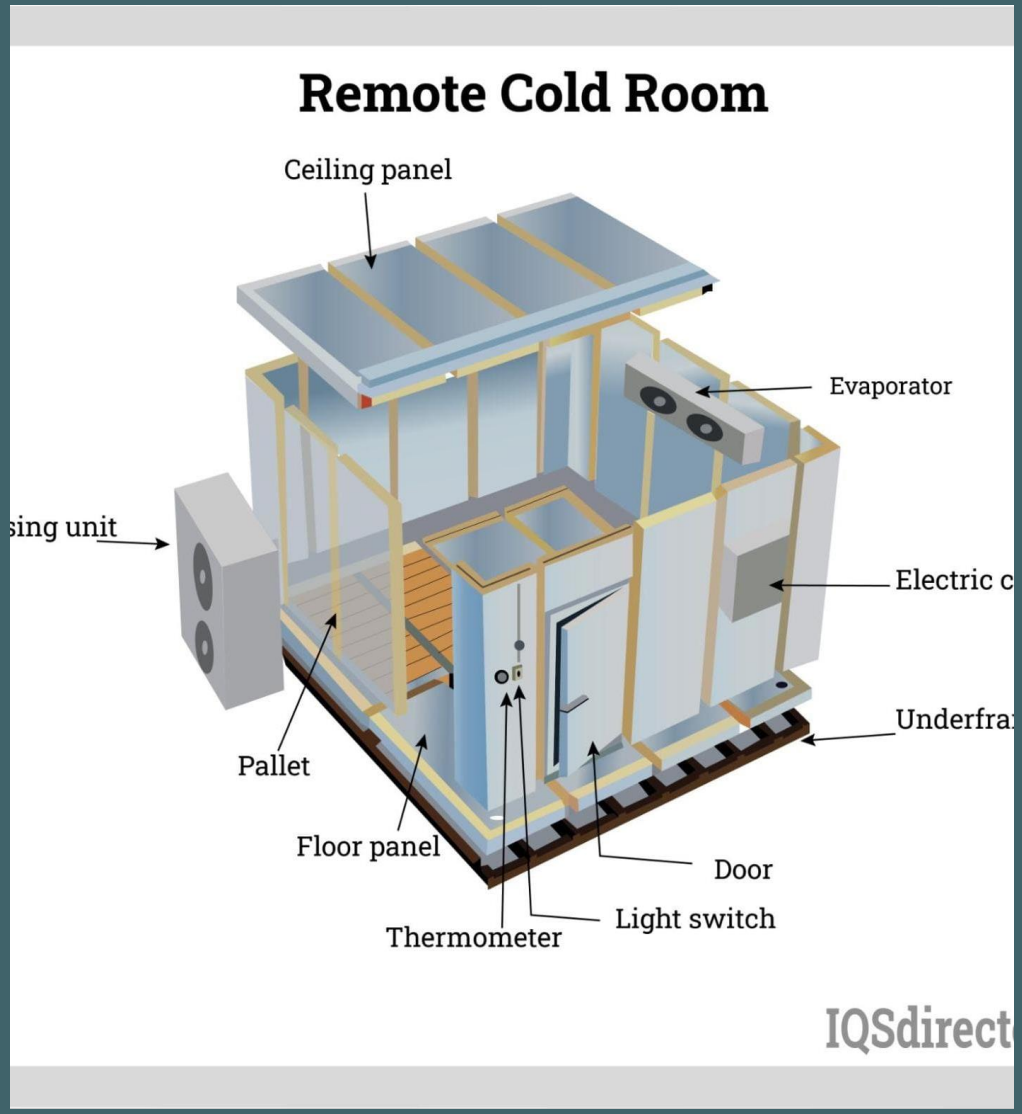
Large – up to 3000 m^3 (3923.85 yd^3) – Large industrial operations such as logistic centers, shipping, and large item storage.

Type of cold rooms:

Remote Cold Rooms
The refrigeration components are placed separately from the cold room itself.

The evaporator is situated inside the cold room, while the compressor and condenser are located away from it

The separation of the compressor and condenser from the cold room is primarily to mitigate the heat and noise they produce.



Type of cold rooms:

Saddle Mount Cold Room
Saddle mount cold rooms refer to a refrigeration system installation where the system is either suspended from the wall or placed on top of the cold room before the roof is installed.

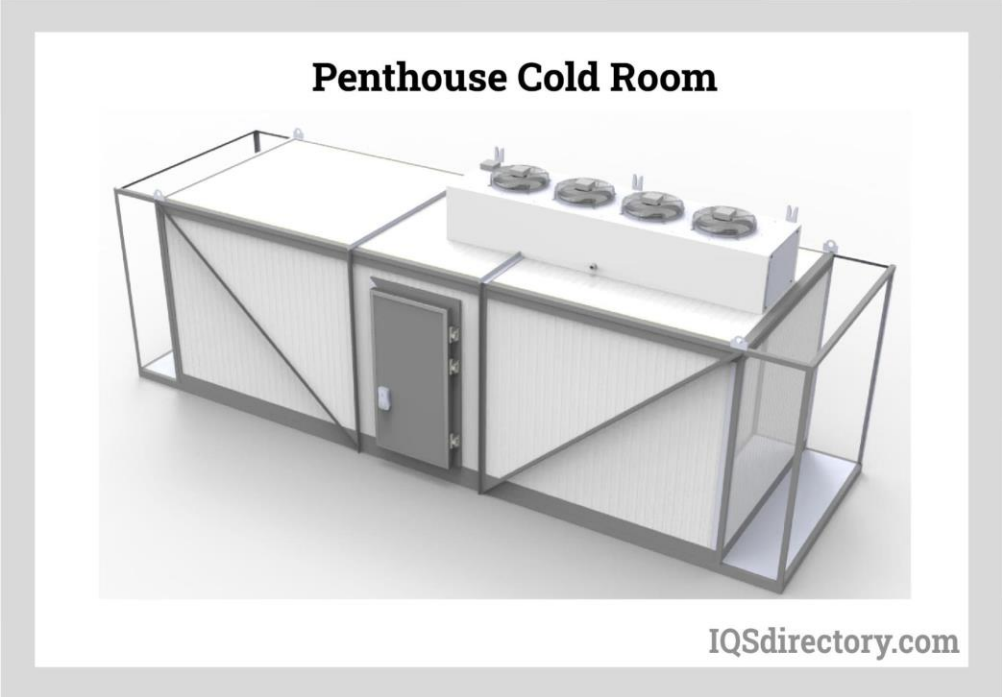
Saddle mount cold rooms are typically categorized as modular or walk-in types due to their compact, integrated design.
The appeal of saddle mount cold rooms lies in their single-unit design, which allows for rapid installation without the need for specialized refrigeration technicians.

Type of cold rooms:

Penthouse Cold Rooms
Similar to top-mounted refrigeration systems but lack an evaporator coil inside the cold room.

They are often chosen for spaces with limited room because the absence of an internal coil provides additional storage capacity. Instead, penthouse cold rooms use a condensate evaporator to prevent liquid damage.

Cooling is achieved through a cooling coil, with air drawn in through louvers and inlets circulating over the coils for efficient heat transfer.



Type of cold rooms:

Prefabricated Cold Room
Also known as modular cold rooms

Are designed for versatility and scalability. These self-contained units can be easily expanded, reduced, or relocated, making them suitable for adapting to changing cold room needs.

Constructed from panels that fit together seamlessly, prefabricated cold rooms offer a secure and tight fit.

Type of cold rooms:

Skid Mounted Cold Room
Are mobile units designed with a steel base for support, resembling the size of a trailer and featuring space underneath for lifting by a crane or large forklift.

These units can be easily transported on a truck bed and are equipped with partitioned walls and doors of varying sizes.

Type of cold rooms:

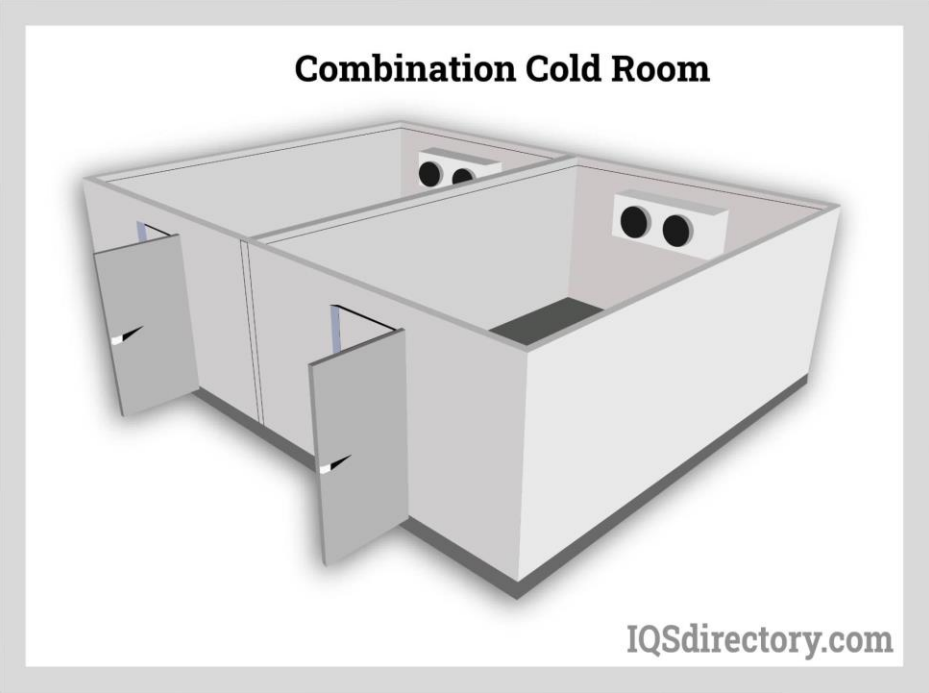
Combination Cold Room

Some cold rooms are required to fulfill multiple roles with differing environmental conditions within a single unit.

Combination cold rooms feature distinct temperature zones, each set to different temperatures to accommodate various materials being tested or stored simultaneously.

This design allows for a range of activities without the need to adjust the cold room's controls frequently.

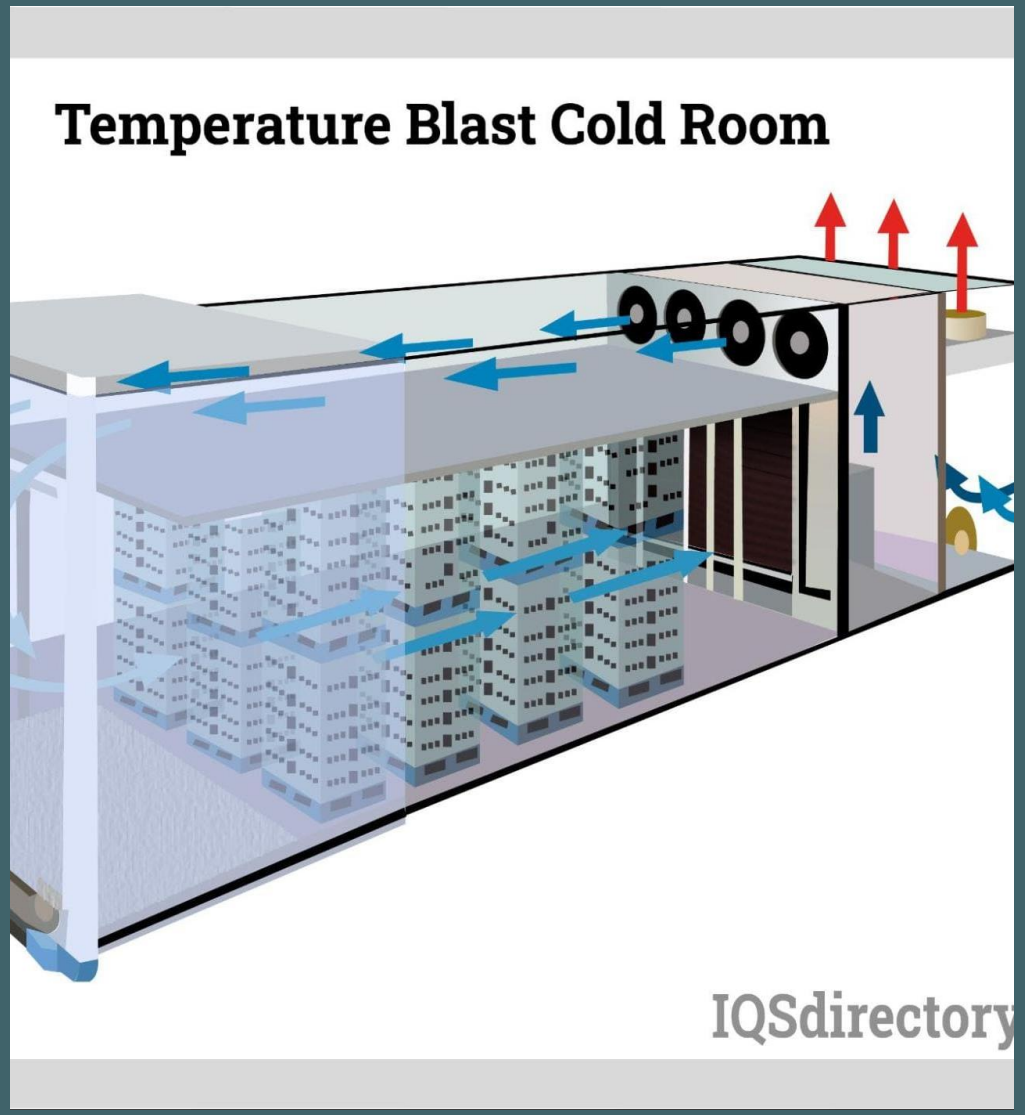
They are used in sectors such as food processing, pharmaceuticals, healthcare, research and development, and logistics.



Type of cold rooms:

Temperature Blast Cold Room
Also known as shock freezers or freezer rooms, are designed to rapidly lower temperatures to quickly freeze products, ensuring high quality.

This process involves using powerful air fans to circulate cold air swiftly across the contents, achieving temperatures ranging from -35°C to -45°C (-31°F to -49°F).



Type of cold rooms:

Walk-In Cold Room
Are large refrigerated storage spaces designed to store and protect perishable products and goods.

They are used by businesses that need substantial cold storage capacity.

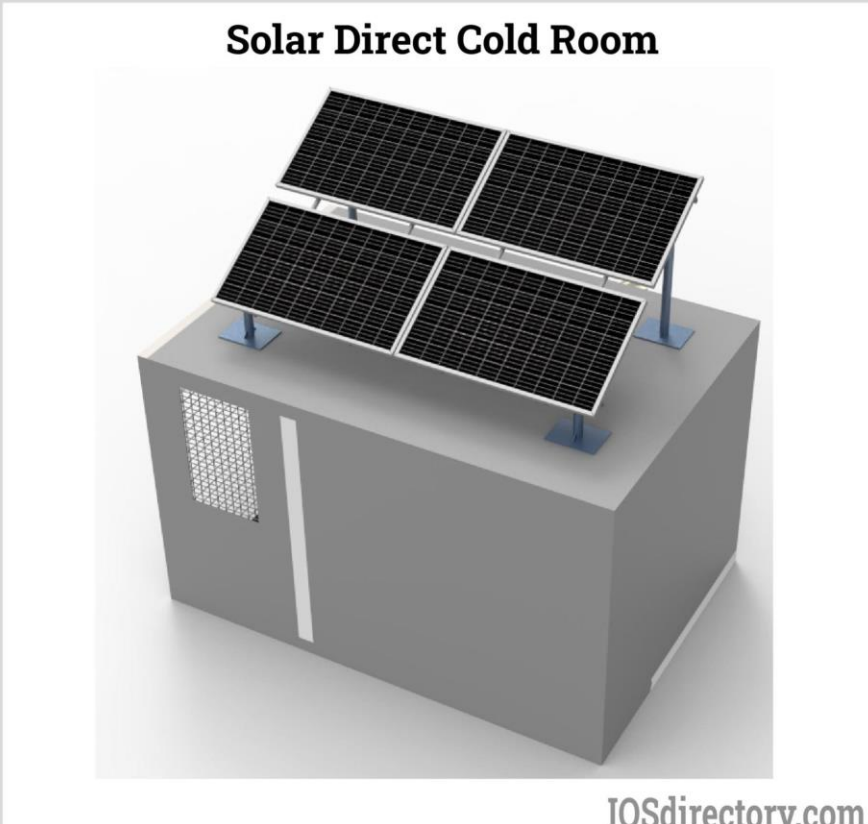
The term "walk-in" refers to a variety of cold rooms, including those used in retail settings where preserving products is crucial.

Walk-in cold rooms can encompass a range of refrigeration systems tailored to different needs.

Type of cold rooms:

Solar Direct Cold Room
The primary function of a solar direct cold room is similar to that of other cold rooms: to maintain low temperatures for storing perishable items and temperature-sensitive equipment.

The key distinction is that solar direct cold rooms are powered by solar panels, unlike conventional cold rooms which rely on traditional electrical sources.



What are the components of a cold room?

Flooring
The choice of flooring for a cold room depends on its temperature and specific needs

Panels
Cold room panels vary depending on the temperature rating of the cold room

Doors
In addition to the number of doors for a cold room, the quality and type of doors are crucial for accessing and maintaining the seal of the cold room
.

Cold Room Refrigeration System

Compressor – The type of compressor for a cold room is determined by the size of the cold room and its desired temperature

Condenser – The condenser is a heat exchanger where heat from the refrigerant is transferred to a flow of water that goes to a cooling tower

Expansion Valve – In the expansion valve, the refrigerant expands, releases pressure, and experiences a temperature drop

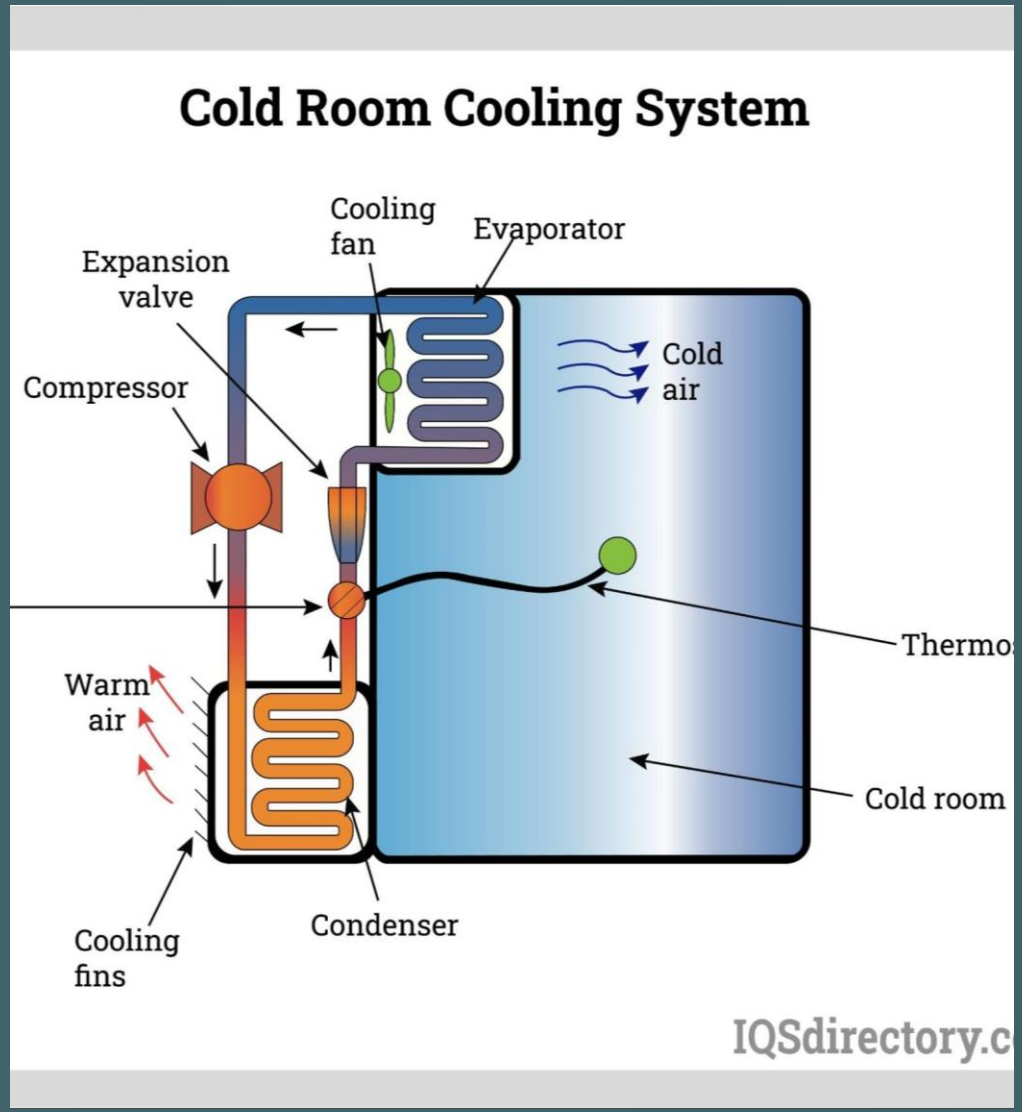
Evaporator – In the evaporator, the refrigerant is at a lower temperature, evaporates, and absorbs heat.

Cool Fan – The cooling fan circulates the low temperature of the refrigerant in the evaporator into the cold room to help maintain the set temperature of the cold room

Cold room cooling system

A. Monoblock systems are compact and fit through a wall or ceiling of the cold room

B. Split or remote systems feature an external condenser and an evaporator located inside the cold room.



Cold room essentials

Regardless of the specific type or use, essential factors for cold rooms include:

- a tight seal
- consistent temperature control
- structural stability
- effective insulation, and
- reliable refrigeration system.

Each of these elements must be meticulously planned and engineered to ensure the cold room's success.

How to Choose a Cold Room?

Manufacturers provide criteria that customers can use to identify the appropriate type and nature of cold room they need.

Purchasing a cold room marks the beginning of a long-term relationship between the manufacturer and the customer, where ongoing support, guidance, and advice are provided.

Considerations:

Stored Materials
The quantity of products stored in a cold room directly impacts its temperature.

Temperature
Despite the variety of cold rooms available, it's essential to determine the precise temperature requirements for the items to be stored.’

Power Supply
Industrial cold storage typically requires 380V or three-phase electricity. It is important to position the cold room close to the electrical supply to prevent draining power from other equipment.

V**entilation**
Like all storage solutions, cold rooms need adequate ventilation to facilitate air circulation and remove any odors from long-stored products.

Available Space

Maintenance
Regardless of a cold room's quality and specifications, regular maintenance and cleaning are essential for optimal performance.

Maintain monthly logs

Poll Q3 What challenges are you facing when dealing with the cold room?

a. Researchers store paper boxes and unknown chemicals
b. Mold is growing uncontrolled on surfaces
c. People get locked inside
d. Employees would not use PPE
e. Other

Cold rooms potential hazards

Cold stress (appropriate clothing, gloves)

Confined space

Slips and trips

Mold contamination

Chemical storage/ exposure

Ergonomics

Market Forces *Temperature-controlled facilities used for pharmaceuticals and home-delivery grocery services will continue to drive demand for cold storage space, industry experts say*. Photograph: Getty Images

Cold stress prevention

Dress in warm, layered clothing for proper insulation to maintain your body temperature to prevent cold stress.

The head loses the most body heat; for extra warmth, wear a warm cap with ear flaps.

Fingers, hands, toes, and feet are susceptible to frostbite with long term exposure to cold. Use insulated, moisture-proof gloves and choose gloves appropriate to the job tasks;

Adequate gripping surfaces help you securely grasp cold or frozen objects. These objects can be heavy; a firm grip and steel-toe boots protect your toes.

Ensure that the boots are slip resistant; water and ice are common in cold storage and pose slip and trip hazards

Cold storage areas may be confined spaces!

Get training and become familiar with the safety features worksite.

Some units have their condensers above the ceiling of the cold room. These are usually in Permit Required Confined Spaces (PRCS) and are labeled as such.

For escape in an emergency, cold storage rooms should have at least one door that opens from the inside.

Lighting must be supplied through a constantly burning bulb or a light with an illuminated switch located inside cold room.

Cold storage areas may be confined spaces!

Ideally, cold storage spaces have doors that are designed not to freeze shut.

If anti-freeze doors are not installed in your workplace, ensure that a firefighter's axe is stored in the room.

Exceptions to this rule include mental and corrective institutions and cold storage with temperatures above 32 degrees Fahrenheit.

Items in cold storage are often valuable and require security. Install audible and visible signal systems inside or outside the room that are tested daily

Cold rooms slips/trips

Non-slip flooring mats protect workers in wet areas

Clean up spills and clutter for good housekeeping and to prevent slip and trip hazards

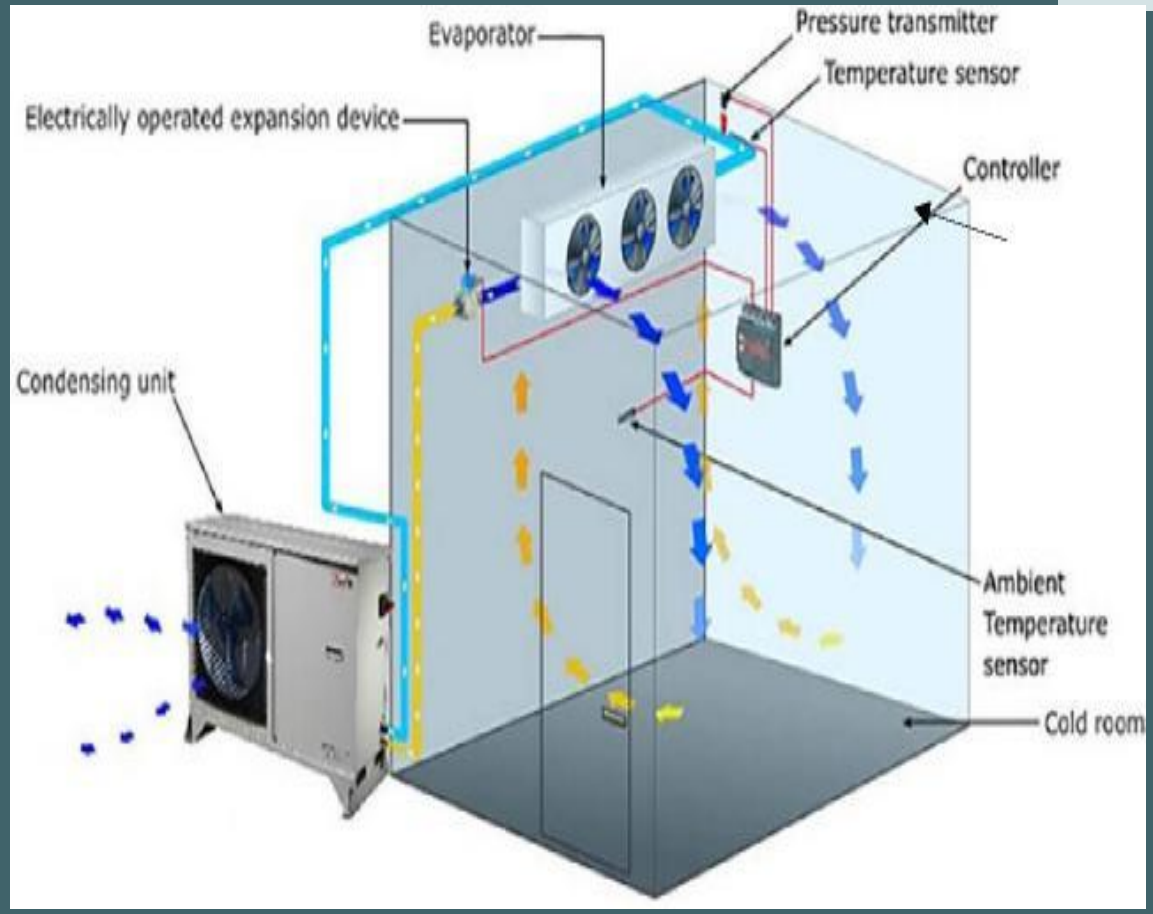
Mold in Cold rooms

Most cold rooms operate as a “closed” ventilation system –the air is constantly recirculating through the room itself.

Cold air blows out from the evaporator (the fans near the ceiling) and cycles through the room

Air circulates through the room, warms up (relatively), and is brought back into the evaporator, and chilled once more before starting the new cycle.

This pattern can allow humidity to build up in the space



Mold growth

Factors favoring mold growth in cold rooms

1. *Infrastructure issues:*

Failure in the evaporator or condenser units, or a blockage in the evaporator drip pan

Cold rooms (especially older ones) have shelves, cabinets and countertops that are made with exposed particle board,

Defective door seal can allow for air outside the room to enter the cold room and increase humidity and condensation

Door not closing firmly on its own

2. Procedural Issues:

Vast majority of the cases, there are issues with how the room is used, and what is being stored within the cold room

When was the room last cleaned?

Mold food sources such as paper, cardboard, growth media, and certain types of caulking

Exacerbated by temperature swings resulting from too frequent entries and exits from the space.

The amount of people in a space, and for how long they – or any individual – is inside the cold room are also major contributors to increased humidity levels inside the room

4 individuals occupy a cold room continuously for a period of about 55 minutes CO2 5,000 ppm

Preventing mold growth in cold rooms old rooms

Keep doors firmly shut

Immediately clean up spilled laboratory liquids, e.g., buffers and media

Limit the storage of organic materials, e.g., paper products, cardboard, miscellaneous trash,

Store paper & porous materials, e.g., Kimwipes, cardboard, blotting paper, etc., in closed, air-tight, plastic containers

Do not use the cold room as a storage closet.

Preventing mold growth in cold rooms

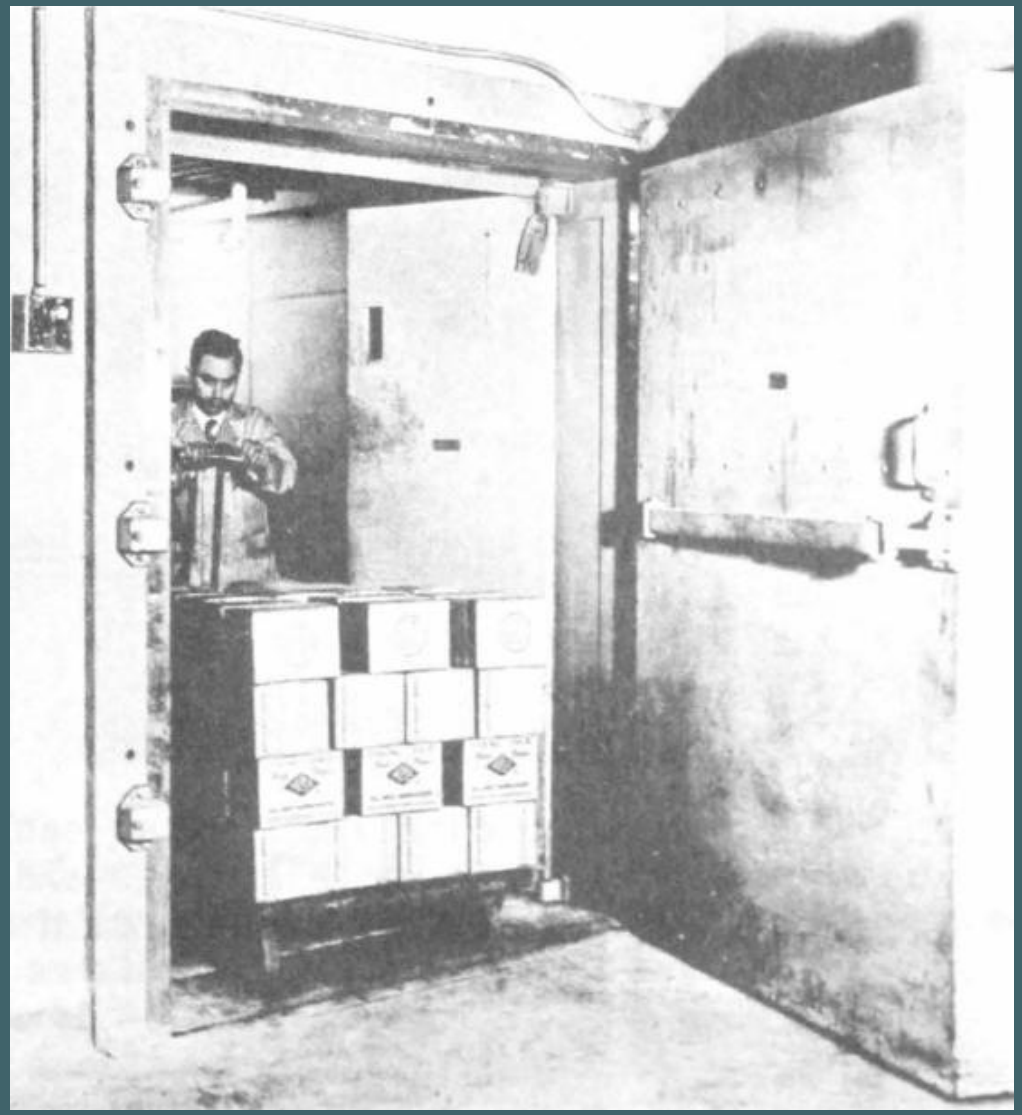
Minimizing personnel activity:
Never prop open the door. Ensure that it closes securely behind you

Removing any items/materials that can contribute to mold growth:
The storage of cellulose containing materials is a leading cause of mold growth. Remove all wood
If unpacking delivery boxes inside the cold room, do not leave the packing materials behind

Periodic checks:
Check for signs of condensation
Ensure that the evaporator unit, and fans appear to be working properly

Report all plumbing leaks, faulty latch/door seal, inconsistent temperatures or lighting issues

If your unit contains a sink, check that there is no standing water in the sink.



An infitting freezer door equipped with a set of flapper doors to minimize loss of cold air while the storage room is being loaded and unloaded. (Photo courtesy of Jamison Cold Storage Door Co.)

Chemical storage/exposure

Store chemicals
properly and with compatible materials

Cautious when dry and liquid nitrogen are used - can pose an asphyxiation hazard by displacing oxygen

Forklifts and combustible
equipment can cause fumes to build up in enclosed spaces

No storage of the following materials should be kept in a cold room:

- Cryogens – due to oxygen deficiency
- Dry Ice – due to oxygen deficiency
- Compressed gases other than air – due to oxygen deficiency
- Flammables – due to fire risk
- Toxic Chemicals (including BME, formalin, chloroform) – due to hazardous atmosphere if spilled
- Acids – due to damage to cold room or compressor
- No flames – Bunsen burner
- Food or Beverages – Contamination risks to food and materials inside cold room

Ergonomic hazards

Protect yourself from strains and sprains always lift reasonable loads

Use proper lifting techniques

Questions?

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