

U-3ARC TRAINING WEBINAR N°6



REGULATION AND OPERATION OF COLD ROOMS

**THERMOSTATIC CONTROLS, PUMP DOWN
AND CONTROL SYSTEMS**

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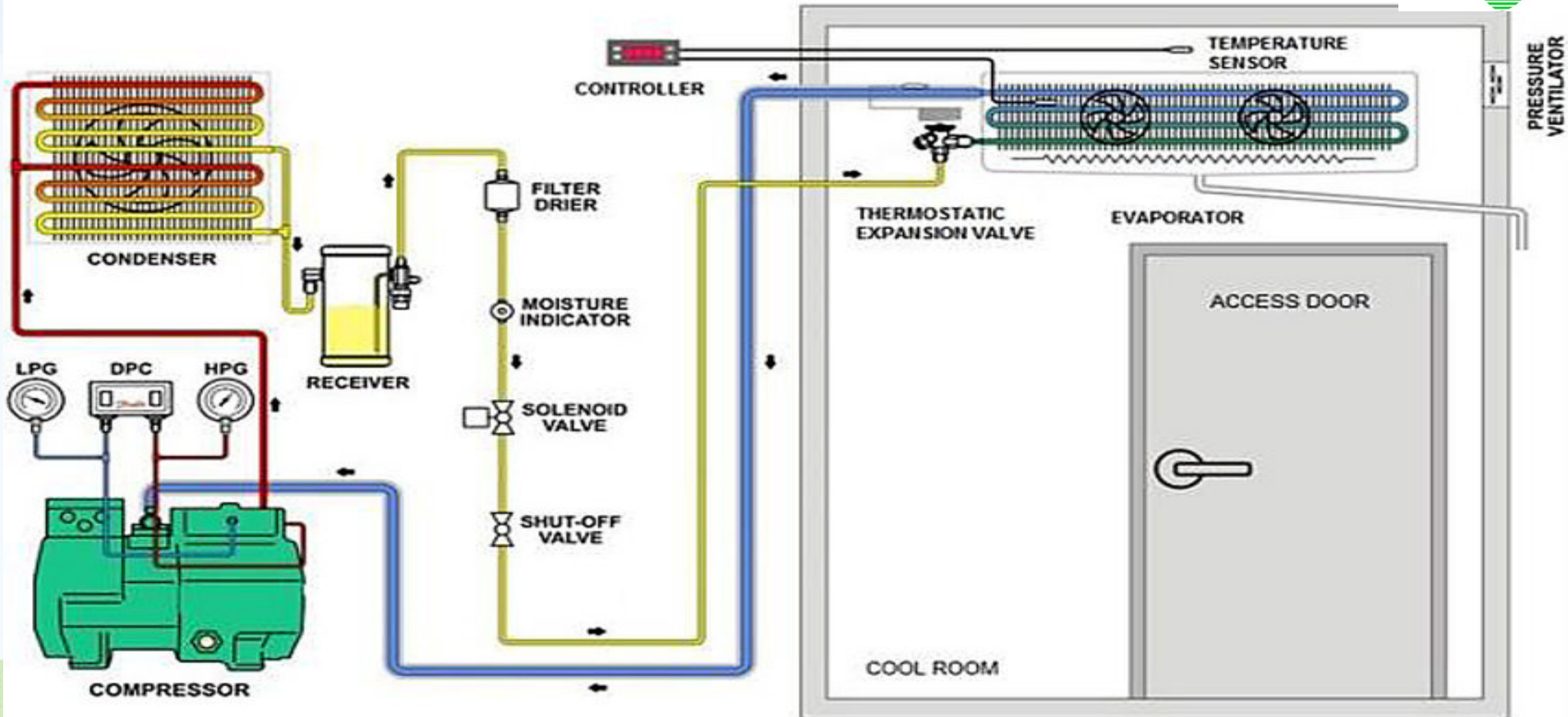


LEARNING OUTCOME/OBJECTIVE

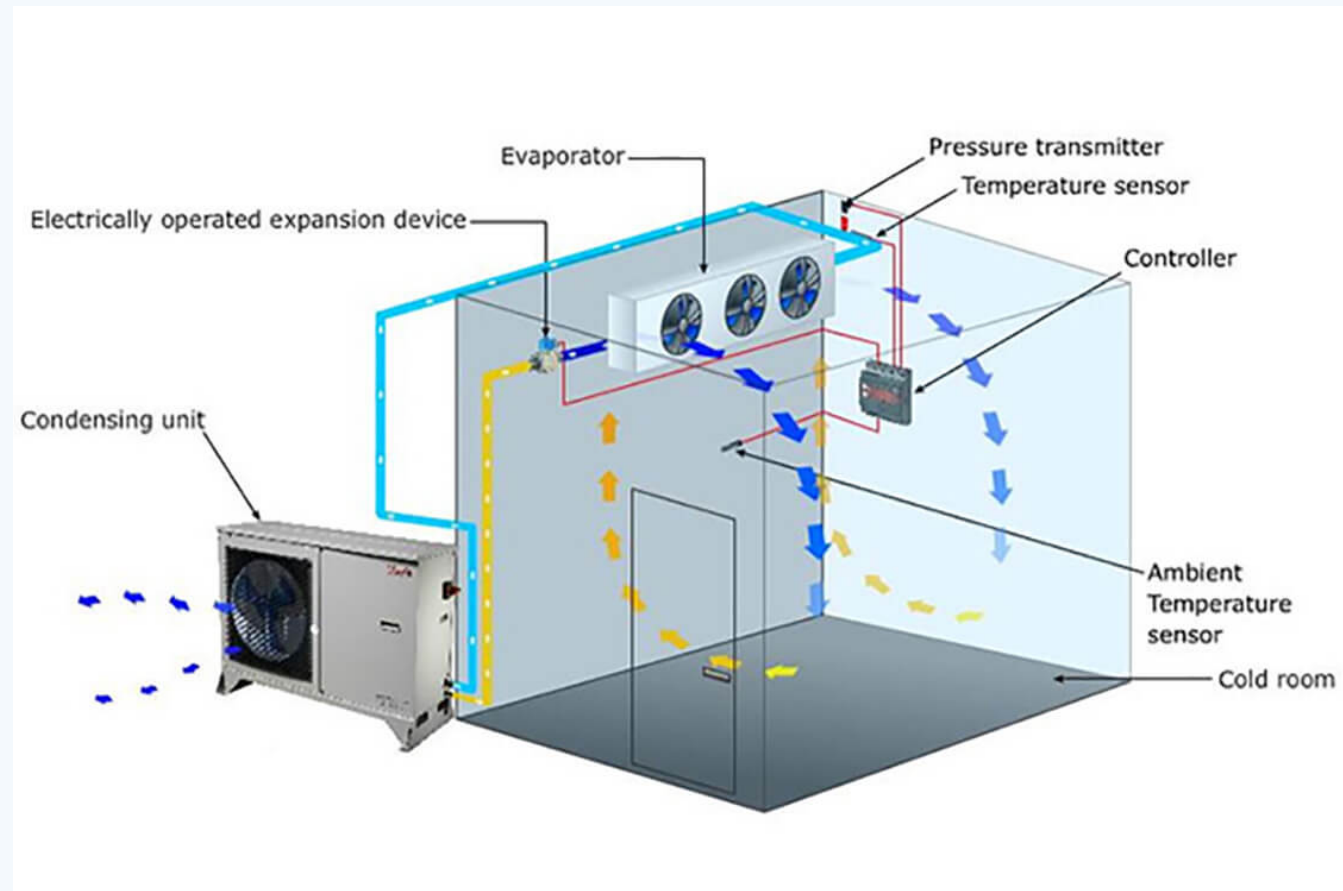
At the end of this webinar, attendee will learn about:

- Components of a Cold Room refrigeration System operation And Controls
- Factors Affecting Cold Room Efficiency and safety
- Performing the refrigeration system controls such as thermostats, defrost timers, and pump down
- Using temperature controllers, remote monitoring and programmable ECMS
- Operational maintenance

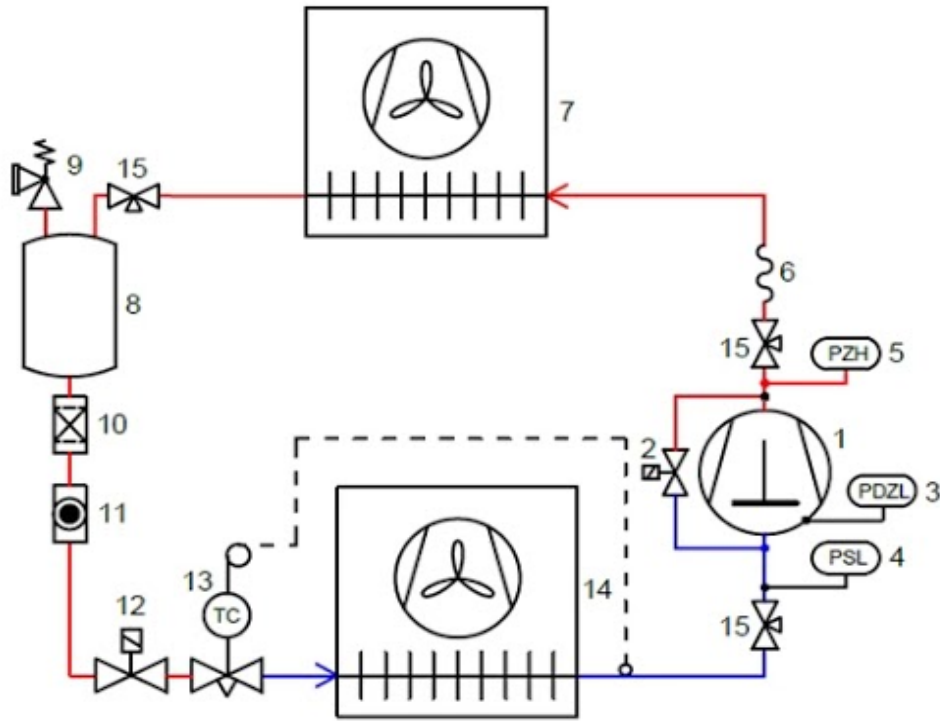
TYPICAL COLD ROOM REFRIGERATION SYSTEM



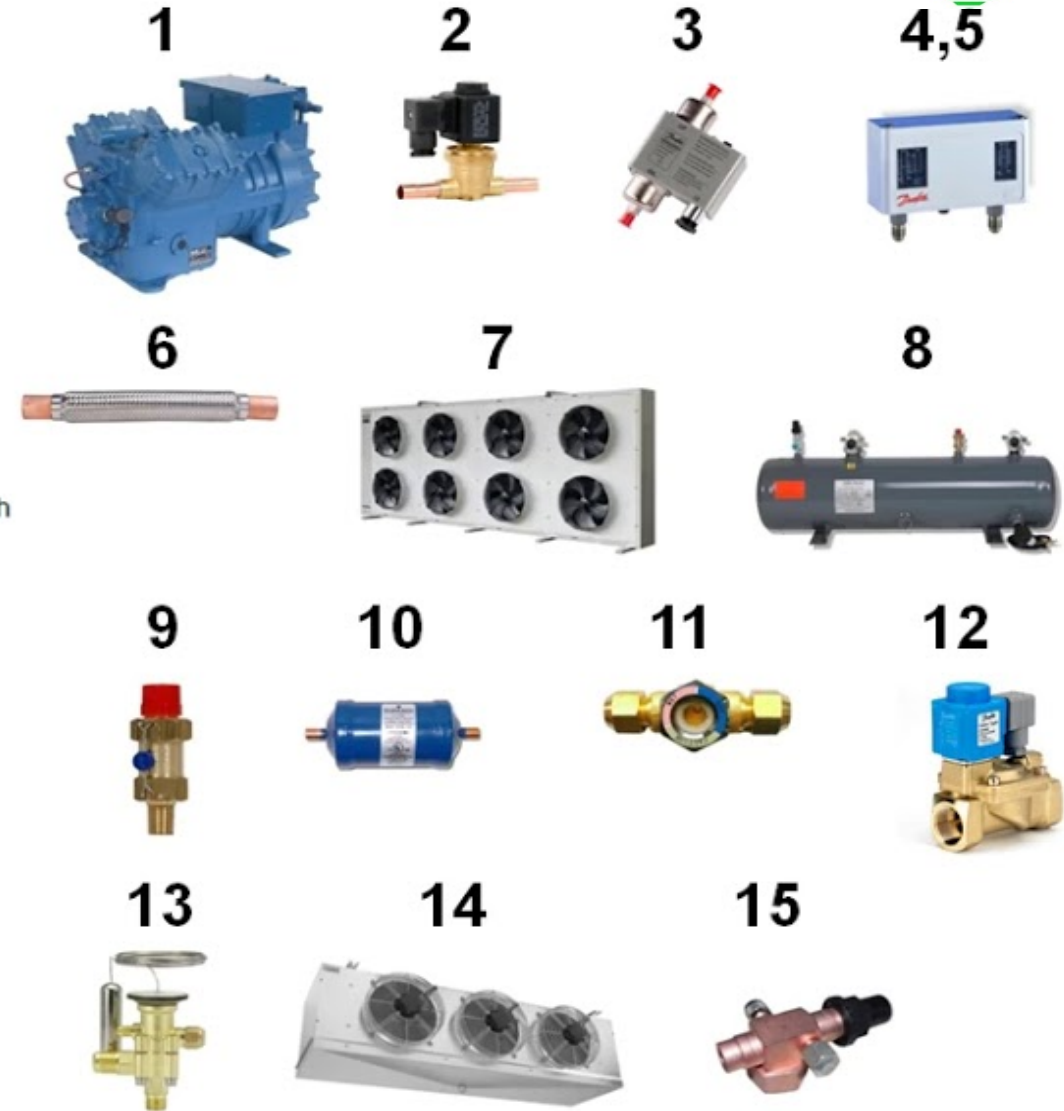
COLD ROOMS PHENOMENON



COMPONENTS OF A COLD ROOM REFRIGERATION SYSTEM AND CONTROLS



- High pressure
— Low pressure
1. Reciprocating compressor
 2. Starting by pass
 3. Oil differential pressure switch
 4. Low pressure switch
 5. High pressure switch
 6. Vibration absorber
 7. Condenser
 8. Liquid receiver
 9. Safety valve
 10. Filter-drier
 11. Sight glass
 12. Solenoid valve
 13. Expansion valve
 14. Evaporator
 15. Rotalock shut-off valve





TYPES OF COLD STORAGE

- Refrigerated Containers including refrigerated Trucks
- Blast Freezers
- Chillers for food storage
- Cold Rooms
- Pharmaceutical Grade Cold Storage Warehouse
- Plant Attached Cold Storage Warehouse

Setting & Regulation of parameters

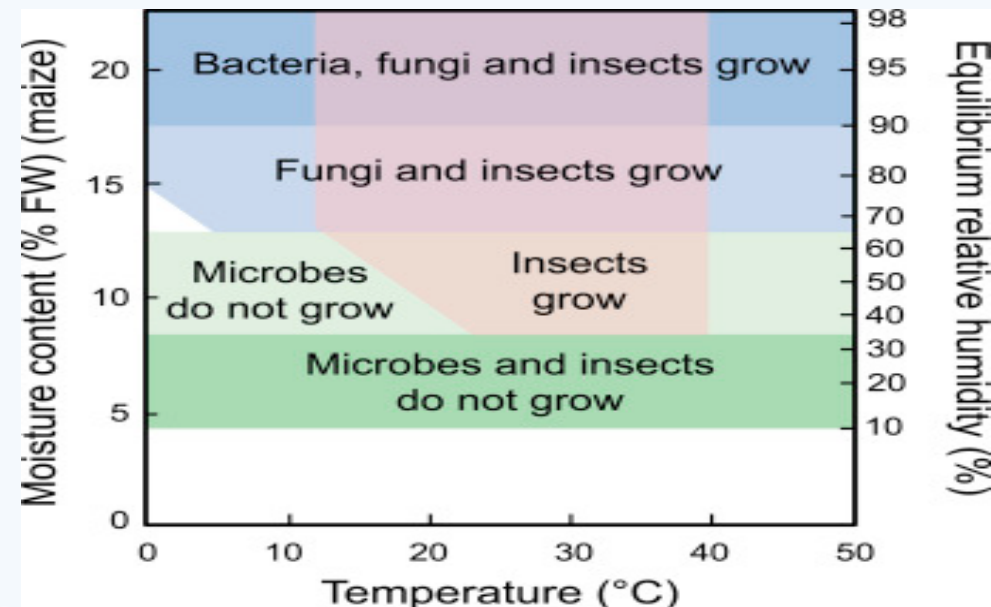
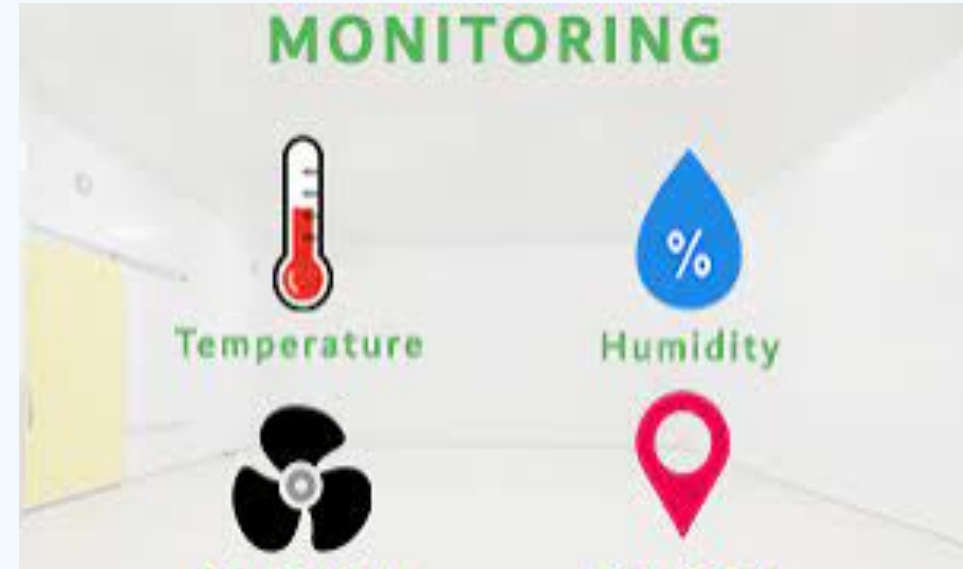


- **PRESSURE/PROTECTION CONTROLS**

- Low Pressure Controls
- High-Pressure Control
- Oil Safety Control
- Demand Defrost Timer Control
- Thermostatic Control
- Pump Down Control

- **EFFIFICENCY**

- Air Movement
- Operating temperatures
- Usage
- Humidity control



PRESSURE/PROTECTION CONTROLS

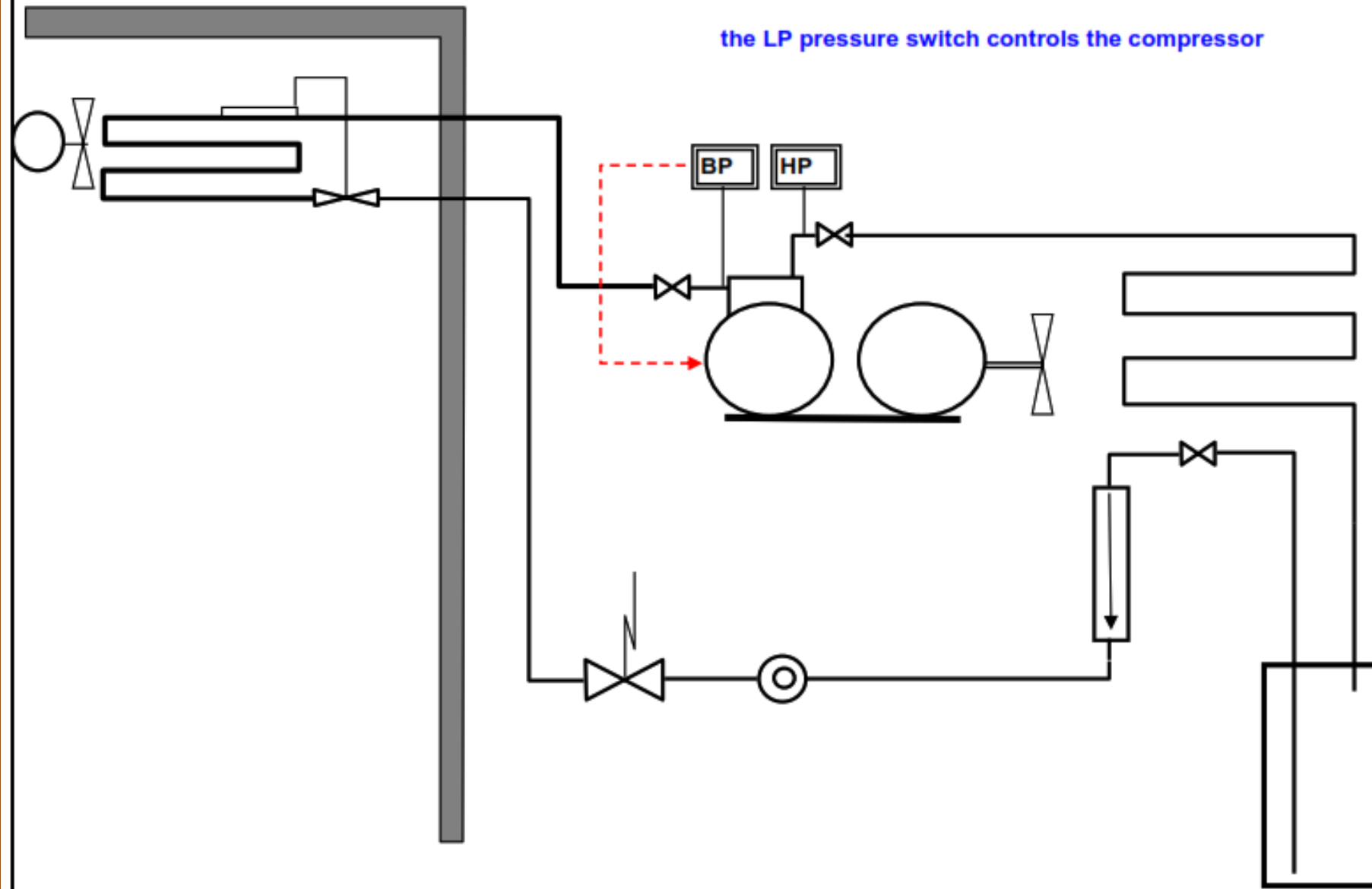


- There is more than one way to prevent compressor overloading. If the compressor can handle up to **40 psig (2,76 bar)**, a **pressure-limiting expansion valve will work**. At anything **over 38 psig (2,62 bar)** , the valve is fully open.
- **LP** -Low pressure controls is
 1. to protect the compressor from damage due to loss of refrigerant (dry run)
 2. To turn the compressor off at the end of a pump-down cycle
 3. As a tstat to regulate the temperature of a refrigerated box
- **HP** - To protect the compressor from damage
 1. A maximum condensing temperature of **70°C (158°F)** would damage the compressor, and
 2. should be at least **50 psig (3,45 bar)** below the cut-out pressure.
- **Oil safety** – When oil is below the required amount, the control tripes will shows that it is just doing its job. It is up to the technician to figure out why it tripped.



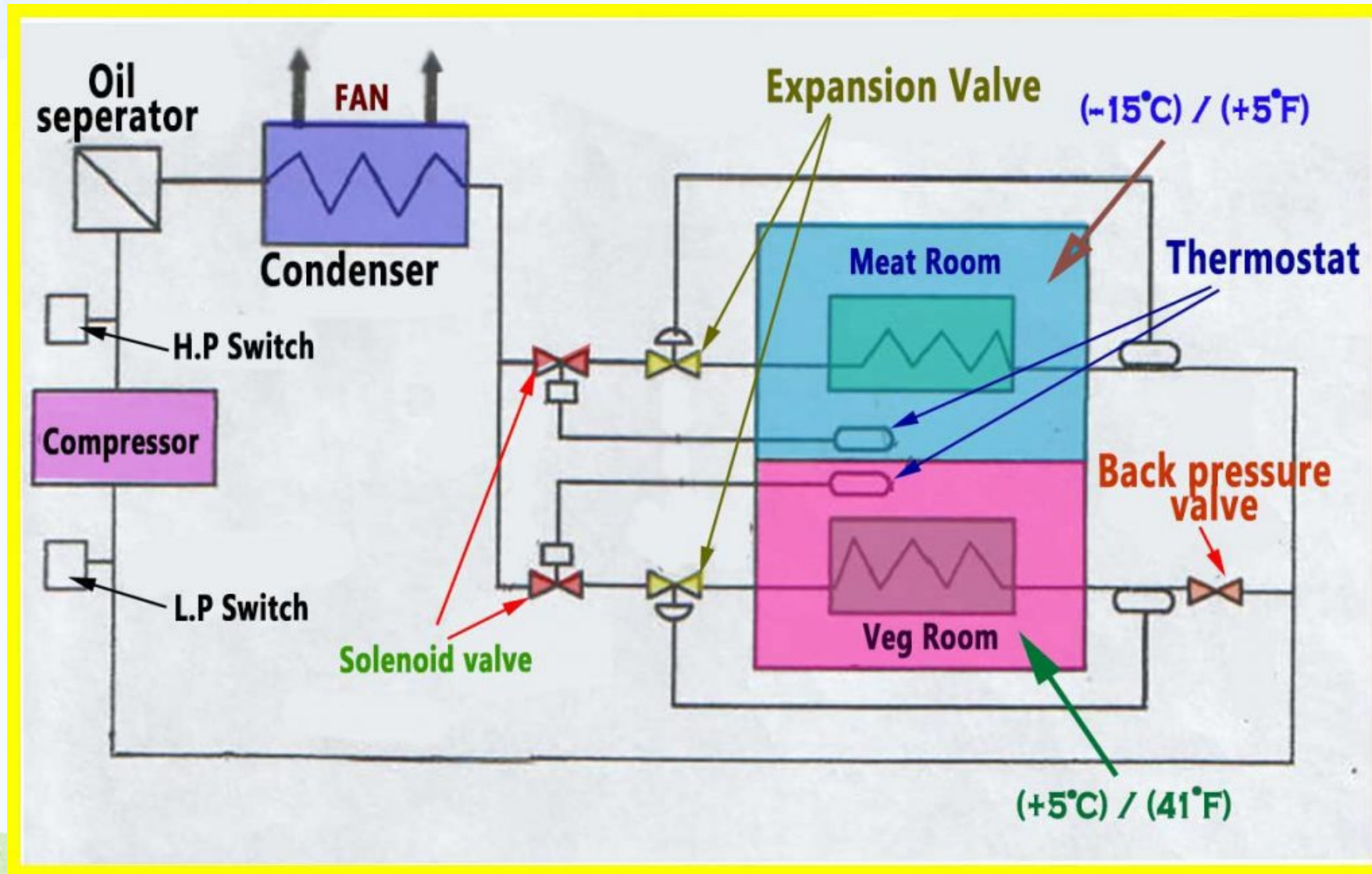
Regulation : BP Pressure switch

the LP pressure switch controls the compressor





Selective thermostatic control of control rooms



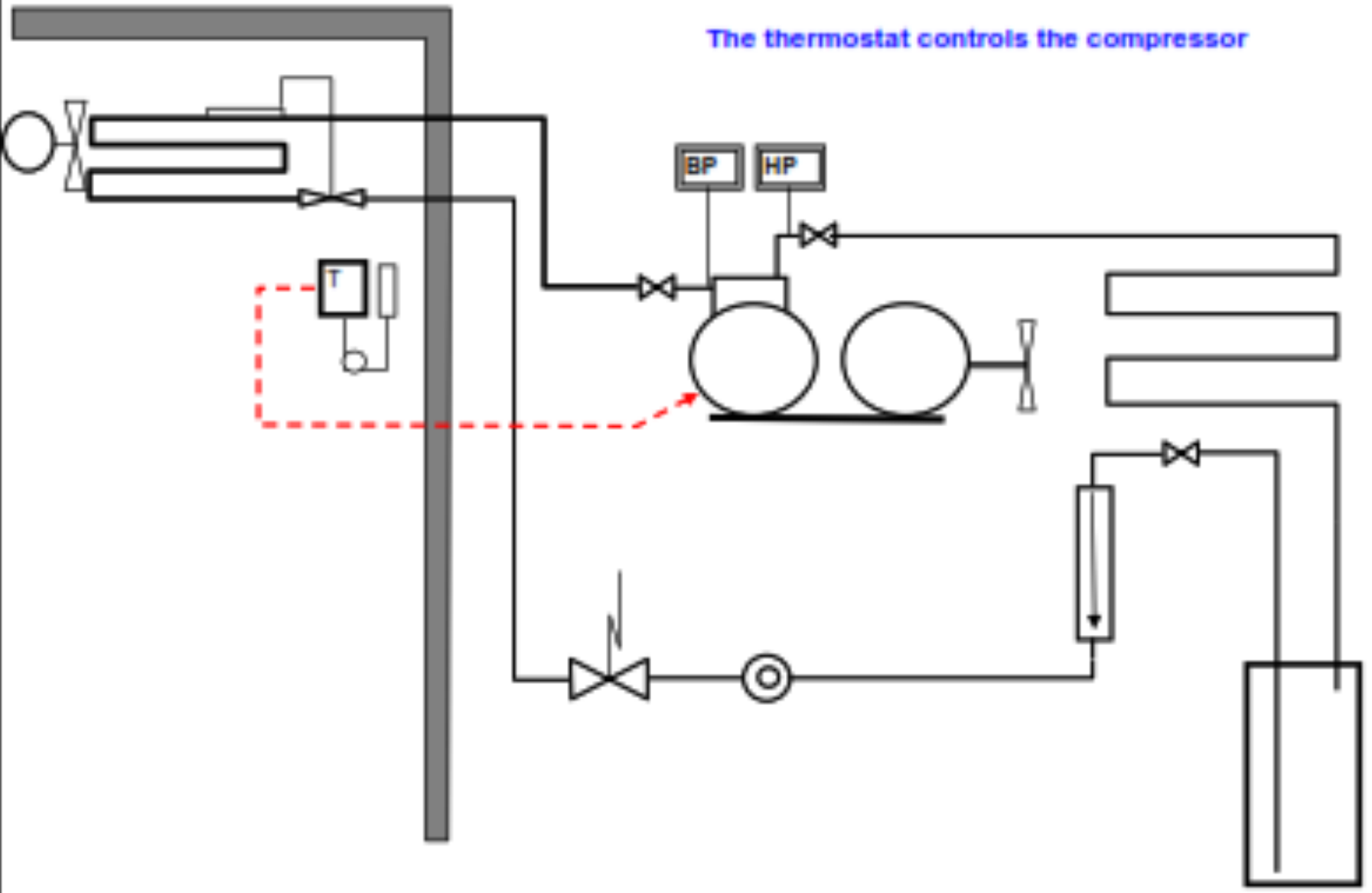
THERMOSTATIC PROCESS



- A thermostat has sensor that is set for a particular temperature level, and either trip or switch an external load (return air)
- Such devices can be electromechanical types or more sophisticated electronic types
- Tstats come in many temperature-sensing ranges and temperature differentials (TDs) (the difference between cut-in and cut-out). When sensing air temperature, the differential is about 3°F (-16°C) to 5°F (- 15°C).
- This fairly wide temperature swing prevents compressor short-cycling and also allows most medium-temperature refrigerators to self-defrost during the off cycle

Thermostatic Regulation

The thermostat controls the compressor

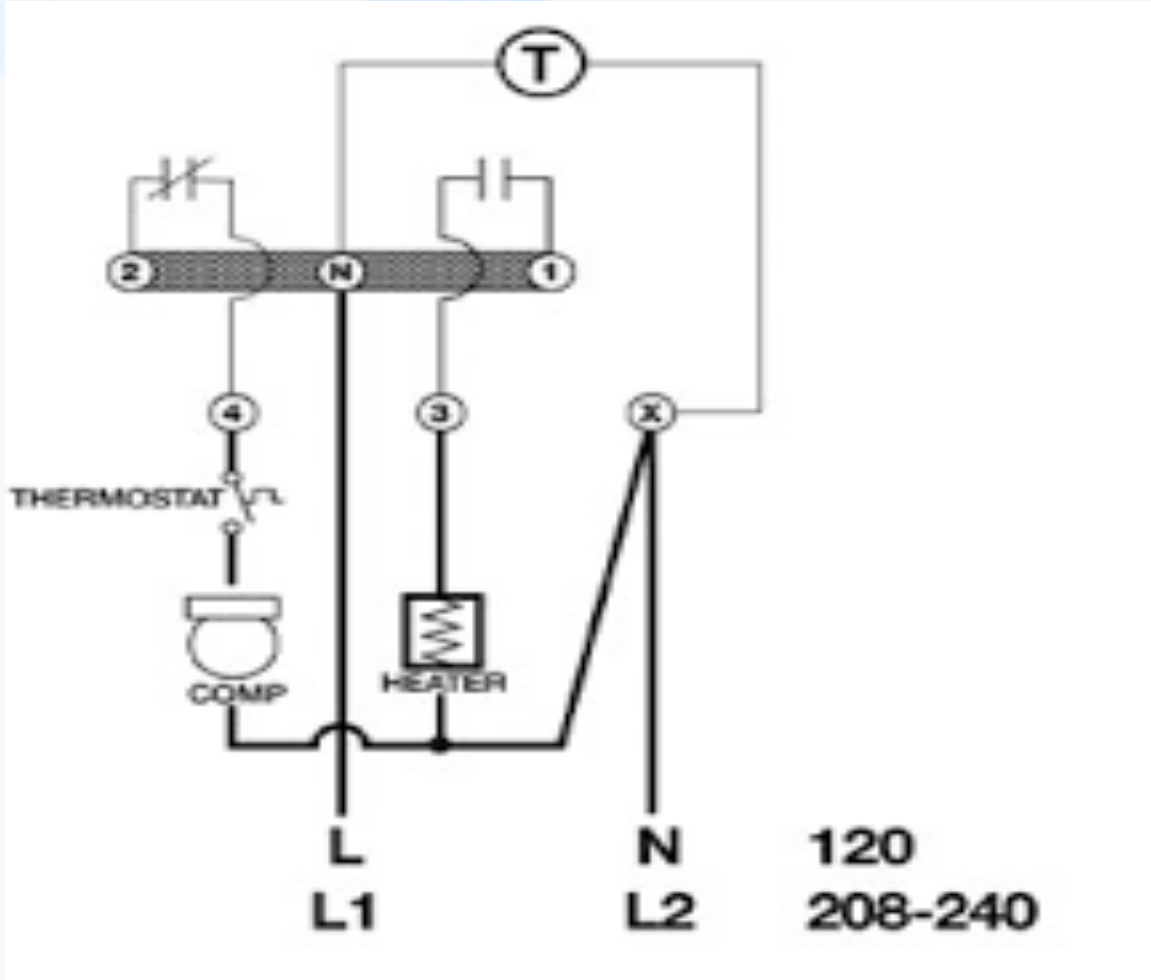


DEFROST DEMAND CONTROL



- The purpose of a pump down system is to prevent liquid refrigerant from “migrating” back into the compressor during an off-cycle. This prevents catastrophic damage of the compressor when the system starts up.
- **An automatic pump down:** can be used on electrical defrost systems in order to prevent the refrigerant from migrating to the suction line, compressor, and oil while in defrost.
- **During defrost (Defrost pump down),** the evaporator is full of liquid and vapor refrigerant. Once the defrost heaters energize, this refrigerant will be driven toward the compressor, trying to seek a lower pressure. When the defrost terminates and the compressor starts back up, there will be enough refrigerant in the suction line and compressor’s crankcase to damage the compressor.

DEFROST CONTROLS



DEMAND DEFROST TIMER CONTROL

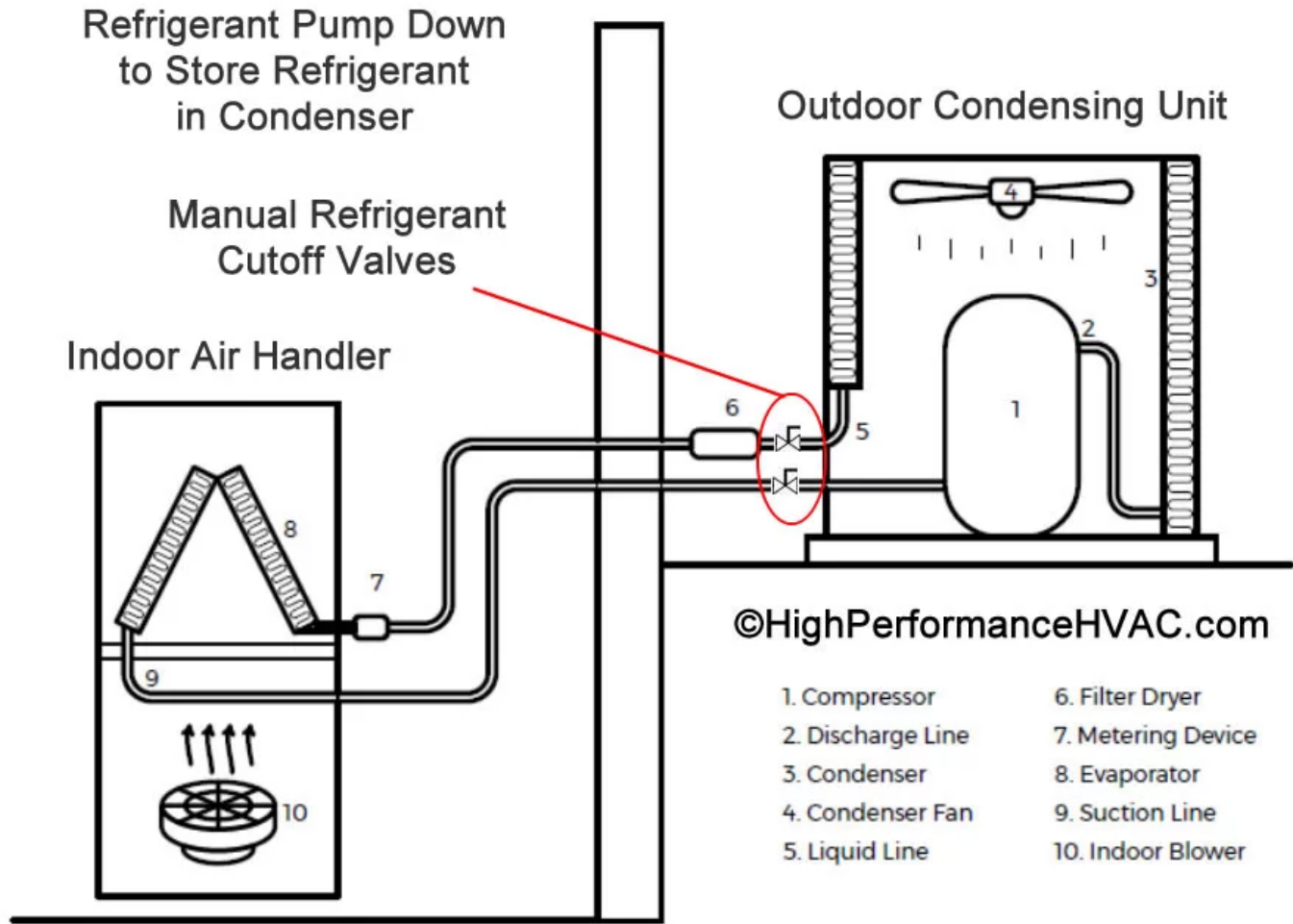
PUMP DOWN CONTROL



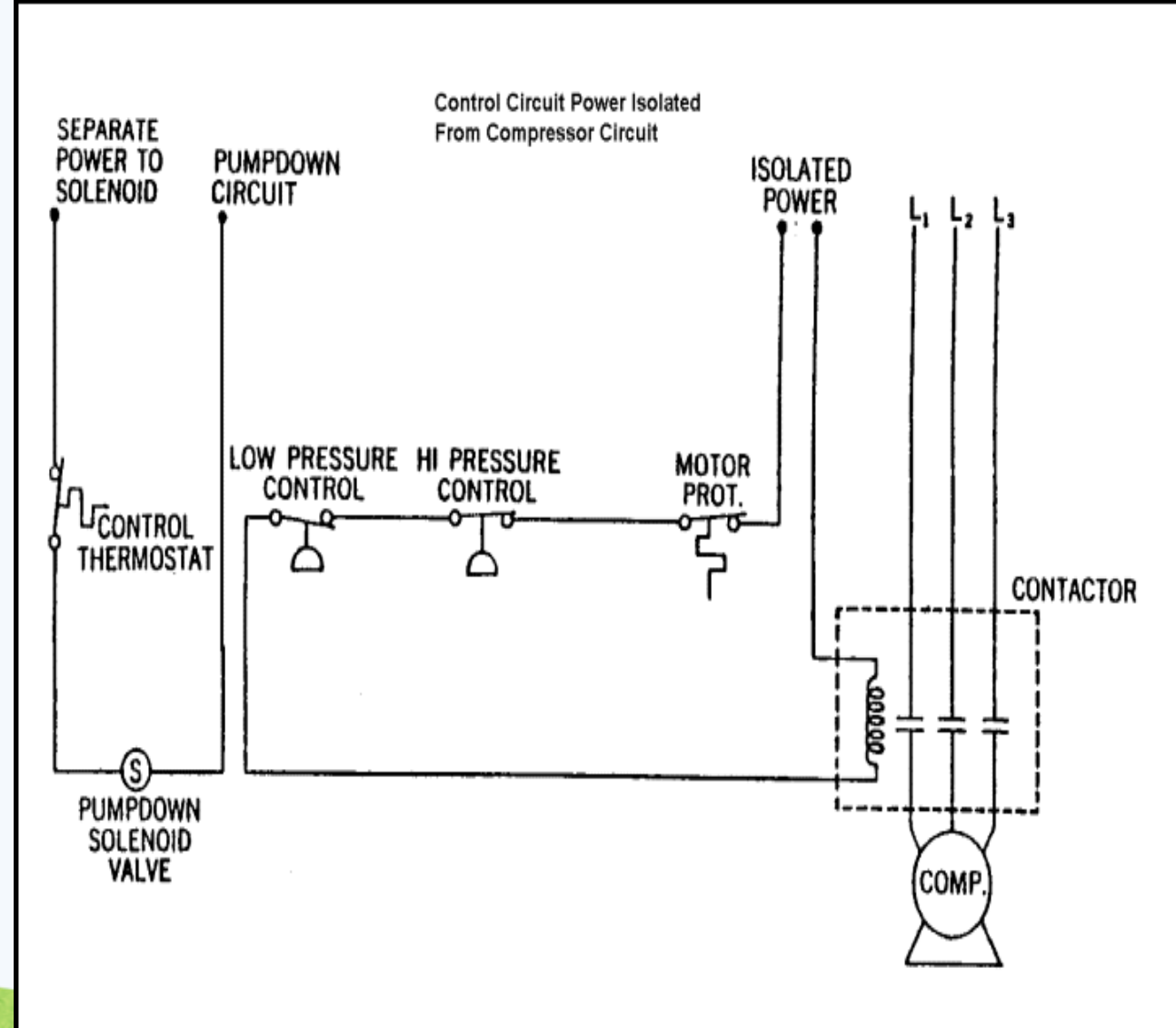
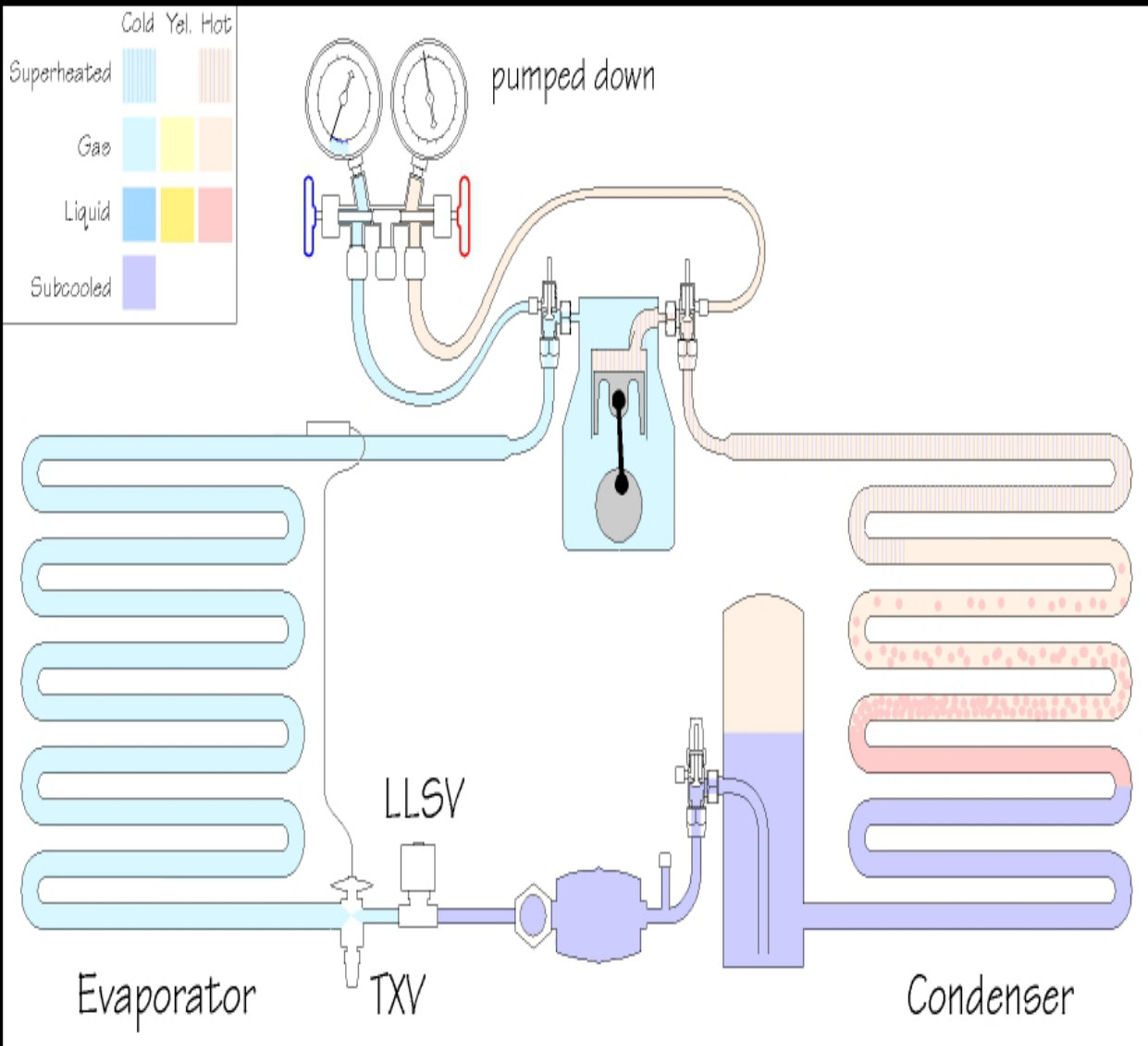
- **Defrost;** By pumping all of the refrigerant out of the evaporator before or during defrost, the compressor will be protected from slugging refrigerant and oil. This process prevents oil foaming from refrigerant migration to the crankcase and slugging of refrigerant from the suction line at start-ups after the defrost cycle.
- **Manual Pump Down;** The process of doing this may sound complicated but it is easy for an HVAC technician. Many HVAC technicians perform the refrigerant pump down method. Especially when they are going to open the refrigerant circuit to make a repair. There are two valves at the condenser, one valve for the suction line and one valve for the liquid line. The HVAC technician closes the liquid line valve and turns the air conditioning on. The compressor pumps all the refrigerant into the condenser coils.
- The HVAC technician watches his gauges carefully. When the pressure gets to zero he quickly closes the suction line valve. This traps the refrigerant in the condenser and then he turns the compressor off. This saves using refrigerant unnecessarily. This is because the same refrigerant in the system is re-used for the new evaporator coil in the Cold room.



MANUAL PUMP DOWN CONTROL

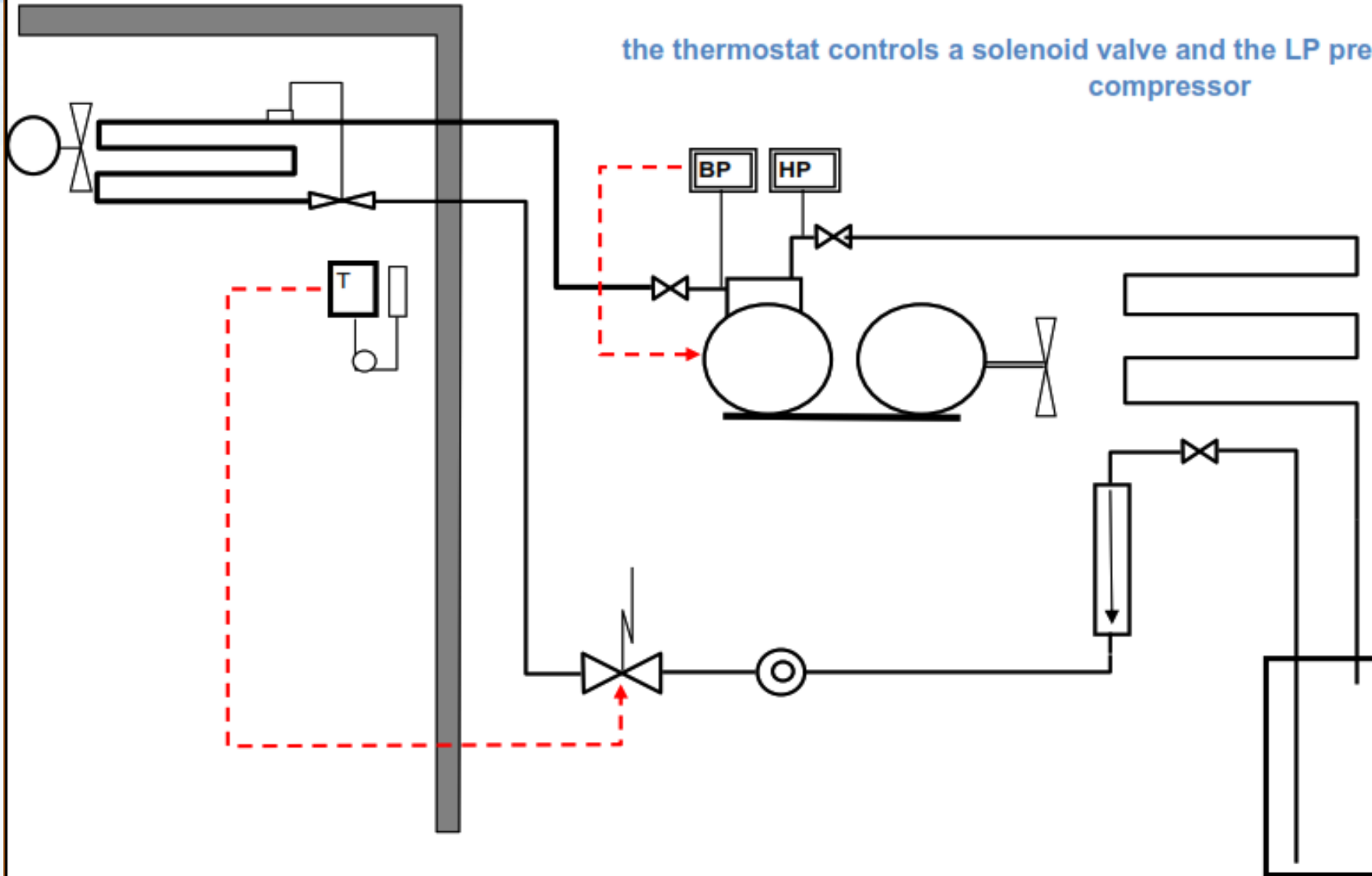


AUTOMATIC PUMP DOWN PROCESS & CIRCUIT



REGULATION : AUTOMATIC PUMP DOWN

the thermostat controls a solenoid valve and the LP pressure switch controls the compressor

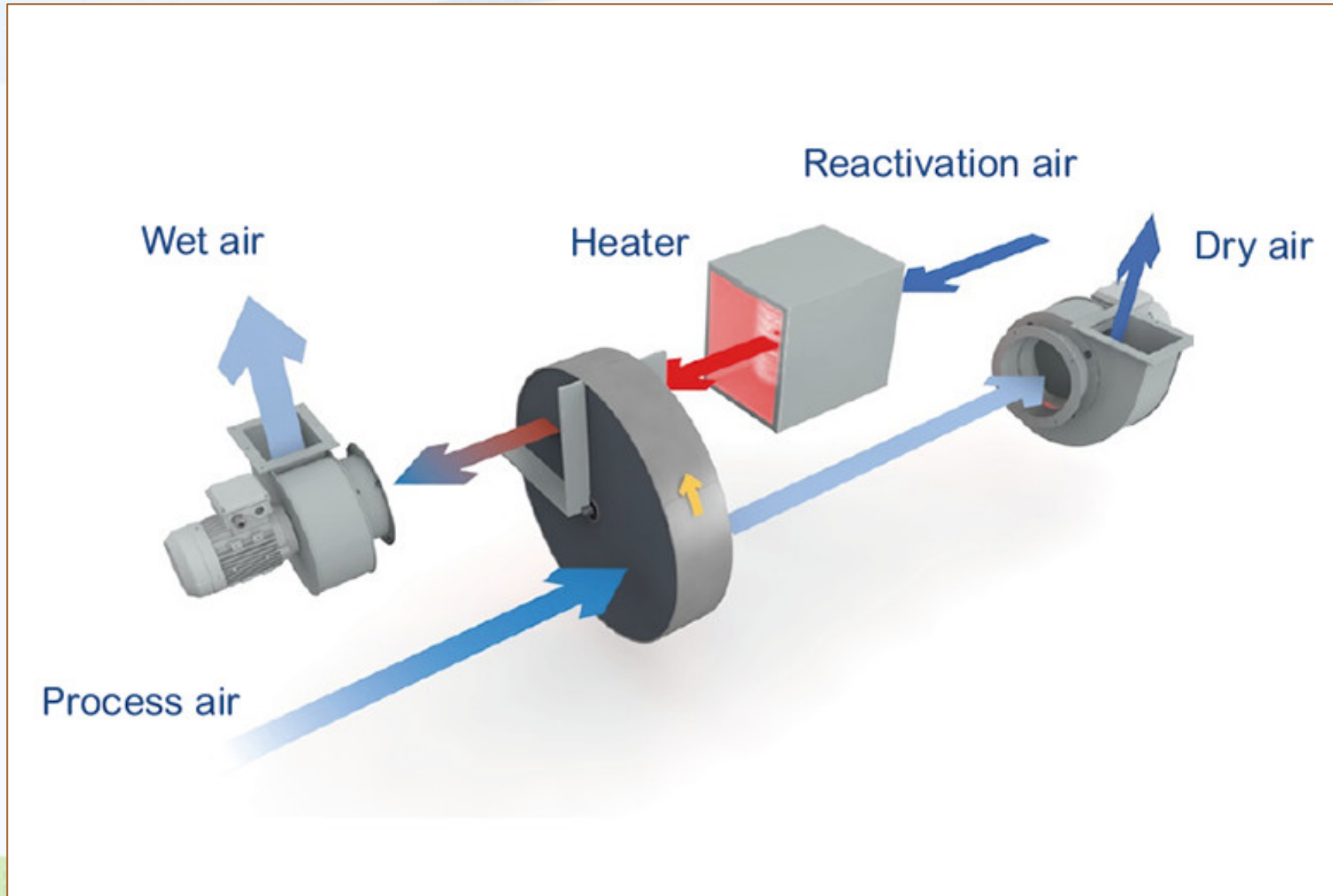


HUMIDITY CONTROLS AND REGULATION



- Preservation of food by air humidity control in cold storage is vital. Foods are hygroscopic materials and their properties vary significantly with the humidity of the air around them, not just with temperature.
- Humidity sensors and activators of de-humidifiers (humidifiers) operation.
- Categories of cold rooms values of temperatures are as shown in the table below.

Humidity control processes





Recommended temperature differences for finned evaporators

Positive cold room with finned evaporator					
Category		Category1	Category2	Category3	Category4
		Very high relative humidity 95% à 90%	High relative humidity 90% à 85%	Average relative humidity 85% à 80%	Low relative humidity 80% à 75%
Mode of circulation of the air	Forced convection	3°C to 5°C	5°C to 7°C	7°C to 9°C	9°C to 12°C
	Evaporator natural	8°C to 10°C	10°C to 12°C	12°C to 15°C	15°C to 20°C
Negative cold room with finned evaporator					
Mode of circulation of the air	Evaporator with forced convection	Frozen or to be frozen products Unpackaged		Frozen or to be frozen products Packed	
		5°C to 6°C		7°C to 8°C	



CLASSIFICATION OF PRODUCTS TO BE PRESERVED

Category1	Category2	Category3	Category4
<ul style="list-style-type: none"> - Cheese - Vegetables - Fresh fish - Pinecones - Un wrapped butter - Some long term Storage fruits 	<ul style="list-style-type: none"> - Fresh meat - Rabbits - Fresh hams - Fresh loins - Oysters - Citrus - Some fruits in particular :apples, pears,green currants, - Most vegetables :Beets, carrots, cauliflower, beans - cutflowers - Eggs inboxes - Certain cheeses 	<ul style="list-style-type: none"> -Various commodities -Fishunderice -Meatinquarters -Onions -Freshpoultry -Fruits with a skin Relatively thick 	<ul style="list-style-type: none"> -Meat,fruit, vegetables, fish -Milk -Cream -Comfits -Bottled drinks - Orin metal barrels -Woolens -Andin general, - All products protected by an airtight envelope



PROGRAMMABLE ELECTRONICS CONTROL MODULE (ECM)

An electronics control module is an embedded system that controls one or more of the cold room electrical or subsystem especially designed for mini-type cold storage.

It perform the following functions:

- Simple parameter setting and easy-to-operate. .
- Set parameters can be modified when working.
- Switch between auto and manual mode.
- Manual operation OPTIONS to control blower fan, compressor and defroster.
- Compressor start-up delay protection.
- Manual and enforced defrost.
- Main low voltage components adopt famous manufacturing products home and abroad

EXAMPLES OF ELECTRONIC AND REMOTE CONTROLLERS' COMPONENTS



single phase cold room



three phase cold room





TROUBLESHOOTING AND MAINTENANCE

❑ **Planned Preventive Maintenance –**

The monthly check-ups and maintenance

- Make sure that the fins of Evaporator & Condenser coils are clean.
- Ensure that the levels of refrigerants are maintained properly.
- The Reverse blowing & control valves should function efficiently.
- The function of defrosting should work properly because defrosting is imperative to the efficiency of the room.
- To make sure there is no malfunctioning, perform a system functional test.

❑ **Annual Maintenance Practices**

- The heat exchanger should be washed chemically. This will help in removing any impurities which may become a hindrance in the efficient functionality of the room.



THANKS FOR LISTENING

Questions, PLEASE???