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Webinar Series

EMERSON
Climate Technologies

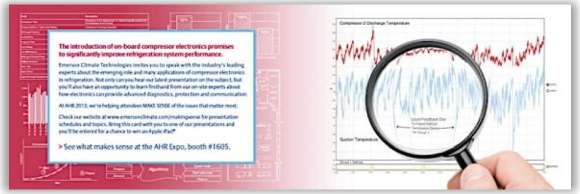
Making Sense Webinars

Emerson and Our Partners Giving Insight on the Three Most Important Issues in Refrigeration

We're Making Sense of the promising role of **new refrigerants.**

We're Making Sense of **energy reduction** technologies.

We're Making Sense of the application of electronics to improve **operational visibility.**



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Making Sense of the promising role of new refrigerants.

Webinar Series

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Seven Keys to Servicing CO_2 Systems

CO_2 Booster Systems From a Service Mechanic's Perspective

July 14, 2015

Presented By:

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Director — CO_2 Business Development

Emerson Climate Technologies

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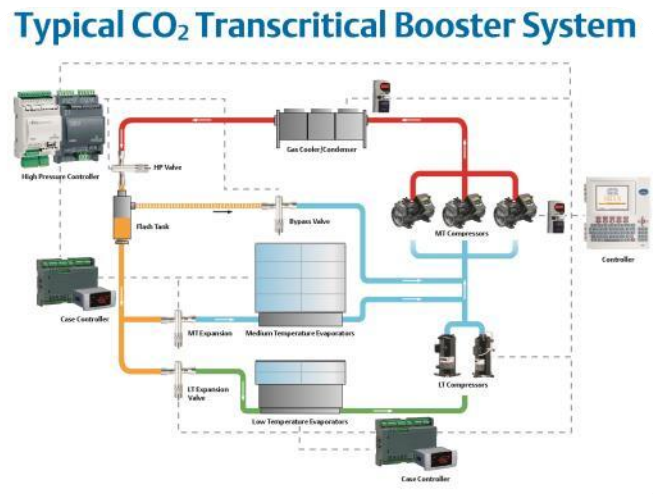
What We'll Cover

- **Three Basic System Architectures**
- **Transcritical Vs Subcritical Operation**
- **Three Main Differences Between HFC and R744 Systems**
  - Low Critical Point
  - High Triple Point
  - High Pressure
- **Dealing with Standstill Pressures**
  - Managing Pressure Reliefs
  - Managing Power Outages
  - How to Mitigate Risk
- **Peculiarities With R744**



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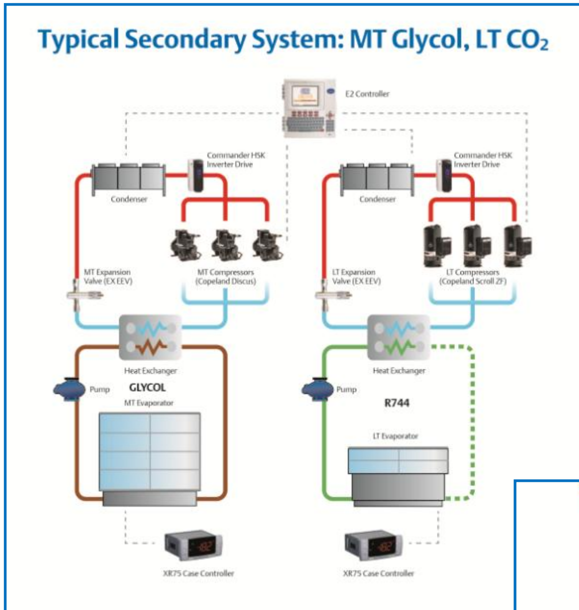
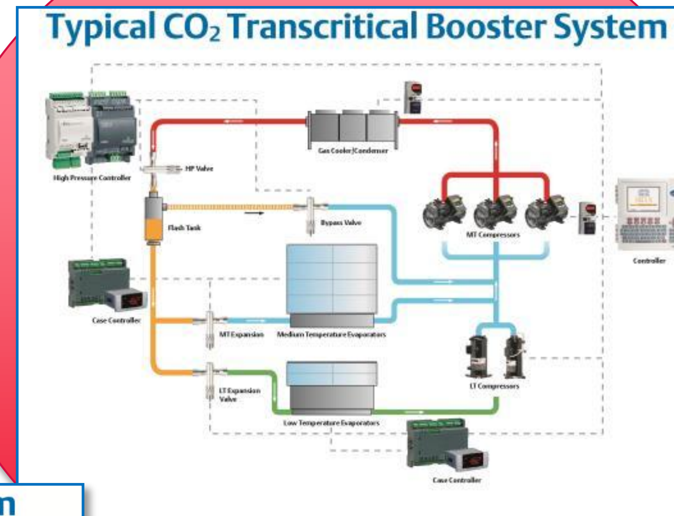
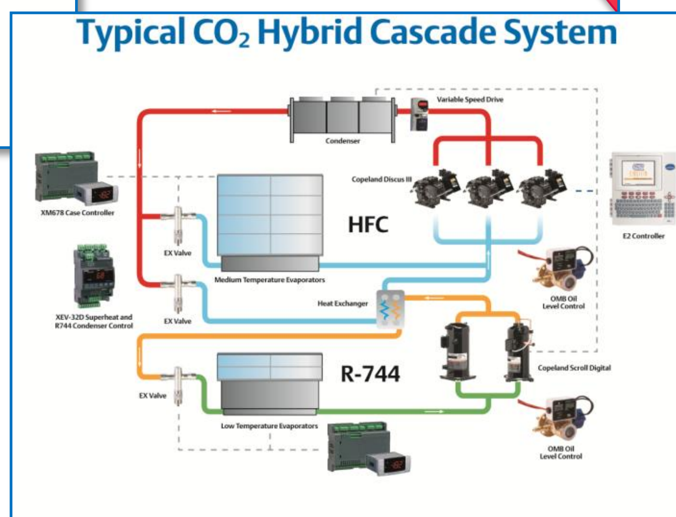
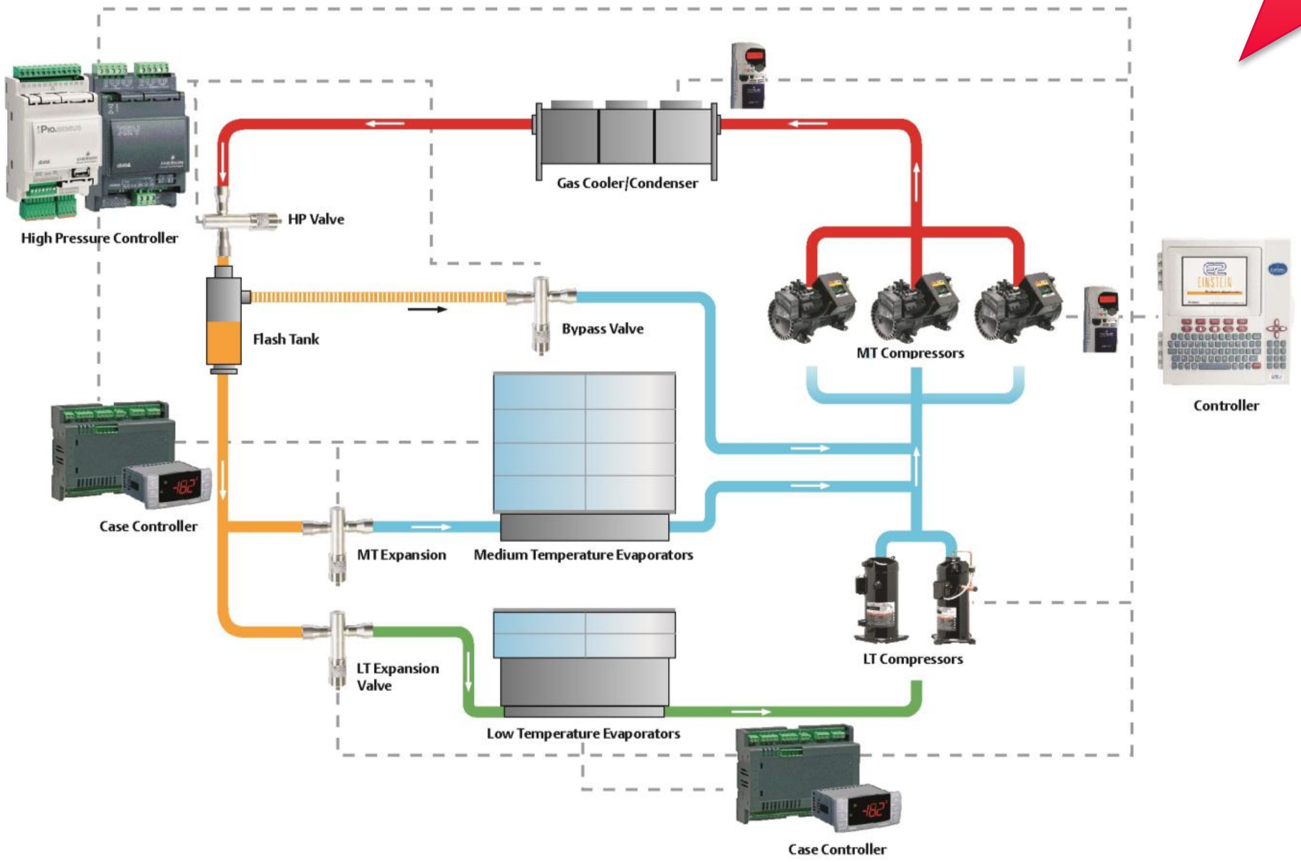
CO_2 Architectures







CO_2 Booster Transcritical



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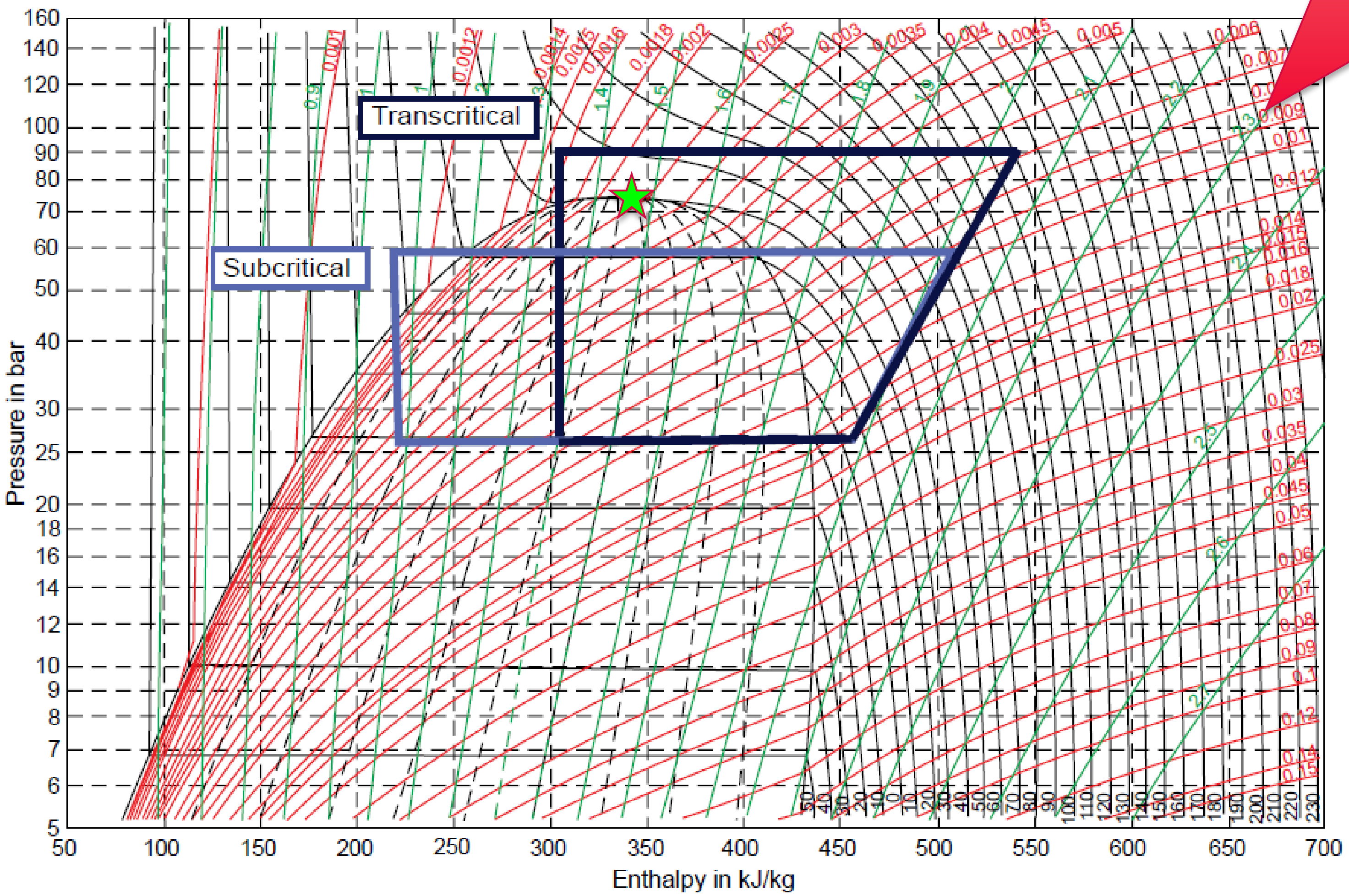
Subcritical vs. Transcritical Operat...



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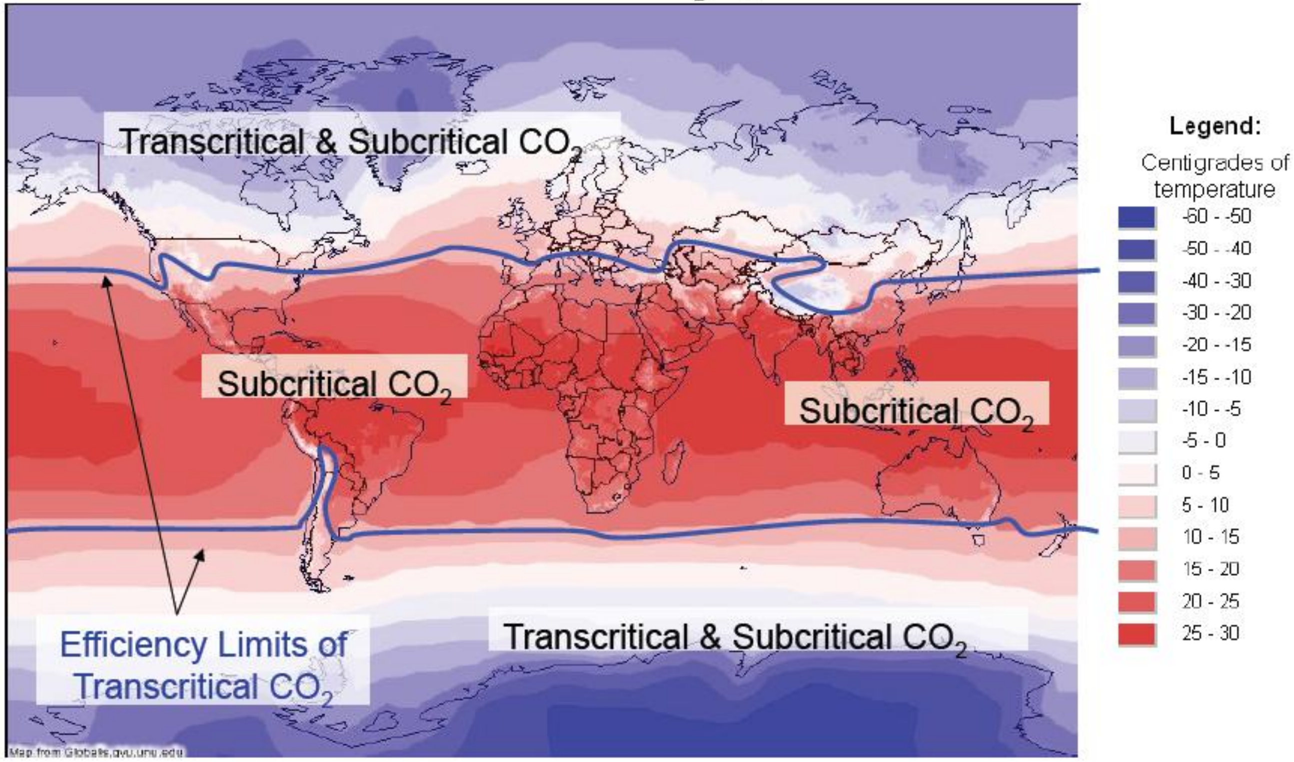
Climatic Impact of CO_2 System Architectures

Fig. 1.2 **Potential Global Distribution:** CO_2-System Alternatives:

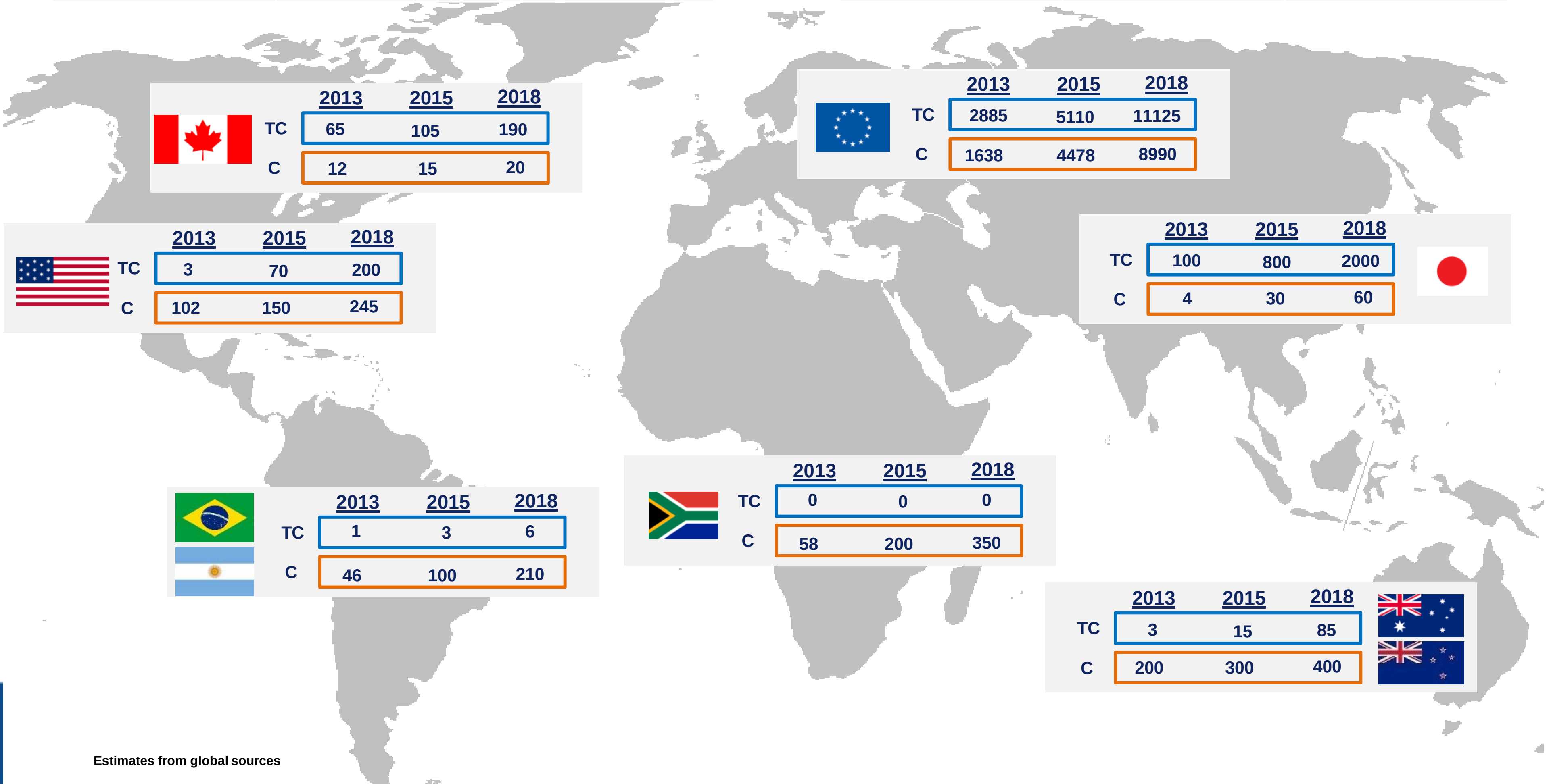


THE CARBON DIOXIDE INDUSTRIAL REFRIGERATION HANDBOOK iiar 1.3

Global Supermarket / C-Store CO2 System Installations

Cumulative Total CO_2 Transcritical Systems		
2013	**2015**	**2018**
3057	6103	13606

Cumulative Total CO_2 Cascade/Secondary Systems		
2013	**2015**	**2018**
2060	5273	10275



	2013	2015	2018
TC	65	105	190
C	12	15	20

	2013	2015	2018
TC	2885	5110	11125
C	1638	4478	8990

	2013	2015	2018
TC	3	70	200
C	102	150	245

	2013	2015	2018
TC	100	800	2000
C	4	30	60

	2013	2015	2018
TC	0	0	0
C	58	200	350

	2013	2015	2018
TC	1	3	6
C	46	100	210

	2013	2015	2018
TC	3	15	85
C	200	300	400

Estimates from global sources

Question 1

What is you occupation?

1. HVAC/R Service Mechanic
2. HVAC/R Service Manager
3. HVAC/R Contracting Owner
4. Engineer
5. Wholesaler
6. Sales
7. Marketing
8. Other

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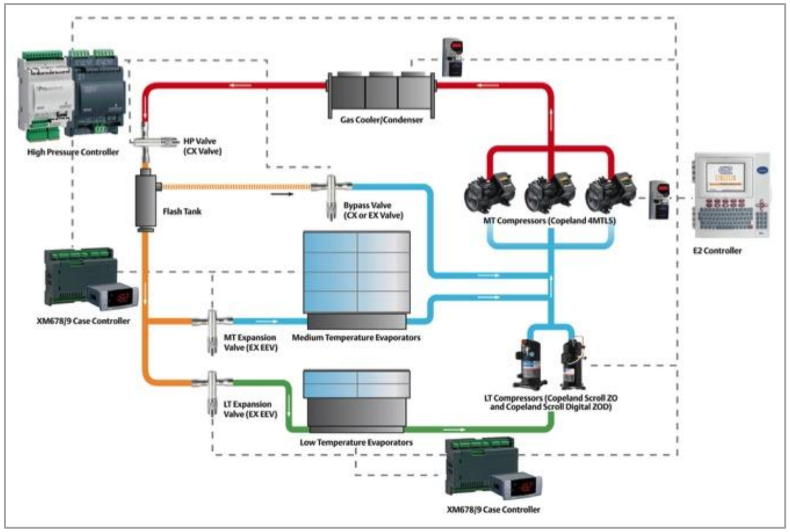

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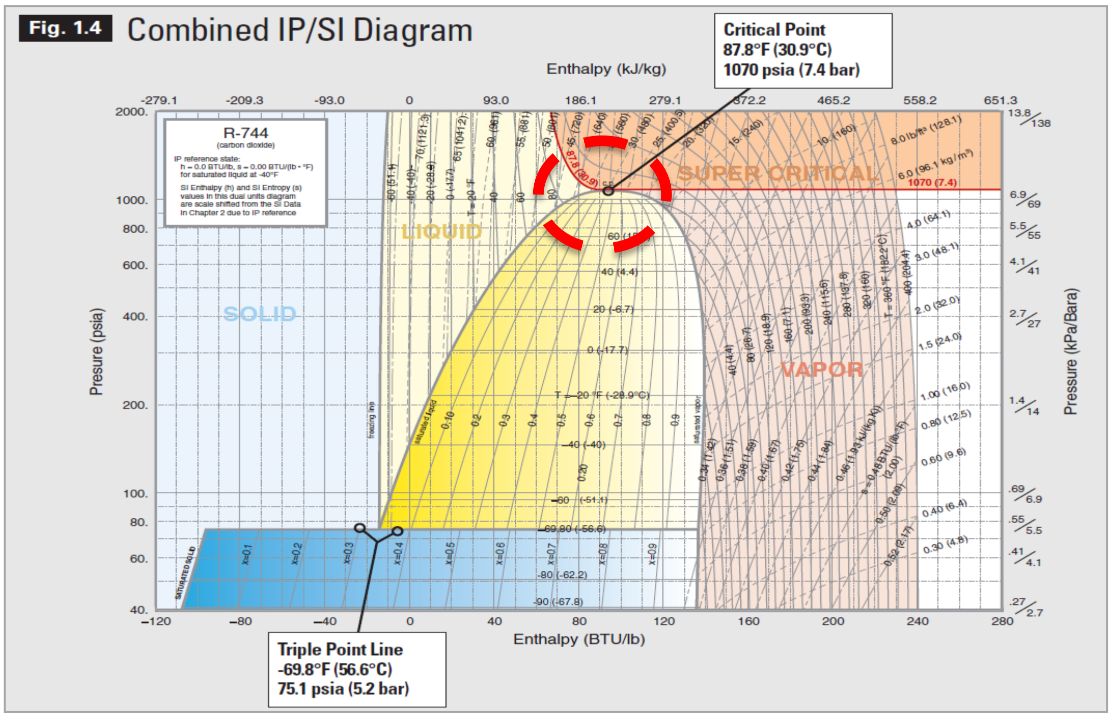
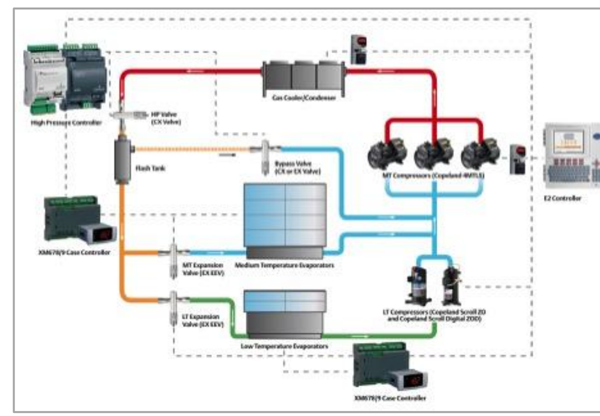
Three Main Differences Between HFC and R744 Systems

1. Low Critical Pressure (1055 psig, 87.8 °F)



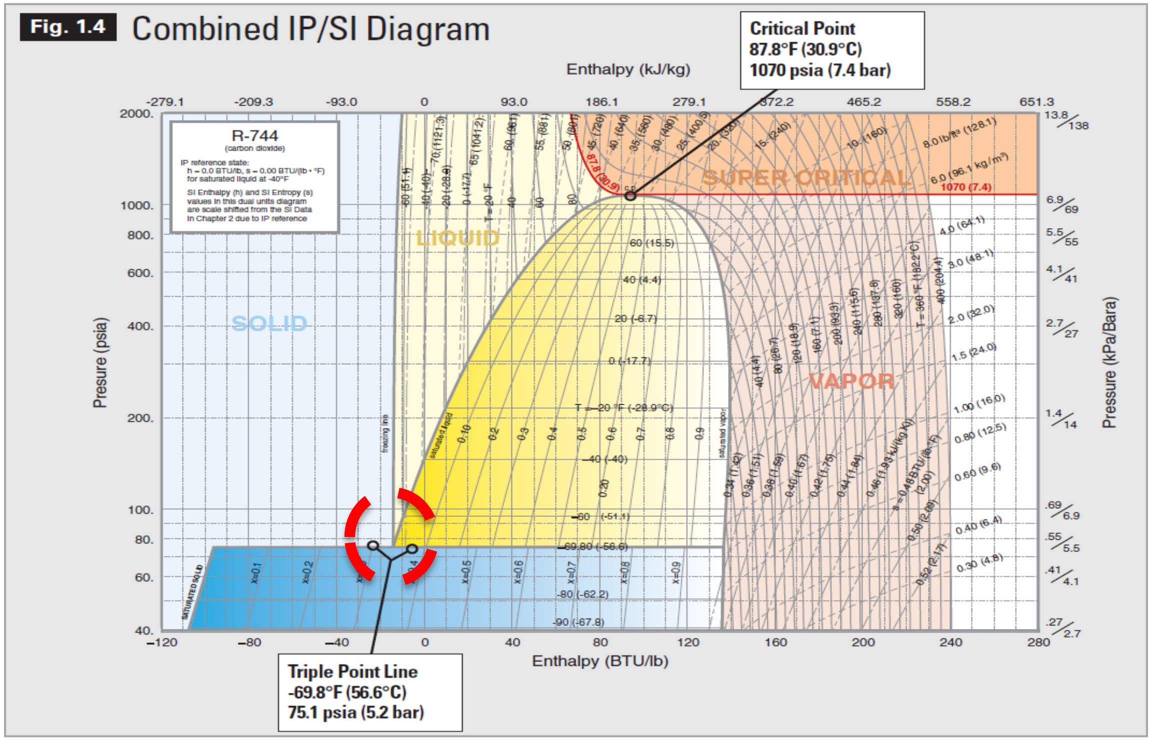
R744 Transcritical Booster System

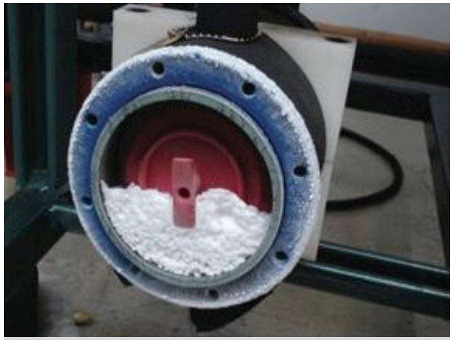


https://www.youtube.com/watch?v=GEr3NxsPTOA Video of Phase change of CO_2

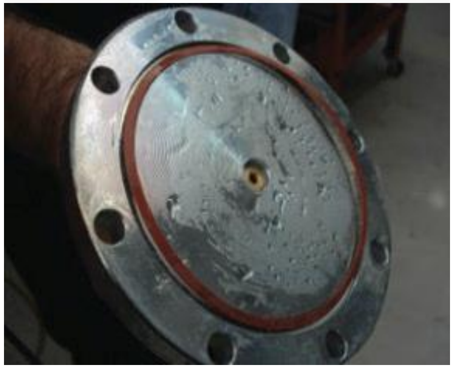
Three Main Differences Between HFC and R744 Systems

2. High Triple Point (60.4 psig, -69.8 °F)



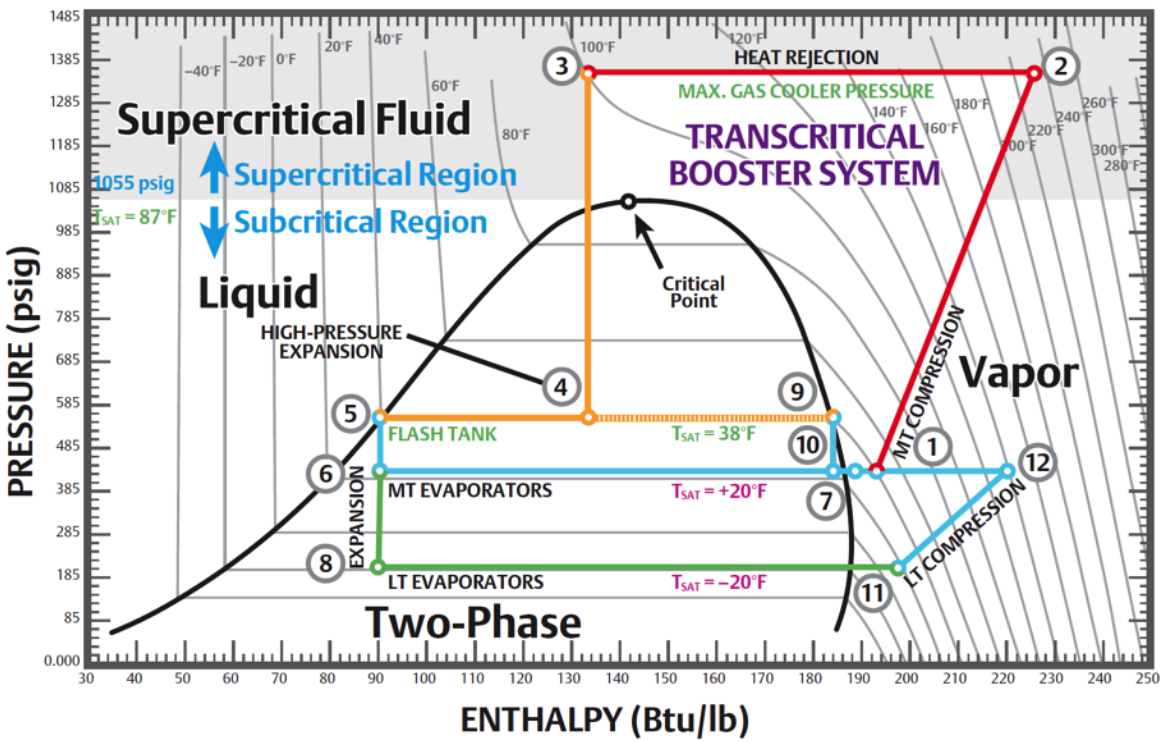


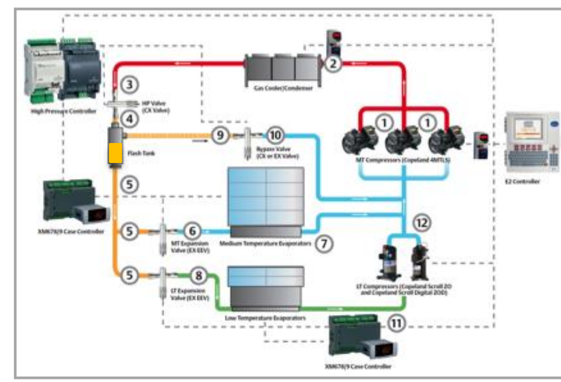
-109.3 °F Surface Temp of Dry Ice



Three Main Differences Between HFC and R744 Systems

3. High Pressures — Operating





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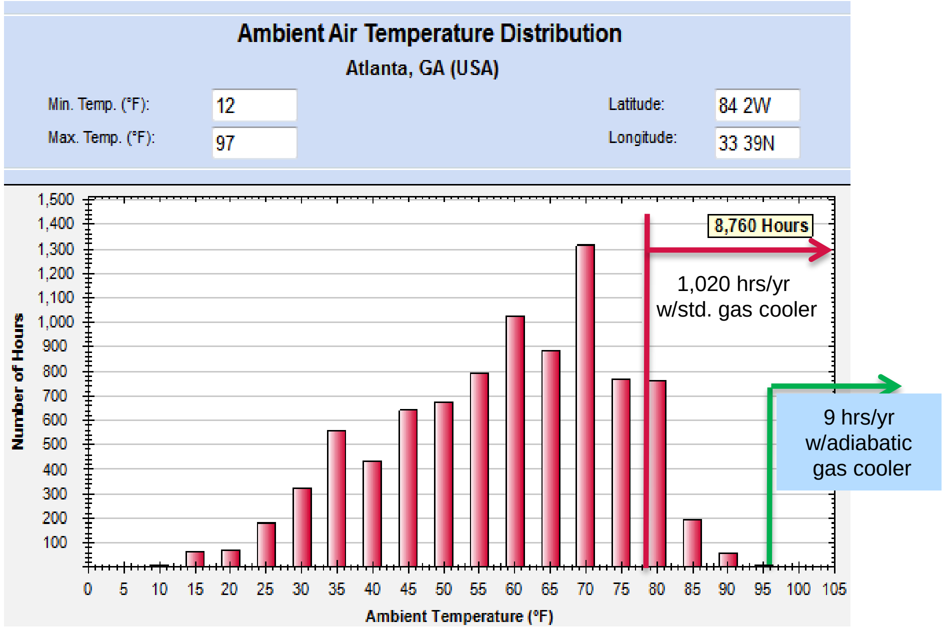
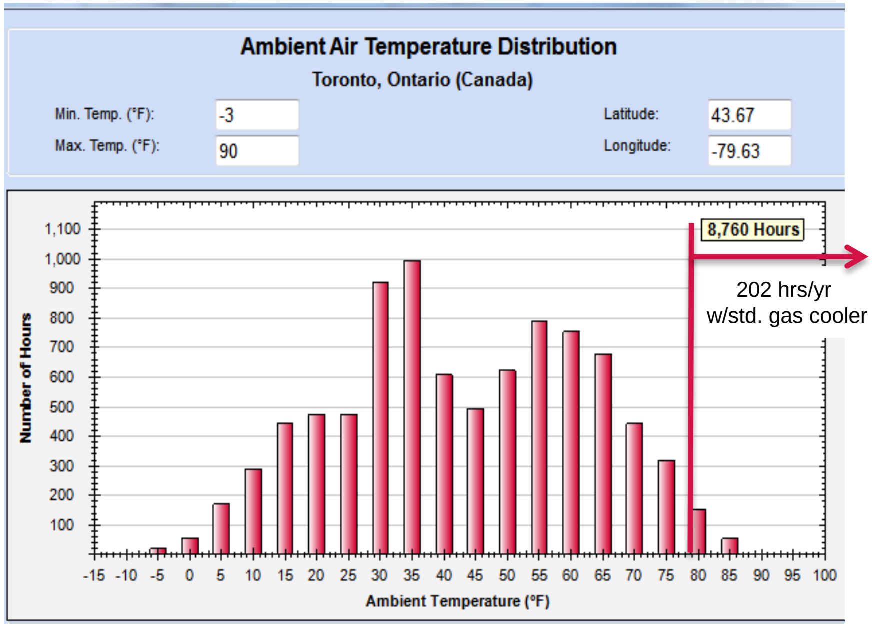
Time Spent in Transcritical

Atlanta, GA



Toronto, ON



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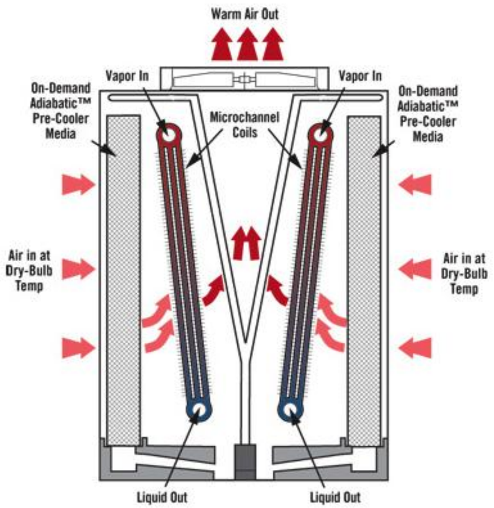
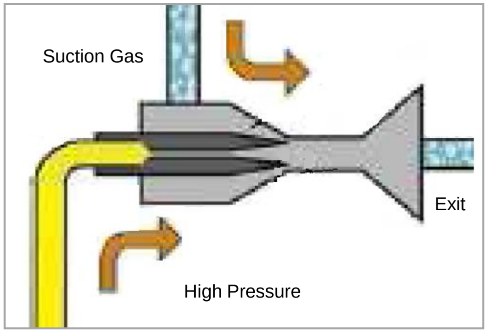
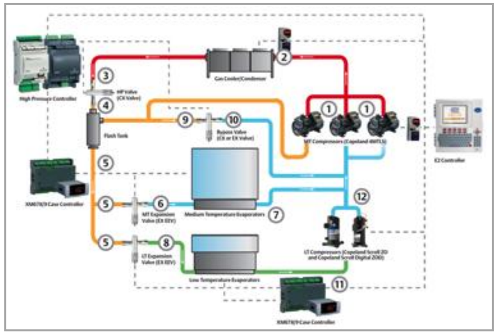
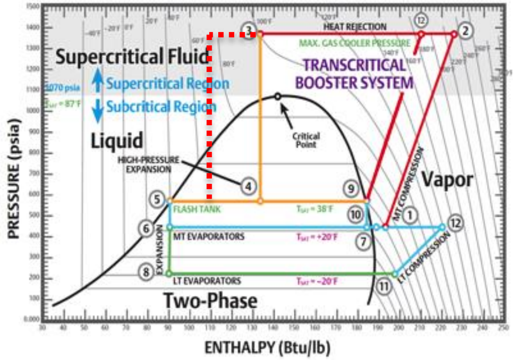
Five Ways of Improving Efficiencies in Warm Ambient Regions

- Spray Nozzles
- Adiabatic Gas Coolers
- Parallel Compression
- Sub-Cooling
- Ejectors









Question 2

- **Have you ever worked on a CO_2 system?**
  - No
  - yes
    - If yes; which type of System?
      1. Secondary (Using R744 as a secondary fluid)
      2. Hybrid Cascade
      3. Booster Transcritical System

Making Sense

Managing Power Outages

How to Mitigate Risk of Blowing Pressure Reliefs

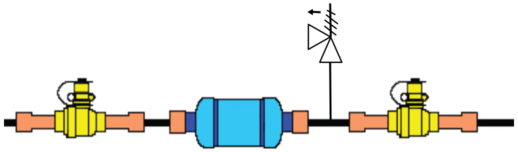
- **Generator and Standby Condensing Units**
- **Need a Refrigerant Plan**
  - Local Codes
  - Stock, Storage
  - Getting it to the Machine Room
- **Concerns With Resumption of Power**

Scroll Thrust Surface Galled

Semi-Hermetic Broken Reed

Service Peculiarities of R744

- Finding leaks is challenging
- Dedicated set of gauges, high-pressure hoses and miscellaneous parts at each store
- Preventative maintenance schedule is critical with R744
- Understand the consequences of trapping R744
- Training of service personnel is required
- Don't just call any "?? & Refrigeration Company" from the phone book for a quote on R744 systems



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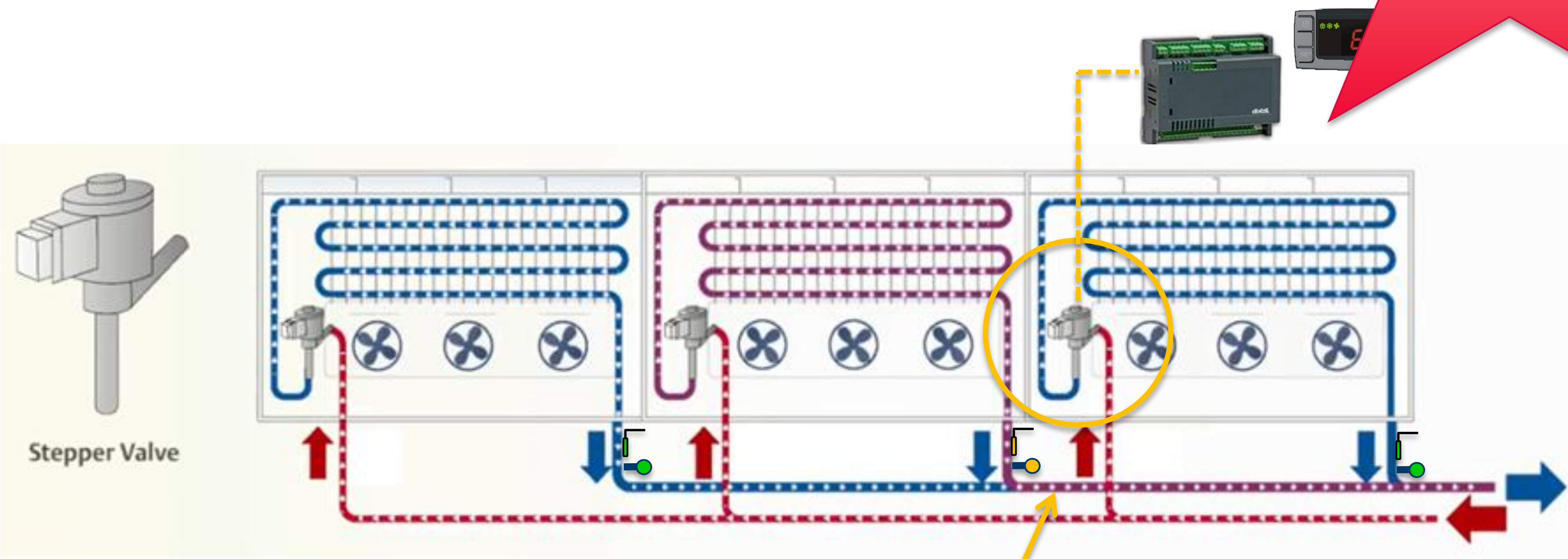
Evaporator Cooling With Closed EEV



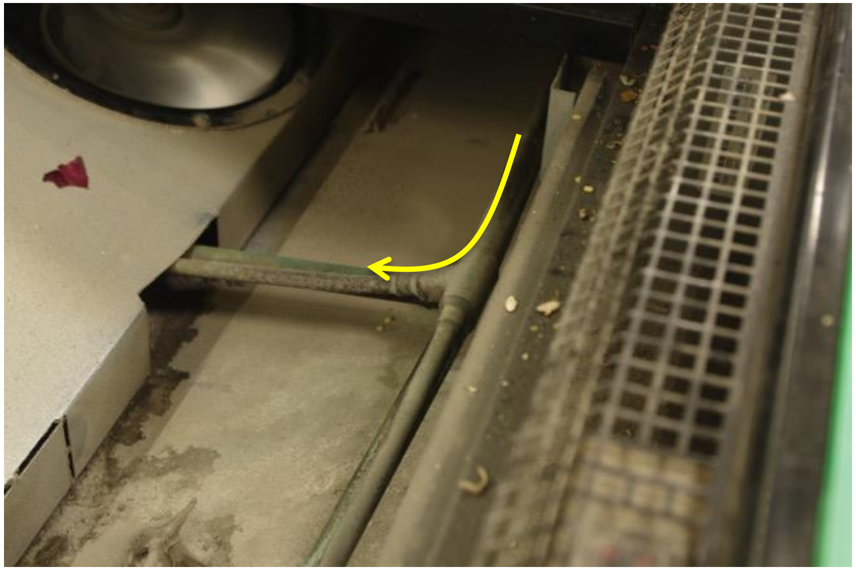
Flood Back

Evaporator Cooling With Closed EEV

- **Issue With Suction Piping Free**
- **Draining Down Into the Case**

Corrected Piping

NO Free Draining

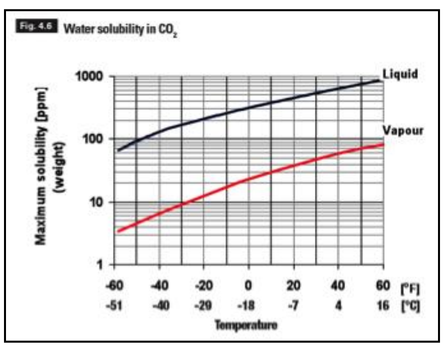


System Cleanliness / Dryness

System Cleanliness

Oil Separator Filter Photo

System Dryness



R744 CO_2 Sensitivity (PPM)				
Liquid Temperature	14 °F	32 °F	41 °F	68 °F
Very Dry	8	11	13	20
Dry/Caution	14	19	22	34
Caution/Wet	29	39	46	72
Wet	46	63	75	116

Steel Pipe

Pipe corrosion caused by carbonic acid

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R744 (CO_2) Cylinder From Linde

Dip Tube Line Designating Liquid Tank

Grade 4 = 99.99% Pure

Key Points to Take Away

- **R744 pressures are higher than HFCs but manageable**
- **Contractor must have strategy with “power off” conditions**
  - To deal with scheduled downtime
  - To deal with unscheduled downtime such as power outages
- **Understanding peculiarities of R744 will reduce maintenance cost and downtime**
- **System cleanliness, including dryness, is key to efficient operation**
- **Properly trained service company will ensure the lowest possible operating costs**

Contact

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Thank You!

Questions and Answers

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