Low Charge Ammonia Panel

ATMOsphere AMERICA
business case
natural refrigerants
25 & 26 June - Atlanta, Georgia

Kurt Liebendorfer
Vice President
Evapco, Inc.
Taneytown, MD

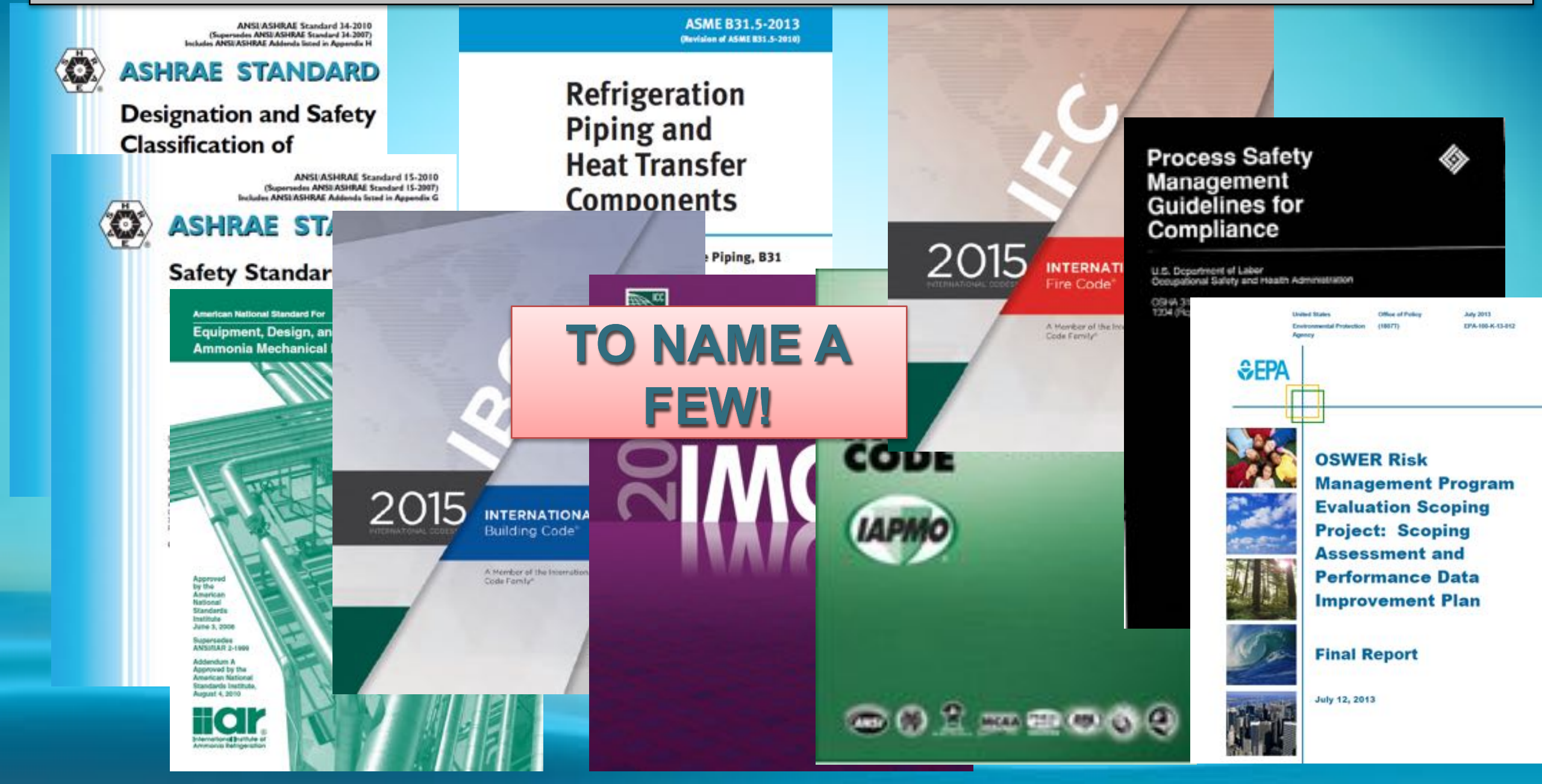
evapco® for LIFE

There is a wave coming for packaged solutions

How to safely ride the wave:

- **Code & Regulatory Compliance**
- **Research & Development + Testing**
- **Reliable & Repeatable Manufacturing**

MANY NATIONAL CODES THAT MUST BE COMPLIED WITH



TO NAME A FEW!

MANY NATIONAL CODES THAT MUST BE COMPLIED WITH

Lower Charge Lower Risk!

iiar

Tech Paper #5

Regulatory & Code Implications for Low Charge Ammonia Systems

Kurt Liebendorfer
Vice President
Evapco, Inc.

Abstract

How is the regulatory burden impacted by installing low charge ammonia refrigeration systems? With the rapidly growing interest, development and application of limited or low charge ammonia systems, there is an increasing need for market awareness and definition of what the benefits and/or implications are from a regulatory and code perspective for such a system, as compared to larger traditional or existing ammonia systems. For example, codes and standards such as OSHA, IIAR, ASHRAE, IIR, IMC and UMC all have various design references and/or criteria related to the quantity of refrigerant in a system, and specify actions or designs that must be undertaken as a result of their specific refrigerant threshold quantity (TQ). This paper will seek to identify these regulated threshold quantities among the various applicable codes or standards so that designers, contractors and end users can better understand the fact or fiction of the various threshold requirements.

This is a very large and broad undertaking because there are so many regulations, codes and standards that may or may not apply to all users. Therefore, the paper is also meant to set the stage for continued investigation, collaboration and validation on the subject matter. Many of the regulations and codes have been coordinated over the years and contain some common requirements. However, as shown in this paper, there is a lack of refrigerant threshold quantities related to charge management, as well as a lack of discussion on refrigerant quantity guidelines. Nevertheless, technological advances and industry awareness now provide a real opportunity to incorporate new TQ's into the regulations and codes. This continued work needs to influence regulatory agencies and code setting bodies to update their documents and to keep pace with the tremendous benefits that low charge technology provides the ammonia refrigeration industry.

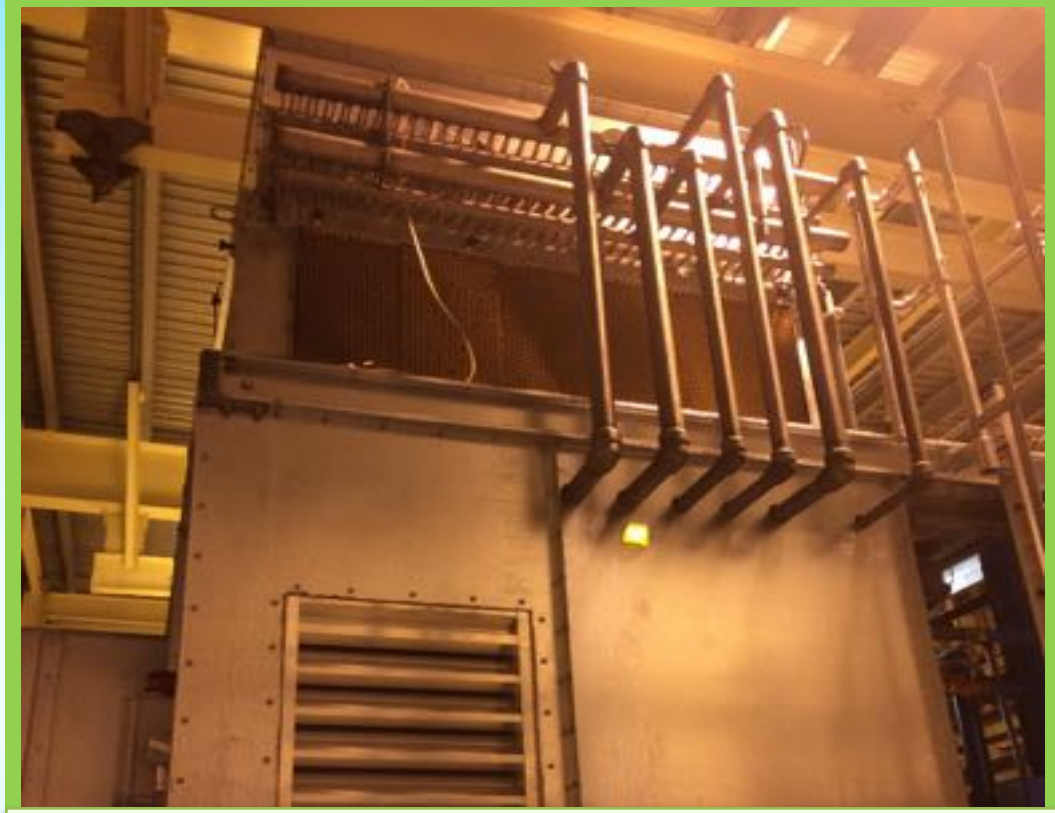
- However, codes and regulations have similar requirements & limited contradictions
- Codes and Regulations treat low charge systems and "typical" systems much the same
- Most criteria must be complied with regardless of the ammonia quantity
- All systems must understand safety intent of PSM due to OSHA's General Duty Clause
- Examples of Machine Rooms code requirements:
  - Required maintenance access
  - Ammonia detection
  - Safety controls
  - Safety relief compliance
  - Ventilation
- Packaged Low charge systems can make seismic code compliance easier & less costly

RESEARCH & DEVELOPMENT + TESTING


Low Temperature Laboratory (- 45°C)

RIGOROUS TESTING: 25 TR TEST UNIT

Air-Cooled
-20°/115°F Design



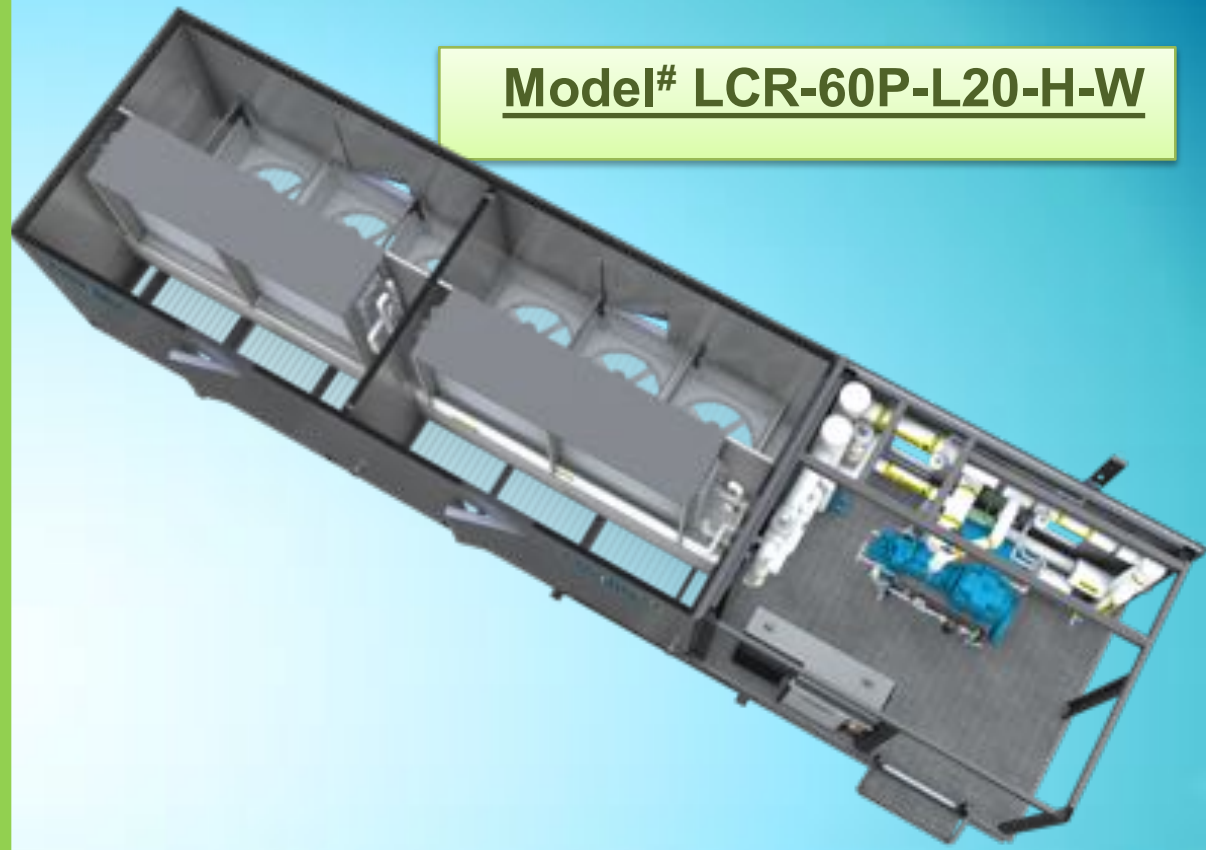
The complete unit operated at full & part loads in Evapco's Environmental Test Lab "D". Put thru extensive testing from -30ºF to 100ºF ambient. Unit continues to run today.

Completed June 2014 & Testing Continues Today

evapco® for LIFE

RIGOROUS TESTING: 60 TR TEST UNIT

Model# LCR-60P-L20-H-W



- Manufactured in Greenup, IL Factory
- Shipped to Taneytown for operational testing
- Unit commissioned on new test pad outside Wilson E. Bradley Research Center

evapco® for LIFE

evapco.com

RELIABLE & REPEATABLE MANUFACTURING

Market adoption of low charge ammonia systems will depend on the availability of:

- High quality product
- Low price product
- Reliable system operation
- Consistency & repeatable at high volumes

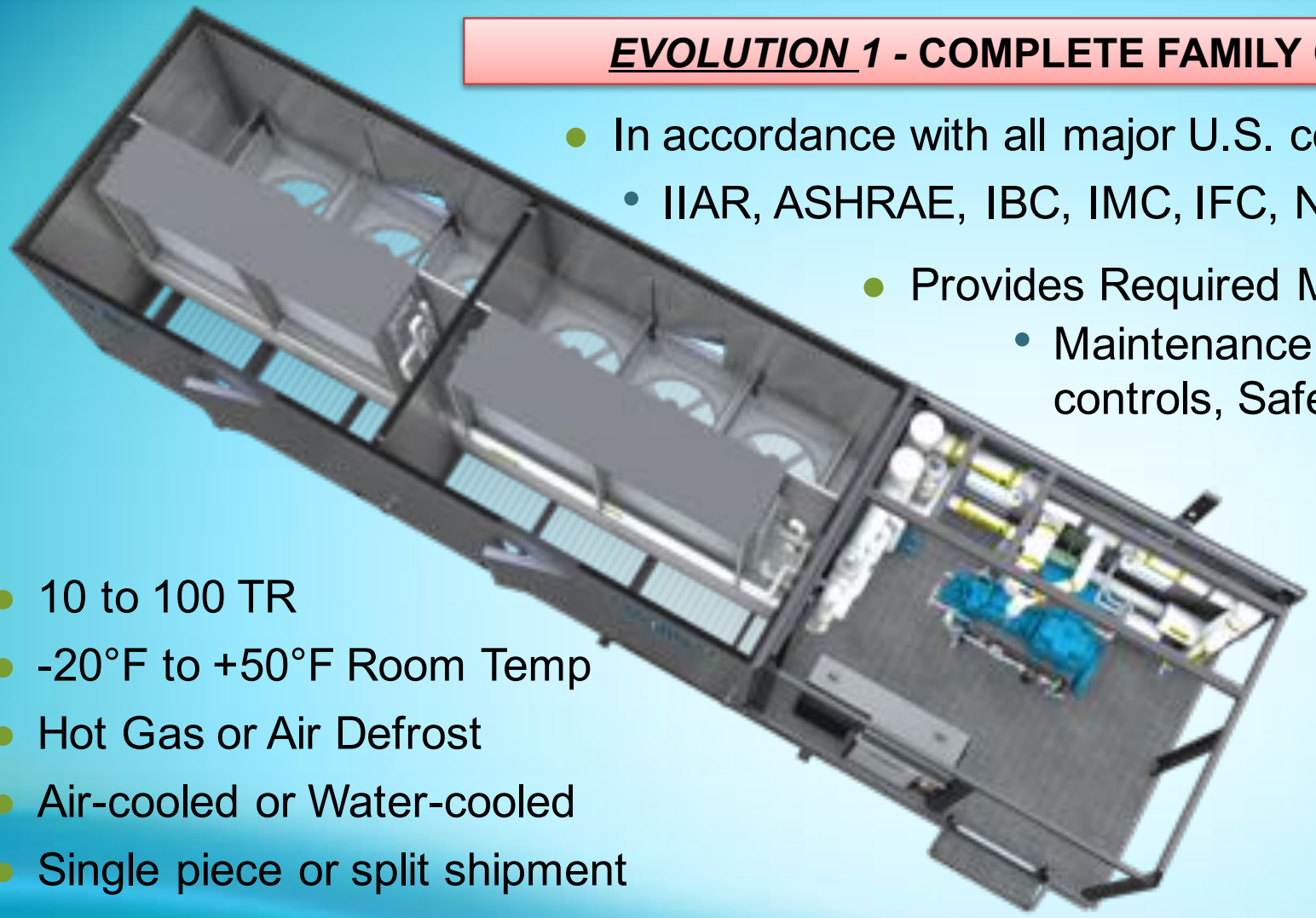
These attributes are proven to be most attainable thru advanced manufacturing processes

RELIABLE & REPEATABLE MANUFACTURING

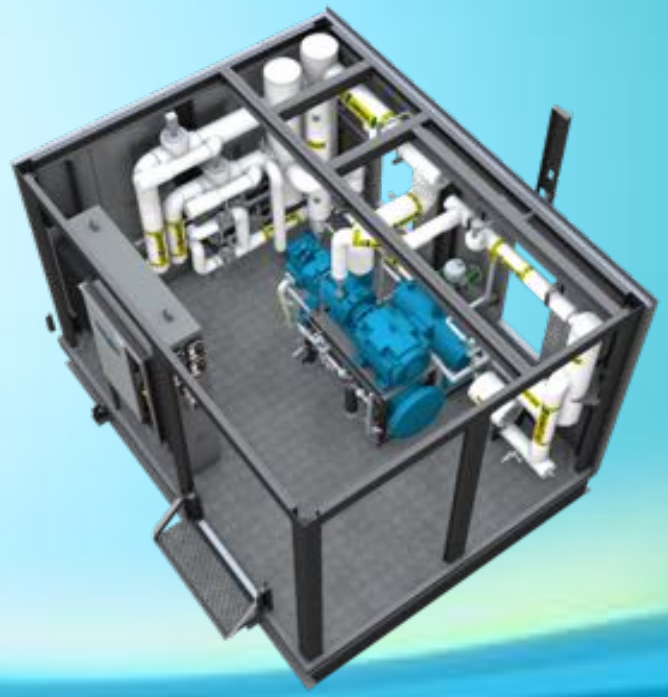
- Evapco expects the packaged low charge NH3 market to rapidly expand over the next 5 years and is positioning to serve that market.
- Field erected CO2/NH3 cascade solutions can be a competitive or alternate solution to NH3 low charge packaged solutions.
  - Advantages of the packaged NH3 approach are easier deployment, quicker installation and lower energy.
  - What if you had user friendly packaged CO2/NH3 cascade systems?
- Over time packaged NH3 solutions can help to close the training gap associated with the use of NH3 (which is often cited as a barrier to it being used more widely).
  - This is possible thru the standardization of the system & SOP's
- Evapco's approach to this market is to eventually expand the applications outside the industrial refrigeration sector.

MILESTONE FOR PACKAGED LOW CHARGE SYSTEMS

EVOLUTION 1 - COMPLETE FAMILY OF PRODUCTS – 250 MODELS



- In accordance with all major U.S. codes:
  - IIAR, ASHRAE, IBC, IMC, IFC, NEC, UL, ASME, ANSI, UMC & OSHA
- Provides Required Machine Room:
  - Maintenance access, Ammonia detection, Safety controls, Safety relief system & Ventilation……



- 10 to 100 TR
- -20°F to +50°F Room Temp
- Hot Gas or Air Defrost
- Air-cooled or Water-cooled
- Single piece or split shipment
- Single point 460V power connection
- Plug & Play

ATMOsphere AMERICA

business case

natural refrigerants

25 & 26 June - Atlanta, Georgia

Safely Ride The Wave thru…..

- Code & Regulatory Compliance
- Research & Development + Testing
- Reliable & Repeatable Manufacturing

And of course – the Evapco way, thru superior customer service!

THANK YOU!