



Overview of Ammonia Refrigeration Systems

A web-based course conducted by the
Industrial Refrigeration Consortium

Industrial Refrigeration Consortium
www.irc.wisc.edu

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This course has been designed to effectively deliver the basics of industrial ammonia refrigeration systems in an easy-to-use and convenient format over the Internet. The course consists of five two-hour sessions delivered in a one week period. A draft course outline has been provided below.



One of the principal benefits of this educational opportunity is the ability to participate without having to travel. Through this delivery format, we are able to maximize the information that you derive from the course while minimizing lost productivity associated with traveling to another location to participate. Companies of attendees benefit by minimizing productivity loss and scheduling impacts, and by avoiding travel expenses.

This course is intended and designed for those who need an overview of the principles of industrial refrigeration systems and key aspects involved with safely operating these systems. In the past, a wide range of staff have benefited from participating in this course including: *plant safety staff, PSM coordinators, refrigeration system operators, plant engineers, plant managers, contractors*, as well as utility and other personnel who want to increase their understanding of ammonia refrigeration systems.

Advantages of E-Learning

In its quest to provide companies with affordable and unified training for employees, the IRC has refined its development of web-based training. Some of the advantages include:

- Training is delivered live by qualified instructors.
- A uniform training program can be delivered to all employees across multiple plants.
- Eliminates travel costs for both students and instructors.
- Can be tailored to your company's training needs.
- Session can be recorded and played back at a later date.
- Students have multiple ways to interact with instructor both during and after class.
- Homework and exams are to verify their level of comprehension.

All web-based courses offered by the IRC feature 1 or 2 instructors providing live audio feed over phone lines while participants view slides, documents, images and animations over their internet connection. Participants can interact with the instructors both on-line and by telephone during the course or can contact the instructors after the session has ended. Most courses are taught in 2 to 4 hour segments over several days. This allows participants stay productive within their plants since there is no off-site travel.

These courses are intended to build employee's understanding of refrigeration theory and fundamentals. Our experience has shown that employees with this sound knowledge make better decisions in their plants-particularly during upset conditions. This foundation of knowledge also makes employees better equipped to receive plant-specific procedure training as required by PSM.

Course Outline

Ammonia – Why is it the Refrigerant of Choice?

- Refrigerant Characteristics
 - Physical, thermodynamic properties
 - Health effects, flammability issues
 - Refrigerant selection criteria
 - Comparison to halocarbons
 - Basic protection practices

Refrigeration Systems Overview

- Basic components
- High-side and low-side components
- Overview of systems: direct expansion, flooded, liquid overfeed

Overview of Properties

- Fundamental properties: pressure, volume, temperature
- Refrigerant phases and behavior during phase change
- Diagram: pressure vs. enthalpy
- Flash gas concepts

Safety Regulations

- OSHA Process Safety Management
- EPA Risk Management Planning
- Incidents
- Reportable releases

Refrigeration System Components: Condensers

- Types: air-cooled, water-cooled, evaporative
- Theory of operation
- Factors influencing performance
- Wet/dry operation
- Fan alternatives: single, two, & variable speed

Refrigeration System Components: Evaporators

- Evaporator Arrangements:
 - Direct-expansion
 - Pumped overfeed
 - Flooded
- Applications
 - Ice banks
 - Scraped surface heat exchangers
 - Bulk storage silos
 - Blast freezing
 - Shell-and-tube
 - Plate and frame / welded plate

Refrigeration Components: Compressors

- Theory of operation: reciprocating, single screw & twin screw
- Configuration: open drive, semi-hermetic, hermetic
- Capacity control/unloading
- Compressor ratings and performance characteristics
- Methods of oil cooling

Refrigeration Components: Valves / Metering Devices

- Valves that stop flow
- Valves that control flow
- Valves that provide safety protection

Safety-Related Components

- Compressors
 - high / low pressure cut-outs
 - oil-related
 - excess vibration systems
- Pressure relief valves
- Accumulator level cut-outs
- Hydraulic lock-up and hydrostatic relief

Refrigeration Systems

- Review of single stage compression systems
- Introduction to multi-stage compression system
- Direct and in-direct liquid expansion
- P&IDs and their importance

Web-based courses currently offered by the IRC

- Advanced Refrigeration Systems for Operators
- Ammonia Awareness Training for Employees
- Intermediate Refrigeration Systems for Operators
- Introduction to Refrigeration Systems for Operators
- Overview of Ammonia Refrigeration Systems

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