Ammonia Refrigeration Series

Introduction to Ammonia Refrigeration Systems

October 14–16, 2015
Madison, Wisconsin

March 2–4, 2016
Madison, Wisconsin

Understand basic theory and system operation as you focus on:

- Refrigeration cycle basics
- Refrigeration system components and layout
- Overview of safety issues, including OSHA and EPA regulations

Easy enroll options: online or toll free. See inside.
Update Your Knowledge
Learn about a proven, long-term refrigerant used in food production and storage facilities: anhydrous ammonia. Anhydrous ammonia is a “natural refrigerant” that has zero ozone-depleting potential and near-zero global warming potential. Successfully used in the industrial sector for decades, ammonia may offer you an attractive option to counter the phase-out of CFC- and HCFC-based refrigerants and the uncertain future of HFC refrigerant alternatives.

Attend this course and discover why interest in ammonia refrigeration systems has never been higher!

Understand Basic Theory and System Operation
Receive a foundational understanding of the principles and practices of ammonia refrigeration systems. The course will develop your background in refrigerants (ammonia), thermodynamics, refrigeration cycles, and related equipment, as applied to ammonia refrigeration systems.

Because this is an introductory level course, you can benefit without extensive prior knowledge of fluid properties, thermodynamics, or refrigeration system theory. However, the course will also be helpful to those with prior knowledge in the areas covered.

Benefits for You
- Learn best practices for ammonia system safety and operation
- Understand equipment used in ammonia systems
- Get answers to your specific questions
- Avoid operational risks by having a solid understanding of ammonia refrigeration
- Receive a valuable set of notes on ammonia refrigeration

Who Should Attend
This course has been specifically designed for:
- Refrigeration system operators and technicians
- Plant engineers and managers
- Maintenance supervisors
- Facilities engineers; application engineers
- Contractors
- Utility and industrial representatives
- PSM coordinators
- Others wanting to gain more knowledge of ammonia refrigeration systems

Stressing the basics required to understand ammonia refrigeration systems, the course will be ideal for those who wish to build their knowledge of ammonia refrigeration.

Key Course Topics
- Material compatibility issues
- Safety issues
- OSHA and EPA regulations
- Refrigeration cycle basics
- Refrigeration system components

Instructors
James L. Denkmann received a BSME degree from Washington University. He spent 10 years in mechanical contracting and then served as a project manager with several large consulting firms. In 1986, he started his own consulting firm in Chicago, Illinois, concentrating on thermal storage and refrigeration systems. Denkmann is also an instructor in the University of Wisconsin–Madison’s Design of Ammonia Refrigeration Systems for Peak Performance and Efficiency course.

Daniel Dettmers is an associate researcher with the Industrial Refrigeration Consortium at the University of Wisconsin–Madison. Dettmers’ expertise includes mechanical integrity, long-range refrigeration system planning, refrigeration system design, and related areas. An experienced instructor, he provides seminar training and technical presentations to a variety of audiences. Dettmers is a principal author of the IRC’s mechanical integrity guidebooks.

Todd B. Jekel, PhD, PE, is a research scientist and assistant director with the Industrial Refrigeration Consortium (IRC) at the University of Wisconsin–Madison. Jekel has been actively conducting research on refrigeration systems including vessel design practices, oil separators, and analysis of dehumidification alternatives for cold storage warehouses.

Douglas T. Reindl, PhD, PE, holds degrees from the Milwaukee School of Engineering and the University of Wisconsin–Madison. He has authored or co-authored four books and numerous technical papers on all aspects related to industrial refrigeration systems. Reindl is a professor in the Department of Engineering Professional Development at the University of Wisconsin–Madison and director of the Industrial Refrigeration Consortium.

Past Participants Say…
“EXCELLENT CONTENT AND PRESENTATION.”
“NOW I FEEL I CAN SAFELY AND COMFORTABLY CONTROL OUR PLANT.”
“OUTSTANDING!”
“The course provided an easy, logical explanation of refrigeration basics.”
“This was a great class. Both teachers did a tremendous job in sharing their expertise.”
“This will help me immediately in my job.”
“Exceeded expectations. Direct application to my current responsibilities and gave me plenty to look at and hopefully improve when I return. I’m looking forward to future courses.”
“Absolutely worth the time.”

ENROLL ONLINE TODAY!
Course Schedule
The course will follow approximately the agenda below. Duration of individual sections of the agenda may vary based on participant interests.

Day 1
Course Introduction
Douglas T. Reindl
Professor, Engineering Professional Development
Director, Industrial Refrigeration Consortium (IRC)
University of Wisconsin–Madison

Refrigeration Systems Overview
• Refrigeration technology alternatives
• Refrigerants and refrigerant selection criteria
• Introduction to system types: direct expansion, flooded, and overfeed

Overview of Refrigerant Properties
• Fundamental properties: pressure, volume, and temperature
• Derived properties: enthalpy, internal energy, and transport
• Refrigerant phases and behavior during phase change
• Latent and sensible energy changes
• Diagrams: pressure vs. enthalpy
• Refrigerant comparison: CFCs, ammonia, water, and CO2
• Flash gas concepts

Refrigerant Property Workshop

Safety in Ammonia Refrigeration
• Safety and health issues associated with refrigerants
• Flammability considerations
• Prevention of incidents and accidents

Overview of Process Safety Management and Risk Management Programs
• Applicability
• Key elements of OSHA’s process safety management program
• EPA’s risk management program

Day 2
Machinery Room Safety Practices
• Definitions
• Equipment
• Key safety systems: ammonia detection, ventilation, emergency controls, and eye wash and shower stations

Refrigeration System Components: Compressors
• Technology alternatives
• Configuration: open drive vs. semi-hermetic or hermetic
• Theory of operation screw (single/twin) and reciprocating
• Capacity control/unloading
• Volume ratio concepts

Refrigeration Systems Workshop
• Identifying cycle state points
• Completing cycle layouts

Refrigeration System Components: Condensers
• Types of heat rejection equipment
• Principles of operation
• Operational considerations

Refrigeration System Components: Valves
• Stop valves
• Check valves
• Regulators
• Expansion valves: thermostatic, electronics, hand, and floats
• Safety relief

Refrigeration Cycle Review

Refrigeration System Components: Evaporators
• Feed configurations: DX, flooded, and liquid overhead
• Air units: ceiling-hung, penthouse/high temperature, and low temperature
• Chillers: plate-and-frame, and shell-and-tube
• Defrost

Refrigeration System Components: Vessels and Pumps
• High-side vessels: high-pressure receiver, thermostiphon pilot, and controlled-pressure receiver
• Low-side vessels: suction traps and transfer stations, recirculators, and surge drums
• Transfer systems
• Liquid refrigerant pumps

Open Discussion

Day 3
Refrigeration Cycle Review

Industrial Refrigeration Consortium (IRC)
The IRC, a collaborative effort between the University of Wisconsin–Madison and industry, offers its members practical refrigeration information and application-oriented research, a telephone hotline, Internet-based information resources, on-site technical assistance, and specialized publications.

To learn more, check the IRC website at irc.wisc.edu, email IRC director Douglas Reindl, dreindl@wisc.edu, or phone toll free 866-635-4721.
Four Easy Ways to Enroll

- Internet: epd.engr.wisc.edu/ammoniarefrigeration
- Phone: 800-462-0876 or 608-262-1299 (TDD 265-2370)
- Mail to: The Pyle Center Attn: Engineering Registration 702 Langdon Street Madison, Wisconsin 53706
- Fax: 800-442-4214 or 608-265-3448

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Course Information
Please enroll me in Introduction to Ammonia Refrigeration Systems
- Course #P519 October 14–16, 2015 in Madison, Wisconsin Fee: $1295
- Course #P519 October 14–16, 2015 in Madison, Wisconsin Industrial Refrigeration Consortium (IRC) Member Fee: $1095
- Course #P950 March 2–4, 2016 in Madison, Wisconsin Fee: $1295
- Course #P950 March 2–4, 2016 in Madison, Wisconsin Industrial Refrigeration Consortium (IRC) Member Fee: $1095
- I cannot attend at this time. Please send me brochures on future courses.

Related Courses from UW–Madison
Principles and Practices of Mechanical Integrity for Industrial Refrigeration Systems November 4–6, 2015
Course #P520
Course #P521
Course #P951
September 7–9, 2016
Course #R155
Course #P952
Design of Ammonia Refrigeration Systems for Peak Performance and Efficiency September 12–16, 2016
Course #R156
To receive a brochure for any of these courses, please call 800-462-0876 or send an email message to custserv@epd.engr.wisc.edu. You can also check out these courses on our website: epd.engr.wisc.edu/ammoniarefrigeration.

Need to Know More?
Call toll free 800-462-0876 and ask for
Program Director: Douglas Reindl dreindl@wisc.edu
Program Associate: Mary Danielson
Or email: custserv@epd.engr.wisc.edu

General Information
Fee Covers Notebook, course materials, break refreshments, lunches, and certificate.
Cancellation If you cannot attend please notify us at least seven days prior to the course start and we will refund your fee. Cancellations received after that date and no-shows are subject to a $150 administrative fee per course. You may enroll a substitute at any time before the course starts.
Location The Pyle Center, 702 Langdon Street, Madison, WI. Phone messages: 608-262-1122.
Please note: Be sure to bring your calculator for problem workshop sessions.

Related Courses from UW–Madison
- Principles and Practices of Mechanical Integrity for Industrial Refrigeration Systems
  - Course #P520
- Intermediate Ammonia Refrigeration Systems
  - Course #P521
- Fundamentals of HVAC
  - Course #P951
- September 7–9, 2016
  - Course #R155
- Ammonia Refrigeration System Safety
  - April 13–15, 2016
  - Course #P952
- Design of Ammonia Refrigeration Systems for Peak Performance and Efficiency
  - September 12–16, 2016
  - Course #R156
To receive a brochure for any of these courses, please call 800-462-0876 or send an email message to custserv@epd.engr.wisc.edu. You can also check out these courses on our website: epd.engr.wisc.edu/ammoniarefrigeration.

Accommodations
October 14–16, 2015
We have reserved a block of guest rooms (rates starting at $94, including continental breakfast) at Lowell Center, 610 Langdon Street, Madison, WI. Reserve a room online at epd.engr.wisc.edu/lodgingP950 or call 866-301-1753 or 608-256-2621 and indicate that you will be attending this course under group code P519EPD. Room requests after September 13 will be subject to availability. Other fees and restrictions may apply.
We have reserved a second block of guest rooms (rates starting at $129, including private airport taxi and parking) at Graduate Madison, 601 Langdon Street, Madison, WI. Reserve a room online at epd.engr.wisc.edu/lodgingBP519 or call 800-589-6285 or 608-257-4391 and indicate that you will be attending this course under group code OCT2015. Room requests after September 22 will be subject to availability. Other fees and restrictions may apply.
March 2–4, 2016
We have reserved a block of guest rooms (rates starting at $119, including continental breakfast) at Lowell Center, 610 Langdon Street, Madison, WI. Reserve a room online at epd.engr.wisc.edu/lodgingP950 or call 866-301-1753 or 608-256-2621 and indicate that you will be attending this course under group code P519EPD. Room requests after February 1 will be subject to availability. Other fees and restrictions may apply.

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