Ammonia Refrigeration Series

Introduction to Ammonia Refrigeration Systems

October 9–11, 2013
Madison, Wisconsin

March 5–7, 2014
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
Introduction to Ammonia Refrigeration Systems
October 9–11, 2013 in Madison, Wisconsin ■ March 5–7, 2014 in Madison, Wisconsin

Update Your Knowledge
This practical course is your opportunity to learn more 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
This course will provide you with a foundational understanding of the principles and practices of ammonia refrigeration systems. The course content will focus on developing 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 an extensive prior knowledge of fluid properties, thermodynamics, or refrigeration system theory. As a refresher, 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

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."

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.

Please note: Be sure to bring your calculator for problem workshop sessions.

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

Course Staff
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 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 related 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.
Course Schedule
The course will follow approximately the agenda below. Duration of individual sections of the agenda may vary based on participant interests.

Day One
8:00 Registration and Continental Breakfast
The Pyle Center
702 Langdon Street
Madison, WI
8:15 Course Introduction
Douglas T. Reindl
Professor, Engineering Professional Development
Director, Industrial Refrigeration Consortium (IRC)
University of Wisconsin–Madison
8:30 Refrigeration Systems Overview
• Refrigeration technology alternatives
• Refrigerants and refrigerant selection criteria
• Introduction to system types: direct expansion, flooded, and overfeed
10:30 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
12:00 Lunch

Day Two
7:45 Continental Breakfast and Conversation
8:15 Machinery Room Safety Practices
• Definitions
• Equipment
• Key safety systems: ammonia detection, ventilation, emergency controls, and eye wash and shower stations
10:30 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
12:00 Lunch
1:00 Refrigeration Systems Workshop
• Identifying cycle state points
• Completing cycle layouts

Day Three
7:45 Continental Breakfast and Conversation
8:00 Refrigeration Cycle Review
9:45 Refrigeration System Components: Condensers
• Types of heat rejection equipment
• Principles of operation
• Operational considerations
3:30 Refrigeration System Components: Valves
• Stop valves
• Check valves
• Regulators
• Expansion valves: thermostatic, electronics, hand, and floats
• Safety relief
5:00 Adjourn

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, e-mail IRC director Douglas Reindl, dreindl@wisc.edu, or phone toll free 866-635-4721.

Bring UW–Madison Expertise to Your Organization!
On-site training can equip your employees in skill areas critical to your success. We can:
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• Empower your employees to quickly translate practical knowledge into productive work
UW–Madison can help you meet your training goals! Contact Corporate Education Director Carl Vieth (608-263-7424 or vieth@wisc.edu) to discuss your opportunities. Or see epd.engr.wisc.edu/onsite.
Four Easy Ways to Enroll

Internet: http://epd.engr.wisc.edu

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

Course Information

Please enroll me in Introduction to Ammonia Refrigeration Systems

- Course #N219 October 9–11, 2013 in Madison, Wisconsin Fee: $1195
- Course #N219 October 9–11, 2013 in Madison, Wisconsin Industrial Refrigeration Consortium (IRC) Member Fee: $995
- Course #P022 March 5–7, 2014 in Madison, Wisconsin Fee: $1195
- Course #P022 March 5–7, 2014 in Madison, Wisconsin Industrial Refrigeration Consortium (IRC) Member Fee: $995
- I cannot attend at this time. Please send me brochures on future courses.

Personal Information (Please print clearly.)

Name ___________________________________________________________
Title ___________________________________________________________
Company _______________________________________________________
Address _______________________________________________________
City/State/Zip __________________________________________________
Phone (_______) ___________________ Fax (_______) ___________________
E-mail _________________________________________________________

Related Courses from UW–Madison

Fundamentals of HVAC
March 12–14, 2014
Course #P023
September 17–19, 2014
Course #P030

Ammonia Refrigeration System Safety
April 14–16, 2014
Course #P024

Achieving Energy Cost Savings for Ammonia Refrigeration Systems
May 19–21, 2014
Course #P025

Design of Ammonia Refrigeration Systems for Peak Performance and Efficiency
September 8–12, 2014
Course #P028

Principles and Practices of Mechanical Integrity for Industrial Refrigeration Systems
November 5–7, 2014
Course #P033

Intermediate Ammonia Refrigeration Systems
December 3–5, 2014
Course #P034

To receive a brochure for any of these courses, please call 800-462-0876 or send an e-mail message to custserv@epd.engr.wisc.edu. You can also check out these courses on our website: epd.engr.wisc.edu/ammoniarefrigeration.

Earn Continuing Education Credit

By participating in this course, you will earn 20 Professional Development Hours (PDH) or 2.0 Continuing Education Units (CEU).

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.

Accommodations

October 9–11, 2013
We have reserved a block of guest rooms (rates starting at $89, including continental breakfast) at Lowell Center, 610 Langdon Street, Madison, WI. Reserve a room online at epd.engr.wisc.edu/lodgingN219 or call 866-301-1753 or 608-256-2621. Room requests after September 10 will be subject to availability. Other fees and restrictions may apply.

We have reserved a second block of guest rooms (rates starting at $89, including parking and Madison Taxi’s sliver cab from airport) at Campus Inn, 601 Langdon Street, Madison, WI. Reserve a room online at epd.engr.wisc.edu/lodgingN219 or call 800-589-6285 or 608-257-4391 and indicate that you will be attending this course under group code 128060. Room requests after September 17 will be subject to availability. Other fees and restrictions may apply.

March 5–7, 2014
A block of hotel rooms will be made available for this course. Please check our website epd.engr.wisc.edu for more information.

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 e-mail custserv@epd.engr.wisc.edu