Ammonia Refrigeration Series

Design of Ammonia Refrigeration Systems for Peak Performance and Efficiency

September 14–18, 2015
Madison, Wisconsin

- Understand refrigeration design principles and practices
- Learn techniques to size and properly lay out system components
- Design safer, more efficient systems

“THIS COURSE WAS GREAT! I REALLY ENJOYED THE GROUP PROJECTS. I CAN SEE WHY OTHERS RETAKE THIS COURSE.”

ENROLL ONLINE TODAY!
Or visit our website.
Design Efficient, High-Performance Systems
Ammonia refrigeration systems are custom designed and constructed to achieve one or more process objectives. The trend in design today is toward systems that can accommodate multiple process objectives while enhancing performance, efficiency, and safety.

This practical five-day course is your opportunity to gain valuable insight into industrial refrigeration system design guidelines and practices that are used in industry today. Your participation in this course will also give you new and valuable understanding of the principles and practices that result in successful ammonia refrigeration system designs.

Key Course Topics
- Refrigeration loads
- Evaporator operation, sizing, and piping
- Valves and valve selection
- Heat rejection system operation and sizing
- Vessel sizing and layouts
- Liquid refrigerant pump operation, selection, and sizing
- Compressor technologies and selection
- Refrigerant piping

Who Should Attend
Owners, plant operators, supervisors, engineers, and designers: Attend this course to develop the skills and capabilities that will enhance your ability to be a smart consumer of refrigeration engineering, design, and build services.

Contractors: Attend this course and get the latest information on system design and operating practices. This course will give you knowledge essential to achieving a competitive advantage. Attend and distinguish yourself from your competitors.

Consulting engineers: Attend and enhance your design skills.

Benefits for You
- Increase your understanding of ammonia refrigeration design principles and practices
- Learn techniques to “right size” and properly lay out system components
- Find out how to design safer systems
- Expand your knowledge of ammonia refrigeration
- Receive a valuable set of ammonia refrigeration notes

Past Participants Say…

“I got a great overview and exposure to the details. I will definitely be a smarter customer for both design services and equipment supply. Also, got some energy tips I’ll be looking at.”

“All was excellent, from the knowledge and skills of the speakers to the facility.”

“I got an extremely well-rounded education on refrigeration systems and associated engineering.”

“I have a completely new perspective on design. The course really cleared up a lot of things in my systems and how they operate.”

“Great course for designers, owners, consultants—anyone around the engine room or plant in general.”

“Very helpful for troubleshooting and problem solving on current systems.”

Your 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 industrial refrigeration systems. He continues today as the principal of his consulting firm with activities expanding into process safety management.

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, is a professor and director of the Industrial Refrigeration Consortium (IRC) at the University of Wisconsin–Madison. Experienced with field evaluation of industrial refrigeration systems, he conducts research related to improving the performance, efficiency, and safety of industrial refrigeration systems.

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.
Course Outline

Day 1

Welcome and Introduction
Douglas T. Reindl
Professor, University of Wisconsin–Madison
Director, Industrial Refrigeration Consortium

Design Considerations for Energy Efficiency
- Review of systems: single-stage, multi-stage, swing
- Single vs. two-stage
- Energy efficiency considerations for industrial refrigeration systems
Douglas T. Reindl

Load Calculations and Psychrometrics
- Temperature requirements
- Load types: envelope, product, internal, equipment, infiltration
- Psychrometrics review
- Sensible and latent loads
- Infiltration loads: theory vs. real-world
- Rules-of-thumb
Todd B. Jekel
Assistant Director, Industrial Refrigeration Consortium

Load Calculation Workshop

Evaporators
- Types
- Performance characteristics
- Manufacturer’s rating methods
- Selection process
- Variable speed drive fans
- Energy efficiency considerations
James L. Denkmann
President, DTS, Ltd.

Assign Homework – Class Design Project
- Preliminary refrigeration system layouts
- Load calculation
- Evaporator selection/layout
Douglas T. Reindl

Adjourn to Work on Class Project

Day 2

Homework Review

Valves and Valve Selection
- Valve types and uses
- Typical valve groups
- Actuating methods (direct-acting, pilot-operated)
- Installation considerations
- Safety considerations
- Energy efficiency considerations
James L. Denkmann

Condensers
- Performance characteristics
- Sizing considerations
- Selection
- Piping considerations (traps, vent line sizing, drainers)
- Fan alternatives: single-speed, two-speed, and variable-speed
- Energy efficiency considerations
Douglas T. Reindl

Condenser Selection Workshop
Douglas T. Reindl

Vessels
- Types: high-pressure receiver, thermosiphon, low-pressure accumulator, flash intercooler
- Configurations: horizontal or vertical
- Ratings
- Proper practices for system integration
- Knock-out velocity
- Refrigerant level control
Todd B. Jekel

Vessel Sizing/Selection Workshop
Todd B. Jekel

Assign Homework
- Evaporator valve selection and valve train layout
Staff

Adjourn to Work on Class Project

Day 3

Homework Review

Liquid Refrigerant Pumps
- Pump types and performance curves
- Net positive suction head: required and available
- Pump selection
- Energy efficiency considerations
Douglas T. Reindl

Compressors
- Compressor technologies
- Compressor ratings
- Full-load and part-load operation
- Oil cooler heat rejection methods (screw compressors)
- Volume ratio (fixed and variable)
- High stage and booster selection
- Energy efficiency considerations
Douglas T. Reindl

Class Design Project

Assign Homework
- Select compressors
- Select condensers
Staff

Adjourn to Work on Class Design Project

Day 4

Homework Review

Refrigerant Piping
- Sizing vapor lines (suction, discharge, hot gas)
- Liquid line sizing
- Wet return line sizing
- Piping practices to minimize potential for hydraulic hammer
- Riser pipe sizing methods
- Energy efficiency considerations
James L. Denkmann
Douglas T. Reindl

Refrigerant Piping Workshop

Heat Recovery Opportunities
- Assessing the potential for heat recovery in ammonia systems
- Heat exchanger options
Douglas T. Reindl

Design Project
Assign Homework
- Class design project
Staff

Adjourn to Work on Class Design Project

Day 5

Homework Review

Finalize Design Project

Design Project Presentations

Question/Answer Session

Final Adjournment

Course Schedule

Registration and course will be held at:
The Pyle Center
702 Langdon Street
Madison, WI

Day 1
8:00 a.m. to 8:30 a.m. Registration and Continental Breakfast
8:30 a.m. to 5:00 p.m. Class

Days 2–4
8:00 a.m. to 8:15 a.m. Coffee and Conversation
8:15 a.m. to 5:00 p.m. Class

Day 5
8:00 a.m. to 8:15 a.m. Coffee and Conversation
8:15 a.m. to 2:00 p.m. Class
Midmorning and midafternoon refreshment breaks and noon lunch will be provided all five days.
Four Easy Ways to Enroll

Internet: epd.engr.wisc.edu/webP517
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 Design of Ammonia Refrigeration Systems for Peak Performance and Efficiency

☐ Course #P517 September 14–18, 2015 in Madison, Wisconsin Fee: $1595
☐ Course #P517 September 14–18, 2015 in Madison, Wisconsin Industrial Refrigeration Consortium Member Fee: $1395
☐ 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

Look for the following courses in the University of Wisconsin’s ammonia refrigeration series, including:

- Process Hazard Analysis (Emphasizing Ammonia Refrigeration Systems) September 23–25, 2015 Course #P518
- Introduction to Ammonia Refrigeration Systems October 14–16, 2015 Course #P519
- March 2–4, 2016 Course #P519
- March 2–4, 2016 Course #P520
- Intermediate Ammonia Refrigeration Systems December 2–4, 2015 Course #P521

- Process Safety Management Audits for Compliance and Continuous Safety Improvement January 13–15, 2016 Course #P949
- Ammonia Refrigeration System Safety April 13–15, 2016 Course #P952

To receive additional information on any of these courses, please call toll free 800-462-0876 and ask for Douglas Reindl, program director. You can also send an email message to custserv@epd.engr.wisc.edu or check out these courses on our website at epd.engr.wisc.edu/ammoniarefrigeration.

Need to Know More?

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

Additional Enrollees

Name ________________________________
Title ________________________________
E-mail ____________________________________

Billing Information

☐ Bill my company ☐ P.O. or check enclosed (Payable in U.S. funds to UW–Madison)

Cardholder's Name ________________________________
Card No. ________________________________ Exp. ________________________________
Payable in U.S. funds to UW–Madison

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 This course will be held at The Pyle Center, 702 Langdon Street, Madison, WI. Phone messages: 608-262-1122.

Accommodations 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/lodgingP517 or call 866-301-1753 or 608-256-2621 and indicate that you will be attending this course under group code PS17EPD. Room requests after August 12 will be subject to availability. Other fees and restrictions may apply.

We have reserved a second block of guest rooms (rates starting at $99, parking and shuttle service) at Graduate Madison, 601 Langdon Street, Madison, WI. Reserve a room online at epd.engr.wisc.edu/lodgingBP517 or call 800-589-6285 or 608-257-4391 and indicate that you will be attending this course under group code TS21. Room requests after August 23 will be subject to availability. Other fees and restrictions may apply.

Earn Continuing Education Credit By participating in this course, you will earn 40 Professional Development Hours (PDH) or 4.0 Continuing Education Units (CEU).