# Ammonia Refrigeration Basics

## Course 461: Ammonia Refrigeration Basics

Covers all aspects of using ammonia as a refrigerant. Describes both single-stage and two-stage ammonia systems. Explains the importance of accumulators and intercoolers in ammonia refrigeration. Concludes with coverage of liquid recirculation system operation.

TPC Training Systems is accredited by IACET to offer **0.5 CEU** for this program.

### Lesson 1: Ammonia Characteristics

*Topics*

Ammonia sources, uses, and chemical characteristics; Environmental, hazardous material concerns; Temperature-pressure relationships; Materials compatibility; MSDS criteria; Safety

*Objectives*

- Name common uses of ammonia and describe benefits of ammonia refrigerant in terms of ozone depletion and global warming potentials (ODP and GWP).
- Describe the properties of ammonia and explain how they affect the use of ammonia as a refrigerant.
- Discuss the toxicity and flammability of ammonia and its classification as a hazardous material.
- Discuss important features of ammonia saturation curves, reactions with metals, and MSDS criteria.
- Name two standards governing ammonia refrigeration systems and describe the four main ammonia safety concerns, steps for their prevention, and first aid treatment in the event of exposure.

### Lesson 2: Single-Stage Ammonia Systems

*Topics*

Positive-displacement systems; Refrigeration loads; Primary, secondary refrigeration system components; Components in parallel; Superheat; Single-stage pressure-enthalpy diagram

*Objectives*

- Briefly compare absorption and mechanical compression systems, compare dynamic and positive-displacement compressors, and name those generally used in industrial ammonia refrigeration systems.
- Explain how a positive-displacement compressor increases the ammonia vapor pressure.
- Define British thermal unit (Btu), specific heat, sensible heat, latent heat, and tons of refrigeration.
- Name four primary components in single-stage ammonia refrigeration systems and describe their functions.
- Describe the functions of the oil separator, high-pressure liquid receiver, king valve, and suction accumulator in single-stage ammonia refrigeration systems.
- Define superheat, enthalpy, and entropy and explain how they are used on the pressure-enthalpy (P-H) diagram.

### Lesson 3: Two-Stage Ammonia Systems

*Topics*

Compression ratio; Compressor capacity; Two-stage system division, Booster desuperheater, intercooler; Two-stage system components, performance; Complex two-stage systems

*Objectives*

- Define compression ratio and explain its importance in single-stage and two-stage industrial ammonia refrigeration systems.
- Explain why flash gas removal, booster discharge-vapor desuperheating, and interstage liquid cooling are desirable in the two-stage system.
- Plot a two-stage refrigeration system on an ammonia pressure-enthalpy (P-H) diagram.
- Name the primary and secondary components of a two-stage refrigeration system and describe component functions.
- Explain why a two-stage system requires less overall power than a single-stage system.

### Lesson 4: Suction Accumulators and Intercoolers

*Topics*

Need for suction accumulators; Accumulator design features; Liquid/vapor separation; Intercoolers; Shell-and-coil vs flash intercoolers; Alternate intercoolers

*Objectives*

- Explain why suction accumulators are needed and describe the damage that can result from liquid entering the compressor.
- Discuss the purposes and reasoning behind the design features, including the boil-out coil, of suction accumulators.
- Describe the various ammonia refrigerant liquid/vapor separation criteria.
- Explain how the intercooler deals with flash gas and desuperheats the booster discharge.
- Describe basic differences between a flash intercooler and a shell-and-coil intercooler.
- Describe typical configurations for alternate intercoolers provided with internally compounded compressors.

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## Lesson 5: Liquid Overfeed (Recirculation) Systems

*Topics*

Liquid overfeed, recirculation systems; Recirculation system advantages and disadvantages; Recirculation vessel design; Pumper drum system; Controlled pressure receiver system

*Objectives*

- Describe the various functions performed within the recirculation vessel.
- Discuss the advantages and disadvantages of recirculation systems.
- Describe design features of horizontal and vertical recirculation vessels.
- Discuss the surge-volume requirements of a recirculation system and reasons for high-level alarm/cutout controls on the recirculation vessel.
- Describe the features and drawbacks of various kinds of liquid-refrigerant pumps.
- Describe the operation of pumper drum (gas-pressure) recirculation systems and controlled pressure receiver (CPR) recirculation systems.