Absorption Chillers

Course 440: Absorption Chillers

Covers the basic principles of absorption refrigeration as compared to mechanical refrigeration. Introduces absorption terminology and common absorption fluid pairs. Examines water/lithium bromide systems, ammonia/water systems, and evolving systems. Concludes with a discussion of chiller selection factors, cost of operation, and absorption system applications.

TPC Training is accredited by IACET to offer **0.6 CEU** for this program.

Lesson 1: Principles of Absorption Chiller Systems

Topics

Basics of Mechanical Refrigeration Systems, Basics of Absorption Refrigeration Systems; History of Absorption Systems; Absorption Terminology; Simple Single-Effect Absorption Cooling Cycle; Common Absorption Fluid Pairs

Objectives

- Explain the differences between a mechanical refrigeration system and an absorption system.
- Describe the basic components in a simple absorption system and their functions in the refrigeration cycle.
- Distinguish between the characteristics of a weak solution and a strong solution and explain the function of each in the absorption cycle.
- Define the terminology associated with absorption systems.
- Describe the steps in a simple single-effect absorption cooling cycle.

Lesson 2: Water/Lithium Bromide Absorption Systems

Topics

Water/Lithium Bromide Absorption Systems; Double-Effect Direct-Fired Absorption System; Solution Flow Cycles; Operating Characteristics; Crystallization

Objectives

- Discuss basic characteristics of water/lithium bromide absorption systems and name common industrial uses.
- Describe the differences between single-effect and double-effect absorption systems.
- Discuss the action of the solution and the refrigerant throughout a solution cycle within absorption systems used for heating only, cooling only, and simultaneous heating and cooling.
- Compare reverse, series, and parallel solution flow cycles.
- Discuss operating characteristics of various absorption machines and explain how the coefficient of performance (COP) is used in equipment selection.
- Describe the cause of crystallization and its effect on an absorption system.

Lesson 3: Lithium Bromide Absorption

Topics

General Limitations; Control Scheme; Start, Run, and Shutdown Sequence; Operating Limits and Safety Controls; Unit Setup; System Maintenance; Insulation; Noncondensable Gases

Objectives

- Discuss the general operating limits of absorption units, including ASHRAE 15 machine room safety requirements.
- Describe the basics and benefits of today's microprocessor-based operation and capacity control.
- Describe the normal absorption unit start, run, and shutdown sequences.
- Name various kinds of system operating controls and safety controls and explain their functions.
- Describe general setup and maintenance requirements and the procedures that keep the absorption chiller operating efficiently.
- Discuss the necessity for insulation and control of noncondensable gases, including air.

Lesson 4: Ammonia/Water Absorption Systems

Topics

Ammonia System Background; Ammonia Characteristics; Basic Ammonia/Water Absorption System; Industrial Ammonia/Water Absorption Systems; Domestic Ammonia Absorption Systems; Ammonia System Advantages; Ammonia System Controls and Maintenance

Objectives

- Discuss the solubility of ammonia in water and other characteristics, including hazards, that affect ammonia absorption systems.
- Explain the function of the analyzer and rectifier in an ammonia absorption system.
- Define the terms strong aqua and weak aqua as related to the ammonia water solution and compare them with the terms strong solution and weak solution as related to a lithium bromide system.
- Describe typical applications for industrial ammonia absorption systems and small residential and commercial ammonia absorption systems.
- Explain the operation of the Platen-Munters ammonia/water/hydrogen system.
- Name reasons why ammonia absorption systems are likely to be used increasingly in the future.

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Lesson 5: Evolving Absorption Systems

Topics

Research to Improve COPs; GAX Heat Pump Cycles; Triple-Effect Cycles; Special Applications; Double Use of Steam Energy; Single-Effect System with Heat Recovery from Hot Processes; Double-Effect System with Solar Heating Source; Power Plant Heat Recovery; Special Absorption Unit Solution Pairs; Hybrid Liquid Desiccant/Absorption System; Hybrid High-Lift Heat Pump with Mechanical Compression

Objectives

- Discuss reasons for continuing testing and development of advanced absorption systems.
- Describe current developments in the GAX ammonia/water residential heat pump systems.
- Describe triple-effect systems and compare absorption and adsorption cycles.
- Explain how special-application absorption systems use recovered heat, waste heat, or a solar array to provide the energy for operation.
- Describe the properties of non-standard solution pairs.
- Explain how two kinds of hybrid arrangements incorporate the absorption system.

Lesson 6: Absorption Systems vs. Mechanical Compression Systems

Topics

Review of Water/Lithium Bromide Absorption Chillers; Review of Ammonia/Water Absorption Units; Mechanical Compression Systems; Chiller Selection Factors; Economic Perspective; Cost of Chiller Operation; Absorption System Application

Objectives

- Describe important characteristics of both single-effect and double-effect water/lithium bromide absorption chillers and ammonia/water absorption units.
- Briefly describe the operation and characteristics of centrifugal chillers.
- Briefly describe the operation and characteristics of reciprocating and screw positive-displacement chillers.
- Name factors that must be considered in selecting air-conditioning equipment for specific applications and compare COPs for the various kinds of equipment.
- Discuss general cost criteria for the various types of energy used to drive the equipment and describe an appropriate absorption system application.