

# Evaporators and Metering Devices

## Course 434: Evaporators and Metering Devices

Explains function and construction of evaporators. Covers: direct-expansion, dry-expansion, and flooded evaporators; and, systems using multiple evaporators. Discusses boosting evaporator performance. Explains evaporator defrosting, maintenance, and troubleshooting. Describes function, operation, and maintenance of metering devices, including hand-operated, automatic, thermostatic, thermal-electric.

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



### Lesson 1: Introduction to Evaporators

#### Topics

The Function of the Evaporator; How the Evaporator Works; Effects of Latent and Sensible Heat; Evaporator Capacity; Temperature Differential; Evaporator Construction; Contact Surface Area; Circulation Velocity; Effects of Water Vapor

#### Objectives

- Explain the function of the evaporator in a refrigeration system.
- List five main factors affecting evaporator capacity, and explain how each can be optimized to gain the greatest possible evaporator capacity.
- Describe the basic evaporator configurations.
- Explain the function of headers and distributors in multiple-circuit evaporators.
- Explain how comfort coolers reduce both air temperature and humidity.

### Lesson 2: Direct Expansion Evaporators and Secondary Refrigeration Systems

#### Topics

Direct-Expansion Evaporators; Dry-Expansion Evaporators; Flooded Evaporators; Evaporator Configurations; Secondary-Refrigeration Systems; Secondary Refrigerants; Compound Secondary-Refrigeration Systems; Multiple-Evaporator Refrigeration Systems; Multiple-Staging Refrigeration Systems; Cascade Refrigeration Systems

#### Objectives

- Compare and contrast dry-expansion and flooded evaporators.
- List the main types of flooded evaporators.
- Explain the process of secondary refrigeration.
- Define eutectic solution and eutectic temperature.
- Describe three types of multiple-evaporator systems.
- Identify cascade and multiple-staging refrigeration systems.

### Lesson 3: Improving Evaporator Performance

#### Topics

Applying Thermodynamics; Net Refrigeration Effect; Superheating and Subcooling; Accumulators; Common Types of Heat Exchangers; Headers; Oil Separation; Circulating Fluids through Evaporators

#### Objectives

- Explain how the laws of thermodynamics apply to refrigeration.
- Describe how to increase the net refrigerating effect of an evaporator.
- Demonstrate—using simple arithmetic—the amount of increase in net refrigerating effect caused by subcooling.
- List several advantages of using a heat exchanger in a refrigeration system.
- Describe three ways of keeping oil out of an evaporator.
- Explain why the circulation of air or water through an evaporator coil improves evaporator performance.

### Lesson 4: Defrosting, Maintaining, and Troubleshooting Evaporators

#### Topics

Defrosting Systems; Condensate Disposal; Manual Defrost Method; Ambient-Air Defrost Methods; Heated-Air Defrost Method; Water Defrost Method; Brine Defrost Methods; Hot-Gas Defrost Methods; Reverse-Cycle Defrost Method; Electric Defrost Method; Fin Straightening; Cleaning Coil Surfaces; Tube Fouling; Water Coil Winterizing; Troubleshooting Frost Problems; Troubleshooting Low-Capacity Problems; Troubleshooting Shell-Type Evaporators; Troubleshooting Flooded Evaporator

#### Objectives

- Explain why periodic defrosting of evaporator coils is necessary.
- List and describe at least five different methods of defrosting an evaporator.
- Explain the differences between the hot-gas and reverse-cycle defrost methods.
- Explain how to clean an evaporator coil, drain pan, and drain line.
- Describe how to remove rust, scale, and sludge from shell-and-tube evaporators.
- List two ways evaporator coils can be winterized.
- Tell how low airflow and excessive moisture increase frost buildup on coil surfaces.
- Explain how dirty coils and damaged fins reduce an evaporator's cooling capacity.

### Lesson 5: Metering Device Types, Maintenance, and Troubleshooting

#### Topics

The Function of Metering Devices; Expansion Valves; Hand-Operated Expansion Valve; Automatic Expansion Valve (AXV); Thermostatic Expansion Valve (TXV); Bulb Charge in the TXV; Capacity of the TXV; Installing the TXV; TXVs for Special Applications; Thermal-Electric Expansion Valve (TEV); Capillary Tubes; Float Valves; Metering Device Maintenance and Troubleshooting; Symptoms of Expansion-Valve Problems

#### Objectives

- Explain the primary function of a metering device.
- Name the five main types of expansion valve, and describe the operation of each.
- Contrast the operation of an internally equalized and an externally equalized TXV.
- Explain how to adjust the superheat on a TXV.
- Describe the structure, operation, and application of high- and low-side float valves.
- Identify three causes of floodback and describe the corrective action for each.
- List the common problems of TXVs along with their solutions.