ATPF-1065: EXPANSION DEVICES AND SPECIAL COMPONENTS

Cuyahoga Community College

Viewing: ATPF-1065 : Expansion Devices and Special Components

Board of Trustees:
2015-12-03

Academic Term:
Spring 2019

Subject Code
ATPF - Applied Ind Tech - Pipefitters

Course Number:
1065

Title:
Expansion Devices and Special Components

Catalog Description:
Course covers expansion devices used in the refrigeration process, specific terminology and the operation of the respective components. In addition, the purpose and operation of expansion devices, including thermostatic and automatic valves, and other special refrigeration enhancing components will be addressed.

Credit Hour(s):
2

Lecture Hour(s):
2

Requisites

Prerequisite and Corequisite
Departmental approval: admission to Pipefitter's apprenticeship program.

Outcomes

Course Outcome(s):
Discuss the purpose and operation of expansion devices used in refrigeration.

Objective(s):
1. Define special terms used with respect to expansion devices.
2. Explain the need for expansion devices in refrigeration.
3. Identify different pressures required in the refrigeration process.
4. List the different types of expansion devices.
5. Review the safety concerns related to working with high pressure refrigerants.

Course Outcome(s):
Discuss the function and operation of the thermostatic expansion valve (TXV) and capillary tube devices.

Objective(s):
1. Explain how the length of the capillary tube relates to refrigerant regulation of the evaporator.
2. Describe respective pressure differentials of capillary tube function.
3. Explain the capillary tube device with respect to constant load systems.
4. List the components of the TXV.
5. Explain how the TXV maintains temperature and pressure in the evaporator coil.
6. Identify the various refrigerants that are used in conjunction with the TXV.
7. Discuss the effect of the boring size of a capillary tube with respect to the function of the metering device.

Course Outcome(s):

Describe the operation of an automatic expansion valve.

Objective(s):

1. Explain how automatic expansion valves maintain constant pressure in evaporators.
2. Differentiate between evaporators and spring pressure.
3. Describe how varying pressures are used in conjunction with needle and seat controls.
4. Explain the operation of automatic expansion valves used to throttle refrigerants at set points.
5. Discuss suction pressures and resulting changes.

Course Outcome(s):

Discuss the various special components that enhance the operation of the refrigeration system.

Objective(s):

1. List the different special components of refrigeration.
2. Discuss the need for low ambient controls.
3. Explain the function of the crankcase pressure in refrigeration.
4. Discuss the purpose and location of the evaporator pressure regulator.
5. Explain the operation of the condenser flooding valve.
6. Discuss the need for equipment safety devices.

Methods of Evaluation:

1. Quizzes
2. Tests
3. Final exam
4. Class participation

Course Content Outline:

1. Refrigeration and expansion devices
    a. Terminology
        i. Capillary tubes
        ii. Bulb pressure
        iii. Spring pressure
        iv. Super heat
        v. Thermistor
        vi. Needle and seat control
        vii. Fixed bore
        viii. Metering device
        ix. External equalizer
        x. Balanced port
    b. Expansion devices
        i. Function
            1. Refrigerant vapor
            2. Liquid refrigerant
        ii. Types
        iii. Metering
    c. Refrigerant pressure
        i. Evaporator
        ii. Suction
        iii. Bulb
        iv. Spring
    d. Expansion device type
        i. Capillary tube
        ii. Thermostatic expansion valve
        iii. Automatic
    e. Safety concerns
        i. High pressures
        ii. Hot gases

iii. Electrical
iv. Personal Protective Equipment
v. Respiratory hazards

2. TXV
   a. Components
      i. Valve body
      ii. Diaphragm
      iii. Needle and seat
      iv. Spring
      v. Packing gland
      vi. Sensing bulb
   b. Temperature and pressure
      i. Thermal element
      ii. Superheat maintenance
      iii. Adjustment
      iv. Bulb and diaphragm
   c. Refrigerants
      i. Tetrafluoro ethane R-134-A
      ii. Dichlorodifluoro methane R-12
      iii. Chlorodifluoro methane R-22
   d. Capillary tubes
      i. Tube length
      ii. Pressure differentials
      iii. Constant load systems
3. Automatic expansion valve
   a. Pressure maintenance
      i. Valve change
      ii. Dimension change
      iii. Sensing element
   b. Evaporator pressure versus spring pressure
      i. Similarities
         1. Coil
         2. Valve
      ii. Differences
         1. Pressure direction
         2. Differential operation
   c. Needle and seat controls
   d. Operation
      i. Throttle refrigerant
      ii. Adjustments and set points
   e. Suction pressures and resultant change
4. Special components
   a. Types
      i. Relief valves
      ii. Solenoid
      iii. Pressure switch
      iv. Evaporator pressure regulator
      v. Oil safety switch
      vi. Condenser flooding valve
      vii. Filter drier
      viii. Crankcase heater
   b. Low ambient controls
      i. Continuous refrigeration
      ii. Head pressure maintenance
      iii. Fan cycling
      iv. Air volume
      v. Condenser flooding
   c. Crankcase pressure

   i. Applied heat
   ii. Oil migration
   iii. Oil affinity
   iv. Crankcase heat
d. Evaporator pressure regulator
   i. Mechanical control
   ii. Superheat maintenance
   iii. Hold back valve
e. Condenser flooding valve
   i. Mild and cold weather
   ii. Refrigerant travel
f. Equipment safety devices
   i. Relief valves
   ii. Pressure switches
   iii. Solenoid
   iv. Disconnects
   v. Oil pressure safety control
   vi. Internal overloads

Resources

Althouse, Turnquist and Bracciano. *Modern Refrigeration and Air Conditioning.* 4th edition. Goodheart-Willcox Co., South Holland, Illinois, 1979.

R. Jesse Phagan. *Applied Mathematics.* 4th edition. Goodheart-Wilcox Co./Tinley Park, Il, 2010.

Thomas W. Frankland. *Pipe Trades.* current edition. Glencoe/McGraw-Hill, New York, New York, 1969.

Resources Other

1. http://www.free-ed.net/sweethaven/MechTech/Refrigeration/coursemain.asp?lesNum=4&modNum=1
2. http://physics.about.com/od/glossary/g/heat.htm
3. http://www.refrigerationbasics.com/1024x768/definitions1.htm

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