ATPF-1015: HEAT, MATTER, AND ENERGY

Cuyahoga Community College

Viewing: ATPF-1015 : Heat, Matter, and Energy

Board of Trustees:
2015-12-03

Academic Term:
Spring 2019

Subject Code
ATPF - Applied Ind Tech - Pipefitters

Course Number:
1015

Title:
Heat, Matter, and Energy

Catalog Description:
A study of heat theory, matter and energy as they relate to the pipefitting service industry. Included are relative definitions, mathematical conversions, and discussion of the laws of thermodynamics and of related topics covering applications to the heating and cooling industry.

Credit Hour(s):
2

Lecture Hour(s):
2

Requisites

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

Outcomes

Course Outcome(s):
Define the terms related to heat theory, matter and energy and discuss how they relate to the pipefitting service industry.

Objective(s):
1. Define temperature in terms of Fahrenheit/Celsius and Rankin/Kelvin scales and explain their use in service work.
2. Explain relative differences between conduction, convection and radiation and discuss applications to heat producing and cooling equipment.
3. Explain how performance ratings of heating and cooling equipment are expressed in terms of absolute temperature.
4. Differentiate between sensible, latent and specific heat.
5. Explain British Thermal Units (BTU).

Course Outcome(s):
Discuss what is meant by pressure and explain it in atmospheric terms.

Objective(s):
1. List different pressure gages used in servicing heating and cooling equipment and describe the various applications.
2. Explain how atmospheric pressure differs with respect to elevation changes.
3. Identify various ways to measure atmospheric pressure.
4. Explain how barometers measure pressure with respect to inches of mercury.
5. Discuss the advantages of using the aneroid barometer for service work.

Course Outcome(s):
Discuss temperature readings taken in terms of Fahrenheit °F and Celsius °C scales and explain scale conversions of each.

Objective(s):

1. Apply mathematical formulas to convert temperature reading from °F to °C.
2. Use conversion tables for respective conversions.
3. Express pressure in terms of metrics.

Course Outcome(s):

Define matter in three states, density, specific gravity and volume and discuss gas laws that relate to refrigeration systems.

Objective(s):

1. Define matter with respect to space and weight.
2. Differentiate between mass and weight.
3. Compare density, specific gravity and specific volume of matter.
4. State Boyle's Law and explain how pressures are affected by pistons and cylinders.
5. Discuss Charles's law and apply the formula to determine pressure changes due to variation in temperature.
6. Explain the General Law of Perfect Gas and how it pertains to the service industry.

Course Outcome(s):

Discuss energy, how it is conserved and contained and how it is used to operate heating and cooling equipment.

Objective(s):

1. Discuss energy in various forms and explain how it is converted to usable heat.
2. Discuss the conservation of energy.
3. Identify energy in various forms including fossil fuel and the sun.
4. Describe energy in term of work.
5. Define power as a rate of work.

Methods of Evaluation:

1. Quizzes
2. Tests
3. Final exam

Course Content Outline:

1. Heat theory, matter and energy
    a. Heat theory
        i. Conduction
        ii. Convection
        iii. Radiation
    b. Temperature
        i. Fahrenheit
        ii. Centigrade
        iii. Conversions
            1. Mathematical equations
            2. Tables
    c. Performance ratings
        i. Heating equipment
        ii. Cooling
        iii. Absolute temperature
    d. Heat types
        i. Sensible
        ii. Latent
        iii. Specific
    e. British Thermal Units (BTU)
2. Pressure
    a. Elevation differences
        i. Sea level
        ii. Mountain zones
        iii. Differences
        iv. Services affects

   b. Measurement
      i. Barometric pressure
      ii. Atmospheric
      iii. Gauge pressure
   c. Barometric
      i. Readings
      ii. Columns and vacuums
      iii. Refrigerant pressures
   d. Aneroid barometer
      i. Practical use
      ii. Durability
   e. Pressure gages
      i. Bourdon tube
      ii. High side
      iii. Low side
      iv. Compound
3. Temperature readings
   a. Mathematical formulas
      i. F ° to C °
      ii. C ° to F °
   b. Conversion tables
   c. Metrics
      i. Application
      ii. Conversions
      iii. Blaze- Pascal
4. Matter
   a. State
      i. Solid
      ii. Liquid
      iii. Gas
   b. Density
      i. Mass to volume
      ii. Tables
      iii. Application
         1. Refrigerant reaction
         2. Volume of air
   c. Specific gravity
      i. Density comparisons
      ii. Equations
         1. Weight
         2. Volume
      iii. Standards
   d. Gas Laws
      i. Boyle’s Law
      ii. Charles Law
      iii. General Law of Perfect Gas
      iv. Application
         1. Air/coil
         2. Refrigerant pressure
         3. Cooling effect
5. Energy
   a. Forms
      i. Electric
      ii. Heat
   b. Conversions
      i. Laws
      ii. Conversion of forms
      iii. Accountability
   c. Sources

   i. Fossil fuel
   ii. Chemical
   iii. Solar
d. Energy and work
   i. Watt
   ii. Force
   iii. Distance
e. Power
   i. Horsepower
   ii. Electric
   iii. Measure of power

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Resources

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

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

United Association Training Department,. *HVAC/R Training.* 2006. International Pipe Trades Training Committee, Inc., Washington, D.C, 2006.

Resources Other

1. http://physics.about.com/od/glossary/g/heat.htm
2. http://www.refrigerationbasics.com/1024x768/definitions1.htm

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