ATPF-1025: BASIC CONTROLS - ELECTRICITY

Cuyahoga Community College

Viewing: ATPF-1025 : Basic Controls - Electricity

Board of Trustees:
2015-12-03

Academic Term:
Spring 2019

Subject Code
ATPF - Applied Ind Tech - Pipefitters

Course Number:
1025

Title:
Basic Controls - Electricity

Catalog Description:
Course covers the application and theory of electricity as it relates to the heating ventilation and air conditioning industry. Also discussed are temperature controls including thermocouples and thermal resistors.

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 electrical theory including atom structure, currents and circuitry and explain how electricity is related to the control mechanisms used in the heating and cooling industry.

Objective(s):
1. Describe the structure of an atom and differentiate between atoms having positive and negative charges.
2. Explain how electricity relates to the heating and cooling industry.
3. State the differences between series and parallel circuits.
4. Describe how Ohm's Law is used to determine resistance for heating elements.

Course Outcome(s):
Discuss the function of capacitors in electric circuits, the various types of capacitors and impedance with respect to current flow.

Objective(s):
1. Identify the different types of capacitors used in electric circuits.
2. Describe the function of capacitors as they relate to the storage of electrical energy.
3. Explain opposition to flow and discuss the different types of resistance as they relate to impedance.
4. Discuss the rating of capacitors in farads and explain capacitive reactance as it relates to the refrigeration industry.

Course Outcome(s):
Describe the procedures followed in measuring electricity.

Objective(s):
1. Describe the function of the volt- ohm –millimeter (VOM).

2. Discuss the safety procedures followed while taking electrical measurements.
3. Explain how the resistance of a load is determined.
4. List the different types of equipment used for measuring electric current.

Course Outcome(s):

Discuss the types and operation of automatic controls used in the heating, air-conditioning and refrigeration industry.

Objective(s):

1. Identify the different types of automatic controls.
2. Explain how bi-metals are used to start, stop or modulate electric currents.
3. Discuss how fluid expansion is used to sense temperature change.
4. Explain how diaphragms and bellows are used to move control mechanisms that are required to operate machinery.
5. Differentiate between thermocouples and manual controls.
6. Describe how thermistors are used to affect current flow.

Methods of Evaluation:

1. Quizzes
2. Tests
3. Final exam

Course Content Outline:

1. Electric theory
    a. Atom structure
        i. Protons
            1. Positive charge
            2. Nucleus
        ii. Electrons
            1. Negative charge
            2. Orbital travel
            3. Number
        iii. Neutrons
    b. Electricity and heating and cooling
        i. Temperature controls
        ii. Safety overloads
        iii. Circuit breakers
    c. Series circuits
        i. Voltage division
        ii. Sum of resistance
        iii. Current flow
    d. Parallel circuits
        i. Voltage and resistance
        ii. Resistance comparisons
        iii. Multiple current paths
    e. Ohm's Law
        i. History
        ii. Circuit relationship
        iii. Components
            1. Voltage
            2. Resistance
            3. Amperage
        iv. Resistance and heating elements
2. Capacitance
    a. Types
        i. Simple
        ii. Starting
        iii. Running
    b. Function

        i. Electron storage
        ii. Blocking device
    c. Impedance
        i. Resistance sum
        ii. Phases
    d. Reactance
        i. Inductive
        ii. Capacitive
    e. Rating
        i. Farads
        ii. Symbols
    f. Capacitive resistance
        i. Heating and cooling industry
        ii. Motors
3. Electrical measurements
    a. Equipment
        i. VOM
        ii. Mill voltmeter
        iii. Digital clamp-on ammeter
    b. Meter functions
        i. Voltage measure
        ii. Current resistance
        iii. Temperature
    c. Safety precautions
        i. Training
        ii. Electrical hazards
            1. Overheating
            2. Insulation failure
            3. Fire potential
            4. Personal protective equipment
        iii. Load resistance
            1. Equipment
            2. Measurement
4. Automatic controls
    a. Types
        i. Thermostat
        ii. Overload switches
        iii. Thermocouple
        iv. Thermal expansion valve
    b. Bi-metals
        i. Types
            1. Steel
            2. Brass
        ii. Functions
            1. Start-up
            2. Shut down
            3. Modulation
    c. Fluid expansion
        i. Temperature change
        ii. Signal transmission
        iii. Diaphragm expansion
    d. Diaphragms
        i. Pressure sensitive
        ii. Temperature
        iii. Operation
        iv. Uses
            1. Modulating
            2. Mechanical operation
            3. Starting device
    e. Thermocouples and manual controls

i. Advantages
ii. Disadvantages

f. Thermisters
i. Temperature sensitive
1. Starting assistance
2. Motor overload protection
ii. Application
iii. Types
1. Positive temperature coefficient
2. Negative temperature coefficient

Resources

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

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

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

Resources Other

http://www.hvacfun.com/f-hvac-controls-control-loops.htm
http://www.reprise.com/host/electricity/
http://www.refrigerationbasics.com/1024x768/definitions1.htm

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