HRA216

RESIDENTIAL AIR CONDITIONING SYSTEMS

5 Credit Hours

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CAREER & TECHNICAL EDUCATION
Alan C. Foster, Associate Dean
I. CATALOG DESCRIPTION

Pre-requisite: HRA110 and HRA112
5 semester hours credit

Residential Air Conditioning Systems covers the theory, installation, diagnosis, and service of residential air conditioning systems including heat pumps. (F)

II. COURSE GENERAL OBJECTIVES

A. Identify common terms in Residential Air Conditioning
B. Identify the basic components of a cooling system
C. Describe the function of each component
D. Identify the electrical component
E. Describe the function of each electrical component
F. Identify common terms related to psychrometrics
G. Plot typical air conditioning processes on a psychrometric chart
H. Identify proper installation procedures
I. Identify terms related to heat pump
J. Describe operation of a heat pump
K. Select balance points for a heat pump installation
L. Troubleshoot air conditioning and heat pump systems

III. COURSE OUTLINE

A. Fundamentals of Air Conditioning (Unit I)
B. Residential Cooling Systems (Unit II)
C. Recovery Reclaim Refrigerant (Unit III)
D. Installation Procedures (Unit IV)

IV. UNIT OBJECTIVES

A. Fundamentals of Air Conditioning (Unit I)

Upon completion of this unit the student should be able to:

1. Definition of air conditioning.
2. Identify methods of temperature control.
3. Explain humidity control and its effect on comfort.
4. Identify air filtering, cleaning and purification.
5. Describe air movement and circulation.
6. Explain relative humidity.
7. Identify dry bulb temperature.
8. Identify wet bulb temperature.
9. Identify a psychrometer.
10. Relate to a psychrometric chart.
11. Explain dew point.
12. Demonstrate the ability to determine relative humidity of a room.
13. Plot wet and dry bulb temperatures on a psychrometric chart.
B. Residential Cooling Systems (Unit II)

Upon completion of this unit the student should be able to:

1. Processes in a cooling cycle.
2. Match terms of a residential cooling system.
3. Identify mechanical components of an air conditioner.
   a. Evaporator
   b. Metering device
   c. Liquid line
   d. Suction line
   e. Compressor
   f. Condenser
   g. Liquid line dryer
   h. Service valves
4. Identify electrical components
   a. Thermostat
   b. Subbase
   c. Condenser fan
   d. Transformer
   e. Contactor
   f. High pressure switch
   g. Low pressure switch
   h. Crankcase heater
   i. Hard start kit
   j. Run capacitor
   k. Overload protector
   l. Lockout relay
5. State how cooling cycle is completed.
6. State sequence of operation of cooling cycle.
7. State sequence of operation of continuous fan operation.
8. Match compressor motor failures with ways they can be detected.
9. Match compressor failures with ways they can be detected.
10. Compare condensing failures with ways they can be detected.
11. Identify function of low side section components of an air conditioner.
12. Compare problems of low side section with probable causes.
13. Arrange in order the steps in using a charging table.
14. Identify the rule of thumb procedure in charging a unit without a charging table.
15. Construct an electrical schematic diagram of an air conditioning condensing unit.
16. Wire complete internal wiring of an air conditioning condensing unit.
17. Wire a control system for an air conditioning system.
18. Demonstrate the ability to use a charging table to check the charge in a capillary cooling system.
19. Demonstrate the ability to perform maintenance on an air conditioner.
20. Use rule of thumb in charging an air conditioning system.
21. Demonstrate the ability to troubleshoot an air conditioning unit on a no cooling complaint.

C. Recovery Reclaim Refrigerant (Unit III)

Upon completion of this unit the student should be able to:

1. No refrigerant will be vented into the atmosphere after July 1, 1992.
2. Describe the effect of CFC refrigerants on the ozone layer.
3. Understand EPA rules governing the phase out of CFC's.
4. Follow the EPA regulations regarding recycling of refrigerants.
5. Discuss the proper procedures to secure, recycle, and reuse CFCs.
6. Identify the various types of refrigerant recovery and recycle equipment.
7. Follow the procedure set forth by the Dept. of Transportation regarding the transportation of refrigerant drums and cylinders.
8. Remove the refrigerant charge from a refrigeration system.
9. Recycle and or reclaim the refrigerant that was removed from the system.
10. Be able to find a refrigerant leak and make repairs.

D. Installation Procedures (Unit IV)

Upon completion of this unit the student should be able to:

1. Apply proper caution to placement of equipment.
2. Select location of equipment for proper air movement.
3. Select location of equipment for accessibility.
4. Employ practice of noise control on location of condensing unit.
5. Employ practice of noise control on location of indoor section.
6. Baffle plenum to direct air flow through evaporator coil.
7. Apply proper procedure in refrigerant piping.
8. Apply proper procedure in condensate drain piping.
9. Follow the National Electrical and local codes.
10. Determine air flow CFM across evaporator coil.
11. Install evaporator coil in furnace plenum.
12. Pipe refrigeration lines from condensing unit to evaporator.
13. Install field wiring for condensing unit per N.E.C.
15. Install field wiring for control system.
16. Check operation of air conditioning system.

E. Heat Pump Systems (Unit V)

Upon completion of this unit the student should be able to:

1. Terms
2. Components of a heat pump.
3. Differences between the operation of a fuenway reversing valve in the heating mode and cooling mode.
4. Operation of heat pump in the defrost mode.
5. Components of heat pump indoor section.
6. Characteristics, advantages and disadvantages of heat pump systems.
7. Differences between components of indoor sections of heat pumps and low side air conditioners.
8. Common component failures of heat pumps in the cooling mode.
9. Proper installation of an electric strip heater.
10. Proper precautions for replacing reversing valves.
11. Major rules for good heat pump operation.
12. Trace operational electrical circuits for first stage heating in a pump.
13. Trace operational electrical circuits for a heat pump in defrost mode.
14. Trace operations electrical circuits for a heat pump in the cooling mode.
15. Trace operational electrical circuits for a heat pump in second stage supplementary heat.
16. Wire control system for a heat pump.
17. Perform maintenance on a heat pump.
18. Troubleshoot a heat pump in a no cooling complaint.
19. Perform maintenance on outdoor section of heat pump.
20. Troubleshoot supplemental heat on a heat pump.
21. Perform maintenance on supplemental heat on a heat pump.
22. Troubleshoot a heat pump on a "no heat" complaint when compressor runs but cycles on overload.
23. Troubleshoot a heat pump on "insufficient heat" complaint when compressor will run.

F. Balance Points (Unit VI)

Upon completion of this unit the student should be able to:

1. Terms.
2. COP of a direct electrical heating element and the COP of a heat pump.
3. COP of a heat pump at given design conditions.
4. Balance points and their relation to COP.
5. Balance points and typical stages in heating continuity.
6. Factors needed to plot balance points.
8. Plot balance point #1 from given design conditions.
9. Plot additional balance points from given design conditions.
10. Advantages of controlled heating stages.
11. Size heat pump on cooling load.
12. Locate equipment to obtain maximum COP from a heat pump.

V. METHOD(S) OF INSTRUCTION

IV. REQUIRED TEXTBOOK(S)


VII. REQUIRED MATERIALS

None

VIII. SUPPLEMENTAL REFERENCES

None
IX. METHOD OF EVALUATION

A. Distribution of the Final Grade:

1. 45% Written - Classroom
2. 45% performance - Lab
3. 10% Attitude and Attendance

B. Assignment of Final Letter Grades:

A = 92 to 100
B = 83 to 91
C = 70 to 82
D = 60 to 69
F = Below 60