APPT 158: RF 402 ADVANCED REFRIGERATION & CHILLERS

Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2023
Units:	7
Hours:	72 lecture, 36 laboratory per quarter (108 total per quarter)
Prerequisite:	Per California Code of Regulations, this course is limited to students admitted to the Air Conditioning & Refrigeration Technology Apprenticeship Program.
Advisory:	Not open to students with credit in APPR 108.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Non-GE
Transferable:	None
Grade Type:	Letter Grade (Request for Pass/No Pass)
Repeatability:	Not Repeatable

Student Learning Outcomes

- A student will be able to describe the theory of centrifugal compression.
- A student will be able to list centrifugal compressor tear-down procedures.
- A student will be able to describe water chiller control systems.

Description

Study of the operation and design of positive displacement water chillers and commercial chiller room equipment. Single-stage and multi-stage centrifugal water chillers are covered. Methods of evaluating chiller performance; students develop troubleshooting skills.

Course Objectives

The student will be able to:

a. Describe the operation and design of positive displacement water chillers
b. Evaluate total system efficiency
c. Describe the operation and design of commercial chiller room equipment
d. Describe operation of single-stage and multi-stage centrifugal water chillers
e. Evaluate chiller performance

Course Content

a. Describe the operation and design of positive displacement water chillers
    i. Types and styles of chiller compressors - reciprocating, scroll, and screw
    ii. Water cooled condensers
    iii. Evaporators
    iv. Hydronics
    v. Lubrication systems
b. Evaluate total system efficiency
    i. Compare design data to actual operating data
    ii. Compare design KW per ton to actual KW per ton
    iii. Troubleshoot to determine causes of efficiency loss
    iv. Determine corrective actions
c. Describe the operation and design of commercial chiller room equipment
    i. Theory of water flow and thermodynamics
    ii. Types and styles of commercial chillers
    iii. Safety equipment and safety procedures
    iv. Chemical feed systems
d. Describe operation of single-stage and multi-stage centrifugal water chillers
    i. Centrifugal refrigerant cycle
    ii. Capacity control using pre whirl guide vanes
    iii. Lubrication and low load oil recovery systems, bearings, and seals
    iv. Condensers, coolers, and re-tube procedures
    v. Prime movers - open motor, hermetic motors, and engine driven
    vi. Starters - STAR DELTA, primary, reactor, and auto transformer
e. Evaluate chiller performance
    i. Compare design KW per ton to actual KW per ton
    ii. Troubleshoot to determine causes of low chiller efficiency
    iii. Determine corrective actions

Lab Content

Students will work individually and in teams on chiller performance evaluation projects.

Special Facilities and/or Equipment

1. Laboratory equipped with refrigeration equipment and tools
2. When taught via Foothill Global Access, on-going access to computer with email software and hardware; email address

Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

Results of written quizzes and tests
Satisfactory completion of shop projects
Comprehensive written final examination
Maintenance of a workbook of student's daily work activities

Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

Lecture
Lab assignment
Group discussion
Demonstration

Representative Text(s) and Other Materials

Carrier Corporation. Carrier Troubleshooting Reciprocating Liquid Chillers. 1994.

International Pipe Trades Joint Training Committee, Inc.. Hydronic Heating and Cooling. 2016.

Auvil, Ronnie J.. HVAC and Mechanical Systems Training Manual. 2014.

Trane. Air Conditioning Clinic Centrifugal Water Chillers. 2021.

Trane. Air Conditioning Clinic Absorption Water Chillers. 2021.

Trane. Air Conditioning Clinic Chilled Water Systems. 2021.

Trane. Air Conditioning Clinic Helical Rotary Water Chillers. 2021.

Trane. Air Conditioning Clinic Ice Storage Systems. 2021.

National Fire Protection Association. NFPA 70E Standard for Electrical Safety in the Workplace, 2015 ed.. 2014.

eHazard Management, LLC. Low Voltage Qualified Electrical Workplace Safety. 2015.

Although some of these textbooks are older than 5 years, they conform to national training standards and are considered seminal works in the discipline. We will adopt the next edition of each text, as it is published.

Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

a. Readings from textbook Carrier Troubleshooting Reciprocating Liquid Chillers: Workbook 1
    i. Session, Safety and Typical Chiller Operation, answer study guide questions
b. Writing assignments given in the laboratory
    i. Record sample maintenance log data given in Troubleshooting text: Exercise 1
    ii. Analyze design and operating data to identify chiller performance problems and write a service report listing recommended corrective actions

Discipline(s)

Air Conditioning, Refrigeration, Heating