



TECHNICAL COLLEGE OF THE LOWCOUNTRY

Technical College of the Lowcountry
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ACR 210 Heat Pumps

COURSE DESCRIPTION

This course is study of the theory of operational principles of the heat pump. This course will cover the heat pump and its mechanical and electrical devices, coil design and airflow characteristics. Also covered are the proper operation, servicing, troubleshooting and repair.

4 Cr (4 lect/pres, 0 lab, 0 other)

COURSE FOCUS

The instructor will instruct the theory of operation of the heat pump. The instructor will teach the proper way to service, troubleshoot, repair and install a heat pump.

TEXT AND REFERENCES

Refrigeration and Air Conditioning Technology
8th. edition, Whitman, Tomczyk, Johnson & Silberstein.
Publisher: Gengage Learning
Published: 2017.
ISBN: 978-1-305-57829-6

Refrigeration and Air Conditioning Technology, Lab Manual
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COURSE GOALS

The following list of course goals will be addressed in the course. These goals are directly related to the performance objectives. (*designates a CRUCIAL goal)

1. characterize heat pump areas
2. explain package heat pump

3. describe heat pumps
4. identify piping material
5. name heat sources
6. define balance point
7. establish outdoor unit location
8. change air filter
9. calculate coefficient of performance
10. verify refrigerant line size
11. check supply air temperature
12. classify metering devices
13. classify refrigerant compressors
14. examine liquid line driers
15. figure auxiliary heat
16. find suction line
17. identify refrigerant lines
18. list heat pump components
19. recognize reversing valve
20. sketch reversing valve
21. specify discharge line
22. clean refrigerant coils
23. do preventive maintenance
24. operate cooling mode
25. operate heating mode
26. perform function test
27. perform subcooling test
28. read charging chart
29. read refrigerant line temperature
30. service heat pump
31. activate defrost cycle
32. balance refrigerant charge
33. check electrical connections
34. decontaminate refrigerant system
35. find refrigerant leak
36. diagnose defective txv
37. label control terminals
38. perform standing leak test
39. set heat anticipator
40. evaluate capacitor values
41. verify resistance of coils
42. demonstrate system pump down
43. obtain motor winding resistance
44. read electrical schematic
45. replace fan motor
46. replace indoor fan motor
47. replace outdoor fan motor
48. install compressor hard start
49. change compressor contactor
50. describe geothermal heat pump
51. classify geothermal heat pumps
52. define geothermal wells
53. describe dry well
54. recognize closed loop
55. recognize open loop

56. clarify water quality
57. draw ground loop configurations
58. backflush closed loop
59. bleed closed loop
60. understand counter flowing heat exchangers

Course Outcomes and Competencies:

Each student will expect to spend at least 4 hours per week preparing for class.

Intended Course Outcome: Trouble shoot and install Heat Pumps complete.

Course Competency: Students will be able to understand reverse cycle refrigeration and heat pump operation.

Performance Measurement Instrument and Success criteria: Students will use knowledge learned to Install and convert equipment to needed configurations.

STUDENT CONTRIBUTIONS

For this course to run properly, the student is expected to be prepared for each class including, but not limited to outside class assignments and participation in class activities.

COURSE EVALUATION

- There will be three open book test worth 10 points. Chapters 42, 43, and 44
- There will be 3 practical quizzes in class worth 30 points.
 - Trouble shoot air to air heat pump
 - Trouble shoot geothermal heat pump
 - Install and convert new heat pump in lab.
- There will be one final exam worth 60 points.

Grading: 90 -100 A

80 - 89 B

70 - 79 C

60 - 69 D

0 - 59 F

COURSE SCHEDULE

The class meets for 4 lecture/presentation hours per week.

Approved by: Kelli Boniecki Developed/Revised: _____

Division Dean for Business & Industrial Divisions

ADA STATEMENT

The Technical College of the Lowcountry provides access, equal opportunity and reasonable accommodation in its services, programs, activities, education and employment for individuals with disabilities. To request disability

accommodation, contact the counselor for students with disabilities at (843) 525-8228 during the first ten business days of the academic term.

ACADEMIC MISCONDUCT

There is no tolerance at TCL for academic dishonesty and misconduct. The College expects all students to conduct themselves with dignity and to maintain high standards of responsible citizenship.

It is the student's responsibility to address any questions regarding what might constitute academic misconduct to the course instructor for further clarification.

The College adheres to the Student Code for the South Carolina Technical College System. Copies of the Student Code and Grievance Procedure are provided in the *TCL Student Handbook*, the Division Office, and the Learning Resources Center.

ATTENDANCE

The College's statement of policy indicates that students must attend ninety percent of total class hours or they will be in violation of the attendance policy.

- Students not physically attending class during the first ten calendar days from the start of the semester must be dropped from the class for NOT ATTENDING.
- Students taking an online/internet class must sign in **and** communicate with the instructor within the first ten calendar days from the start of the semester to indicate attendance in the class. Students not attending class during the first ten calendar days from the start of the semester must be dropped from the class for NOT ATTENDING.
- Reinstatement requires the signature of the division dean.
- In the event it becomes necessary for a student to withdraw from the course **OR if a student stops attending class, it is the student's responsibility to initiate and complete the necessary paperwork.** Withdrawing from class may have consequences associated with financial aid and time to completion.
- When a student exceeds the allowed absences, the student is in violation of the attendance policy. The instructor **MUST** withdraw the student with a grade of "W", "WP", or "WF" depending on the date the student exceeded the allowed absences and the student's progress up to the last date of attendance

OR

- Under extenuating circumstances and at the discretion of the faculty member teaching the class, allow the student to continue in the class and make-up the work. This exception must be documented at the time the allowed absences are exceeded.
- Absences are counted from the first day of class. There are no "excused" absences. All absences are counted, regardless of the reason for the absence.
- A student must take the final exam or be excused from the final exam in order to earn a non-withdrawal grade.
- A copy of TCL's **STATEMENT OF POLICY NUMBER: 3-1-307 CLASS ATTENDANCE (WITHDRAWAL)** is on file in the Division Office and in the Learning Resources Center.

ONLINE ATTENDANCE PROCEDURE

For all online courses, students must complete an assignment designated by the instructor during the first week of classes. The instructor will drop the student from the course if the initial assignment is not completed.

Instructors will withdraw students from the class when 90% attendance is not maintained. Attendance in an online course is defined by regular course access and by timely completion of assignments as required by the instructor. Each student will be expected to access the web class at least once a week and complete 90% of assignments on

time. Additional access is encouraged and may be necessary for successful completion of classes.

Failure to log in and complete assignments will result in the student being withdrawn from the course. The instructor will assign a grade of "W," "WP," or "WF" based upon the student's academic standing as the last date of attendance, which is the last login. Students are responsible for any financial matters associated with an administrative withdrawal. If a student fails to email the instructor (using the my.tcl.edu email account) requesting to be dropped from the course and has not submitted the initial assignment required during the first week of class, the instructor will assign a "Never Attended" code in the student information system (web-advisor) no later than ten calendar days after the first day of the class. Students who are dropped as a result of never attending the course are still responsible for all fees associated with the course.

HAZARDOUS WEATHER

In case weather conditions are so severe that operation of the College may clearly pose a hardship on students and staff traveling to the College, notification of closing will be made through the following radio and television stations: WYKZ 98.7, WGCO 98.3, WGZO 103.1, WFXH 106.1, WWVW 106.9, WLOW 107.9, WGZR 104.9, WFXH 1130 AM, WLVH 101.1, WSOK 1230 AM, WAEV 97.3, WTOC TV, WTGS TV, WJWJ TV, and WSAV TV. Students, faculty and staff are highly encouraged to opt in to the Emergency Text Message Alert System. www.tcl.edu/textalert.asp

EXTRA:

Emergency Text Message Alert

Students, faculty and staff are highly encouraged to opt in to the Emergency Text Message Alert System. Participants receive immediate notification of emergency events and weather cancellations via text messaging on their cell phones. Participants can also opt in to receive non-emergency news and announcements. Go to www.tcl.edu. On the homepage, click on "emergency TextAlert at TCL" and fill out the form or go to www.tcl.edu/textalert.asp

GRADING METHODOLOGY

The final grade must be 70 or more (a grade "C" or better) in order to pass the course and progress to the next course. Students absent from an examination or presentation will receive a "0" grade for the examination unless other arrangements are made with the individual instructor prior to the examination or presentation day or on the examination or presentation day before the test/presentation is scheduled to be given.

The student is responsible for notifying the instructor for the reason of the absence. It is also the responsibility of the student to contact the appropriate instructor to arrange to make up the examination. Arrangements may be completed by telephone.

If the instructor is not available, a message should be left on the instructor's voice mail AND with another member of the faculty or administrative assistant. The make-up exam will be scheduled and the instructor will decide the method of examination. Messages sent by other students are unacceptable.

Syllabus Safety Addendum

Purpose

The purpose of this safety addendum is to provide each student with safety guidelines during an incident, emergency, or disaster at TCL. In addition, it provides students guidelines for lockdown procedures, evacuation procedures, and active shooter.

Definition

An incident is any event, potential or actual, that may impact normal operations but has no immediate health or life threatening consideration or serious effect on the overall functional capacity of the College. An event of this nature

should be reported to the Office of the Vice President for Administrative Services. Also notify the off-site campus administrator if applicable.

An emergency is any incident, potential or actual, which may endanger life or health or which affects an entire building or buildings, and will disrupt the overall operations of the College. Outside emergency services will probably be required, as well as major efforts from campus support services. Major policy considerations and decisions will usually be required from the college administration during times of crises. An emergency should be reported immediately by directly using **911** if life or health/injury considerations exist and then to the Office of the President or Vice President for Administrative Services as quickly as possible. Also notify the off-site campus administrator if applicable.

A disaster is any event or occurrence that has taken place and has seriously impaired or halted the operations of the College. In some cases, mass personnel casualties and severe property damage may be sustained. A coordinated effort of all campus-wide resources is required to effectively control the situation. Outside emergency services will be essential. In all cases of disaster, an Emergency Control Center will be activated, and the appropriate support and operational plans will be executed. The disaster should be immediately reported, first by calling **911** and then to the Office of the President or Vice President for Administrative Services. Also notify the off-site campus administrator if applicable.

Types of Emergencies

- Hurricane
- Tornado
- Fire
- Biochemical or Radiation Spill
- Explosion/Bomb
- Downed Aircraft (crash which directly impacts campus operations)
- Utility Failures
- Violent or criminal behavior
- Psychological Crisis

Procedures

Active Shooter

Run/hide/fight (<http://www.fbi.gov/about-us/cirg/active-shooter-and-mass-casualty-incidents/run-hide-fight-video>)

Building Evacuation

1. Building evacuations occur when an alarm sounds and/or upon notification by Security or the Emergency Director.
2. When the building evacuation alarm is activated during an emergency, individuals should exit according to the building evacuation plan and alert others to do the same.
3. Once outside, individuals should proceed to a clear area that is at least 500 feet away from the affected building. Streets, fire lanes, hydrant areas and walkways should be kept clear for emergency vehicles and personnel.
4. Individuals should not return to an evacuated building unless told to do so by Security or the Emergency Director.
5. Individuals should assist persons with disabilities in exiting the building. Elevators are reserved for disabled persons

Campus Evacuation

1. A uniformed Security Guard, the Emergency Director, or an Emergency Resource Team member will announce evacuation of all or part of the campus grounds.

2. All persons (students and staff) are to immediately vacate the campus, or in the case of a partial evacuation relocate to another part of the campus grounds as directed.

Lockdown

1. Clear the halls
2. Report to the nearest classroom/office
3. Assist those needing special assistance
4. Ensure classroom/office doors are closed and locked
5. Turn off lights
6. Stay away from doors and windows (out of the line of sight)
7. BE QUIET and follow instructor's directions
8. Silence cell phones
9. Wait for the "All Clear" before leaving

Updated 3/22/19