

APSM 153B: ELECTRIC MOTORS & MOTOR CONTROLS IN HVAC SYSTEMS

Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2022
Units:	2.5
Hours:	30 lecture, 10 laboratory per quarter (40 total per quarter)
Prerequisite:	Per California Code of Regulations, this course is limited to students admitted to the Sheet Metal Apprenticeship Program.
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 successful student will be able to describe an electric motor capacitor checkout procedure.
- A successful student will be able to explain the operation of a three phase electric motor.

Description

Students learn the basic aspects of the types of motors and their controls used in HVAC systems.

Course Objectives

The student will be able to:

1. Describe application and operations of various types of electric motors
2. Identify different types of motor controls
3. Identify different motor protection devices
4. Describe the types of motor drives
5. Interpret motor nameplate data
6. Troubleshoot motors and motor control devices

Course Content

1. Describe application and operations of various types of electric motors
 - a. Describe the different types of open single phase motors used to drive fans, compressors, and pumps (Lec)
 - b. Describe the applications of various types of motors (Lec)
 - c. State which motors have high starting torque (Lec and Lab)
 - d. List the components that cause a motor to have high starting torque (Lec and Lab)

- e. Describe a multi-speed permanent split-capacitor motor and indicate how the different speeds are obtained (Lec and Lab)
 - f. Explain the operation of a three phase motor (Lec and Lab)
 - g. Describe a motor used for a hermetic compressor (Lec and Lab)
 - h. Explain the motor terminal connections used in various compressors (Lec and Lab)
 - i. Describe the different types of compressors that use hermetic motors (Lec and Lab)
 - j. Describe the use of variable speed motors (Lec and Lab)
2. Identify different types of motor controls
 - a. Identify the proper power supply for a motor (Lec and Lab)
 - b. Describe the application of three phase versus single phase motors (Lec and Lab)
 - c. Explain how the noise level in a motors can be isolated from the conditioned space (Lec and Lab)
 - d. Describe the different types of motor mounts (Lec and Lab)
 - e. Identify the various types of motor drive mechanisms (Lec and Lab)
 3. Identify different motor protection devices
 - a. Describe the difference between a relay, a contactor, and a starter (Lec and Lab)
 - b. State how the locked rotor of a motor affects the choice of a motor (Lec and Lab)
 - c. List the basic components of a contactor and a starter (Lec and Lab)
 - d. Compare two types of external motor overloads protection (Lec and Lab)
 - e. Describe conditions that must be considered when resetting safety devices to restart electric motors (Lec and Lab)
 4. Describe the types of motor drives
 - a. Describe different types of electric motor problems (Lec and Lab)
 - b. List common electrical problems in electric motors (Lec and Lab)
 - c. Identify various mechanical problems in electric motor (Lec and Lab)
 - d. Describe a capacitor checkout procedure (Lec and Lab)
 - e. Explain the difference between troubleshooting a hermetic motor problem and troubleshooting an open motor problem (Lec and Lab)
 5. Interpret motor nameplate data (Lec and Lab)
 6. Troubleshoot motors and motor control devices (Lec and Lab)

Lab Content

1. Observe motor component demonstrations in the lab
2. Demonstrate tests and analysis for common motor problems

Special Facilities and/or Equipment

1. Laboratory with sheet metal service tools
2. Personal protective equipment
3. 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

Responses in class discussions
Comprehensive written final examination
Comprehensive final project
Demonstration of assigned skills to acceptable level per instructor

Method(s) of Instruction

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

Lecture
Discussion
Demonstration
Lab assignments followed by discussion

Representative Text(s) and Other Materials

Whitman, B., B. Johnson, J. Tomczyk, and E. Silberstein. Refrigeration and Air Conditioning Technology, 8th ed.. 2016.

Auvil, Ronnie J.. HVAC Controls Systems, 4th ed.. 2017.

These are the standard sheet metal textbooks/workbooks used for this course. Although one or more may not be within five years of the required published date, they are the most current books used when teaching this course.

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

1. Sample reading assignment: From the Refrigeration and Air Conditioning Technology textbook, Units 17, 18, 19 and 20, "Types of Electric Motors, Application of Motors, Motor Controls and Troubleshooting Electric Motors"
2. Sample writing assignment: Answer review questions related to assigned reading

Discipline(s)

Sheet Metal or Air Conditioning, Refrigeration, Heating