

COURSE OUTLINE
CET 241 Airflow in Commercial and Critical Environments
3 Credit Hours

Course Description

This course teaches fundamental concepts regarding airflow, including testing and balancing. It will also explore the effects of fume hoods and biosafety cabinets on airflow in critical environments.

Prerequisite(s)

CET 101 OSHA 30 – Safety Orientation OSHA 30
CET 111 Electrical Fundamentals I or HVA 1104 Electrical Fundamentals
CET 122 Building Systems and CET: HVAC or HVA 1044 HVAC Fundamentals
CET 221 Basic Controls

Purpose of Course

The purpose of this course is to prepare students to work on HVAC airflow systems in commercial and critical environments, including airflow through biosafety cabinet and fume hoods, and testing and balancing techniques.

Required Materials

- Sugarman, Samuel C. 2014. Testing and Balancing HVAC Air and Water Systems, 5th ed. Lilburn, GA: Fairmont Press.

Optional Resources

- Auvil, Ronnie J. 2014. HVAC and Refrigeration Systems. Orland Park, IL: American Technical Publishers.
- Gladstone, John. 1996. HVAC Testing, Adjusting, and Balancing Field Manual. McGraw-Hill Education.
- Testing, Adjusting, and Balancing Bureau (TABB) website: www.tabbcertified.org

Learning Outcomes

The intention is for the student to be able to:

1. Demonstrate an ability to make heat load estimates for a building space.
 - a. Calculate design temperature differences.
 - b. Calculate gross and net wall areas.
 - c. Calculate velocity from air flow volumetric rate and vice versa.
 - d. Use wall area, infiltration factors, air change requirements, heat generation from lights and appliances, and ventilation to calculate and adjust heat load requirements.
2. Demonstrate knowledge of components of a forced-air distribution system.
 - a. Define the different components of a forced-air distribution system, including air handling units (AHU), rooftop units (RTU), ductwork, balancing dampers, fans, registers, return grills, terminal units, fire dampers, and duct smoke detectors.
 - b. Identify different types of supply plenum configurations (radial, extended, reducing, perimeter loop, hybrid), including advantages and disadvantages of each.
 - c. Discuss the differences in roles between zoning and balancing dampers.

3. Demonstrate a knowledge of pressure and pressure differences and their role in moving air through an HVAC system.
 - a. Define negative and positive pressure.
 - b. Discuss the relationships among static pressure, velocity pressure, and total pressure.
 - c. Discuss how duct size, damper positions, and blower speeds affect pressure and air flow.
 - d. Map a path of pressure drop through a blower, supply plenum, room, and return duct.
 - e. Use a manometer to measure pressures.
 - f. Use an Equal Friction Chart to determine unknown values for Friction loss, air volumetric flow rate, velocity, or duct diameter when two knowns are given.
 - g. Discuss dangers to a cooling coil if airflow is reduced or recirculated as bypass too much.
 - h. Discuss duct pressure changes in relation to blowers and dampers.
 - i. Use a friction chart to determine the pressure drop in a duct based on duct dimensions, fittings, and airflow rate.
4. Demonstrate an ability to use airflow equations to calculate system variables.
 - a. Discuss the differences between static pressure and velocity pressure.
 - b. Calculate volumetric airflow based on air velocity and vice versa.
 - c. Average airflow velocity measurements across a duct cross section.
 - d. Use fan law equations to predict volumetric airflow based on changes in RPM.
5. Demonstrate an ability to use Testing, Adjusting, and Balancing (TAB) procedures and instruments.
 - a. List the steps involved in testing and balancing an air distribution system.
 - b. Adjust dampers to achieve desired airflow ratios among two or more branch ducts.
 - c. Describe how a manahelic pressure gauge works.
 - d. Describe how a thermal anemometer works.
 - e. Describe how a rotating vane works.
 - f. Describe how a pitot tube works.
 - g. Describe how duct testing is conducted.
 - h. Take air flow readings with an anemometer.
 - i. Take pressure differential readings using a dual port manometer.
 - j. Convert pressure units between psi and inches H₂O, absolute and gauge.
6. Demonstrate an understanding of critical environment considerations for airflow.
 - a. Write a program that signals alarms when air pressure differences fall out of specification.
 - b. Write a program to maintain proper air pressure differences when a fume hood or biosafety cabinet operation status is changed.
 - c. Describe how to change a HEPA filter properly.
7. Demonstrate knowledge of fume hood and biosafety cabinet testing procedures.
 - a. Describe how diffusers and a tracer gas can be used to test a fume hood.
 - b. Determine the average velocity across the opening of a fume hood.
 - c. List steps involved in testing a Biosafety Cabinet.

Learning Units

- I. Heat Load Calculations
- II. Mechanical Components
- III. Pressure differences and Airflow

- IV. Airflow Calculations
- V. Testing, Adjusting, and Balancing
- VI. Critical Environment Control
- VII. Fume Hoods and Biosafety Cabinet Effects

Method of Delivery/Instruction

☒ Face-to-Face ☒ Blended ☐ Online

Learning activities will be assigned within and outside the classroom or online to assist the student to achieve the intended learning outcomes through lecture, Instructor-led class discussion, hands-on experiences, and others at the discretion of the instructor.

Method of Grading and Evaluation

The student will be graded on learning activities and assessment tasks. Grade determinants may include the following: daily work, quizzes, chapter or unit tests, comprehensive examinations, student projects, student presentations, class participation or forum posts, and other methods of evaluation employed at the discretion of the instructor.