

Comprehensive Exam Topics: Fundamentals of Ventilation

Introduction

Principle of ventilation. Ventilation rate / space air exchange rate. Indoor air pollutants and their sources. Mass / thermal and balance of the ventilated room. Limit concentrations (PEL and MPC). Calculation of volume air flow rate / time of ventilation / concentration. Pettenkoffer's criterion.

Psychrometrics

Moist air. Dalton's law. Equation of state for ideal gasses. Enthalpy / relative humidity / humidity ratio and density of moist air. Psychrometric chart vs. h-x diagram. Dry bulb / dew-point / wet bulb temperature. Mixing of 2 air flows (moisture and enthalpy balance).

Natural ventilation

Basic principles. Stack pressure effect. Wind pressure. Shaft ventilation. Infiltration. Natural ventilation by louvers.

Fans

Fan types. Power / specific fan power. Fan performance curves. Fan laws. Fan and system pressure relationship. Duct system and fan characteristics – working point. Parallel fan operation. Serial fan operation. Control of the fans.

Air space diffusion

Mixing / displacement ventilation. Types of supply air outlets (diffusers / grilles / etc.)

Heat exchangers

Calculation of the capacity of heating coil / cooling coil / humidifier. Heat recovery types / efficiency.

Mechanical vent.

Calculation of volume air flow rate. Supply air / outdoor air / recirculated air. Supply and room air temperature difference. Dimensioning of heating coils (ventilation only / ventilation + air heating, ventilation + partial air heating).

Duct design

Reynolds number. Air flow in duct. Laminar / turbulent flow. Duct system characteristics. Pressure losses (friction and local losses). Coefficient of friction. Moody's diagram. Velocity method of duct dimensioning. Principle of static regain method.

Dimensioning of single duct air systems

Design scheme of single duct air system. Basic principles of dimensioning.