

Generating Steam in the Power Plant

Course 112: Generating Steam in the Power Plant

Covers energy principles and boiler maintenance. Explains coal, oil, and natural gas combustion, and how to conserve energy through improved combustion control.

TPC Training is accredited by IACET to offer **0.5 CEU** for this program.



Lesson 1: Transforming Energy into Work

Topics

Energy and Matter; Fuels; Combustion; Temperature Measurement; Pressure Measurement; Quantity of Heat; Heat Transfer; Conduction; Radiation; Convection; Sensible and Latent Heat; Vaporization; Boiling Point; Enthalpy; Heat and Work; Basic Steam Generation

Objectives

- Define energy and describe the main forms of energy encountered in a power plant.
- Explain the process of combustion and list the three elements necessary for combustion to occur.
- Explain the principles of temperature and pressure measurement and describe the four scales on which temperature is measured.
- Describe the methods of heat transfer and the types of effects heat transfer can have on a material.
- Summarize the interrelationship of temperature, volume, and pressure in a gas.

Lesson 2: Boiler Operation

Topics

Types of Boilers; Boiler Characteristics; Water Treatment for Boiler Use; Boiler and Cooling Tower Blowdown; Wastewater Disposal; Efficiency in the Power Plant; Thermodynamic Efficiency; Conserving Energy in the Power Plant

Objectives

- Compare the two basic types of boilers.
- Describe the characteristics by which boilers are classified.
- Explain the different processes by which water is treated for use in a boiler.
- Define blowdown and explain its importance in boiler operation.
- List the problems associated with wastewater disposal and describe how these problems are overcome.
- Describe the factors that affect boiler efficiency, as well as auxiliary equipment efficiency.
- Calculate thermodynamic efficiency.
- List practices that aid in energy conservation in all areas of the power plant.

Lesson 3: Boiler Maintenance

Topics

Soot Removal; Scale Removal; Corrosion; Casing Corrosion; Refractory; Control Systems; Calibration and Cleaning; Compressed Air Systems; Maintaining Boiler Auxiliaries; Maintaining Stacks and Cyclones; Maintenance Schedules and Reports

Objectives

- Explain how the two types of sootblowers remove soot and slag from heat exchange surfaces.
- Describe how scale forms on boiler surfaces and list the three common removal methods.
- Explain why both hot-end and cold-end corrosion occur in a boiler, and tell what practices help prevent corrosion.
- Describe how refractory should be maintained and list the problems that can occur if it is not properly maintained.
- List the primary functions of boiler control systems and describe the three common types.
- Explain how to calibrate and clean boiler control systems and maintain compressed air systems.
- Summarize maintenance procedures for boiler auxiliaries such as pumps, valves, motors and electric circuits.

Lesson 4: Combustion and How It Works

Topics

Coal Ranks; Coal Analyses; Coal Sizes; Coal Storage; Oil Properties; Natural Gas; Chemistry of Combustion; Oil Burners; Gas Burners; Flame Color; Flame Adjustment for Oil and Gas; Coal Firing Systems; Pulverized Coal Burners; Overfeed Stokers; Underfeed Stokers; Ash Analysis for Carbon; Combustion Efficiency; Handling Unburned Solids

Objectives

- Identify the different ranks of coal and describe how the makeup of coal affects its heating value.
- List the properties that are tested in a coal analysis.
- Summarize the properties of oil and natural gas fuels.
- Explain the combustion process in detail.
- Describe how to interpret and adjust a flame's characteristics in coal, oil, and gas burners.
- Describe the three types of coal firing systems.
- List the ways in which combustion efficiency is measured.

Generating Steam in the Power Plant

Lesson 5: Steam Generation

Topics

The Steam Generation Process; Temperature and Pressure Relationship; Superheating Steam and Steam Quality; Volume and Pressure Relationship; Steam Tables for Saturated Steam; How to Use Steam Tables; Circulation of Boiler Water; Steam Circulation and Tube Temperature; Steam Drum Design; Operating a High-Pressure Boiler at Low Pressure; The Complete Steam Generation System; Conserving Energy; Blowdown; Makeup Water

Objectives

- Trace the flow of water and steam through the boiler system.
- Explain the relationship between temperature and pressure and explain why superheated steam has a higher quality than saturated steam.
- Read a steam table properly and apply its information to a boiler system.
- Compare natural circulation boilers with forced circulation boilers, and explain how pressure and temperature affect the type of boiler used.
- Describe the process of operating a high-pressure boiler at low pressure.
- Describe how proper maintenance of steam traps, valves, packing, flanges, and insulation improve the energy conservation rate in a boiler system.