

Steam Plant Fundamentals

This ten-day course begins by reviewing a simple wind power plant and the basic energy processes and equipment, such as equipment for converting chemical energy to heat energy, equipment for transferring heat energy to steam energy, and equipment for converting steam energy to mechanical energy, and converting mechanical energy into electrical energy. Along the way, we describe the boiler feedwater cycle as it applies to a steam power plant. The combustion process is fully described followed by the steam-water cycle in boilers, how turbines are classified, constructed, and operate, and the steam-water cycle in turbines; followed by a description of the condenser steam cycle, and the function and components of the condensate and boiler feed system. The next topic describes the water treatment process, including sources of water, reasons for purification of water, and the methods of water treatment. We also review the mechanical equipment and processes associated with a steam generating plant, and describe the oils and lubrication requirements for plant equipment. The next section describes valves, traps, and associated system piping, and explains the pumps and air compressors used in a steam plant. Instrumentation and control systems that comprise the steam plant operating systems and a description of steam plant operating procedures using checklists and typical operating procedures are provided. The final section describes the job of the plant operator.

I. Basic Power Plant Theory

- Simple Power Plants
- Basic Energy Processes and Equipment
- Boiler Feedwater Cycle
- Pressure and Flow
- Temperature and Heat
- Properties of Water

II. The Combustion Process

- Combustion
- Fuel Handling and Preparation
- Handling Combustion Air and Gas
- Heat Flow
- Ash Removal
- Furnace Explosions

III. Steam Cycles (Boilers and Turbines)

- Steam-Water Cycle (Boilers)
- Steam-Water Cycle (Turbine)

- Condenser Steam Cycle
- Condensate and Boiler Feed System

IV. Water Treatment and Circulating Water System

- Water Treatment Process
- Circulating Water System

V. Steam Plant Mechanical Equipment

- Oils and Lubrication
- Valves, Traps, and Piping
- Pumps and Compressors

VI. Steam Plant Instrumentation and Controls

- Instrumentation
- Main Control Systems

VII. Steam Power Plant Operation

- Plant Operating Procedures
- Station Performance
- Job of the Operator