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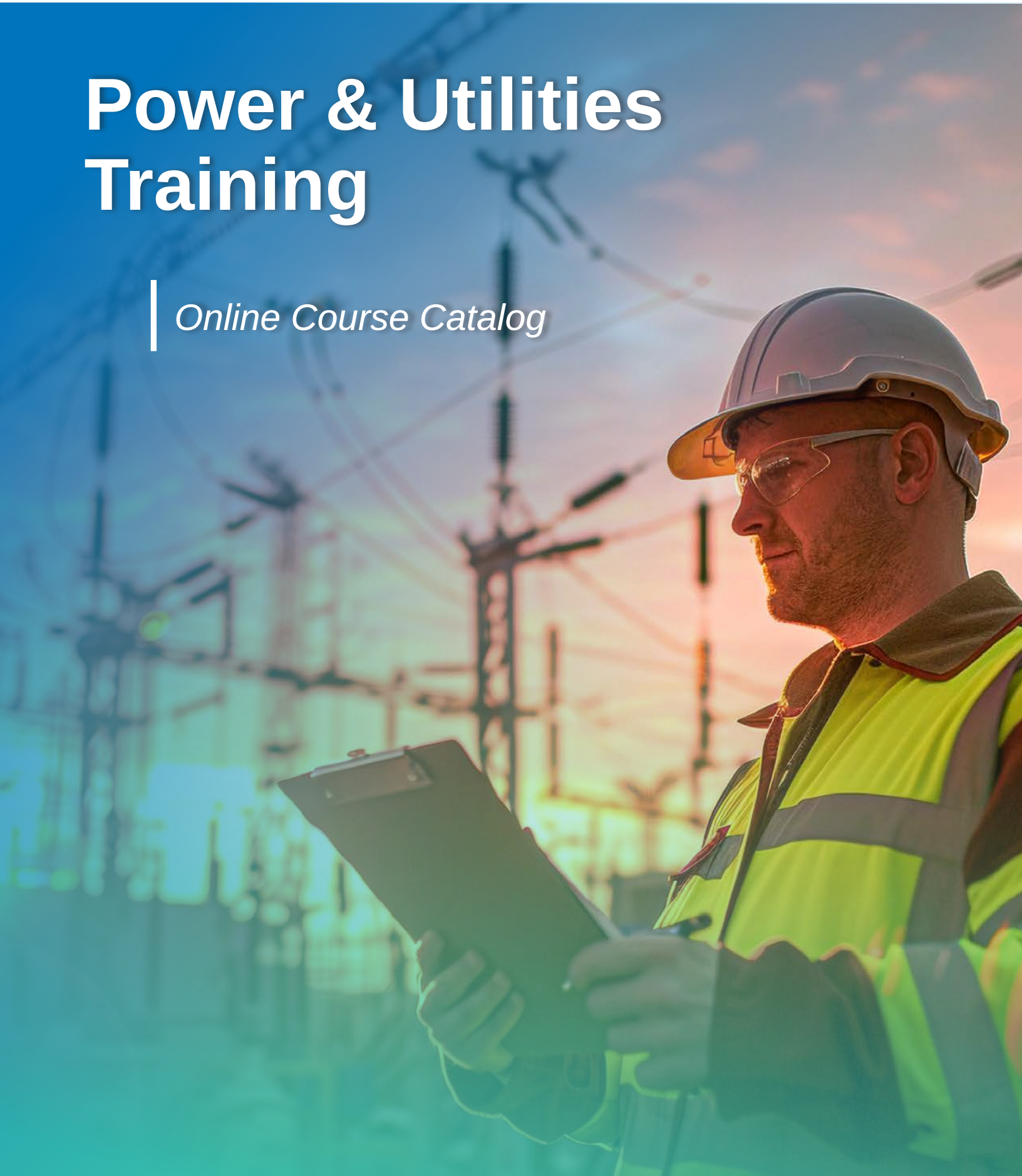
Power & Utilities Training

Online Course Catalog



Power & Utilities Training

Vector Solutions offers a comprehensive range of training courses tailored specifically for the Power & Utilities sector. These courses adhere strictly to OSHA regulation 29 CFR 1910.269, focusing on the operation and maintenance of electric power infrastructure, including generation, control, transformation, transmission, and distribution lines.

Table of Contents

Vector Solutions' Power & Utilities training catalog is designed to cover all essential safety protocols relevant to various job assignments and the operation of power generation equipment, ensuring that participants receive thorough and relevant utility training courses.

BOILERS

- Analysis of Boiler Efficiency
- Boiler Efficiency 1: Air Heaters and Preheaters
- Boiler Efficiency 2: Oil and Gas Fired Furnaces
- Boiler Efficiency 2: Windboxes, Burners, and the Furnace
- Boiler Efficiency 3: Superheaters, Reheaters, and the Economizer
- Boiler Fundamentals
- Boilers: Combustion, Water, and Steam
- Efficient Boiler Operation
- Efficient Operation of Oil and Gas Fired Boilers
- Power Plant Boilers: Abnormal Conditions and Emergencies
- Power Plant Boilers: Combustion and Operation
- Power Plant Boilers: Normal Operations
- Power Plant Boilers: Startup and Shutdown
- Power Plant Boilers: Water and Steam

Analysis of Boiler Efficiency (1-hour)

This course explains how air heaters and preheaters affect boiler efficiency and heat rate. After completing this course, participants should be able to identify boiler parameters commonly associated with air heaters and preheaters and explain how boiler efficiency and heat rate are affected by changes in those parameters. They should also be able to explain how problems with air heaters and preheaters can be recognized and corrected.

Boiler Efficiency 1: Air Heaters and Preheaters (1-hour)

This course explains how air heaters and preheaters affect boiler efficiency and heat rate. After completing this course participants should be able to identify boiler parameters commonly associated with air heaters and preheaters and explain how boiler efficiency and heat rate are affected by changes in those parameters. They should also be able to explain how problems with air heaters and preheaters can be recognized and corrected.

Boiler Efficiency 2: Oil and Gas Fired Furnaces (1-hour)

This course is designed to explain how the windbox, the burners, and the furnace affect the efficiency and heat rate of oil and gas fired boilers. After completing this course, participants should be able to explain how the windbox, the burners, and the furnace operate together to sustain combustion, and how problems with these components can be recognized and corrected.

Boiler Efficiency 2: Windboxes, Burners, and the Furnace (1-hour)

This course is designed to explain how the windbox, the burners, and the furnace affect boiler efficiency and heat rate. After completing this course, participants should be able to explain how the windbox, the burners, and the furnace operate together to sustain combustion, and how problems with these components can be recognized and corrected

Boiler Efficiency 3: Superheaters, Reheaters, and the Economizer (1-hour)

This course describes how superheaters, reheaters, and the economizer affect boiler efficiency and heat rate. After completing this course, participants should be able to describe how superheaters and reheaters add heat to steam, and how the economizer adds heat to feedwater. They should also be able to explain how attemperators control steam temperatures and protect superheaters and reheaters; and how problems with superheaters, reheaters, and economizers affect heat rate.

Boiler Fundamentals (1-hour)

Boilers are commonly used to provide a source of steam for industrial plants. The plant personnel who operate and maintain boilers need to have a good working knowledge of the fundamental principles of boiler operation. They also have to know how to monitor and control the operation of boilers in their plant and the systems associated with the boilers.

BACK

Boilers: Combustion, Water, and Steam (2-hour)

This course is designed to familiarize participants with some of the equipment and flow paths associated with combustion and steam production in a boiler. After completing this course, participants should be able to describe the parts and operation of typical gas burners, oil burners, and stokers. They should also be able to explain how air flow is produced in a boiler, why the proper fuel-to-air ratio must be maintained, and how air heaters improve the efficiency of boiler operation. Finally, participants should be able to explain how water circulation occurs in a boiler and describe the use of economizers and moisture separators.

Efficient Boiler Operation (1-hour)

This course explains some of the fundamental aspects of turbine efficiency. After completing this course, participants should be able to identify energy flows that enter and exit a typical turbine generator set, and explain how to determine the efficiency of a turbine.

Efficient Operation of Oil and Gas Fired Boilers (1-hour)

This course describes how changes in parameters can affect boiler efficiency and heat rate. After completing this course, participants should be able to explain how changes in key boiler parameters can affect boiler efficiency and heat rate, how some of the possible causes of those changes can be identified, and how problems that can cause parameters to change can be recognized during a boiler walkdown

Power Plant Boilers: Abnormal Conditions and Emergencies (2-hour)

This course is designed to familiarize participants with common boiler problems and some of the basic causes of boiler explosions. After completing this course, participants should be able to describe basic procedures for dealing with the loss of certain boiler auxiliaries, leaks, overpressure conditions, and equipment fires. They should also be able to describe some basic causes of boiler explosions and explain what operators can do to help prevent boiler explosions.

Power Plant Boilers: Combustion and Operation (2-hour)

This course is designed to familiarize participants with the basic principles associated with combustion in a boiler and the flow of air and combustion gases during boiler operation. After completing this course, participants should be able to identify the elements needed for combustion in a boiler, explain how fuel is delivered to the burners, and describe the parts and operation of various types of burners. They should also be able to describe the air and gas flow path through a boiler and describe methods used to remove particulates and harmful gases from combustion gases. In addition, participants should be able to explain when and why vents, drains, blowdown valves, and soot blowers are used.

Power Plant Boilers: Normal Operations (2-hour)

This course is designed to familiarize participants with the tasks involved in operating boilers under normal conditions. After completing this course, participants should be able to explain what steady state conditions for a boiler are and describe typical operator concerns associated with the energy losses that occur during operation of a boiler under steady state conditions. They should also be able to describe operator responsibilities for monitoring and controlling the boiler's steam/water system, air/gas system, steam temperature, and ash removal systems

BACK

Power Plant Boilers: Startup and Shutdown (2-hour)

This course is designed to familiarize participants with basic techniques for starting up and shutting down drum-type boilers and once-through boilers. After completing this course, participants should be able to describe basic procedures for performing a cold startup of a drum-type boiler, lighting off the furnace, warming up the boiler, and establishing the boiler flame. They should also be able to describe basic procedures for shutting down a typical drum-type boiler. In addition, participants should be able to compare and contrast the startup and shutdown of a drum-type boiler with the startup and shutdown of a once-through boiler.

Power Plant Boilers: Water and Steam (1-hour)

This course is designed to familiarize participants with the basic principles associated with the flow of water and steam in various types of boilers. After completing this course, participants should be able to describe the flow path of water through a typical drum-type boiler, explain the differences between natural circulation and controlled circulation, and describe the functions and components of a typical boiler drum. They should also be able to describe the flow path of steam from the boiler to the condenser in a typical generating unit and explain the function of each component in the flow path. In addition, participants should be able to explain why some boilers operate above the critical point, describe the flow path of water in a once-through supercritical boiler, and explain how steam pressure is maintained in a drum-type boiler and in a once-through boiler.

BACK

COAL HANDLING – EQUIPMENT

- Ash Handling
- Auxiliary Equipment
- Car Dumpers
- Coal Preparation Equipment
- Control Equipment
- Conveyors
- Dust Control
- Dust Control Equipment (2 modules)
- Handling Wet and Frozen Coal
- Stackers

Ash Handling (1-hour)

Ash is the solid residue that is produced when coal is burned. To keep a coal-fired plant operating, ash must be collected, removed from the plant, and properly disposed of.

Auxiliary Equipment (1-hour)

Auxiliary equipment is used to perform support operations in a typical coal handling system. Support operations, such as weighing coal and collecting coal samples, help provide important information for coal handling and other plant operations. This training program explains why coal is weighed and sampled, and describes some of the auxiliary equipment used to perform these jobs. It also covers some of the preventative maintenance tasks that coal handlers may perform to keep auxiliary equipment in good working condition.

Car Dumpers (1-hour)

Coal handlers operate and maintain the equipment used to transport and unload coal cars. This equipment may include rotary car dumpers, positioners, and retarders. To help coal handlers develop the skills needed to work safely with this equipment, this course describes how rotary car dumpers, positioners, and retarders work. It also explains how this equipment is generally operated during receiving operations, and how it is maintained.

Coal Preparation Equipment (1-hour)

Coal preparation is an important aspect of coal handling. When coal leaves a plant's coal handling system, it generally is sent to one of two places. Depending on the design of the plant, the coal may go directly to a boiler furnace to be burned, or it may go through coal processing equipment, such as a pulverizer, before it is burned. In either case, coal usually has to be prepared during coal handling so that the pulverizing and burning will be more efficient. Coal preparation involves the use of special equipment that operators are often required to inspect, maintain, and troubleshoot. Operating coal preparation equipment properly can help prolong the life of the equipment and maximize the efficiency of the coal handling system.

Control Equipment (1-hour)

The components of a coal handling system are operated with control equipment. The proper operation of the control equipment ensures that the components are started and stopped in the correct sequence so that coal moves smoothly from one component to the next. If one of the components in the sequence is not operated properly, the entire system could come to a stop, and equipment could be damaged. This course describes how control equipment is used to operate coal handling components so that they work together smoothly as a system. Troubleshooting procedures that can be used to determine the cause of a coal handling system malfunction also are covered.

Conveyors (1-hour)

Coal handlers operate and maintain the equipment used to transport coal to a plant for burning or to a coal pile for storage. This equipment includes conveyors, feeders, and chutes. Coal handlers must also inspect and maintain equipment such as magnetic separators and cleaning devices, which help transport operations run smoothly. This course explains how the equipment involved in transport operations works, and how it should be inspected and maintained.

BACK

Dust Control (1-hour)

Dust control is an important part of coal handling operations. This course looks at where coal dust is produced, how it can spread, and how it can be kept from spreading. Specific attention is directed to equipment and techniques that are commonly used to control dust in coal handling systems.

Dust Control Equipment (2 modules) (2-hour)

Dust from coal handling operations must be controlled to protect personal health, equipment, and the environment. There are many different types of equipment used to control coal dust, and operating it may be part of a coal yard worker's job. Dust control equipment is classified into two main groups: equipment used to control dust inside buildings and equipment used to control dust outside in the coal yard. This course focuses on the equipment used in the coal yard.

Handling Wet and Frozen Coal (1-hour)

Wet and frozen coal can create difficult problems for coal handlers, including clogging equipment and impeding or blocking coal flow. However, many of the problems resulting from wet or frozen coal can be greatly reduced, and sometimes entirely avoided, by following certain precautions, by properly using specialized equipment, and, in some cases, by planning ahead. This training program covers the types of problems caused by wet and frozen coal, as well as methods and equipment that are commonly used to avoid, minimize, or respond to these problems.

Stackers (1-hour)

Plants that burn coal typically store their coal in outdoor piles. To move the coal to the storage pile, a machine called a stacker is often used. An important aspect of coal handling is operating a stacker, coordinating its operation with the rest of the coal handling system, and keeping it in good working condition by performing regular inspections and minor maintenance.

BACK

COAL HANDLING – FUNDAMENTALS

- Coal Handling Overview (3 modules)

Coal Handling Overview (3 modules) (3-hour)

Coal handlers work with a variety of equipment designed to help them perform the job of keeping a plant supplied with coal. This equipment, known collectively as the coal handling system, provides an efficient way of carrying out basic coal handling operations, which includes receiving, transporting, storing, and preparing coal. Coal handling systems can also be designed to perform other functions such as weighing coal, taking coal samples, controlling coal dust, and removing ash. This course explains how coal handling systems receive, transport, and store coal outdoors.

BACK

COAL HANDLING – MOVING

- Bulldozers
- Coal Pile Management
- Coal Yard Maintenance

Bulldozers (1-hour)

The coal that is delivered to a plant is often unloaded and sent directly to bunkers that supply the boiler furnaces. However, when the bunkers are full, the coal delivered to the plant is typically deposited on storage piles. Bulldozers are used to spread coal out on these storage piles and to reclaim coal from the piles when it is needed in the plant. Bulldozers are also used to manage coal piles to reduce the risk of fires and to minimize loss from erosion due to wind and rain. Coal handlers who use bulldozers must know how to operate them safely and correctly, and how to take care of them properly. This training program focuses on the use of bulldozers in coal handling operations. Emphasis is placed on practical applications, inspection procedures, minor maintenance procedures, and basic operating procedures.

Coal Pile Management (1-hour)

Plants that need to burn large quantities of coal also need to maintain large coal reserves. The most common way of storing coal is in large outdoor storage piles. Coal pile management involves moving coal to and from storage piles, and maintaining the piles to deal with coal pile fires and environmental factors such as rain and wind.

Coal Yard Maintenance (1-hour)

Coal is a heavy, abrasive, and corrosive material that can be difficult for equipment to handle. To handle coal, equipment must often run at high speeds and carry heavy loads. To do its job, coal handling equipment must be continually maintained to ensure it stays in good running condition. This course examines the maintenance jobs that are commonly performed on coal handling equipment and describes how coal handlers may be involved with equipment maintenance.

BACK

COAL HANDLING – TRANSPORT

- Rail Yard Operations

Rail Yard Operations (1-hour)

Receiving and unloading coal are rail yard operations that are commonly performed by coal handlers. To help coal handlers develop the knowledge and skills necessary to work safely with rail yard equipment, this course covers basic rail yard equipment, including tracks, switches, coal cars, and locomotives. It also describes how the braking system on a coal car generally operates, emphasizes the safe working practices associated with mounting and dismounting coal cars, and covers effective communication among members of a rail yard crew.

BACK

COMBINED CYCLE

- Combined Cycle: Distributed Control Systems
- Combined Cycle: Heat Recovery Steam Generators
- Combined Cycle: Normal Operations

Combined Cycle: Distributed Control Systems (2-hour)

In this course, we'll focus on distributed control systems (DCS) as they relate to combined cycle power plants. We'll look at the overall purpose of a DCS and examine the components that make up the system. We'll also look at how a DCS can be used to monitor normal plant operation, and change device states and set points. And we'll see how a DCS can be used to troubleshoot malfunctions and abnormalities.

Combined Cycle: Heat Recovery Steam Generators (2-hour)

In this course, we'll focus on heat recovery steam generators as they apply to combined cycle power plants. We'll cover some fundamentals related to the basic types of heat recovery steam generators (HRSGs) and to some general design considerations and we'll look at the components found in the various sections of an HRSG.

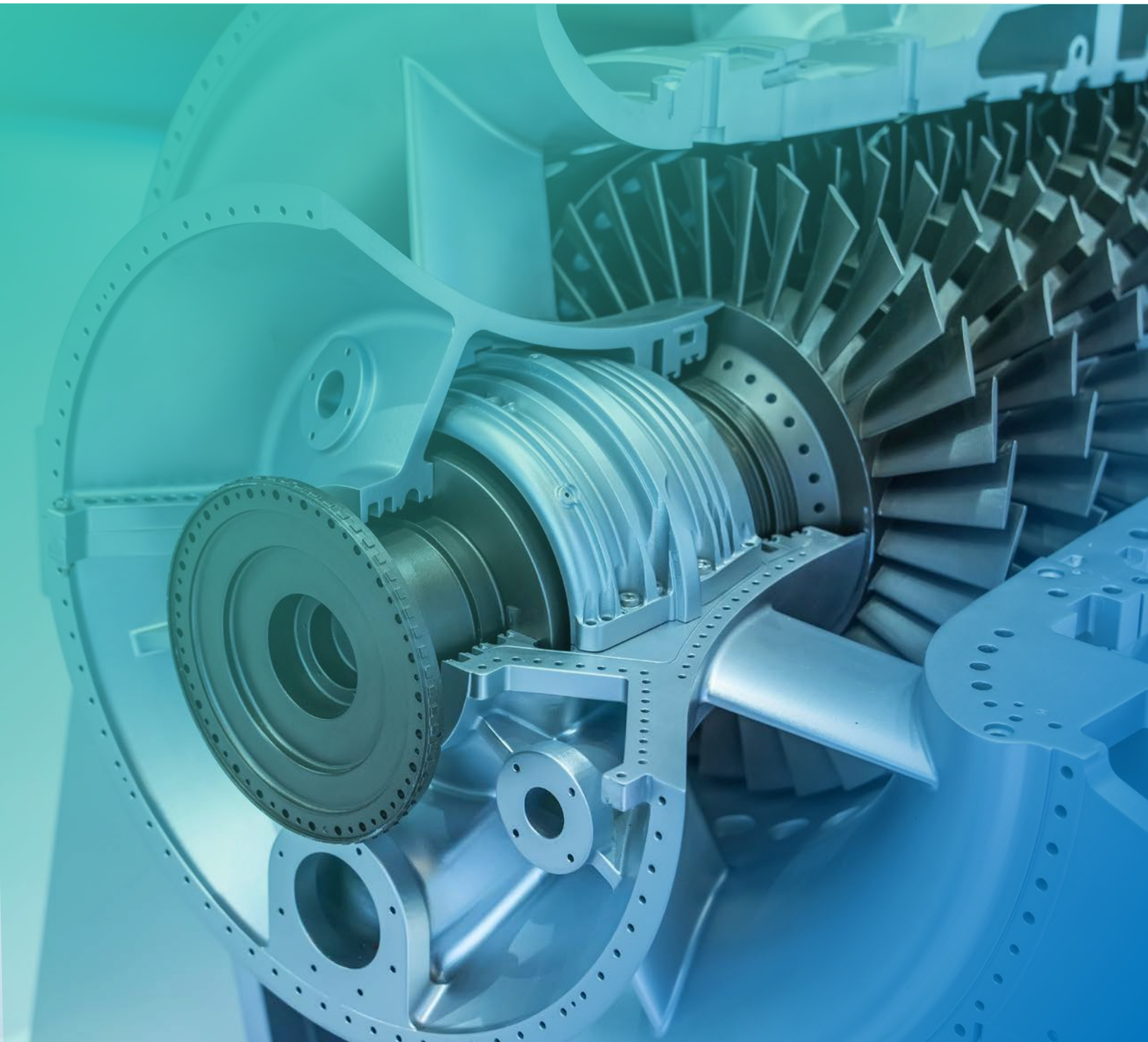
Combined Cycle: Normal Operations (2-hour)

In this course, we'll focus on the normal operation of a combined cycle power plant. We'll look at an overview of the major components of a combined cycle plant, and we'll see how procedures for plant control are developed and updated. We'll also look at the procedures involved in starting up and shutting down a plant, and we'll see how a distributed control system (DCS) helps operators monitor and maintain a plant during normal operation.

BACK

COMBUSTION TURBINE

- Combustion Turbine: Abnormal Operations
- Combustion Turbine: Components
- Combustion Turbine: Normal Operations
- Combustion Turbine: Principles
- Combustion Turbine: Support Systems (2 modules)



Combustion Turbine: Abnormal Operations (1-hour)

In this program, we'll cover some problems that can occur during operation of a simple cycle combustion turbine that drives an electric generator, and we'll see how operators can deal with these problems. We'll look at problems that can occur during startup and shutdown. We'll also look at some of the abnormal conditions that can occur within the different component sections of the turbine generator unit, and its support systems.

Combustion Turbine: Components (1-hour)

In this course, we will focus on the components that make up a typical combustion turbine, including those related to the intake and compression of the inlet air, the combustion of the fuel/air mixture, and the expansion of hot combustion gases through and out of the turbine.

Combustion Turbine: Normal Operations (2-hour)

In this course, we'll focus on operator responsibilities that are typically associated with the normal operation of a simple cycle combustion turbine that drives an electric generator. We'll see pre-startup checks that operators perform, and we'll look at steps involved in starting up the unit and then shutting it down. We'll also identify conditions that operators monitor during normal turbine operation, and we'll cover some routine inspection and maintenance tasks that operators may perform.

Combustion Turbine: Principles (2-hour)

In this course, we will focus primarily on combustion turbines that drive electric generators. From this perspective, we will go over the general principles of operation for a combustion turbine. We will look at the fundamentals of how combustion turbines work. We will examine factors that affect turbine efficiency, and we will see some of the many different applications in which combustion turbines are used.

Combustion Turbine: Support Systems (2 modules) (4-hour)

Module 1 - In this course, we will focus on several vital support systems that are associated with combustion turbines including the inlet air system, the lubricating oil system and the starting system, and different types of fuel systems. Module 2 - In this course, we'll cover three support systems that are critical for safe and efficient operation of a combustion turbine. These are the control system, the fire protection system, and the environmental system.

BACK

CONDENSERS

- Condenser Efficiency
- Efficient Condenser Operation

Condenser Efficiency (1-hour)

This course is designed to teach participants how condenser performance can affect the efficiency of a generating unit. After completing this course, participants should be able to identify energy flows into and out of a condenser and know how these flows are related to the efficiency of the condenser and to unit heat rate. Participants should also be familiar with different methods of determining condenser efficiency, such as by checking parameters and indicators and using condenser performance curves and circulating water pump selection curves. In addition, participants learn how changes in condenser vacuum can affect unit heat rate and operating costs.

Efficient Condenser Operation (1-hour)

This course is designed to explain how three general categories of problems can affect condenser vacuum, efficiency, and unit heat rate. After completing this course, participants should be able to describe how tube fouling and blockages, air leakage into the condenser, and circulating water flow and temperature problems affect efficiency and unit heat rate. They should also be able to identify ways to recognize and respond to these problems.

BACK

ENVIRONMENTAL PROTECTION

- Environmental Protection Systems - Air Pollution
- Environmental Protection Systems - Water Pollution

Environmental Protection Systems - Air Pollution (1-hour)

This course is designed to familiarize participants with the basic concepts associated with what air pollution is and how it can be controlled. After completing this course, participants should be able to explain what air pollution is, where it can come from, and how it can be monitored. They should also be able to explain how air pollution from industrial facilities can be controlled.

Environmental Protection Systems - Water Pollution (1-hour)

This course explains how water pollution standards are expressed, what the standards are for certain pollutants, and where many pollutants come from. The course also discusses how industrial facilities keep their discharges of potential pollutants below the standards set for them and describes some of the techniques and types of equipment that industry uses to prevent the discharge of pollutants into the environment.

BACK

FURNACES

- Furnace Fundamentals
- Furnace Introduction
- Furnaces: Operating Conditions
- Furnaces: Startup and Shutdown

Furnace Fundamentals (1-hour)

An important part of an operator's job when working with any furnace is to make sure that the furnace is running efficiently in order to save fuel, maximize the amount o f heat that is produced, and minimize the amount of heat that is wasted. More importantly, careful furnace operation helps prevent explosions, injury, and damage to equipment.

Furnace Introduction (1-hour)

Furnaces are an important source of heat for many industrial facilities. Furnaces, which can also be referred to as fired process heaters, are basically enclosed structures that produce heat by the combustion of fuels. This course will review the major components that make up furnaces, explain how combustion takes place inside a furnace, and identify the different flow paths inside a furnace.

Furnaces: Operating Conditions (2-hour)

This course is designed to familiarize participants with general operator responsibilities associated with operating a furnace. After completing this course, participants should be able to identify instrumentation used to monitor furnace operating conditions and explain the basic operating principles, temperature control systems, and process fluid control systems. They should also be able to identify conditions that should be checked during furnace operations and explain how to detect and respond to abnormal conditions.

Furnaces: Startup and Shutdown (2-hour)

This course is designed to familiarize participants with basic procedures for starting up and shutting down a furnace. After completing this course, participants should be able to describe basic procedures for preparing a furnace for startup, establishing the flow of process fluid, and lighting the burners. They should also be able to describe general considerations and basic procedures associated with planned furnace shutdowns and unplanned, or emergency, furnace shutdowns.

BACK

OVERHEAD LINE

- Transformer Troubleshooting
- Transmission and Distribution: Transmission Line Installation
- Transmission and Distribution: Working on Distribution Poles
- Transmission Line Repair - Hot Sticks
- Transmission Structures
- Troubleshooting Overhead Lines
- Working on De-energized Transmission Lines

Transformer Troubleshooting (1-hour)

The purpose of this course is to teach techniques for troubleshooting single-phase transformers and three-phase transformer banks. The course demonstrates how to identify a faulted transformer. It also demonstrates how to isolate transformers and how to test for proper no-load voltage. At the conclusion of this course, participants should be able to identify a faulted single-phase transformer, isolate it, and test it for proper no-load voltage. They should also be able to identify a faulted transformer in a three-phase transformer bank, isolate the faulted transformer, and test it for proper no-load voltage.

Transmission and Distribution: Transmission Line Installation (1-hour)

The purpose of this interactive online course is to describe and demonstrate an approach to installing a transmission line. This work is not a routine part of a lineworker's job in many locations, but an understanding of the basic approach is useful to individuals who are responsible for maintaining lines. At the conclusion of this course, participants should understand how to plan and set up an installation job, the purpose of guard structures, and how to set them up. They should also know how to pull conductors into place to properly sag and how to clip them permanently to the insulators.

Transmission and Distribution: Working on Distribution Poles (1-hour)

The purpose of this course is to teach the basic principles involved in working safely on distribution. To illustrate these principles, you will be shown some resources available for planning distribution work. This interactive online course will teach you general considerations associated with planning a distribution job. You will also learn how a variety of tools and equipment can be used, including an auxiliary arm. Additionally, you will learn how to replace secondary conductors, move energized conductors, and how to install floating dead-ends.

Transmission Line Repair - Hot Sticks (1-hour)

The purpose of this course is to teach the theory and practice involved in safe use of hot sticks to perform live transmission line repair. Basic safety issues and basic techniques for the care, selection, and use of hot sticks are presented. The course builds on a basic understanding of how to work on transmission towers and the use of high-voltage rigging techniques to demonstrate replacement of string insulators using hot sticks. At the conclusion of this course, participants should be able to describe the safety issues important in performing live transmission line repair using hot sticks. They should be able to care for, select, and use hot sticks. They should also be able to explain how to replace string insulators in all three common positions.

Transmission Structures (1-hour)

The purpose of this course is to teach how transmission structures are built. It is recognized that transmission structure construction is not a routine part of a lineman's job in most locations; however, a basic understanding of how this work is done is useful for maintaining transmission lines. The course describes how transmission structure foundations are laid and covers three types of construction methods for erecting transmission structures. At the conclusion of this course, participants should be able to describe how two types of transmission structure foundations are laid. They should also be able to explain how transmission structure construction is planned and describe three ways that transmission structures are erected.

BACK

Troubleshooting Overhead Lines (1-hour)

The purpose of this course is to teach how to go about patrolling overhead lines. The importance of patrolling to reliable operation of the lines is discussed, and examples of structure, hardware, conductor, insulator, and obstruction problems are shown and explained. An example of how to detect problems while patrolling an overhead line is also given. At the conclusion of this course, participants should be able to explain why patrolling overhead lines is important. They should understand the types of problems to look for when patrolling overhead lines. They should be able to detect structure problems, problems with broken or damaged hardware on a pole or tower, problems with conductors and insulators, and current or developing obstructions of the lines. They should also be able to demonstrate the ability to detect problems when patrolling overhead lines.

Working on De-energized Transmission Lines (1-hour)

The purpose of this course is to teach principles and practices for working safely on de-energized transmission lines. The course explains how a de-energized line could become energized if the proper safety practices are not followed. An approach to de-energizing, isolating, testing, and grounding a transmission line is presented. At the conclusion of this course, participants should be able to describe the dangers of a de-energized line's becoming energized. They should be able to describe how to safely de-energize, isolate, test, and ground a transmission line. They should also be able to describe or demonstrate how to use temporary grounds and personal grounds.

BACK

POWER PLANT OPERATION

- Cycle Efficiency
- Efficient Power Plant Operation
- Introduction to Heat Rate Improvement
- Power Plant Efficiency: Problems and Analysis
- Power Plant Operation: Safety and Pollution Control
- Power Plant Protection: Boiler and Turbine Protections
- Power Plant Protection: Fundamentals
- Power Plant Protection: Integrated Systems
- Power Plant Thermodynamics
- Power Plant: Condenser and Circulating Water
- Power Plant: Power & Energy
- Power Plant: Power Generation
- Power Plant: Steam Systems
- Principles of Heat Transfer

Cycle Efficiency (1-hour)

This course is designed to familiarize participants with the concept of a boiler envelope and with the input/output method and the heat loss method of determining boiler efficiency. After completing this course, participants should be able to explain what a boiler envelope is and identify energy flows into and out of the boiler envelope. They should also be able to describe how the input/output method and the heat loss method are used to determine boiler efficiency, and identify factors that must be considered when each method is used. Also covered are factors over which the boiler operator has some control.

Efficient Power Plant Operation (1-hour)

This course is designed to explain why unit heat rate is higher than normal during certain operating conditions and describe what can be done to prevent additional efficiency losses from occurring during these conditions. After completing this course, participants should be able to explain how careful planning and following plant procedures can reduce efficiency losses during unit startups and shutdowns. They should also be able to explain why parameters should be kept at their setpoints during reduced power operation, and how changes in weather conditions affect efficiency and heat rate.

Introduction to Heat Rate Improvement (1-hour)

By the conclusion of this course, participants should be able to describe what heat rate is and how it can be determined, and explain how the operating efficiencies of units and components can be determined. They should also be able to describe how operations, maintenance, and engineering groups contribute to the efficient operation of a power plant.

Power Plant Efficiency: Problems and Analysis (1-hour)

This course is designed to reinforce major concepts taught in the heat rate improvement series by having participants participate in the identification and analysis of problems that affect heat rate. After completing this course, participants should be able to identify some of the problems that commonly occur in power plants by using related parameters, and describe how heat rate and fuel consumption are affected by these problems. The final segment in the course summarizes key points from the courses in the heat rate improvement series.

Power Plant Operation: Safety and Pollution Control (2-hour)

This course is designed to familiarize participants with some of the basic concepts associated with personal protection, tagging procedures, and pollution control. After completing this course, participants should be able to describe some of the basic protective equipment that operators commonly use and explain how a tagging system protects personnel who work on or around plant equipment. They should also be able to describe methods of controlling air pollution, thermal pollution, water pollution, and noise pollution.

Power Plant Protection: Boiler and Turbine Protections (2-hour)

This course is designed to familiarize participants with devices and techniques used to protect boilers and turbines. After completing this course, participants should be able to identify common boiler and turbine problems and explain how they can be prevented or minimized.

BACK

Power Plant Protection: Fundamentals (1-hour)

This course is designed to familiarize participants with various types of hazards that may exist in a power plant. After completing this course, participants should be able to identify common types of mechanical and electrical hazards, temperature and pressure hazards, and fire and chemical hazards. They should also be able to describe devices and techniques that can be used to prevent or minimize these hazards.

Power Plant Protection: Integrated Systems (1-hour)

This course is designed to familiarize participants with the interaction of various systems that work together to protect plant equipment. After completing this course, participants should be able to interpret logic diagrams that represent the functions carried out by plant protection equipment. They should also be able to identify conditions that can cause a boiler trip, a turbine trip, and a generator trip.

Power Plant Thermodynamics (1-hour)

After completing this course, participants should be able to explain the basic processes of a typical steam/water cycle and the way the efficiencies of those processes relate to the overall efficiency of the plant. Participants should also be able to explain the effects of changing or modifying the components of a steam/water cycle and to explain what Rankine efficiency is.

Power Plant: Condenser and Circulating Water (1-hour)

The condenser and the circulating water system play a vital role in plant operation and efficiency by completing the steam/water cycle. Part of an operator's job involves monitoring and controlling the condenser and circulating water system. Therefore, it is important to have a good understanding of how these components work and what problems can affect them.

Power Plant: Power & Energy (1-hour)

Power plant operators are responsible for maintaining power production and making sure the plant operates safely and efficiently. To see why this is important, it is helpful to understand how an individual plant fits into a power system providing electricity and distributing electricity to customers.

Power Plant: Power Generation (1-hour)

This course covers topics related to power generation at power plant systems, including voltage induced in an alternating current (AC) generator, generator output current, generator excitation, hydrogen cooling systems, and stator cooling systems.

Power Plant: Steam Systems (1-hour)

Steam Systems is a course designed to familiarize participants with the design and operation of the steam systems found in a typical power plant.

BACK

Principles of Heat Transfer (1-hour)

This course is designed to familiarize participants with the basic laws governing heat in motion in a power plant. The course explains basic thermodynamic principles and shows how they apply to the efficiency of plant processes. After completing this course, participants should be able to explain the basic principles of thermodynamics and why they are important to power plant operation. They should also be familiar with temperature/entropy charts, and explain how they are used to determine and compare the efficiency of various processes in a plant cycle.

BACK

PROCESS EQUIPMENT & OPERATIONS

- Operator Responsibilities: Plant Production and Safety

Operator Responsibilities: Plant Production and Safety (0.5-hour)

The primary responsibility of a plant operator is to ensure that a unit functions safely and efficiently. To fulfill that responsibility an operator must be able to perform different types of duties under a variety of operating conditions. In this interactive online course, we'll focus on operator responsibilities related to plant production and we'll examine some safety responsibilities and regulations that apply to various operating conditions. We'll also examine some safety permits and regulations that operators must be familiar with.

BACK

RIGGING (ITD)

- Advanced Rigging - Transmission & Distribution

Advanced Rigging - Transmission & Distribution (1-hour)

Advanced Rigging course is designed to familiarize participants with the various types of weights and tensions associated with rigging in line work. The procedures and concepts presented assume a familiarity with basic electrical theory and transmission and distribution systems. Participants without this prior training may require additional explanation or instruction. At the conclusion of this course, participants should be able to explain the difference between static force loads and dynamic force loads, and how to determine the weight of each type of load. Participants should also be able to explain line tension, bisect tension, and guy tension, and they should be able to determine each type of tension for a given job. In addition, participants should be able to define the term ‘safety factor’ in terms of rigging, and they should be able to use a safety factor to plan safe rigging.

BACK

T&D CONSTRUCTION

- Series and Street Lighting
- Transmission and Distribution: Service Installation

Series and Street Lighting (1-hour)

Series and Street Lighting is designed to familiarize participants with electrical street lighting systems that use series alternating current (AC) circuits. The components and operation of series street lighting circuits are discussed, as well as how to identify some common street lighting circuit faults. To obtain maximum advantage from this course, participants should have an understanding of basic electrical theory and the components and operation of distribution systems. They should also be familiar with circuit and wiring diagrams. At the conclusion of this course, participants should be able to describe the design and operation of series street lighting circuits and the components that make up a series street lighting system. They should also be able to describe basic troubleshooting procedures for determining the cause of a fault in a series street lighting circuit.

Transmission and Distribution: Service Installation (1-hour)

Each service installation job you do will be different because of different site conditions, but the basic installation skills and practices you will learn in this course can be applied no matter what type of service installation job you're doing. This interactive online course will teach you how to install and connect services. You will learn about the different types of connectors available and how service conductors are joined together using some of those connectors. You will also learn how to install single phase, overhead, and underground residential service. Additionally, you will learn how to install three-phase service, and how to replace an existing three-phase service without affecting the customer.

BACK

T&D DISTRIBUTION

- Transmission and Distribution: Distribution Line Installation and Removal
- Transmission and Distribution: Distribution Line Replacement
- Transmission and Distribution: Overhead Distribution Systems

Transmission and Distribution: Distribution Line Installation and Removal (1-hour)

Sometimes changes are made in the area around a distribution line that make it necessary to relocate or replace a portion of that line. This interactive online course will familiarize you with the general procedures involved in completing a typical distribution line installation and removal. You will learn how to plane an installation and removal job and how to perform the major steps involved in doing the job. You will also learn how to pull and sag lines, parallel a new line with an existing line, remove conductors, and remove equipment.

Transmission and Distribution: Distribution Line Replacement (1-hour)

The purpose of this course is to teach how to replace conductors in an existing line with new conductors. The situation described is one that often occurs when it is necessary to increase the size of the conductors in a line. This interactive online course demonstrates how to install the new conductors, parallel them with the existing conductors, and remove the old conductors. The importance of maintaining the proper clearances and the importance of maintaining the integrity of the existing line are explained. Safety is emphasized throughout the course. At the conclusion of this course, participants should be able to plan a replacement job and demonstrate how to perform the major steps involved in doing the job. They should be able to install temporary crossarms, transfer lines, pull and sag new lines, parallel a new line with an existing line, and remove old conductors.

Transmission and Distribution: Overhead Distribution Systems (1-hour)

The purpose of this interactive online course is to teach the basic layout of overhead distribution systems, to explain how to identify circuits and equipment in the field, and to introduce delta- and wye-connected distribution systems. The basic theory underlying the operation of delta and wye systems is presented, and the differences between them are discussed. At the conclusion of this course, participants should be able to describe the basic layout of an overhead distribution system and identify circuits and equipment in the field. They should understand the basic characteristics of delta and wye systems and should be able to identify delta and wye circuits in the field. They should also understand the importance of identifying whether a system is connected delta or wye before any work is performed.

BACK

T&D EQUIPMENT

- Bucket Trucks (2 modules)
- Hydraulic Derricks
- Mobile Hydraulic Systems

Bucket Trucks (2 modules) (2-hour)

Module 1- The purpose of this course is to teach the major parts of a bucket truck, safety features commonly found on bucket trucks, and some of the pre-use inspections that can be made on a bucket truck. It is assumed that participants has no previous experience in operating bucket trucks. After completing the course, participants should practice operating the controls of a bucket truck under the supervision of experienced personnel. At the conclusion of this course, participants should be familiar with the major parts of bucket trucks. They should also be familiar with the basic types of bucket trucks, the boom controls, some of the common safety features and overrides, and some of the common pre-use inspections that can be performed on a bucket truck. Module 2 - The purpose of this course is to teach some basic techniques that can be used to operate a bucket truck safely and efficiently. Techniques for setting up and operating a bucket truck at three typical job sites are described. It is assumed that participants is already familiar with the basic parts of a bucket truck and understands how to use the bucket controls to operate the booms. After completing the course, participants should practice setting up and operating a bucket truck at a job site under the supervision of experienced personnel. At the conclusion of this course, participants should be able to set up and operate a bucket truck at a job site.

Hydraulic Derricks (1-hour)

The purpose of this course is to familiarize participants with three types of hydraulic digging equipment: digger derricks, backhoes, and trenchers. The major working parts and controls and safe operating practices for each are described. Each piece of equipment is shown safely performing a job typical of those for which it is designed. After completing this course, participants should be able to locate and identify the major working parts and controls of digger derricks, backhoes, and trenchers. They should also be able to summarize the uses for which each machine has been designed and describe each machine’s safe operation in the field.

Mobile Hydraulic Systems (1-hour)

The purpose of this course is to teach basic operation and maintenance of mobile hydraulic systems used on line trucks. The course presents the basic principles of hydraulic power and explains how these principles are used to produce motion. Inspection and routine maintenance of mobile hydraulic systems are also discussed. At the conclusion of this course, participants should have a basic understanding of how mobile hydraulic systems operate. They should be able to identify components of a mobile hydraulic system and explain how they function. They should also be able to inspect a mobile hydraulic system and perform minor maintenance.

BACK

T&D MAINTENANCE

- Compressors and Pneumatic Tools
- Hydraulic Hand Tools (2 modules)
- Transmission and Distribution: Power Quality

Compressors and Pneumatic Tools (1-hour)

The purpose of this course is to teach the basic operating principles and general operating procedures for air compressors and the following pneumatic tools: jackhammers, tamps, pumps, circular air saws, and duct blowing rigs. The course shows how to use the tools efficiently for several construction and maintenance jobs. Emphasis is placed on the important safety precautions associated with using these tools. At the conclusion of this course, participants should have a basic understanding of how to operate an air compressor. They should also know how to use pneumatic tools safely and efficiently on a job.

Hydraulic Hand Tools (2 modules) (2-hour)

Module 1 - The purpose of this course is to teach the basic principles of operation of three commonly used types of hydraulic hand tools: breakers, pole pullers, and tamps. The course also presents some of the basic principles of hydraulics and shows how these principles apply to the operation of a hydraulic power system. At the conclusion of this course, participants should have a basic understanding of how hydraulic breakers, pole pullers, and tamps operate. They should be able to identify the basic external and internal parts of the tools and explain their functions. They should also know the safety precautions that are applicable to using hydraulic hand tools on a job. Module 2 - The purpose of this course is to teach the basic principles of operation of three types of hydraulic hand tools: chain saws, impact wrenches, and presses. In addition to showing how these tools work, the course explains how to use them to perform some of the tasks commonly assigned to transmission and distribution linemen. At the conclusion of this course, participants should have a basic understanding of how hydraulic chain saws, impact wrenches, and presses operate. They should also know how to use and maintain each type of tool safely and efficiently.

Transmission and Distribution: Power Quality (0.75-hour)

This course is designed to familiarize participants with the issues and problems associated with maintaining power quality. To obtain maximum benefit from this course, participants should have a general understanding of the basic concepts of electric power generation, transmission, and distribution. At the conclusion of this course, participants should be able to explain the basic concepts of power quality, identify sources and causes of power quality problems, and describe the effects of power quality problems on residential and commercial customers. They should also be able to identify equipment and methods for preventing and monitoring power quality problems.

BACK

T&D SAFETY

- Distribution Line Safety
- Safety in Substations and Switchyards
- Safety in Transmission and Distribution Maintenance
- Safety in Underground Line Maintenance
- Transmission and Distribution: Transmission Line Safety

Distribution Line Safety (1-hour)

The Distribution Line Safety course is designed primarily to introduce participants to principles and techniques of equipotential grounding. Although the course is intended as an introduction to equipotential grounding, the procedures and concepts presented assume a familiarity with basic electrical theory, distribution systems, grounding theory and application, and basic distribution line work methods and procedures. Participants without this prior training may require additional explanation or instruction. At the conclusion of this course, participants should be able to explain the purpose of grounding an overhead line during maintenance work and describe ways in which an isolated or de-energized line can become energized. Participants should also be able to define the term 'zone of equipotential' and explain how equipotential grounding operates to safeguard linemen in the event of a ground fault condition. Finally, participants should be able to describe or demonstrate how grounding equipment can be used to set up a zone of equipotential.

Safety in Substations and Switchyards (1-hour)

The purpose of this course is to teach the basic safety principles and practices applicable to substation and switchyard maintenance work. The course describes electrical, chemical, and personal hazards that may be encountered in substations and switchyards. A general procedure for responding to imminent dangers and accidents is also presented. At the conclusion of this course, participants should be able to identify hazards in substations and switchyards and explain why safety practices are important. They should be able to recognize hazards and unsafe practices on the job, and they should have a general understanding of how to respond to imminent dangers and accidents.

Safety in Transmission and Distribution Maintenance (1-hour)

The purpose of this course is to teach the basic safety considerations involved in performing maintenance work on transmission and distribution (T&D) systems. Specific electrical shock hazards and how to avoid them are discussed. The course describes hazards that may be encountered in overhead, underground, and substation and switchyard maintenance work. At the conclusion of this course, participants should have a basic understanding of the types of hazards that may be encountered in T&D maintenance work.

Safety in Underground Line Maintenance (1-hour)

The purpose of this course is to teach the basic safety principles and practices applicable to underground line maintenance work. The principles covered are applicable to work area safety, to the use of test equipment to ensure respiratory and electrical safety, to ensure the structural integrity of underground work sites, to the use of respirators, and to emergency responses. At the conclusion of this course, participants should be able to identify some of the hazards found in and around underground work areas. They should be able to recognize and explain methods used to provide a safe work environment. They should also be able to describe the use of personal safety equipment and identify the safety considerations involved in a typical vault emergency.

BACK

Transmission and Distribution: Transmission Line Safety (1-hour)

This course is designed to cover three major areas relating to safety in transmission line work: personal safety, electrical safety, and work site safety. Specific attention is directed to proper clothing and protective equipment; hazards associated with slipping, tripping and falling, and lifting and moving loads; electrical hazards and steps that can be taken to safeguard against them; and how personnel can work safely at the job site, both on the ground and while climbing transmission structures. This interactive online course assumed a familiarity with basic electrical theory and transmission and distribution systems. Participants without this prior training may require additional explanation or instruction.

BACK

T&D SYSTEMS AND THEORY

- High Voltage AC Power (2 modules)
- Introduction to Smart Grid
- Transmission and Distribution: Framing Specifications and Basic Construction Diagrams
- Transmission and Distribution: Introduction to Transmission and Distribution Systems
- Transmission and Distribution: Substations and Switchyards
- Transmission and Distribution: Using Various Types of Electrical Diagrams and Geospatial Information Systems

High Voltage AC Power (2 modules) (2-hour)

Module 1 - The purpose of this course is to introduce transmission and distribution (T&D) personnel to some of the factors that influence transmission efficiency and power loss. The course explains how T&D systems are designed to minimize power loss and how resistance, capacitive reactance, and inductive reactance can be manipulated to help maintain minimum levels of power loss. At the conclusion of this course, participants should know what power loss is and how power loss is affected by impedance. They should understand that impedance comes from resistance, capacitive reactance, and inductive reactance. Module 2 - The purpose of this course is to teach participants basic alternating current (AC) power theory. The course focuses on the relationships between various types of power and on the functions of transformers, voltage regulators, and capacitors in a distribution system. At the conclusion of this course, participants should be able to define apparent power, true power, reactive power, and power factor and explain the meaning of each term in the context of three-phase AC distribution systems. They should also be able to describe how delta and wye configurations affect voltage and current and how voltage regulators and capacitors are used to affect the power factor in a three-phase distribution system.

Introduction to Smart Grid (1-hour)

This course will describe what the smart grid is and why it was developed. It will also describe advanced sensing and measurement techniques and control strategies that are used within smart grid systems. Finally, the course will provide an overview of advanced technologies developed for smart grid systems.

Transmission and Distribution: Framing Specifications and Basic Construction Diagrams (1-hour)

The purpose of this course is to teach participants the kinds of information that can be obtained by reading electrical system diagrams and to illustrate how this information can be used to assist lineworkers who work on electrical systems. Practical examples of how to get information are given throughout the course. At the conclusion of this course, participants should know what kind of information is typically found on construction diagrams, on schematic diagrams, and in specification manuals. They should know how to use all of these references to determine the information necessary to do a job.

Transmission and Distribution: Introduction to Transmission and Distribution Systems (1-hour)

The purpose of this interactive online course is to teach participants how transmission and distribution (T&D) systems generally deliver to customers the power produced by power plants. The course describes how the major components of a T&D system function and how electricity flows through these components on its journey from the power plant to customers. At the conclusion of this course, participants should have a basic understanding of how transmission and distribution systems operate. They should be able to identify the basic components of a transmission and distribution system and explain their functions. They should also be able to describe the flow path from a power plant, through a typical T&D system, to the customer.

BACK

Transmission and Distribution: Substations and Switchyards (1-hour)

Electricity affects almost everything we do. Sometimes its impact is so subtle, we don't even realize it's there. Just about everybody depends on it and expects it to be available when it's needed. From the businesses that use electricity to process information to suburban homeowners who rely on electricity for the basic conveniences we've grown accustomed to, to the rural dairy farmer who relies on electricity to operate much of his machinery, our entire country is interlaced with transmission and distribution systems that get electricity to where it's needed when it's needed. The purpose of this interactive online course is to teach the basic safety principles and practices applicable to substation and switchyard maintenance work. The course describes electrical, chemical, and personal hazards that may be encountered in substations and switchyards. A general procedure for responding to imminent dangers and accidents is also presented. At the conclusion of this course, participants should be able to identify hazards in substations and switchyards and explain why safety practices are important. They should be able to recognize hazards and unsafe practices on the job, and they should have a general understanding of how to respond to imminent dangers and accidents.

Transmission and Distribution: Using Various Types of Electrical Diagrams and Geospatial Information Systems (1-hour)

Did you know different types of electrical system diagrams are used to show large portions of an electrical system down to a single structure or even a portion of a structure? The purpose of this course is to teach the basic kinds of information that can be obtained from various types of electrical system diagrams: one-line diagrams, plan-profile diagrams, framing diagrams, and GIS technology. The course shows how these diagrams are read and interpreted and how information can be used to complete an assignment. This interactive online course will show participants what information is typically found on one-line, plan profile, framing diagrams, and GIS applications. They should also be able to interpret diagrams to determine the location of a job site and then plan the best route to the site. In addition, participants should be able to use a framing diagram to determine what materials should be present at a work site and in what quantities.

BACK

TURBINES

- Analysis of Turbine Efficiency
- Power Plant Turbines: Bearings and Operation
- Power Plant Turbines: Steam Flow
- Turbine Efficiency (3 modules)

Analysis of Turbine Efficiency (1-hour)

This course explain how a typical turbine is designed to convert energy to work and how turbine efficiency is affected by problems with internal turbine components. After completing this course, participants should have an understanding of how internal components, particularly the turbine blades, affect turbine efficiency and heat rate. They should also be able to identify ways to recognize and correct efficiency problems associated with a turbine.

Power Plant Turbines: Bearings and Operation (2-hour)

This course is designed to familiarize participants with basic principles associated with turbine shaft bearing lubrication, turbine speed control, and turbine operation. After completing this course, participants should be able to identify and describe the functions of the components of a typical turbine lube oil system. They should also be able to describe the basic components and operation of a typical turbine speed control system. In addition, participants should be able to describe operator responsibilities associated with turbine startup, operation, and shutdown.

Power Plant Turbines: Steam Flow (2-hour)

This course is designed to familiarize participants with basic principles associated with the construction and operation of steam turbines. After completing this course, participants should be able to state the functions of the main parts of a typical turbine and describe how steam causes impulse blades and reaction blades to turn a turbine's wheels. They should also be able to describe the purpose and operation of a gland steam seal system, a gland steam seal exhaust system, a carbon seal, and a water seal.

Turbine Efficiency (3 modules) (3-hour)

Module 1 - This course examines some of the conditions that can cause operating parameters to change and some of the effects of those changes. After completing this course, participants should be able to explain why it is important to operate a turbine as close to its design parameter values as possible, and describe how changes in certain parameters affect efficiency, heat rate, and fuel consumption.

Module 2 - This course is designed to explain how turbine efficiency and unit heat rate are affected by the use of attemperation, by the positioning of the turbine control valves, and by changes in extraction steam flows. After completing this course, participants should be able to explain why superheat and reheat attemperation cause heat rate to increase, and describe ways to prevent frictional losses in the turbine control valves. They should also be able to describe how heat rate is affected by changes in extraction steam flows.

Module 3 - This course introduces the fundamental aspects of heat transfer and relates that information to component and plant efficiency. After completing the course, participants should be able to explain how heat transfer occurs and identify factors that affect heat transfer. They should also be able to explain how changes in operating conditions affect the factors associated with heat transfer.

BACK

UNDERGROUND LINE/CABLE

- Cable Splicing (2 modules)
- Cable Terminations
- Transmission and Distribution: Underground Residential Distribution Systems
- Transmission and Distribution: Using Line Test Equipment

Cable Splicing (2 modules) (2-hour)

Module 1 - The purpose of this course is to teach the principles of underground cable splicing and to demonstrate how cable splices are made. The course explains how to approach splicing in both primary and secondary cable. Demonstrations of splicing both types of cable are presented. At the conclusion of this course, participants should be able to explain how cable splices are made. They should know how to make a splice in either primary or secondary cable. They should also understand how heat shrink and cold shrink splices are used.

Module 2- The purpose of this course is to teach the principles of splicing paper-insulated lead-covered (PILC) cables. The course explains how to prepare PILC cable for several typical splices made on primary PILC cables. Demonstrations of making several typical splices on PILC cables are presented. At the conclusion of this course, participants should be able to explain how several typical splices on PILC cables are made. They should know how to make a straight splice, a typical transitional splice, and one type of trifurcating transitional splice on a PILC cable.

Cable Terminations (1-hour)

The purpose of this course is to teach the principles of high-voltage cable terminations and to demonstrate how such cable terminations are made. The course explains the problems associated with voltage stress and the function of stress cones. Demonstrations of how to make several different kinds of cable terminations are presented. At the conclusion of this course, participants should be able to explain what voltage stress is and how terminations are built to avoid voltage stress problems. They should understand how to make a high-voltage termination in a substation. They should also know how to make terminations at pedestals and how to install a pothead.

Transmission and Distribution: Underground Residential Distribution Systems (1-hour)

Recent developments in technology, such as the development of cable and equipment that can be directly buried in the ground have made underground installation of electrical service to residential areas easier than ever. Today, many residential subdivisions have all their utilities installed underground, giving a cleaner, more picturesque look to the neighborhood. This interactive online course is about underground residential distribution systems, also known as URD systems. URD systems are local distribution systems designed primarily to be buried in the ground and serve residential customers. The purpose of this course is to give you a basic understanding of the common types of URD systems, as well as some of the various components that may be used in a URD system. We'll also be looking at some of the ways a URD system can be inspected. Finally, we'll see a demonstration of how a URD system has been set up to allow work to be done on it safely and efficiently.

Transmission and Distribution: Using Line Test Equipment (1-hour)

The purpose of this course is to introduce types of line test equipment used in the field to detect voltage, amperage, and resistance; to show how this equipment is used; and to show the kinds of readings that can be expected from this equipment. After completing this course, participants should be able to identify types of line test equipment used in the field. They should have a basic understanding of the use of this equipment; they should know how to determine which instrument to use; and they should be able to demonstrate the use of each meter to take a reading.

BACK

WATER TREATMENT

- Water Treatment: Water for Plant Systems (2 modules)

Water Treatment: Water for Plant Systems (2 modules) (4-hour)

This course is designed to familiarize participants with basic concepts associated with removing dissolved solids and gases from water, and with the safe use of chemicals in water treatment. After completing this course, participants should be able to describe ways in which dissolved solids and gases can cause problems in plant equipment. They should also be able to describe how these impurities can be removed by devices such as water softeners, demineralizers, activated carbon filters, aerators, and de-aerators. In addition, they should be able to explain how chemicals are used in water treatment and identify safety precautions associated with the use of chemicals

BACK

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