

VILT Course Descriptions

 - Indicates courses recognized by the North American Electric Reliability Corporation as approved learning activities.

Last Update: 11/23/21

Overview of Electric Utility Systems (S-001)

Target audience: Intended for non-technical employee of an Electric Utility, to include power generation, transmission, and distribution operating companies.

It provides a basic overview of electricity and how electrical power is produced and delivered to the end use customer. This course will provide an overview of the interconnected power system (grid) operation. It will also include a description of the type, role and function of Electric Utilities and the regulatory and compliance requirements in North America.

Fundamentals of Electricity Series

Target audience: As initial or refresher training on electrical theory for the technical electrical utility employee.

F-101 DC Series Circuits

In this lesson we are going to concentrate on the basics. Providing a brief introduction the atom and the relationship of the subatomic particles protons, neutrons and electrons as it applies to current flow. This lesson will also introduce the terms and relationship of basic electrical quantities including current, voltage, and resistance through demonstrating the application of Ohm's law, as well as demonstrating the application of Kirchhoff's Laws combined with Ohm's Law and the Power equation as needed to obtain values of circuit components or segments in order for unknown and total circuit values.

F-102 DC Parallel Circuits

F-102 begins with a review of the information introduced in F-101, this lesson revisits Kirchhoff's Current and Voltage Laws, as well as the Rules of Resistance in a DC parallel circuit configuration. It includes application of these new concepts as well as Ohm's Law and the Power Equation to solve for unknown and total circuit values in a DC parallel circuit.

F-103 DC Complex Circuits

Continuing with a review of Lesson 2 and Lesson 3, Lesson 4 combines the theories and concepts introduced in Lesson 2 (DC Series Circuits) and Lesson 3 (DC Parallel Circuits) for Kirchhoff's Current Law, Kirchhoff's Voltage Law, Ohm's Law and the Power Equation as they are applied to determine electrical values (voltage, current, resistance and power) in a DC Series-Parallel circuit configuration.

VILT Course Descriptions

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F-104 Reactive Power in DC Circuits

In the Fundamentals of Electricity lessons 1 - 4 we concentrated on the basic electrical quantities of voltage, current, resistance, and power in a direct current (DC) system. We introduced Ohm's Law and Kirchhoff's Voltage and Current laws and how they apply to different DC circuit configurations. In this lesson we will introduce reactive power (capacitive and inductive reactance) in a DC circuit. We will introduce the operating characteristics of capacitors and inductors in DC circuit applications and their affect on voltage, current and resistance. This lesson will provide requisite knowledge to prepare learners for future lesson Intro To AC Power.

Emergency Operations Series

Target audience: The series is towards experienced transmission and generation system operating personnel, or personnel otherwise associated with power system operations.

E-101 Blackstart Principles: **NERC**

This segment will consist of a Virtual Instructor-Led Training presentation providing an overview of the equipment and system characteristics associated with a system restoration from Blackstart resources IAW NERC Standard EOP-005-3. This will include identifying the system characteristics of Blackstart generation, the Ferranti Rise Effect as well as resources to support voltage and VAR control during a restoration. Additionally, we will explore an example of a Blackstart Restoration plan and address the elements of effective communications and communications protocols IAW NERC Standard COM-002-4.

E-102 Geomagnetic Disturbances (not accredited at this time)

In this lesson, we will discuss the relationship between the Sun, the Earth and magnetic fields and how Geomagnetic Induced Currents enter the power system. This course will cover issues that arise from these currents and how to mitigate potential damage. Other topics include: NERC standards for Geomagnetic Disturbances, past Geomagnetic storms, lessons learned and the Space Weather Prediction Center as well as how they can assist with your operations during Solar Magnetic Disturbances.

Generation Series

Target audience: Generation and transmission system operating personnel, including but not limited to craft positions and technical support positions.

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This is an On-line training series delivered utilizing the Cisco WebEx Training Platform. The course is broken down into 5 separate 4 hour segments. The series is delivered so a participant can complete the entire series in one five (5) day week by attending a separate 4-hour segment each day. The segments (lessons) in the course are:

G-101 Generation Principles: **NERC**

This lesson will describe the principle operational theory and components of an Alternating Current (AC) electrical generator covering the concepts of torque angle, the relationship of generator speed and system frequency and the purpose of a generator capability curve.

G-102 Generation Mechanical Operations: **NERC**

This lesson will discuss the major mechanical components of the prime mover at a hydro-electrical generating station. Topics introduced will be turbine theory, bearings, heat exchangers, pumps and some additional supporting components and structures at a typical hydro-electric generation station.

G-103 Generation Speed Governors: **NERC**

This lesson will discuss the primary purpose of a speed governor of the mechanical type. The concepts of a speed sensing and speed droop governor will be compared and related to the frequency control of an electrical power system operated as an island and interconnected. There will also be discussions on identifying potential operational issues with a speed governor.

G-104 Generation Synchronization Lab: **NERC**

This lesson will discuss the operational closing of power circuit breakers during system configurations of energizing, paralleling and synchronizing AC electrical sources.

G-105 Generator Common Trouble Alarms: **NERC**

Provides an in-depth look at the common alarms observed in a hydro-electric generation facility. Alarm sources along with common causes and operator response will be identified. Alarms will include those associated with generator excitation, governor control systems, lubrication systems, creep detection, water levels, flooding, cooling water systems and protective relay control systems.

G-106 Generation Relay Protection (not accredited at this time)

This lesson focuses on protective relaying of generation equipment and the connection to transmission lines. Details found in this course include practical understanding and identification

VILT Course Descriptions

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of protective and control equipment for the generator and step up transformers, zones of protection, protection schemes, and relay communication systems. Associated NERC Standards will be discussed.

Transmission Series

Target audience: Transmission and generation system operating personnel, including but not limited to craft positions and technical support positions.

T-101 Transmission System Principles **NERC**

This lesson focuses on the principles of electrical transmission and the characteristics of electricity in an alternating current transmission system. Details found in this lesson include voltage levels, conductor basics, Surge Impedance Loading (SIL) and practical understanding of alternating current in electrical transmission and the associated characteristics of voltage, current and the non-resistive component of reactance. Associated NERC Standards will be discussed.

T-102 Transmission System Equipment **NERC**

This lesson focuses on transmission system equipment and transmission line elements including conductors, insulators, towers and structures and ground protection. Details found in this course include practical understanding and identification of components and elements of construction of transmission lines and right of way siting. Associated NERC Standards will be discussed.

T-103 Transmission System Substation **NERC**

This course covers the basic equipment found in switchyards and substations. Also included are the function and types of substations, related transmission and distribution systems and how each system is tied to one another. Associated NERC Standards will be discussed.

T-104 Transmission System Operations (not accredited at this time)

This lesson covers the basic roles and responsibilities of Transmission System Operations Personnel. The goal of this lesson is to overview the role and responsibilities of the Transmission System Operator along with the interaction with other entities operating within the North American Bulk Electric System. Associated NERC Standards will be discussed.

T-105 Transmission System Relay Protection **NERC**

This lesson focuses on protective relaying of substation equipment and transmission lines. Details found in this lesson includes an introduction to the types and typical causes of faults as

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well as the identification of protective and control equipment, zones of protection, protection schemes, and relay communication systems. Associated NERC Standards will be discussed.

T-106 Transmission HVDC (not accredited at this time)

This lesson will look at the differences between AC and DC transmission. The location and operation of AC-DC-AC facilities in Western North America as well as High Voltage Direct Current Transmission lines. We will also discuss the procedures and required equipment for rectifications and inversion, the advantages and disadvantages between AC and DC operations along with modes of operation.

System Operations Series:

Target audience: Transmission and generation system operating personnel, including but not limited to craft positions and technical support positions.

S-101 Interconnected

This lesson will review the operation of the North American Bulk Electric System with topics to include events analysis that resulted in the decision to implement enforceable operating standards by the Federal Energy Regulatory Commission (FERC). The North American Electric Reliability Corporation (NERC) will be discussed as to their structure and purpose of the NERC Rules of Procedure. NERC standards will be discussed that requires operators to maintain bulk electric system parameters which help to provide a stable and reliable electric power system.

S-102 Communications **NERC**

In this training will look at the differences between active and passive listening. We will identify barriers of effective communication. We will analyze important aspects of emergency communication. We will identify protocols that must be followed in NERC COM-002-4. We will define the term Operating Instruction and the proper use of three-part communication when receiving or issuing Operating Instructions.

(No S103 as of right now)

S-104 Personal Grounding

This lesson will take a look at the basic concepts around the hazards associated with working on or near deenergized electrical equipment and some recommended actions the personnel can take to recognize and safeguard against these potential electrical hazards. Safety policies or

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procedures referenced will be from the Western Area Power Administration. Participants from other agencies and organizations should review and follow the applicable policies and procedures from their agency's management.

S-105 System Operations Dynamics

This lesson that will look at the interconnected system and how system dynamics drive it's operation. We will look at the electric power equation and Power angle and explain how we can use these to explain power angle stability. We will discuss power system oscillations and the damping of those oscillations and what happens if they go undamped. We will look at Power System Stabilizers and what they do to help control power system oscillations. We will look an actual event and the how power system oscillations broke the system up. We will look at Voltage Stability and PV the PV curve and describe how they indicate the approach of Voltage collapse and what the system operator can do to help prevent Voltage collapse.

S-106 System Operating Limits (SOL) & Interconnected Reliability Operating Limits (IROL) **NERC**

This course will define SOL and IROL, as well as which functional entities is responsible for establishing operating limits and the criteria used. We will also discuss SOL Exceedance, some methodologies used to identify operating limits IAW NERC Standard FAC-014-2 Establish and Communicate System Operating Limits as well as introducing transmission loading relief procedures to prevent or manage potential or actual SOL and IROL exceedances (NERC Standard IRO-006-5 — Reliability Coordination — Transmission Loading Relief) including discussions on the procedures in the Eastern (IRO-006-EAST-2 – TLR Procedure for the Eastern Interconnection) and Western (IRO-006-WECC-3 – Qualified Path Unscheduled Flow (USF) Relief) Interconnects. We will address actions to prevent, mitigate or respond to real or potential SOL and IROL exceedance with such actions as dispatching generation, or other action up to and including shedding load.

Power Plant & System Operations (SERIES):

Target audience: Power Plant Operations personnel, including but not limited to Generator Operators, Power Plant technical support and maintenance personnel.

Provides in-depth knowledge of power plant operations. Generating equipment and its protection, governor response, and voltage regulating equipment are examined. Concepts including power system dynamics and the inter-dependency of the interconnected electric power designed to be followed up with hands-on operation of the EPTC's Miniature Power System by problem solving exercises in the EPTC's Miniature Power System.

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Power System Principles I & II:

This is a self-paced training, the purpose of the Power System Principle module is to conduct a brief review of some fundamental math concepts that are very important to have an enhanced experience when discussing and applying the principles of electrical theory in AC and DC electric circuits. Please disregard the dates: the course is self-paced. Once registered, we will send you instructions on how to take the training.