



Shovel Electrical eLearning Course Catalog

Maintaining a skilled, knowledgeable workforce is a challenge everyone faces. With changing technologies and fluctuations within the mining industry, it can be especially daunting. Whether you need training for a new hire or a veteran, it can be difficult to find training that is engaging, technologically relevant and easy to fit into busy schedules. Product Training and Publications, the technical communication and training group within P&H Mining Equipment, strives to provide you with the knowledge, skills and competencies needed for your employees to achieve their highest performance potential.

Product Training and Publications has identified eLearning as the primary delivery method for the knowledge components of Fundamental and Product Specific Training. eLearning provides several advantages over traditional training methods:

- eLearning content can be accessed on any computer that has Internet access by any individual who has the appropriate login and password credentials.
- Immediate availability of training content. Students receive the training they require right now, when the training is required most. This provides a quicker, more productive workforce.
- Reduces the cost of training by eliminating travel, living, and other expenses associated with Instructor Led Training.
- Provides students with the ability to learn at their own pace and in their own comfortable environment.
- Improved retention of technical and operational content.
- The training content can be delivered to a large contingent of people in varying locations and be technically consistent across the board.
- Training content can be tailored to an individual's personal strengths and weaknesses. This provides a targeted more effective training solution for today's workforce.
- When used as a prerequisite to Instructor Led Training, eLearning can level the playing field between novice and senior personal. This makes the Instructor Led Training more effective by allowing the Instructor to spend more time developing skills rather than knowledge-based components.

This Course Catalog contains descriptions of the eLearning Lessons available to you through Product Training and Publications.

Lesson Duration:

Each eLearning Lesson is designed to be 45 minutes in duration. However, because eLearning is self-paced training, actual duration may vary per student.

Target Audience:

Shovel Operators, Technicians, and Engineers who will operate and/or perform maintenance on P&H Mining Shovels.

Prerequisites:

Students should have a basic working knowledge of computers, and fundamental understanding of electronics, mechanics, pneumatics, hydraulics, operation, etc., as it applies to the systems of a P&H Shovel.

Lesson Location:

eLearning content can be accessed on any computer that has Internet access by any individual who has the appropriate login and password credentials.



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Computer Requirements:

It is recommended that all computers accessing eLearning content have the basic minimum requirements:

- Internet Explorer version 7 or better.
- Flash Player version 8 or better.
- Java version 1.5 or better.
- Latest version of Windows Media Player.
- Adobe Reader version 8 or better.



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Shovel Electrical eLearning

Module 4 Power Electronics

Lesson 4.1	Power Distribution
Lesson 4.2	Power Conversion
Lesson 4.3	Protection Circuits
Lesson 4.6	RPC Theory and Operation of the RPC – Centurion
Lesson 4.7	DC Motor Theory
Lesson 4.8	DC Motor Maintenance
Lesson 4.9	Power Distribution AC Shovels
Lesson 4.10	Protective Circuits – AC Shovels
Lesson 4.11	IGBT Supply Unit
Lesson 4.12	Inverter Unit
Lesson 4.13	AC Motor Theory and Operation

Module 5 Control Systems

Lesson 5.1	AC800
Lesson 5.2	Remote IO
Lesson 5.3	Communications Devices

Module 6 Drive Systems

Lesson 6.2	DCS800 Drill
Lesson 6.3	DCS800 Shovel
Lesson 6.7	Drive Control Unit - AC

Module 8 Miscellaneous Electrical Equipment

Lesson 8.1	UPS System
Lesson 8.2	Connectors and Fiber Optic Cables
Lesson 8.3	Profibus Copper Wire
Lesson 8.5	TripRite
Lesson 8.6	Milltronics
Lesson 8.7	Payload
Lesson 8.8	PQM
Lesson 8.9	ELSPEC PQM
Lesson 8.16	Introduction to PreVail

Module 9 HMI Devices

Lesson 9.5	Touch Screen System
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Electrical System Curriculums

Below are pre-determined curriculums based on the different electrical systems available for P&H Shovels.

Centurion AC Package

Lesson 3.1	Shovel Introduction (Reference the General eLearning Course Catalog)
Lesson 3.2	Orientation Basics (Reference the General eLearning Course Catalog)
Lesson 3.5	Shovel Electrical Overview – AC Shovels (Reference the General eLearning Course Catalog)
Lesson 3.6	Touch Panels – AC Shovels (Reference the General eLearning Course Catalog)
Lesson 4.6	Theory and Operation of the RPC – Centurion
Lesson 4.9	Power Distribution – AC Shovels
Lesson 4.10	Protective Circuits – AC Shovels
Lesson 4.11	IGBT Power Unit
Lesson 4.12	Inverter Unit
Lesson 4.13	AC Motor Theory and Operation
Lesson 5.1	AC800
Lesson 5.2	Remote IO
Lesson 5.3	Communication Devices
Lesson 6.7	Drive Control Unit – AC Shovels
Lesson 8.1	UPS System
Lesson 8.2	Connectors and Fiber Optic Cables
Lesson 8.3	Profibus Copper Cable
Lesson 8.5	TripRite
Lesson 8.6	Milltronics

Centurion DC Package

Lesson 3.1	Shovel Introduction (Reference the General eLearning Course Catalog)
Lesson 3.2	Orientation Basics (Reference the General eLearning Course Catalog)
Lesson 3.3	Electrical Overview (Reference the General eLearning Course Catalog)
Lesson 3.4	P&H Centurion Control Systems – Touch Panels (Reference the General eLearning Course Catalog)
Lesson 4.1	Power Distribution
Lesson 4.2	Power Conversion
Lesson 4.3	Protection Circuits
Lesson 4.6	Theory and Operation of the RPC – Centurion
Lesson 4.7	DC Motor Theory
Lesson 4.8	DC Motor Maintenance
Lesson 5.1	AC800
Lesson 5.2	Remote IO
Lesson 5.3	Communication Devices
Lesson 8.1	UPS System
Lesson 8.2	Connectors and Fiber Optic Cables
Lesson 8.3	Profibus Copper Cable
Lesson 8.5	TripRite
Lesson 8.6	Milltronics
Lesson 8.7	Payload
Lesson 9.6	Touch Screen System

Shovel Electrical Lesson Descriptions

Module 4 Power Electronics Lessons

Lesson 4.1 Power Distribution

Lesson Description:

This Lesson provides Maintenance Personnel with the knowledge of High Voltage Distribution on P&H Electric Mining Shovels.

Objectives:

Upon completion of this Lesson the student will:

- Identify all safety issues and conduct a risk analysis.
- Identify and explain the purpose of all the major components utilized.
- Demonstrate proficiency in loading, configuring, usage and application of test equipment and remote programming panels as required.
- Remove and replace faulty components including a failure analysis.
- Explain the relationship to the rest of the shovel systems.
- Analyze schematics, control diagrams, and relevant documentation utilized for troubleshooting and repair.
- Describe the purpose of the High Voltage Systems in relation to overall Electric Mining Shovel operation.
- Identify critical personal safety procedures when working on P&H Mining Equipment's High Voltage Systems.
- Assess risk to humans and machine related to maintaining and servicing the High Voltage Systems.
- Describe the purpose of all major Assemblies of the High Voltage System.

Lesson Outline:

- Introduction
- Topic 1 Tail Cable
- Topic 2 Air Disconnect Switch with Earthing
- Topic 3 Collector Ring Assemblies
- Topic 4 High Voltage Cabinet
- Topic 5 Key Interlock System
- Topic 6 Main Transformer
- Topic 7 Bus Bars
- Topic 8 Suppression
- Topic 9 Auxiliary/Field Transformer

Lesson 4.2 Power Conversion

Lesson Description:

This Lesson provides Maintenance Personnel with the basic knowledge of Power Conversion used on a P&H Mining Shovels.

Objectives:

Upon completion of this Lesson the student will:

- Identify all safety issues and conduct a risk analysis.
- Identify and explain the purpose of all the major components utilized.

- Demonstrate proficiency in loading, configuring, usage and application of test equipment and remote programming panels as required.
- Remove and replace faulty components including a failure analysis.
- Explain the relationship to the rest of the shovel systems.
- Analyze schematics, control diagrams, and relevant documentation utilized for troubleshooting and repair.

Lesson Outline:

- Introduction
- Topic 1 Power Conversion - Theory of Operation
 - Subtopic 1 AC Characteristics
 - Subtopic 2 Diodes and Rectification
 - Subtopic 3 Full Wave and Bridge Rectifiers
 - Subtopic 4 Three Phase Diode Bridges
 - Subtopic 5 SCR Rectification
 - Subtopic 6 Three Phase AC and Firing Angles
 - Subtopic 7 Bridge Configurations
- Topic 2 SCR Testing
- Topic 3 Converter Cabinet Layout

Lesson 4.3 Protection Circuits

Lesson Description:

This Lesson provides Maintenance Personnel with knowledge of the Protection Circuits located on P&H Electric Mining Shovels.

Objectives:

Upon completion of this Lesson the student will:

- Identify all safety issues and conduct a risk analysis.
- Identify and explain the purpose of all the major components utilized.
- Demonstrate proficiency in loading, configuring, usage and application of test equipment and remote programming panels as required.
- Remove and replace faulty components including a failure analysis.
- Explain the relationship to the rest of the shovel systems.
- Analyze schematics, control diagrams, and relevant documentation utilized for troubleshooting and repair.

Lesson Outline:

- Introduction
- Topic 1 Instantaneous Overload Relay
- Topic 2 Main Transformer Thermal Overloads
- Topic 3 Ground Fault Relays
- Topic 4 Suppression Circuits
- Topic 5 Phase Monitor Relay
- Topic 6 Diverter Circuits
- Topic 7 Main Phase Sensing Relay

Lesson 4.6 RPC Theory and Operation – Centurion

Lesson Description:

In this Lesson you will learn about Reactive Power Compensation, or RPC, theory, and the components used for RPC - Centurion on a P&H Electric Mining Shovel.

Objectives:

Upon completion of this Lesson the student will:

- Identify all safety issues and conduct a risk analysis.
- Identify and explain the purpose of all the major components utilized.
- Demonstrate proficiency in loading, configuring, usage and application of test equipment and remote programming panels as required.
- Remove and replace faulty components including a failure analysis.
- Explain the relationship to the rest of the shovel systems.
- Analyze schematics, control diagrams, and relevant documentation utilized for troubleshooting and repair.

Lesson Outline:

- Topic 1 RPC Component Overview - Centurion
- Topic 2 RPC Power Circuit Operation
- Topic 3 RPC Control Circuit Operation
- Topic 4 RPC Cabinet Layout
- Topic 5 RPC Troubleshooting

Lesson 4.7 DC Motor Theory

Lesson Description:

This Lesson discusses the theory of DC Motors on P&H Electric Mining Shovels.

Objectives:

Upon completion of this Lesson the student will:

- Be able to identify the components used in the construction of a DC Motor.
- Understand the function of those components.
- Be able to state the function of torque in a DC Motor and how it is developed.
- Be able to describe how Counter Electromotive Force, (CEMF) is developed in a DC Motor.
- Be able to describe the relationship between field current and magnetic field size in a DC Motor.
- Be able to state the function of the CEMF that is developed in a DC Motor.
- Be able to describe how the speed of a DC Motor is adjusted.
- Be able to describe the relationship between armature current and armature torque produced in a DC Motor.
- Be able to identify the P&H application of DC Motor configurations.

Lesson Outline:

- Topic 1 P&H Mining DC Motors
- Topic 2 Types of DC Motors
- Topic 3 DC Motor Construction
- Topic 4 Principles of Operation
- Topic 5 Generator Action in a DC Motor

- Topic 6 Armature Reaction
- Topic 7 DC Motor Speed Control

Lesson 4.8 DC Motor Maintenance

Lesson Description:

This Lesson describes the inspection and maintenance practices associated with the Peak Performance of P&H DC Motors.

Objectives:

Upon completion of this Lesson the student will:

- Understand the elements associated with Motor Peak Electrical Performance.
- Be able to describe and identify Satisfactory Commutator surface conditions.
- Be able to describe and identify Commutator surface conditions for concern.
- Be able to describe and identify Unsatisfactory Commutator surface conditions.
- Understand the steps necessary to maintain the proper Commutator surface conditions.
- Understand the importance and steps required for inspecting and maintaining the Brushes and Brush Holders on P&H DC Electric Motors.
- Understand the steps required for replacing the Brushes on P&H DC Electric Motors.
- Describe grease lubrication practices for P&H DC Electric Motors.
- Identify the locations of lube points associated with P&H DC Electric Motors.
- Understand the lubrication requirements for replacement P&H DC Electric Motors.
- Understand the lubrication procedures for P&H DC Electric Motors during and after extended storage.
- Understand the lubrication procedures for remanufactured P&H DC Electric Motors.
- Understand and describe the conditions associated with Insulation Failures.
- Understand and be able to describe the steps required for performing Insulation Resistance Inspection for P&H DC Electric Motors.
- Understand the conditions that cause detrimental conditions for P&H DC Electric Motors.
- Be able to describe the inspections process for P&H DC Electric Motors first time use.
- Be able to describe the inspections process for P&H DC Electric Motors after Start-up.

Lesson Outline:

- Topic 1 Introduction
- Topic 2 Commutator Maintenance
- Topic 3 Brush Maintenance
- Topic 4 Lubrication Practices
- Topic 5 Insulation System
- Topic 6 Insulation Resistance Inspection
- Topic 7 Detrimental Conditions
- Topic 8 Motor Inspection

Lesson 4.9 Power Distribution AC Shovels

Lesson Description:

This Lesson provides Maintenance Personnel with the knowledge of High Voltage Distribution on P&H AC Electric Mining Shovels.

Objectives:

Upon completion of this Lesson the student will:

- Have a thorough understanding of the high voltage distribution of a P&H AC Shovel.
- Understand the purpose and function of the Tail Cable.
- Understand some basic safety principles associated with the handling of the Tail Cable.
- Identify the basic components of a Tail Cable.
- Understand the purpose, function, and operation of the Air Disconnect Switch with Earthing.
- Identify the location and components of the Lower High Voltage Cabinet.
- Understand the purpose, function, and operation of the Collector Ring Assembly.
- Identify the location and components of the Collector Ring Assembly.
- Understand the purpose, function, and operation of the Upper High Voltage Cabinet.
- Identify the location and components of the Upper High Voltage Cabinet.
- Understand the purpose, function, and operation of the Main Transformer Contactor.
- Understand the purpose, function, and operation of the Key Interlock System.
- Understand the purpose, function, and operation of the Main Transformer.
- Identify the location and components of the Main Transformer.
- Understand the purpose, function, and operation of the Auxiliary Transformer.
- Identify the location and components of the Auxiliary Transformer.
- Understand the purpose, function, and operation of the Lighting Transformer.
- Identify the location and components of the Lighting Transformer.

Lesson Outline:

- Introduction
- Topic 1 Tail Cable
- Topic 2 Air Disconnect Switch with Earthing
- Topic 3 Collector Ring Assembly
- Topic 4 High Voltage Cabinet
- Topic 5 Key Interlock System
- Topic 6 Main Transformer
- Topic 7 Auxiliary Transformer
- Topic 8 Lighting Transformer

Lesson 4.10 Protection Circuits AC Shovels

Lesson Description:

This Lesson provides Maintenance Personnel with knowledge of the Protection Circuits located on the Shovel.

Objectives:

Upon completion of this Lesson the student will:

- Have a thorough understanding of the purpose, location, and operation of the Main Transformer Thermal Overloads, or TTMT.

- Have a thorough understanding of the purpose, location, and operation of the Instantaneous Overload Relay, or QTTM.
- Have a thorough understanding of the purpose, location, and operation of the Ground Fault Relays, GFRM and GFRA.
- Have a thorough understanding of the purpose, location, and operation of the Main Phase Sensing Relay, or PSR.
- Have a thorough understanding of the purpose, location, and operation of the Undervoltage Monitor, or UVM.
- Have a thorough understanding of the purpose, location, and operation of the E-Stop Safety Relay, or ESSR.

Lesson Outline:

- Topic 1 Main Transformer Thermal Overloads
- Topic 2 Instantaneous Overload Relay
- Topic 3 Ground Fault Relays
- Topic 4 Main Phase Sensing Relay
- Topic 5 Undervoltage Monitor
- Topic 6 E-Stop Safety Relay

Lesson 4.11 IGBT Supply Unit

Lesson Description:

This Lesson describes the purpose, component location, operation, removal and replacement of the IGBT Supply Unit used on P&H AC Shovels.

Objectives:

Upon completion of this Lesson the student will:

- Have a basic understanding of the Theory of IGBT Technology.
- Be able to locate the AC Drive System Module on a typical Shovel Deck Plan.
- Be able to locate the IGBT Supply Unit within the AC Drive System Module.
- Be able to identify the components associated with the IGBT Supply Unit.
- Have an understanding of the purpose and function of the LCL Line Filter.
- Have an understanding of the purpose and function of the IGBT Supply Module.
- Understand the proper procedure for removing and replacing the modules of the IGBT Supply Unit.

Lesson Outline:

- Topic 1 IGBT Theory
- Topic 2 IGBT Supply Unit Location
- Topic 3 IGBT Supply Unit Operation
- Topic 4 Removing and Replacing Modules

Lesson 4.12 Inverter Unit

Lesson Description:

This Lesson describes the purpose, component location, operation, removal and replacement of the Inverter Unit used on P&H AC Shovels.

Objectives:

Upon completion of this Lesson the student will:

- Be able to locate the AC Drive System Module on a typical Shovel Deck Plan.
- Be able to locate the Inverter Unit within the AC Drive System Module.
- Be able to identify the components associated with the Inverter Unit.
- Have an understanding of the purpose and function of the Inverter Module.
- Understand the proper procedure for removing and replacing the modules of the Inverter Unit.

Lesson Outline:

- Topic 1 Inverter Unit Location
- Topic 2 Inverter Unit Operation
- Topic 3 Removing and Replacing Modules

Lesson 4.13 AC Motor Theory and Operation

Lesson Description:

This Lesson provides information on the theory of operation and maintenance practices associated with P&H AC Motors.

Objectives:

Upon completion of this Lesson the student will:

- Have a thorough understanding of AC Motor theory as it relates to Induction Motors.
- Have a working vocabulary of the components associated with the AC Motors on P&H equipment.
- Understand the proper maintenance practices required to keep P&H AC Motors operating at optimal performance.

Lesson Outline:

- Topic 1 AC Motor Theory
- Topic 2 Types of Motors
- Topic 3 AC Motor Maintenance

Module 5 Control System Lessons

Lesson 5.1 AC800

Lesson Description:

This Lesson provides the electrical maintenance technician or end-user of P&H Mining Equipment with the necessary knowledge and working skills to maintain the Advant Controller 800 used on electric mining shovels.

Objectives:

Upon completion of this Lesson the student will:

- Describe the purpose of the AC800 Controller.
- Locate and identify the components of the AC800 Controller.
- Identify/explain the function of each component of the AC800 Controller.
- Remove and replace the AC800 Controller.
- Remove and replace the external battery backup for the AC800 Controller.
- Remove and replace the Communication Interface modules for the AC800 Controller.
- Download the AC800 Controller application.
- Describe the AC800 Controller troubleshooting procedures and corrective actions.

Lesson Outline:

- Topic 1 Theory of Operation
- Topic 2 Hardware Overview
- Topic 3 Installation
- Topic 4 Software Overview
- Topic 5 Control Builder Basics
- Topic 6 Procedures
- Topic 7 System Maintenance and Troubleshooting

Lesson 5.2 Remote I/O

Lesson Description:

This Lesson provides the electrical maintenance technician or end-user of P&H Mining Equipment with the necessary knowledge and working skills to maintain the Remote I/O System used in the Centurion Control System.

Objectives:

Upon completion of this Lesson the student will:

- Describe the purpose of the Remote I/O System.
- Locate and identify the main components of the Remote I/O System.
- Identify the function of each main component of the Remote I/O System.
- Remove and replace the I/O devices.
- Perform diagnostics of the Remote I/O System.

Lesson Outline:

- Topic 1 Theory of Operation
- Topic 2 Components
- Topic 3 Module Diagnostics
- Topic 4 Install and Remove

Lesson 5.3 Communications Devices

Lesson Description:

This Lesson provides the electrical maintenance technician or end-user of P&H Mining Equipment with the necessary knowledge and working skills to maintain the Communication Devices used in the Centurion Control System.

Objectives:

Upon completion of this Lesson the student will:

- Know the purpose of the Communication Devices.
- Locate and identify each Communication Device.
- Identify/explain the function of each Communication Device.

Lesson Outline:

- Topic 1 Ethernet Electrical Lean Switch
- Topic 2 Profibus Optical Bus Terminal
- Topic 3 Profibus Resolver Interface Module
- Topic 4 Power Rail Booster
- Topic 5 DDCS Branching Unit

Module 6 Drive Systems Lessons

Lesson 6.2 DCS800 Drill

Lesson Description:

This Lesson provides the maintenance technician with the necessary knowledge of the theory of operation of the DCS800 Digital Drive.

Objectives:

Upon completion of this Lesson the student will:

- Explain the purpose of the DCS800.
- Locate and identify the hardware components associated with the DCS800.
- Identify and explain the function of each hardware component associated with the DCS800.
- Identify and explain the DCS800 troubleshooting procedures and corrective actions.

Lesson Outline:

- Topic 1 Theory of Operation
 - Subtopic 2 Drill
- Topic 2 Hardware Overview
 - Subtopic 3 DCS800 Drill
- Topic 3 Troubleshooting
 - Subtopic 2 DCS800

Lesson 6.3 DCS800 Shovel

Lesson Description:

This Lesson provides the maintenance technician with the necessary knowledge of the theory of operation of the DCS800 Digital Drive.

Objectives:

Upon completion of this Lesson the student will:

- Explain the purpose of the DCS800.
- Locate and identify the hardware components associated with the DCS800.
- Identify and explain the function of each hardware component associated with the DCS800.
- Identify and explain the DCS600 and/or DCS800 troubleshooting procedures and corrective actions.

Lesson Outline:

- Topic 1 Theory of Operation
 - Subtopic 1 Shovel
- Topic 2 Hardware Overview
 - Subtopic 2 DCS800 Shovel
- Topic 3 Troubleshooting
 - Subtopic 2 DCS800

Lesson 6.7 Drive Control Unit - AC

Lesson Description:

This Lesson describes the purpose, component location, and operation, of the Drive Control Unit used on P&H AC Shovels. Also discussed is the operation of the Drive Control Unit Control Panel, CDP 312R.

Objectives:

Upon completion of this Lesson the student will:

- Be able to locate the Control Cabinet on a typical Shovel Deck Plan.
- Be able to locate the Drive Control Units within the Control Cabinet.
- Be able to identify the connectors associated with the Drive Control Unit.
- Have an understanding of the purpose, function, and operation of the Drive Control Unit.
- Have an understanding of the function of the Option Modules associated with the Drive Control Unit.
- Understand the buttons and controls associated with the CDP 312R, Drive Control Unit Control Panel.

Lesson Outline:

- Topic 1 System Overview
- Topic 2 Drive Control Unit Location
- Topic 3 Drive Control Unit
- Topic 4 CDP 312R

Module 8 Miscellaneous Electrical Equipment Lessons

Lesson 8.1 UPS System

Lesson Description:

This tutorial provides the electrical maintenance technician or end-user of P&H Mining Equipment with the necessary knowledge and working skills to understand the UPS System.

Objectives:

Upon completion of this Lesson the student will:

- Describe the purpose of the UPS system.
- Locate and identify the hardware components of the UPS system.
- Identify/explain the function of each hardware component of the UPS system.
- Identify/explain the procedures of the UPS system.
- Distinguish/recognize the alarm signals and troubleshooting procedures of the UPS system.

Lesson Outline:

- Topic 1 General Information
- Topic 2 Settings and Procedures
- Topic 3 Troubleshooting

Lesson 8.2 Fiber Optic Connectors and Cables

Lesson Description:

The Drive Control Modules, AC800, and Remote I/O Systems on P&H Centurion Electric Mining Shovels contain high-speed communication links utilizing fiber-optic cabling. This Lesson provides information on those fiber optic cables.

Objectives:

Upon completion of this Lesson the student will:

- Understand general information regarding Plastic Fiber Optics with Simplex Connectors and the tools utilized in the P&H Centurion System.
- Describe how to set the cutting depth of the cable knife.
- Describe how to strip the outer jacket of the Plastic Fiber Optic Cable.
- Describe how to remove the buffer from the Plastic Fiber Optic Cable.
- Describe how to fit Simplex connectors to Fiber Optic Cable.
- Describe how to grind and polish Simplex Connectors.
- Describe how to assemble a Plug Adapter.

Lesson Outline:

- Required Tools
- Topic 1 General Information
- Topic 2 Cable Knife Cutting Depth
- Topic 3 Stripping the Outer Jacket
- Topic 4 Removing the Buffer
- Topic 5 Fitting Simplex Connectors
- Topic 6 Grinding and Polishing
- Topic 7 Assembling the Plug Adapter

Lesson 8.3 Copper Profibus Wire

Lesson Description:

This Lesson provides the learner with instructions for fast and easy assembly of PROFIBUS copper cables.

Objectives:

Upon completion of this Lesson the student will:

- Identify the different components associated with the Bus Connector.
- Have the knowledge to assemble PROFIBUS copper cables.

Lesson Outline:

- Introduction
- Topic 1 Bus Connector
- Topic 2 Assembly

Lesson 8.5 TripRite

Lesson Description:

This Lesson provides the electrical maintenance technician or end-user of P&H Mining Equipment with the necessary knowledge and working skills to understand the TripRite System.

Objectives:

Upon completion of this Lesson the student will:

- Describe the basic Theory of Operation of the TripRite.
- Locate and identify the hardware components of the TripRite.
- Identify/explain the function of each hardware component of the TripRite.
- Identify/explain the function of software used on the TripRite.
- Locate and identify the hardware components of the Drive Monitor.
- Identify/explain the function of each hardware component of the Drive Monitor.
- Identify/explain the TripRite troubleshooting procedures and corrective actions.

Lesson Outline:

- Topic 1 Theory of Operation
- Topic 2 Hardware Overview
- Topic 3 Software Overview
- Topic 4 Troubleshooting

Lesson 8.6 Milltronics

Lesson Description:

This Lesson provides detailed information on the MultiRanger Lube Level Sensor used on P&H Electric Mining Shovels.

Objectives:

Upon completion of this Lesson the student will:

- Describe the purpose and function of the MultiRanger Lube Level Sensor.
- Describe the components associated with the MultiRanger and the MultiRanger Lube Level Sensor.
- Setup and use the different tools used to interface with the MultiRanger Lube Level Sensor.
- Navigate the Touch Panel to view the screens applicable to the Lube System.
- Have the knowledge required to perform basic maintenance and troubleshooting techniques on the MultiRanger Lube Level Sensor.

Lesson Outline:

- Introduction
- Topic 1 Components
- Topic 2 Interfacing
- Topic 3 Transducer
- Topic 4 Touch Panel Lube Screens
- Topic 5 Maintenance and Troubleshooting

Lesson 8.7 Payload

Lesson Description:

This Lesson introduces the operator and/or technician to Payload. The Payload System is designed to accurately weigh the material in a dipper after the dig cycle while swinging to the haul truck for loading.

Objectives:

Upon completion of this Lesson the student will:

- Understand the terms and definitions associated with the Payload System.
- Be able to identify and have a thorough understanding of the components associated with the Payload System.
- Understand the theory of operation of the Payload System.
- Be able to identify, navigate to, and use the Touch Panel Screens associated with the Payload System.
- Have a thorough understanding of how to perform a Laser Calibration of the Payload System.
- Have a thorough understanding of how to perform a Bias Calibration of the Payload System.
- Have a thorough understanding of how to perform a Payload System Verification.
- Have a thorough understanding of how setup the Shovel Production Monitor screen.
- Be able to identify potential faults/warnings associated with the Payload system.
- Understand how to properly maintain and clean the reflector tape and laser.

Lesson Outline:

- Topic 1 System Overview
- Topic 2 Theory of Operation
- Topic 3 Payload Displays (GUI)
- Topic 4 Operator Setup
 - Subtopic 1 Laser Calibration
 - Subtopic 2 Bias Calibration
 - Subtopic 3 Payload System Verification
 - Subtopic 4 Setting up the Shovel Production Monitor
- Topic 5 Fault Displays
- Topic 6 Maintenance

Lesson 8.8 PQM**Lesson Description:**

This Lesson provides information on the specifications, controls and indicators, programming, and monitoring of recorded values for the Power Quality Meters provided on P&H Mining Equipment.

Objectives:

Upon completion of this Lesson the student will:

- Be introduced to the Power Quality Meter and understand basic features, how it's connected, what it can measure, its alarms, how it communicates, and its base specifications.
- Have a thorough understanding of the front panel controls and indicators and use them to navigate to the Power Quality Meter Setpoints for programming and Actual Values for monitoring.
- Have a thorough understanding of the Power Quality Meter Programming Setpoint messages by using the front panel controls to navigate and learn about each message.
- Have a thorough understanding of the Power Quality Meter Monitoring Actual Value messages by using the front panel controls to navigate and learn about each message.

Lesson Outline:

- Topic 1 Introduction
- Topic 2 Specifications
- Topic 3 Controls and Indicators
- Topic 4 Programming
- Topic 5 Monitoring

Lesson 8.9 ELSPEC PQM**Lesson Description:**

This Lesson provides information on the specifications, controls and indicators, programming, and monitoring of recorded values for the ELSPEC Power Quality Meters provided on P&H Mining Equipment.

Objectives:

Upon completion of this Lesson the student will:

- Be able to identify and describe the components of the ELSPEC PQM.
- Be able to identify and describe the connectors and LED's associated with the ELSPEC PQM.
- Understand how to establish communication with the ELSPEC PQM for the first time.

- Have an understanding of how to configure the ELSPEC PQM using the Embedded HTML Site.
- Have an understanding of how to monitor real time data, as it is collected by the ELSPEC PQM, using the Embedded HTML Site.
- Be able to identify and describe the various screens of the ELSPEC PQM Embedded HTML Site.
- Be able to identify and describe the components of the ELSPEC PQM RDU.
- Be able to identify and describe the connectors and LED's associated with the ELSPEC PQM RDU.
- Understand the ELSPEC PQM RDU Main Screen and the different screens associated with the various icons.

Lesson Outline:

- Topic 1 System Components
- Topic 2 Communications Specifications
- Topic 3 Configuring via the Embedded HTML Site
- Topic 4 Monitoring via the Embedded HTML Site
- Topic 5 Monitoring Energy via the Embedded HTML Site
- Topic 6 Monitoring Power Quality via the Embedded HTML Site
- Topic 7 Monitoring Service via the Embedded HTML Site
- Topic 8 Monitoring Multi I/O via the Embedded HTML Site
- Topic 9 Remote Display Unit

Lesson 8.16 Introduction to PreVail

Lesson Description:

This Lesson provides familiarization of the navigation and screens associated with PreVail.

Objectives:

Upon completion of this Lesson the student will:

- Understand what PreVail is and who it is meant for.
- Know how to log into Prevail.
- Have a thorough understanding of the PreVail Dashboard and what information it offers.
- Understand what the purpose of the Dashboard Object buttons are.
- Have a thorough understanding of the Dashboard Menu.
- Understand the purpose of each screen under the Production menu.
- Understand the purpose of each screen under the Maintenance menu.
- Understand the purpose of each screen under the Reports menu.

Lesson Outline:

- Introduction
- Topic 1 PreVail Login
- Topic 2 PreVail Dashboard Objects
- Topic 3 PreVail Dashboard Menu
- Topic 4 Production, Maintenance, and Reports PreVail Screens

Module 9 HMI Devices Lessons

Lesson 9.5 Touch Screen System

Lesson Description:

This Lesson provides the electrical maintenance technician or end-user of P&H Mining Equipment with the necessary knowledge and working skills to understand the Touch Screen System.

Objectives:

Upon completion of this Lesson the student will:

- Identify/explain the purpose of the Touch Screen System.
- Locate and identify the hardware components of the Touch Screen System.
- Identify/explain the function of each hardware component of the Touch Screen System.
- Identify/explain the functions available in the Touch Screen System.
- Identify/explain the Touch Screen troubleshooting procedures and corrective actions.

Lesson Outline:

- Topic 1 Theory of Operation
- Topic 2 Hardware Overview
- Topic 3 Procedures Overview
- Topic 4 Operation Screen Procedures
- Topic 5 Diagnostic Screen Procedures
- Topic 6 Setup Screen Procedures
- Topic 7 Activity Screen Procedures
- Topic 8 Help Screen Procedures
- Topic 9 Troubleshooting