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# Online training for the power industry

**GPiLEARN™**  
BLENDED TRAINING SOLUTIONS

[www.gpilearnwbt.com](http://www.gpilearnwbt.com)



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Train Anytime... Anywhere... With GP



## GPiLEARN™

BLENDED TRAINING SOLUTIONS

Thousands of power plant workers worldwide are using GPiLEARN to optimize workforce performance.

General Physics Corporation (GP) has been helping power companies find solutions to workforce qualification issues for over 40 years. We are the industry leader in technical online training for power plants.

With GPiLEARN you can easily implement a blended learning solution that makes a lasting impact on your engineers, technicians, operators, and other skilled workers.

Make sure your employees have the skills needed to operate and maintain the plant safely and efficiently. Select GP's online training solution.

## GPiLEARN Benefits

- Access thousands of power plant lessons and exams
- Manage blended learning using a world-class Learning Management System (LMS) from Oracle
- Schedule and track your classroom courses, online training, "hands-on" qualifications (Job Performance Measures), procedures, and other site-specific materials using GPiLEARN
- Allow workers to access GPiLEARN anytime, anywhere they have internet access
- Develop and assign structured curriculums for each job classification
- Provide centralized record-keeping for workers and supervisors
- Reduce training costs per employee
- Avoid hidden hosting, training, and maintenance fees
- Obtain an Associates or Bachelors Degree through GP's accredited degree program



General Physics Corporation  
**ENERGY SERVICES**  
YOUR POWER PLANT EXPERTS

GP now offers online training programs in Spanish. Contact GP to learn more about this version.



## GP's Online Training Programs

GP's online training programs are designed to help power plants develop a traditional or multi-skilled workforce, improve knowledge, reduce accidents, and improve ROI.

Our online courses include animations, review questions, interactive exercises, and audio to keep the audience engaged throughout the learning process. Lessons are bookmarked so they can be resumed if an employee is called away while studying. There is an exam for each lesson to test the employee's knowledge.

GP's comprehensive content includes courses for:

- Power Plant Operators
- Mechanics
- Electricians
- Instrumentation and Control Technicians
- Cross-Trained Technicians
- Chemists and Lab Technicians
- Coal Handling Personnel (Material Handling)
- Performance Engineers (Heat Rate)
- New Hires (Fundamental Training)

The following types of courseware can be accessed on GPiLEARN:

- Conventional Power Plants (coal fired-, oil fired-, gas fired-, CFB-, and refuse-boilers)
- GE Frame 7F Combined Cycle Plants
- Siemens 501F Combined Cycle Plants
- Combustion Turbines [LM2500, LM6000, Frame 6, Frame 7EA, and V84 (2000E)]
- OSHA Compliance
- Environmental Compliance
- Nalco™ Water Treatment
- Waste-to-Energy Plants
- Hydroelectric Plants
- Wind Farms
- Flue Gas Conditioning (Scrubbers, SCRs, and SNCRs)
- NERC Standards
- NERC Generator Owner and Generator Operator

**GP's "off-the-shelf" content can be customized instead of developing site-specific courseware "from scratch" and re-inventing the wheel.**

GP provides various consulting services to complement your current training programs. GP believes in complete, efficient, and effective training programs that encompass a blended learning approach of web-based training, "hands-on" training and qualification, and instructor-led courses. Our services include:

- Training Program Design and Consulting
- Curriculum Development
- System Descriptions (Development and Updates)
- Operating Procedures (Development and Updates)
- "Hands-On" Qualification Support (Job Performance Measures)
- Site-Specific Visual Operating Procedures (Web-based VOPs)
- Alarm Response and Troubleshooting Scenario Training
- Instructor-Led Courses
- Plant Commissioning Support and Startup Training
- Apprenticeship Programs
- Maintenance Training
- Hiring and Screening Support
- Training Needs Assessments
- Job Task Analyses
- OSHA/EH&S Compliance Training
- Simulator Training and Services
- NERC Compliance and Training
- Just-In-Time Operator Training



GP is an authorized provider of the International Association of Continuing Education and Training (IACET). When you successfully complete approved GPiLEARN curricula, you enhance your knowledge to further your career and earn valuable CEU's that can be used towards degree programs and professional certifications.



## Earn College Credits for Courses on GPiLEARN™



*“GP has been and continues to be the class act in employee training and development.”*

— Pat Bray  
Safety and Training Coordinator  
Otter Tail Power Company

### Available Degree Programs

With today's demanding work schedules, online training offers a convenient way for you or your staff to earn their degrees. GPiLEARN has partnered with three colleges who give college credit for many of our courses. As a result, using GPiLEARN to educate your skilled workforce and plant management not only helps you improve safety, efficiency, and performance, it also helps you attract the kind of professionals who aim to achieve.

Through our strategic partnerships, over 40% of the GPiLEARN courses have now been approved for college credit by institutions of higher learning. You can earn college credits at any of the following institutions of higher learning.



[www.bismarckstate.edu/energy/gpi/](http://www.bismarckstate.edu/energy/gpi/)  
800.445.5073



[www.centralia.edu](http://www.centralia.edu)  
360.736.9391 x 280



[www.excelsior.edu](http://www.excelsior.edu)  
888.647.2388



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BLENDED TRAINING SOLUTIONS

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## Basic Academics (Math)



Basic Academics (Math) contains many courses that cover various math principles.

### BA01 Basic Academics

- BA0101:** Placement of Decimals
- BA0102:** Math Problems Using Addition, Subtraction, Multiplication, and Division
- BA0103:** Math Problems Using Whole Numbers and Decimals
- BA0104:** Averaging
- BA0105:** Fractions to Decimals
- BA0106:** Decimals to Fractions
- BA0107:** Decimals and Fractions Into Percentages
- BA0108:** Percentages Into Fractions and Decimals
- BA0109:** Negative Powers of Ten
- BA0110:** Positive Powers of Ten
- BA0111:** Area
- BA0112:** Volume
- BA0113:** Density
- BA0114:** Specific Gravity
- BA0115:** Conversion
- BA0116:** Measurement Systems
- BA0117:** Utilizing Conversion Units
- BA0118:** Dimensional Properties
- BA0119:** Dimensional Problems
- BA0120:** Degrees/Minutes/Seconds
- BA0121:** Relationships Between Tables and Graphs
- BA0122:** Tables and Graphs Related to Math
- BA0123:** Problem Solving Using Tables and Graphs
- BA0124:** Triangles

## Power Fundamentals™

The Power Fundamentals series contains various courses that focus on theoretical and systems training for power plant workers.

### PF01 Safety

- PF0101:** Plant Hazards and Protective Gear
  - Hard Hats
  - Eye Protection
  - Hearing Protection
  - Respiratory Protection
  - Confined Space Entry
  - Trip and Fall Hazards
- PF0102:** Basic First Aid
  - Emergency Communication
  - Securing and Assessing Accident Victims
  - Cardiopulmonary Resuscitation (CPR)
  - Controlling Blood Loss
  - Bloodborne Pathogens and Biohazardous Waste
- PF0103:** Fire Protection
  - Combustion Triangle
  - Fire Prevention
  - Fire Response
  - Fire Protection Systems
  - Portable Fire Extinguishers
- PF0104:** Work Authorizations and Material Safety Data Sheets
  - Safety Tag-Out Procedures
  - Warning Signs and DOT Placards
  - MSDS

### PF02 Introduction to Power Generation

- PF0201:** Energy Conversion Process
  - Energy Conversion Fundamentals
  - Power Plant Cycle
  - Efficiency Improvements
  - Energy and Fuel Sources
- PF0202:** Combustion System Components
  - Pulverized Coal Components
  - Secondary and Combustion Air
  - Fuel Supply Components
  - Proper Combustion
- PF0203:** Fluidized Bed Combustion
  - Fluidized Bed Combustion Overview
  - CFB Combustion Process
  - CFB Combustion Air and Flue Gas
  - CFB Boiler Water and Steam Circuits
  - Stack Emissions and Waste Products
- PF0204:** Boiler Water and Steam Cycle
  - Boiler Water/Steam Cycle Fundamentals
  - Waterwall Tubes
  - Economizer and Superheater
- PF0205:** Basic Turbine Overview
  - Basic Turbine Components and Turbine Steam Flow
  - Condensers and Turbine Exhaust Steam
  - Condenser Auxiliaries
- PF0206:** Plant Auxiliary Systems
  - Feedwater Heating Basics
  - Feedwater Heaters and Deaeration
  - Boiler Feed Pumps

## PF03

### Physical Properties

- PF0301:** Units of Measurement
- Units of Measurement
  - Fundamental Units
  - Physical Properties
  - Volume
  - Density
  - Specific Gravity
- PF0302:** Pressure
- Air Pressure
  - Measurements of Pressure
  - Negative Pressure and Back Pressure
  - Manometers
  - Head Pressure and Draft Pressure
  - Air and Fluid Flow
- PF0303:** Energy
- Potential Energy and Kinetic Energy
  - Temperature Scales and Conversions
  - Thermocouples and RTDs
  - Energy Conservation
- PF0304:** Phases and States of Matter
- Three Phases of Matter
  - Latent Heat
  - Enthalpy
  - Density of Water
  - Steam Tables
  - Frozen Pipes and Flashing

## PF04

### Combustion Basics

- PF0401:** Fuels
- Combustion
  - Origin of Fossil Fuels
  - Coal
  - Fuel Oil
  - Natural Gas
- PF0402:** Chemistry of Combustion
- Combustion Process
  - Combustion Requirements
  - Fuel/Air Ratio
  - Thermal Decomposition
  - Boiler Applications
- PF0403:** Heat Transfer
- Conduction
  - Convection
  - Radiation
  - Furnace Heat Transfer

## PF05

### Ash Removal (Boiler Plants)

- PF0501:** Introduction to Ash Handling
- Ash Characteristics
  - Ash Formation
  - Ash Deposits
  - Ash Collection
  - Operational Considerations
- PF0502:** Bottom Ash Removal System
- Ash Disposal
  - Boiler Seal
  - Dry Bottom Ash System
  - Wet Bottom Ash System
  - Drag Chain Ash System
  - Ash Water System
- PF0503:** Fly Ash Handling System
- Air Systems and Positive Displacement Blowers
  - Pressurized Ash Systems
  - Vacuum Ash Systems
  - Conveyor Ash Systems

## PF06

### Combustion Turbine (LM2500)

- PF0601:** Combustion Turbines (LM2500)
- Combustion Turbine Overview
  - Combustion Turbine Thermodynamics
  - Compressors
  - Combustors
  - Turbines
  - LM2500 Specifics
- PF0602:** Major Components of the LM2500 Gas Turbine
- LM2500 Overview
  - Compressor
  - Combustor and HP Turbine
  - Power Turbine
  - High-Speed Coupling and Exhaust
  - Accessory Drive
- PF0603:** Gas Turbine and Control Oil Systems
- Lubrication Theory
  - Sump Description
  - Lubrication Systems
  - Variable Stator System
  - Generator Lube Oil Supply System
  - Starting System
- PF0604:** Air Inlet, Fuel Supply, and Water Injection Systems
- Air Inlet
  - Fuel Gas
  - Liquid Fuel
  - Fuel Nozzles and Water Injection

## PF07

### Combustion Turbine (Frame 6)

- PF0701:** Combustion Turbine (Frame 6)
- Combustion Turbine Overview
  - Combustion Turbine Thermodynamics
  - Compressors
  - Combustors
  - Turbines
  - Frame 6 Engine Overview
- PF0702:** Starting Systems and Auxiliary Air Systems
- Air Filter and Cleaning System
  - Starting System
  - Cooling and Sealing Air System
- PF0703:** Lube, Hydraulic, and Control Oil Systems
- Lube Oil and Bearing Feed System
  - Lube Oil Supply System
  - Hydraulic and Control Oil System
  - Combustion Turbine Trip Oil System
- PF0704:** Combustion Components and Fuel Systems
- Combustion System Overview
  - Dry Low NO<sub>x</sub> Burner Operation
  - Fuel Oil and Atomizing Air System
  - Atomizing Air System
  - Fuel Gas System
  - Reduction Gear
- PF0705:** Generator Operations
- Cooling System
  - Generator Excitation System
  - Generator Relay Protection

- PF08 Combustion Turbine (Frame 7EA)**
- PF0801:** Combustion Turbine (Frame 7EA)
- Combustion Turbine General Overview
  - Combustion Turbine Thermodynamics
  - Compressors for Combustion Turbines
  - Combustors for Combustion Turbines
  - Turbines for Combustion Turbines
  - Frame 7EA Engine Overview
- PF0802:** Starting System and Auxiliary Air Systems
- Air Filter and Cleaning System
  - Starting System
  - Cooling and Sealing Air System
- PF0803:** Lube, Hydraulic, and Control Oil Systems
- Lube Oil and Bearing Feed System
  - Lube Oil Supply and Pumping System
  - Lube Oil Flowpaths
  - Hydraulic and Control Oil System
- PF0804:** Combustion Components and Fuel Systems
- Combustion Systems
  - Liquid Fuel Systems
  - Atomizing Air System
  - Fuel Gas System
- PF0805:** Generator Support Systems
- Hydrogen Cooling System
  - Seal Oil System
  - Hydrogen Seals
  - Generator Excitation
  - Electrical Protective Relays
  - Hydrogen Gas System

- PF09 Combustion Turbine V84 (2000E)**
- PF0901:** Combustion Turbine V84 (2000E)
- Combustion Turbine Overview
  - Combustion Turbine Thermodynamics
  - Compressors
  - Combustors
  - Turbines
  - Siemens V84 (2000E) Combustion Turbines
- PF0902:** Combustion Turbine Generator Starting and Air System
- Inlet Air Systems
  - Cooling and Sealing Air
  - Starting Systems
- PF0903:** Lube, Shaft, and Control Oil System and Turning Gear
- CTG Lube Oil System
  - Rotor Lift Oil System
  - Control Oil System
  - Turning Gear
- PF0904:** Fuel System
- Liquid Fuel Oil System
  - Ignition Gas System
  - Fuel Gas System
  - Burner Assemblies
- PF0905:** Combustion Turbine Control
- Automatic Startup Sequence
  - Automatic Shutdown Sequence
  - Turbine Supervisory and Protection System

- PF10 Boiler (Plant Boilers)**
- PF1001:** Steam Drums
- Steam Drum Overview
  - Steam Drum Internals and Operation
  - Thermal Stress Precautions
  - Steam Drum Overstress
- PF1002:** Waterwall Circulation, Superheaters, and Drains
- Boiler Flowpaths
  - The Boiling Process
  - Steam Quality
  - Downcomers and Waterwalls
  - Reasons for Drum Level Control
  - Superheaters and Attemperation
  - Vents and Drains
- PF1003:** Economizer, Reheater, Gas Flow, Attemperators, and Sootblowing
- Economizer
  - Reheater
  - Attemperators
  - Sootblowing Systems
  - Sootblower Operation

- PF11 Heat Recovery Steam Generators (Combined Cycle Plants)**
- PF1101:** Steam Drums
- Basic Steam Drum Operating Cycle
  - Steam Drum Thermal Stress
- PF1102:** HRSG Flowpaths and Components
- Economizer
  - Evaporator
  - Superheater
  - HRSG Heat Balance and Tube Bundle Arrangement
  - Steam Quality and Tube Features
  - Drum Level Protection
  - Vents and Drains
- PF1103:** HRSG Auxiliary Systems
- Steam Flow Auxiliary Systems
  - Attemperators
  - Duct Burners
  - CO Catalyst and SCR Systems
  - Chemical Addition Systems

- PF12 Steam/Water Cycle**
- PF1201:** Condenser and Circulating Water
- Condensers
  - Liquid Ring Vacuum Pumps
  - Steam Jet Air Ejectors
  - Circulating Water
  - Cooling Towers
- PF1202:** Pumps
- Overview of Centrifugal Pumps
  - Volute Pumps
  - Mixed Flow Pumps
  - Diffuser Pumps
  - Pump Bearings
  - Pump Seals
- PF1203:** Feedwater Components and Cycle Operation
- Open and Closed Feedwater Heaters
  - Turbine Water Induction Protection
  - Deaerators
  - Condensate and Feedwater System
  - Feedwater Heater Operating Procedure



## PF13 Plant Systems

### PF1301: Compressed Air and Plant Cooling Systems

- Overview of Plant Air Systems
- Reciprocating Air Compressors
- Centrifugal Air Compressors
- Screw Air Compressors
- Air Dryers
- Closed Cycle Cooling Water System

### PF1302: Valves, Traps and Piping

- Gate, Check, Butterfly, and Ball Valves
- Safety Valves and Relief Valves
- Electromatic Relief Valves
- Traps
- Plant Piping

## PF14 Steam Turbines

### PF1401: Turbine Auxiliaries Overview

- Steam Turbine Overview
- Turbine Lube Oil System
- Turbine Gland Steam Seal System
- Turbine Electro-Hydraulic Control Fluid System
- Turbine Supervisory Instrument System
- Exhaust Hood Sprays
- Extraction Steam

### PF1402: Thermal/Mechanical Understanding

- Basic Turbine Theory
- Impulse and Reaction Blading
- Turbine Classification
- Interstage Sealing
- Main Steam Admission Components
- Turbine Expansion, Bearings, and Lubrication
- Turning Gear and Rupture Diaphragm

### PF1403: Turbine Operation

- Mechanical-Hydraulic Control (MHC) Governor Explanation
- Electro-Hydraulic Control (EHC) Governor Explanation
- EHC Control System
- Lube Oil System Startup
- Steam Seal System Startup
- Turbine Drains Operating Procedure

## PF15 Generators and Basic Electricity

### PF1501: Practical Basic Electricity

- Voltage and Current
- Conductors and Insulators
- Resistance and Resistors
- Methods of Producing Electricity
- Ohm's Law
- Work and Electric Power
- DC Series Circuits
- DC Parallel Circuits

### PF1502: AC Electricity and Generators

- Magnetism
- Types of Magnets
- Electromagnetic Induction
- Generators
- Generator Types
- Values of an AC Waveform
- Resistance, Inductance, Capacitance, and Impedance
- AC Circuits and Power Factor



### PF1503: Basic Generator / Exciter Operation

- Excitation Systems
- Generator Control Systems
- Generator Control (Voltage, MVAR, Frequency, MW)
- Generator Synchronizing
- Generator Cooling
- Shaft Seal Oil System
- Gas Control System
- Core Monitor

## PF16 Plant Electrical Systems

### PF1601: Station Service Systems and Transformers

- Introduction to Station Service Systems
- High Voltage Station Service Systems
- Low Voltage Station Service Systems
- Transformer Principles
- Transformer Construction

### PF1602: Circuit Breakers

- Classes and Functions of Circuit Breakers
- Types of Circuit Breakers
- Basic Motor Control
- Medium-Duty and Heavy-Duty Circuit Breakers
- Relays and Circuit Breaker Controls
- Arc Suppression
- Circuit Breaker Operation Safety

### PF1603: General Relaying

- Purpose of Relays
- Relay Devices 25, 27, 32, 37, 40, 46, 49
- Relay Devices 50, 51, 59, 64, 81, 86, 87
- Relay Zones of Protection

### PF1604: Motors

- Construction of AC Induction Motors
- Theoretical Operation of AC Induction Motors
- General Operating Characteristics of AC Induction Motors
- Classification of Motors
- Synchronous Motor Overview
- DC Motors

## PF17 Plant Instrumentation and Controls

### PF1701: Power Plant Controls

- History of Plant Control Systems
- Analog Electronic Controls
- Permissives and Interlocks
- Microprocessor Controls
- Comparison Between Analog and Microprocessor Controls
- Programmable Logic Controllers

### PF1702: Understanding Control Loops

- Introduction to Plant Control Loops
- Feedback Control Loops
- Feedforward Control Loops
- PID Control Loops
- Tuning Parameters
- Fail/Open and Fail/Closed Valves

### PF1703: Field Devices

- Input and Output Devices
- Bourdon Tube Gauges
- Pressure and Flow Transmitters
- Limit Switches and Position Transducers
- Level Devices
- Field Device Applications and Signals

## PF18 Water Treatment

### PF1801: Introduction to Chemistry

- Atoms and Elements
- Compound Formation
- Chemical Formulas
- Chemical Equations
- Chemical Reactions
- Water and Solutions
- Corrosion Cell

### PF1802: Water Treatment System Components

- Clarifier Operations
- Filtration Systems
- Zeolite Softeners
- Softener Regeneration
- Reverse Osmosis

### PF1803: Scale, Deposit, and Fouling

- Cooling System Water Treatment
- Corrosion
- Corrosion Control
- Deposition
- Microbiological Growth

### PF1804: Demineralization

- Demineralizer Operation and Regeneration
- Mixed Bed Operation and Regeneration
- Degasifier

## PF19 Pollution Control (Boiler Plants)

### PF1901: The Environment

- Noise Pollution
- Land Pollution
- Water Pollution
- Air Pollution

### PF1902: Particulate Removal Equipment

- Introduction to Particulate Control
- Pulse Jet Baghouse
- Reverse Air and Shaker Baghouses
- Baghouse Operation
- Electrostatic Precipitator
- Electrostatic Precipitator Efficiency and Operation

### PF1903: Gaseous Emissions Control

- Introduction to Gaseous Emissions Control
- Wet Scrubbers
- Dry Scrubbers
- Scrubber Chemical Reactions

### PF1904: Water Pollution

- Types of Water Pollution
- Operation of Wastewater Treatment Equipment

## PF20 Emissions Control (Gas Turbines)

### PF2001: The Environment

- The Basic Environmental Life-Cycle Illustration
- The Four Types of Pollution
- Types of Air Pollutants

### PF2002: Catalysts

- Basic Environmental Concerns for Combined Cycle Plants
- Overview of Catalysts
- The Carbon Monoxide Catalyst Reduction Unit
- The SCR NO<sub>x</sub> Reduction Unit

### PF2003: Steam and Water Injection Systems

- NO<sub>x</sub> Water Injection
- NO<sub>x</sub> Steam Injection

### PF2004: Water Pollution

- Overview of Water Pollution
- Suspended Solids
- Operation of Waste Water Treatment Equipment

## PF21 Plant Performance

- PF2101:** Introduction to Performance
- Efficiency and Energy Conversion
  - Thermodynamics and Component Efficiency
  - Heat Rate and Heat Balance
  - Turbine-Generator Section
  - Feedwater Section
- PF2102:** Boiler Efficiency
- Boiler Losses
  - Operator Impact on Boiler Efficiency
  - Air Heater Operation
  - Air Heater Performance
  - Feedwater Heater Operation
  - Feedwater Heater Performance
- PF2103:** Turbine Cycle Performance
- Initial Steam Pressure
  - Steam Pressure and Efficiency
  - Final (Exhaust) Steam Pressure
  - Condenser Heat Transfer
  - Initial Steam Temperature
- PF2104:** Miscellaneous Losses
- Traps
  - Thermodynamic Traps
  - Mechanical Traps
  - Thermostatic Traps
  - Trap Operation
  - Auxiliary Power

## PF22 LM6000 Combustion Turbine

- PF2201:** LM6000 Combustion Turbine Overview
- Design Considerations
  - Classification of Combustion Turbines
  - Characteristics of Combustion Turbines
  - Advanced Combustion Turbine Design
- PF2202:** LM6000 Main Components
- Air Inlet
  - Compressor
  - Combustion Section
  - Turbine
  - Exhaust
  - Bearings
  - Gears and Couplings
  - Clutch
  - Turbine Base and Enclosure
- PF2203:** LM6000 Combustion Turbine Generator
- Construction
  - Excitation
  - Synchronous Condenser
- PF2204:** LM6000 Support Systems (Part 1)
- Electrical System
  - Ventilation and Combustion Air Filter System
  - Exhaust System
  - Starting System
  - Fuel Supply System
  - Water and Steam Injection System
- PF2205:** LM6000 Support Systems (Part 2)
- Turbine Lube Oil System
  - Generator Lube Oil System
  - Lube Oil Cooling System
  - Water Wash System
  - Fire Protection System

- PF2206:** LM6000 Operations and Maintenance (Part 1)
- Maintenance Philosophy and Planning
  - Maintenance Features of Combustion Turbines
  - Major Factors Affecting Maintenance
- PF2207:** LM6000 Operations and Maintenance (Part 2)
- Maintenance Inspections
  - Parts, Manpower Planning, and Inspection
- PF2208:** LM6000 Performance and Reliability
- Factors Affecting Combustion Turbine Reliability
  - Performance Improvements
  - Combustion System Improvements
  - Emissions Reduction
  - Control System Reliability Improvements
  - Impact of Operating Modes
- PF2209:** LM6000 Control System
- Subsystems of Control Systems
  - Communication Pathways Between Subsystems

## PF23 Coal Fundamentals

- PF2301:** Introduction to Coal Handling
- Transporting Coal
  - Unloading Coal
  - Stackout, Storage, and Reclaim of Coal
- PF2302:** Unloading Rail Delivered Coal
- Rail Car Unloading
  - Thaw Shed and Shacker
  - Safety
- PF2303:** Unloading Barge Delivered Coal
- Barge Unloading
  - Components and Functions of a Barge Unloader
  - Safety
- PF2304:** Coal Conveyors
- Standard Coal Conveyor Components
  - High Angle Coal Conveyor Components
  - Air Coal Conveyor Components
  - Safety Components and Issues
- PF2305:** Stackout, Reclaim, and Coal Pile Management
- Coal Storage, Stackout, and Reclaim
  - Coal Pile Management
  - Safety
- PF2306:** Crushers and Trippers
- Crusher
  - Tripper
  - Safety
- PF2307:** Rail Yard Operation
- Railcar
  - Railyard Equipment
  - Safety

# Power Plant Operations



Our Power Plant Operations series contains many courses for conventional power plant operators.

## OPO1 Power Generation Process

- OPO101:** Major Components of an Alternating Current (AC) Generator
- OPO102:** Principles of an AC Generator
- OPO103:** Auxiliary Systems of an AC Generator
- OPO104:** Basic AC Power Calculations

## OPO2 Advanced Turbine Operation

- OPO201:** Complete Startup of Turbine/Generator
- OPO202:** Complete Shutdown of Turbine/Generator
- OPO203:** SALI Charts with and without Rotor Stress Indicator (RSI)
- OPO204:** Operating Limits of Turbine/Generator
- OPO205:** Purpose of Turbine Components and Instrumentation
- OPO206:** Operation of Turbine Components
- OPO207:** Purpose of Generator Components and Instrumentation
- OPO208:** Operation of Generator Components
- OPO209:** Lesson has been combined with OPO204 and OPO205
- OPO210:** Lesson has been combined with OPO204
- OPO211:** Corrective Action for Transient Conditions
- OPO212:** Lesson has been combined with OPO204
- OPO213:** Lesson has been combined with OPO201

## OPO3 Emergency Diesel Generators

- OPO301:** Operation of the Emergency Diesel Generator Lube Oil Systems
- OPO302:** Operation of Emergency Diesel Generator Batteries and Charger
- OPO303:** Functions of the Safety Features of the Emergency Diesel Generator
- OPO304:** Alignment of Emergency Diesel Generator Fuel Systems
- OPO305:** Startup Procedure for the Emergency Diesel Generator
- OPO306:** Procedure to Tie the Emergency Diesel Generator to the Plant Electrical System
- OPO307:** Components of the Emergency Diesel Generator
- OPO308:** Isolating and Tagging of the Emergency Diesel Generator

## OPO4 Advanced Boiler Operation

- OPO401:** Startup of a Boiler, From a Cold Boiler to Turbine Roll-Off
- OPO402:** Shutdown of a Boiler
- OPO403:** Air and Gas Flow Through the Boiler, From Fans to Stack
- OPO404:** Flowpath of Water and Steam From Economizer Inlet to Main Condenser
- OPO405:** Corrective Actions for Various Transient Conditions
- OPO406:** Boiler Hydrostatic Test
- OPO407:** Operating Limits of Boilers and Boiler Components
- OPO408:** Safety Valves of the Boiler
- OPO409:** Pressure Range Where the Boiler Safety Valves Lift
- OPO410:** Operation of Pressurematic Vent Valves
- OPO411:** Operation of the Furnace Safeguard Supervisory System (FSSS)
- OPO412:** FSSS Power Supply for Low Voltages
- OPO413:** Purpose of All Boiler Instrumentation
- OPO414:** Sootblowing Effect on Furnaces
- OPO415:** Operation of a Bowl Mill

## OPO5 Boiler Gas and Fuel Oil Systems

- OPO501:** Major Components of the Fuel System
- OPO502:** Function of the Major Components of the Fuel System
- OPO503:** Flowpath of Fuel Through the Fuel System
- OPO504:** Alignment of the Fuel System for Startup
- OPO505:** Alignment of the Fuel System for Shutdown
- OPO506:** Normal Operation of the Fuel System
- OPO507:** Association of Temperature and Viscosity in Burning of Fuel Oil
- OPO508:** Power Sources for the Major Components of a Fuel System
- OPO509:** Safety Features of the Fuel System
- OPO510:** Functions of the Safety Features of the Fuel System
- OPO511:** Operation of the Fuel Unloading Terminals
- OPO512:** Procedure to Isolate and Tag the Fuel System Components

# Power Plant Operations

## OP06 Circulating Water System

- OP0601:** Function and Types of Circulating Water Systems
- OP0602:** Major Components of The Circulating Water System
- OP0603:** Flowpath of Water Through the Circulating Water System
- OP0604:** Alignment for the Startup of the Circulating Water System
- OP0605:** Alignment for a Shutdown of the Circulating Water System
- OP0606:** Chemical Treatment of the Circulating Water System
- OP0607:** Flowpath of the Chemical Feed for a Circulating Water System
- OP0608:** Power Sources for Circulating Water System Components
- OP0609:** Safety Features and Their Function in the Circulating Water System
- OP0610:** Lesson has been deleted
- OP0611:** Blowdown NPDS Limits
- OP0612:** Isolating and Tagging of Circulating Water System Components
- OP0613:** Identifying NPDS Limits

## OP07 Generator Operation

- OP0701:** Purpose of Generators
- OP0702:** Major Components of Generators
- OP0703:** Lesson has been combined with OP0702
- OP0704:** Transformers Associated with Generators
- OP0705:** Interaction of Associated Transformers with Generators
- OP0706:** Systems of Generators Cooled by the Cooling Water System
- OP0707:** Operation of Stator Cooling System
- OP0708:** Major Components of the Generator Seal Oil System
- OP0709:** Flowpath of the Seal Oil System
- OP0710:** Power Sources of Generator Seal Oil Components
- OP0711:** Major Components of the Generator Bearing Oil System
- OP0712:** Flowpath of the Generator Bearing Oil System
- OP0713:** Power Sources of the Generator Bearing Oil System Components
- OP0714:** Lesson has been combined with OP0711 and OP0708
- OP0715:** Components of the Generator Hydrogen System
- OP0716:** Power Sources of the Generator Hydrogen System
- OP0717:** Purging of the Generator with Air, Carbon-Dioxide, and Hydrogen
- OP0718:** Power Sources of Generator Major Components
- OP0719:** Safety Features of the Generator
- OP0720:** Lesson has been combined with OP0719
- OP0721:** Isolating and Tagging of Generator Components

## OP07 Generator Operation (cont'd)

- OP0722:** Major Subsystems of the Generator
- OP0723:** Lesson has been combined with OP0722
- OP0724:** Conditions Required to Synchronize the Generator

## OP08 Precipitators

- OP0801:** Major Components of Precipitators
- OP0802:** Function of Precipitators
- OP0803:** Flowpath of Flue Gas Through the Precipitators
- OP0804:** Startup Alignment for Precipitators
- OP0805:** Alignment for Shutdown of Precipitators
- OP0806:** Safety Features of Precipitators
- OP0807:** Functions of the Safety Features of Precipitators
- OP0808:** Power Sources for the Precipitators
- OP0809:** Functions of Precipitator Key Interlock System
- OP0810:** Operation Sequence of Precipitator Key Interlock System
- OP0811:** Isolating and Tagging of Precipitator Components

## OP09 Turbine Operation

- OP0901:** Function of the Main Steam Turbine
- OP0902:** Turbine Steam Valves
- OP0903:** Lesson has been combined with OP0902
- OP0904:** Flowpath of Steam Through the Turbine
- OP0905:** Two Types of Turbine Bearings
- OP0906:** Functions of Subsystems of the Turbine
- OP0907:** Major Components of the Turbine and Their Function
- OP0908:** Lesson has been combined with OP0907
- OP0909:** Components of the Turbine Front Standard
- OP0910:** Lesson has been combined with OP0909
- OP0911:** Components of the Turbine Lube Oil System
- OP0912:** Flowpath of the Turbine Lube Oil System
- OP0913:** Flowpath of the Turbine Lube Oil Filtration
- OP0914:** Effect of High Backpressure on Turbine Operation
- OP0915:** Turbine Supervisory Instrumentation and Function
- OP0916:** Condenser Vacuum Affects on Turbine Operation
- OP0917:** Power Sources for Turbine Components
- OP0918:** Safety Features of the Turbine
- OP0919:** Lesson has been combined with OP0918
- OP0920:** Function of the Turbine Exhaust Hood Spray
- OP0921:** Function of the Turbine Steam Seal System
- OP0922:** Isolation and Tagging of Turbine Components
- OP0923:** Function of the Condenser Tube Spray System

# Power Plant Operations

## OP10

### Boiler Fans

- OP1001:** Fans Associated with the Boiler
- OP1002:** Function of Fans Associated with the Boiler
- OP1003:** Major Components of the Fans
- OP1004:** Lesson has been deleted and combined with OP1003 and OP1005
- OP1005:** Operation of the Major Components for Fans
- OP1006:** Function of the Air Preheater
- OP1007:** Major Components of the Air Preheater
- OP1008:** Functions of the Major Components of the Air Preheater
- OP1009:** Operation of the Major Components of the Air Preheater
- OP1010:** Alignment for the Startup of the Fans
- OP1011:** Alignment for the Shutdown of the Fans
- OP1012:** Alignment of the Air Preheater for Startup
- OP1013:** Alignment of the Air Preheater for Shutdown
- OP1014:** Lesson has been deleted and combined with OP1015
- OP1015:** Functions of the Safety Features of the Fans
- OP1016:** Lesson has been deleted and combined with OP1017
- OP1017:** Safety Concerns, Protective Features and Functions of the Air Preheaters
- OP1018:** Power Sources for Fans and Fan Auxiliaries
- OP1019:** Power Sources for Air Preheater and Auxiliaries
- OP1020:** Air Preheater Wash System
- OP1021:** Function and Operational Variables of the Air Preheater Wash System
- OP1022:** Major Components of the Air Preheater Wash System
- OP1023:** Alignment for the Startup of the Air Preheater Wash System
- OP1024:** Shutdown Alignment of the Air Preheater Wash System
- OP1025:** Flowpath of the Air Preheater Wash System
- OP1026:** Power Sources for the Air Preheater Wash System
- OP1027:** Isolating and Tagging of Fan Components
- OP1028:** Isolating and Tagging of Air Preheater Components
- OP1029:** Isolating and Tagging of Air Preheater Wash System Components
- OP1030:** Function and Operation of the Steam Air Heater System
- OP1031:** Lesson has been deleted and combined with OP1030
- OP1032:** Major Components of the Steam Air Heater System

## OP10

### Boiler Fans (cont'd)

- OP1033:** Alignment of Steam Air Heaters for Service
- OP1034:** Alignment to Remove Steam Air Heaters From Service
- OP1035:** Flowpath of the Steam Air Heater System
- OP1036:** Isolating and Tagging of the Steam Air Heater Components

## OP11

### Sootblowing System

- OP1101:** Function of the Sootblowing System
- OP1102:** Major Components of the Sootblowing System
- OP1103:** Function of the Major Components of the Sootblowing System
- OP1104:** Flowpath and Sources of Steam for Sootblowing System
- OP1105:** Alignment for Operation of the Sootblowing System
- OP1106:** Shutdown Alignment of the Sootblowing System
- OP1107:** Operation of the Sootblowing System Computer or Controller
- OP1108:** Safety Features of the Sootblowing System
- OP1109:** Function of the Safety Features of the Sootblowing System
- OP1110:** Power Sources for the Sootblowing System
- OP1111:** Isolating and Tagging of Sootblowing System Components

## OP12

### Boiler Operation

- OP1201:** Major Components of the Boiler
- OP1202:** Function of the Boiler Drum
- OP1203:** Function of the Superheat and Reheat Attemperators
- OP1204:** Flowpath of Water and Steam Through the Boiler Components
- OP1205:** Boiler Alignment for Cold Startup
- OP1206:** Boiler Alignment for Shutdown
- OP1207:** Procedures for Handling Transient Conditions of Boiler
- OP1208:** Boiler Valve Alignment to Fill and Vent
- OP1209:** Power Sources for the Major Components of a Boiler
- OP1210:** Safety Features of the Boiler
- OP1211:** Function of the Boiler Safety Features
- OP1212:** Function of the Flash Tank
- OP1213:** Subcritical and Critical Operation Ramps
- OP1214:** Identification and Monitoring of Steam Trap Operations
- OP1215:** Function of the Superheater Condenser
- OP1216:** Isolating and Tagging of Boiler Components
- OP1217:** Function of the Superheat and Reheat Dampers
- OP1218:** Function of the Blowdown Tank



## OP13 Electro-Hydraulic Control (EHC) Systems

- OP1301:** Major Components of the EHC System
- OP1302:** Function of Major Components of the EHC System
- OP1303:** Flowpath of the EHC System
- OP1304:** Purpose of Fuller's Earth Caking Process
- OP1305:** Alignment of the EHC System Fuller's Earth Caking Process
- OP1306:** Purpose of the EHC Air Dryer/Breather
- OP1307:** Purpose of the EHC Filter System and Selector Valve
- OP1308:** Operation of the EHC Filter System and Selector Valve
- OP1309:** Alignment for Startup of the EHC System
- OP1310:** Power Source for the EHC System Major Components
- OP1311:** Safety Features of the EHC System
- OP1312:** Function of Safety Features of the EHC Components
- OP1313:** Isolating and Tagging of the EHC System Components
- OP1314:** Automated Dispatch System (ADS) Runups
- OP1315:** Automated Dispatch System (ADS) Rundowns
- OP1316:** Automated Dispatch System (ADS) Runbacks

## OP14 Mechanical Hydraulic Control (MHC) Systems

- OP1401:** Function of the MHC System
- OP1402:** Major Components of the MHC System
- OP1403:** Oil Flowpath of the MHC System
- OP1404:** Power Sources for the MHC System
- OP1405:** Isolating and Tagging of the MHC System
- OP1406:** Alignment of the MHC System for Startup

## OP15 Pulverizers and Feeders

- OP1501:** Major Components of the Pulverizers and Feeders
- OP1502:** Function of the Pulverizers and Feeders
- OP1503:** Flowpath of Coal Through Pulverizers and Feeders
- OP1504:** Pulverizer Oil Systems
- OP1505:** Functions of the Pulverizer Oil Systems
- OP1506:** Startup Alignment of the Pulverizers and Feeders
- OP1507:** Power Sources for Pulverizers, Feeders, and Components
- OP1508:** Safety Features of the Pulverizers and Feeders
- OP1509:** Safety Feature Functions of the Pulverizers and Feeders
- OP1510:** Inerting Steam Operation
- OP1511:** Seal Air Sequence for Pulverizer Startup
- OP1512:** Function of the Pyrite System
- OP1513:** Operation of the Pyrite System
- OP1514:** Isolating and Tagging of Pulverizer and Feeder Components

# Mechanical Maintenance

Our Mechanical Maintenance series contains numerous courses for power plant mechanics.

## MM01 Centrifugal Pump Maintenance

- MM0101:** Centrifugal Pump Theories
- MM0102:** Performance Issues in Centrifugal Pumps
- MM0103:** Cavitation in Centrifugal Pumps
- MM0104:** Centrifugal Pump Components
- MM0105:** Centrifugal Pump Applications
- MM0106:** Identification of Sealing Mediums Used in Pumps
- MM0107:** Centrifugal Pump Disassembly
- MM0108:** Centrifugal Pump Inspection
- MM0109:** Identification of Defective Parts in Centrifugal Pumps
- MM0110:** Centrifugal Pump Reassembly
- MM0111:** Lesson has been combined with MM0112 - MM0115
- MM0112:** Horizontal, Single-Stage, Centrifugal Pump Overhaul
- MM0113:** Horizontal, Multi-Stage, Centrifugal Pump Overhaul
- MM0114:** Vertical, Single-Stage, Centrifugal Pump Overhaul
- MM0115:** Vertical, Multi-Stage, Centrifugal Pump Overhaul

## MM02 Bearing Maintenance and Lubrication

- MM0201:** Lubrication for Sliding and Rolling Surfaces
- MM0202:** Types and Uses of Lubricants
- MM0203:** Identification of Lubrication Characteristics by Bearing Types
- MM0204:** Proper Lubrication Techniques
- MM0205:** Loading and Bearing Types
- MM0206:** Bearing Selections
- MM0207:** Bearings by Type
- MM0208:** Lesson has been combined with MM0207
- MM0209:** Bearing Operating Characteristics
- MM0210:** Sliding Surface Bearings
- MM0211:** Principles of Rolling Contact Bearings
- MM0212:** Bearing Component Matching by Type
- MM0213:** Identification of Seals Used with Bearings
- MM0214:** Use of Seals
- MM0215:** Removal of Sliding Surface Bearings
- MM0216:** Installation of Sliding Surface Bearings
- MM0217:** Bearing Disassembly
- MM0218:** Lesson has been combined with MM0216
- MM0219:** Sliding Surface/Rolling Contact Bearing Inspection
- MM0220:** Bearing Inspections
- MM0221:** Sliding Surface and Rolling Contact Bearing Repair Procedures
- MM0222:** Replacement of Defective Parts
- MM0223:** Removal of Rolling Contact Bearings
- MM0224:** Installation of Rolling Contact Bearings

## MM03 Pedestal Grinder

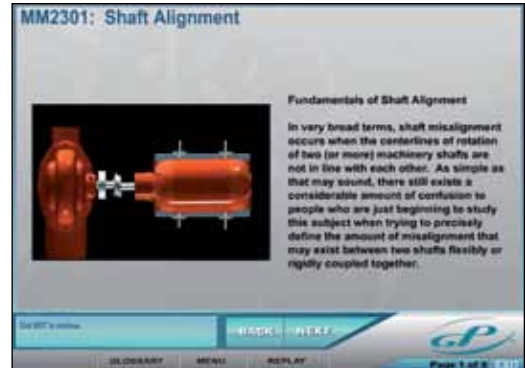
- MM0301:** Grinding Wheel Dressing and Truing

## MM04 Surface Grinder

- MM0401:** Grinding of Parts Parallel and to Size

## MM05 Band Saw

- MM0501:** Saw to Layout Lines on Band Saw



## MM06 Piping

- MM0601:** Piping and Instrumentation Drawing Symbols
- MM0602:** Interpretation of Piping and Instrumentation Drawings
- MM0603:** Types of Piping
- MM0604:** Piping Applications
- MM0605:** Fittings
- MM0606:** Pipe Hangers and Support Systems
- MM0607:** Pipe Hangers and Support System Operation
- MM0608:** Pipe Joining Methods
- MM0609:** Fitting Applications
- MM0610:** Pipe Joining Applications
- MM0611:** Pipe Joining Methods Explained
- MM0612:** Use of Pipe Fittings
- MM0613:** Erecting Piping Runs
- MM0614:** Piping Symbols

## MM07 Gaskets and O-Rings

- MM0701:** Gasket Creation
- MM0702:** O-Ring Creation
- MM0703:** O-Ring Selection
- MM0704:** Removal of Sealing Mediums
- MM0705:** Installation of Sealing Mediums

## MM08 Heat Exchangers

- MM0801:** Heat Exchanger Theories
- MM0802:** Heat Exchanger Types and Characteristics
- MM0803:** Heat Exchanger Fouling, Corrosion, and Erosion
- MM0804:** Heat Exchanger Testing
- MM0805:** Heat Exchanger Inspections
- MM0806:** Heat Exchanger Repairs
- MM0807:** Heat Exchanger Tube Cleaning
- MM0808:** Removal and Replacement of Heat Exchangers
- MM0809:** Lesson has been combined with MM0806
- MM0810:** Gauge Glass Repair

# Mechanical Maintenance

## MM09 Coupling and Shaft Alignment

- MM0901:** Measurement of Coupling Hubs for Outside Diameter (O.D.) Offset and Face Angular Misalignment
- MM0902:** Procedure for Shimming to Compensate for Angular Face and Offset O.D. Misalignment
- MM0903:** Alignment with Straightedge and Taper Gauge
- MM0904:** Indicator Bar Sag Prevention Techniques
- MM0905:** Dial Indicator Setup and Graph Paper Plotting
- MM0906:** Determination of Misalignment Conditions
- MM0907:** Alignments to within 0.002-Inch Tolerance
- MM0908:** Rim and Face Formulas
- MM0909:** Setup of Alignment Equipment to Instruction Booklet Specifications
- MM0910:** Calculation of the Formula to Determine Repositioning
- MM0911:** Alignment for Vertical and Horizontal Misalignment
- MM0912:** Reverse Alignment

## MM10 Rigging and Lifting Practices

- MM1001:** Proper and Safe Usage of Scaffolding
- MM1002:** Selection of Scaffolding Components for Their Correct Usage
- MM1003:** Scaffolding and Stay Assembly
- MM1004:** Scaffolding and Stay Disassembly
- MM1005:** Safe Usage of Personal Lifting Devices
- MM1006:** Lesson has been combined with MM1005
- MM1007:** Lesson has been combined with MM1005
- MM1008:** Proper Use of *Riggers Handbook*
- MM1009:** Safe Working Loads for Various Types of Slings and Hardware
- MM1010:** Types of Rigging and Lifting Equipment
- MM1011:** Inspecting the Rigging Equipment
- MM1012:** Planning a Rigging and Lifting Job
- MM1013:** Lesson has been combined with MM1010
- MM1014:** Proper Use of Rigging and Lifting Equipment
- MM1015:** Safe Performance of Lifts Using Manually Operated Lifting Devices
- MM1016:** Safe Performance of Lifts Using Electric Powered Lifting Devices
- MM1017:** Safe Performance of Lifts Using Hydraulic Lifting Devices
- MM1018:** Safe Performance of Lifts with Air-Operated Lifting Devices
- MM1019:** Safe Performance of Lifts with a Mobile Crane
- MM1020:** Safe Movement of Materials/Equipment with a Mobile Crane
- MM1021:** Safe Performance of Lifts with a Boom Truck
- MM1022:** Safe Movement of Materials/Equipment with a Boom Truck
- MM1023:** Lesson has been combined with MM1001
- MM1024:** Scaffolding Terminology
- MM1025:** Types of Scaffolds

## MM11 Precision Measurement

- MM1101:** Fractional Inch Graduations - Steel Rule
- MM1102:** Outside Thimble Micrometer Ratchet Use
- MM1103:** Precision Measuring "Feel"
- MM1104:** Micrometer "Zero" Calibration
- MM1105:** Outside Micrometer Measurements
- MM1106:** Measuring Device Orientation
- MM1107:** Vernier Scale Readings
- MM1108:** Measuring with a Vernier Caliper
- MM1109:** Measuring with an Inside Micrometer
- MM1110:** Measurement with a Small Hole Gauge
- MM1111:** Errors in Transferring Measurements
- MM1112:** Measurement with a Telescoping Gauge
- MM1113:** Measuring with a Depth Rule and a Depth Micrometer
- MM1114:** Lesson has been combined with MM1113
- MM1115:** Measurement with Protractors
- MM1116:** Measuring with a Dial Indicator
- MM1117:** Lesson has been combined with MM1116
- MM1118:** Measuring with a Radius Gauge
- MM1119:** Measuring with a Thickness Gauge and a Taper Gauge
- MM1120:** Lesson has been combined with MM1119
- MM1121:** Checking Concentricity
- MM1122:** Measuring with a Screw Pitch Gauge and a Thread Micrometer
- MM1123:** Measurement with Wire and Sheet Metal Gauges
- MM1124:** Measuring with a Dial Caliper
- MM1125:** Lesson has been combined with MM1122
- MM1126:** Use of a GO/NO Gauge

## MM12 Conveyor Belt Maintenance

- MM1201:** Types of Conveyors
- MM1202:** Plant Conveyor Usage
- MM1203:** Conveyor Adjustments
- MM1204:** Conveyor Adjustment Techniques
- MM1205:** Conveyor Fastening/Connecting Methods
- MM1206:** Conveyor Belt Fastening/Connecting Techniques
- MM1207:** Conveyor Misalignment Safeguards
- MM1208:** Drive Belts Used in the Plant
- MM1209:** Use of Drive Belts (V-Belts, Gear Belts, etc.)
- MM1210:** Sheaves Used in the Plant
- MM1211:** Use of Sheaves in the Plant
- MM1212:** Drive Belt Adjustments
- MM1213:** Drive Belt Replacement
- MM1214:** Feeder Belt Replacement
- MM1215:** Lesson has been combined with MM1204
- MM1216:** Conveyor Component Replacement
- MM1217:** Conveyor Component Repair

# Mechanical Maintenance

## MM13 Valve Maintenance

- MM1301:** Valve Theory
- MM1302:** Valve Types and Characteristics
- MM1303:** Operation Characteristics of Selected Valves
- MM1304:** Components of Selected Valves
- MM1305:** Characteristics of Valves to Applications
- MM1306:** Sealing Mediums Used in Valves
- MM1307:** Valve Disassembly
- MM1308:** Valve Inspections
- MM1309:** Replacement of Defective Parts that are Critical in Valves
- MM1310:** Valve Part and Component Repair
- MM1311:** Valve Reassembly
- MM1312:** Globe Valve Overhaul
- MM1313:** Gate Valve Overhaul
- MM1314:** Safety Valve Overhaul
- MM1315:** Relief Valve Overhaul
- MM1316:** Ball Valve Overhaul
- MM1317:** Plug Valve Overhaul
- MM1318:** Diaphragm Valve Overhaul
- MM1319:** Butterfly Valve Overhaul
- MM1320:** Check Valve Overhaul
- MM1321:** Control Valve Overhaul
- MM1322:** Plug, Gate, and Globe Valve Operating Characteristics
- MM1323:** Lesson has been combined with MM1304
- MM1324:** Replacement of Defective Parts

## MM14 Positive Displacement Pump Maintenance

- MM1401:** Pump Theories and Differences
- MM1402:** Lesson has been combined with MM1404
- MM1403:** Types of Safety Devices Used for Positive Displacement Pumps
- MM1404:** Positive Displacement Pump Applications
- MM1405:** Positive Displacement Pump Disassembly
- MM1406:** Positive Displacement Pump Reassembly
- MM1407:** Visual Inspection of Positive Displacement Pumps
- MM1408:** Defective Part Replacement
- MM1409:** Positive Displacement Pump Overhaul
- MM1410:** Lesson has been combined with MM1406
- MM1411:** Lesson has been combined with MM1409
- MM1412:** Piston Pump Overhaul
- MM1413:** Diaphragm Pump Overhaul
- MM1414:** Lobe Pump Overhaul
- MM1415:** Vane Pump Overhaul to Criteria in Manuals
- MM1416:** Liquid Ring Pump Overhaul
- MM1417:** Shaft and Impeller Repair

## MM15 Drill Press

- MM1501:** Procedure to Drill Holes to Layout Lines
- MM1502:** Procedure to Drill Holes Through the Center of Round Stock
- MM1503:** Procedure to Countersink, Counterbore, and Spotface on a Drill Press
- MM1504:** Procedure to Ream Holes to Size on a Drill Press
- MM1505:** Tap Types and Thread Classifications
- MM1506:** Procedure to Tap Holes Using a Drill Press
- MM1507:** Selection of Correct Speed to Drill Size and Material

## MM16 Air Compressor Maintenance

- MM1601:** Compressor Theory and Classifications
- MM1602:** Operating Characteristics of Selected Compressors
- MM1603:** Positive Displacement Compressor Components
- MM1604:** Positive Displacement Screw Compressors for "Wet" or "Dry"
- MM1605:** Matching of Characteristics of Compressors to Applications
- MM1606:** Air Compressor Intercoolers
- MM1607:** Air Compressor Aftercoolers
- MM1608:** Compressors with Dryers
- MM1609:** Air Compressor Sealing Mediums
- MM1610:** Air Compressor Disassembly
- MM1611:** Air Compressor Inspections
- MM1612:** Replacement of Defective Parts on Air Compressors
- MM1613:** Air Compressor Reassembly
- MM1614:** Single-Stage Piston Air Compressor Overhaul
- MM1615:** Multi-Stage Piston Air Compressor Overhaul
- MM1616:** Screw-Type Air Compressor Overhaul
- MM1617:** Shaft and Impeller Repair
- MM1618:** Positive Displacement Reciprocating Compressor Components

## MM17 Fluid Power (Hydraulics)

- MM1701:** Incompressibility of Fluids
- MM1702:** Basic Components Common to Fluid Power Systems
- MM1703:** Fluid Power System Diagramming
- MM1704:** Purpose of Actuators
- MM1705:** Basic Operations of an Actuator
- MM1706:** Fluid Power System Control Valves
- MM1707:** Valve Operation in Fluid Power Systems
- MM1708:** Functions of Valves in Fluid Power Systems
- MM1709:** Purpose of Accumulators
- MM1710:** Types of Accumulators
- MM1711:** Identification of Fluid Power Pumps
- MM1712:** Operating Principles of Fluid Power Pumps
- MM1713:** Fluid Power Pump Applications
- MM1714:** Fluid Power Pump System Routine Maintenance

# Mechanical Maintenance

## MM17 Fluid Power (Hydraulics) (cont'd)

- MM1715:** Identification of Fluid Power Motors
- MM1716:** Operating Principles of Fluid Power Motors
- MM1717:** Fluid Power Motor Applications
- MM1718:** Fluid Power Motor Routine Maintenance
- MM1719:** Identification of Fluids and Additives Used in Hydraulic Systems
- MM1720:** Fluid Characteristics
- MM1721:** Fluid Applications
- MM1722:** Fluid Power System Reservoirs
- MM1723:** Purpose of Filters
- MM1724:** Hydraulic System Heat Exchangers
- MM1725:** Fluid Power System Vendors Manuals
- MM1726:** Identification of Fluid Power Component Malfunctions
- MM1727:** Fluid Power System Problems and Possible Remedies
- MM1728:** Lesson has been combined with MM1727
- MM1729:** Location of Various Components of a Fluid Power System
- MM1730:** Types of Repairs Made to Selected Fluid Power Components
- MM1731:** Replacement of Parts and Fluid Power Components
- MM1732:** Fluid Power Component Replacement
- MM1733:** Stacker Reclaimer Hydraulic System
- MM1734:** Rotary Car Dumper Hydraulic System
- MM1735:** Bowl Mill Hydraulic System
- MM1736:** Fluid Power System Routine Maintenance Activities

## MM18 Layout/Bench Work

- MM1801:** Rough Layout of a Workpiece
- MM1802:** Precision Layout of a Workpiece
- MM1803:** Stock Sawing with a Hand Hacksaw
- MM1804:** Straight and Draw Filing of Metal
- MM1805:** Sizing Holes with Hand Reams
- MM1806:** Tapping Threads by Hand
- MM1807:** Hand Methods of Deburring Parts
- MM1808:** Hand Methods of Removing Broken Studs
- MM1809:** Cutting Threads by Hand Using a Threading Die and Tap
- MM1810:** Broaching of a Keyway Using an Arbor Press
- MM1811:** Operate a Powered Keyway Cutter
- MM1812:** Cutting Threads by Machine Using a Threading Die

## MM19 Lathes

- MM1901:** Grind a Right-Hand Turning Tool
- MM1902:** Operator Control of Engine Lathe
- MM1903:** Remove and Install Chucks and Face Plates with Cam Locks
- MM1904:** Rough Centering Work in a 4-Jaw Chuck
- MM1905:** Facing in a Chuck
- MM1906:** Center Drilling in Chucks and Collets
- MM1907:** Alignment of Lathe Centers
- MM1908:** Mounting of Workpieces Between Centers

## MM19 Lathes (cont'd)

- MM1909:** Straight Turning Between Centers
- MM1910:** Knurling of a Workpiece
- MM1911:** Taper Turning with Tail Stock Off-Set Method
- MM1912:** Straight Turning Work Held in a Chuck on an Engine Lathe
- MM1913:** Precision Centering Work in a 4-Jaw Chuck
- MM1914:** Cutting Steep Tapers and Chamfers
- MM1915:** Drilling on a Lathe
- MM1916:** Machine Reaming on a Lathe
- MM1917:** Parting and Grooving on a Lathe
- MM1918:** Grind a 60 Degree Threading Tool
- MM1919:** Cutting External Unified Standard Screw Threads
- MM1920:** Grind a Radius Tool
- MM1921:** Grind a Round Nose Form Tool
- MM1922:** Radius and Fillet Turning
- MM1923:** Boring on a Lathe
- MM1924:** Cut Internal Unified Standard Screw Threads
- MM1925:** Center Drill Work Between Centers
- MM1926:** Grind a Right-Hand Facing Tool
- MM1927:** Taper Turning on a Lathe with a Taper Attachment
- MM1928:** Mount, Face, and Turn Work on a Mandrel
- MM1929:** Reverse the Jaws in a 4-Jaw Independent Chuck
- MM1930:** Change the Jaws in a 3-Jaw Universal Chuck
- MM1931:** Reverse the Jaws in a 3-Jaw Universal Chuck with Cap Screw Mounted Jaws
- MM1932:** Use of a Steady Rest
- MM1933:** Straighten a Shaft

## MM20 Vertical Milling Machine

- MM2001:** Vertical Milling Operations Control Familiarity [LAGUN]
- MM2002:** Install and Remove a Collet and End Mill
- MM2003:** Align Spindle Perpendicular to the Table
- MM2004:** Mount and Align a Vise on the Mill Table
- MM2005:** Square a Workpiece Clamped to the Mill Table
- MM2006:** Square a Workpiece Held in a Vise on a Vertical Mill
- MM2007:** Locating, Drilling, and Reaming Holes by Coordinated Method
- MM2008:** Locate and Bore Holes by Coordinated Method
- MM2009:** Step Drill Holes Accurately to Size
- MM2010:** Mill a Slot or a Pocket
- MM2011:** Countersinking, Counterboring, and Spot Facing
- MM2012:** Mill a Square on a Workpiece
- MM2013:** Mill a Hexagon on a Workpiece
- MM2014:** Machine a Flat Surface Using a Fly Cutter
- MM2015:** Mill Multi-Level Surfaces
- MM2016:** Mill a Fillet with Ball End Mill

# Mechanical Maintenance

## MM21 Welding

- MM2101:** How Cutting Tip Size is Selected to Obtain a Neutral Flame
- MM2102:** Proper Setup for Oxy-Acetylene Cutting Equipment
- MM2103:** Safe Usage of Oxy-Acetylene Cutting Equipment
- MM2104:** Oxy-Acetylene Cutting
- MM2105:** Proper Flame Settings in Relation to Welding Tip Size and Material Thickness
- MM2106:** Setting Proper Oxy-Acetylene Flame for Fusion Welding
- MM2107:** Matching of Proper Filler Metals to Base Metals
- MM2108:** Matching of Filler Metal Requirements to Base Metals for Fusion Welding
- MM2109:** Oxy-Acetylene Fusion Welding on Carbon Steel
- MM2110:** Flame Setting for Oxy-Acetylene Brazing for Various Silver Alloy Fillers
- MM2111:** Reducing/Carburizing of the Flame for Brazing Various Metal Alloys
- MM2112:** Matching of Proper Filler Metals to Base Metals to Achieve Strength and Integrity
- MM2113:** Matching of Filler Metals for Brazing to Various Types of Base Metals
- MM2114:** Oxy-Acetylene Brazing on Various Metal Alloys
- MM2115:** Proper Flame Setting for Braze Welding Various Thickness of Carbon Steel and Cast Irons
- MM2116:** Braze Welding of Various Joint Configurations
- MM2117:** Proper Braze Welding of Various Bead Configurations
- MM2118:** Braze Welding of Various Base Metal Types
- MM2119:** Matching of Braze Welding Filler Metals with Various Base Metals
- MM2120:** Oxy-Acetylene Braze Welding on Carbon Steel and Cast Iron Base Metals
- MM2121:** Shielded Metal Arc Welding on Carbon Steel Plate to A.W.S. - BU - 2A Prequalified Joint Weld Procedures
- MM2122:** Shielded Metal Arc Welding on Carbon Steel Pipe
- MM2123:** Shielded Metal Arc Welding on Carbon Steel Pipe with Gas Tungsten Arc Welding Root
- MM2124:** SMAW on Carbon Steel Tube, Gas Tungsten Arc Welding for Root with Carbon Steel Filler
- MM2125:** Gas Tungsten Arc Welding on Carbon Steel Tube with Stainless Steel Filler
- MM2126:** Electric Arc Welding Process for Welding in Various Positions
- MM2127:** Electric Arc Welding Filler Metal Selection Based on Positions
- MM2128:** Matching of Electric Arc Welding Filler Metals to Their Application Positions
- MM2129:** Selection of Electric Arc Filler Metals Based on Application and Positions
- MM2130:** Welding Positions and Their Orientations

## MM21 Welding (cont'd)

- MM2131:** Usage of Polarities (DC) and Current Flow in Electric Arc Welding with Covered Electrodes
- MM2132:** Setup of Electric Arc Welding Equipment for SMA Welding in Both Polarities on Steel Plate
- MM2133:** Welding Positions and Their Orientations for Pipe Welding
- MM2134:** Setup of Pipe Coupons for SMA Welding in the 2G, 5G, and 6G Fixed Pipe Positions
- MM2135:** Fit-Up Procedure for Chill Rings on Selected Size Pipes
- MM2136:** Fit-Up of Chill Rings on Various Pipe Sizes
- MM2137:** Differences between Mild Carbon Steel Filler Metals and Stainless Steel Filler Metals
- MM2138:** Differences in Weldability Between Carbon Steel and Stainless Steel
- MM2139:** Explain the Setup of GTAW Equipment for Straight Polarity Welding with Argon Shielding Gas
- MM2140:** Demonstrate Setup of GTAW Equipment for Straight Polarity Welding with Argon Shielding Gas
- MM2141:** Joint Fit-Up Procedure for Welding Proper Size GTAW Root Pass on Pipe
- MM2142:** Proper Joint Fit-Up Procedure for Welding GTAW Root Pass on Pipe
- MM2143:** Argon Backing Gas Purge Systems for Root Protection Against "Sugaring" Pipe
- MM2144:** Electric Arc Welding Process for Welding in the Flat Position
- MM2145:** Electric Arc Welding Filler Metal Selection Based on the Flat Position
- MM2146:** Matching of Electric Arc Welding Filler Metal Application to the Flat Position

## MM22 Lubrication Maintenance and Oil Analysis

- MM2201:** Fundamentals of Lubrication
- MM2202:** Lubrication Sampling Fundamentals
- MM2203:** Maintenance, Purification, and Filtration of Oil and Grease Lubricated Systems
- MM2204:** Failure Mode Indicators
- MM2205:** Lubricant Testing and Analysis

## MM23 Laser Aided Shaft Alignment

- MM2301:** Shaft Alignment
- MM2302:** Identifying and Correcting Soft Foot
- MM2303:** Shaft Alignment Using Laser Based Systems
- MM2304:** Laser Alignment Safety and System Operating Information
- MM2305:** Laser Alignment Troubleshooting
- MM2306:** The Function of Couplings and Major Coupling Types

## MM24 Hand Tools

- MM2401:** Non-powered Hand Tools - Part 1
- MM2402:** Non-powered Hand Tools - Part 2
- MM2403:** Power Tools
- MM2404:** Measuring Tools
- MM2405:** Fasteners



Our Electrical Maintenance series contains many courses for power plant electricians.

## EL01 Prints and Drawings

- EL0101:** Classifications of Prints and Drawings
- EL0102:** Schematic Diagrams
- EL0103:** Connection Diagrams
- EL0104:** Logic Diagrams
- EL0105:** Single-Line Diagrams
- EL0106:** Elementary Diagrams
- EL0107:** Electrical-Electronic Print and Drawing Reading
- EL0108:** Symbols/Components on Prints and Drawings
- EL0109:** Tracing of Flowpaths of Plant Piping and Instrumentation Diagrams (P&IDs)
- EL0110:** Location and Usage of Plant Print Indexes

## EL02 Electrical Codes and Standards

- EL0201:** Safety Codes and Standards
- EL0202:** Safety Hazards Associated with Electrical Equipment



## EL03 Single- and Three-Phase Circuits

- EL0301:** Calculation of Electrical Values of Single-Phase AC Circuits
- EL0302:** Drawing Single-Phase AC Circuits
- EL0303:** Calculation of Electrical Values of Three-Phase AC Circuits
- EL0304:** Drawing of Three-Phase AC Circuits
- EL0305:** Building of Single-Phase AC Circuits
- EL0306:** Building of Three-Phase AC Circuits

## EL04 Transformers

- EL0401:** Transformer Characteristics
- EL0402:** Essential Parts of a Simple Transformer
- EL0403:** Relationship between Primary and Secondary Voltages and Transformer Turns Ratio
- EL0404:** Potential Transformer
- EL0405:** Current Transformer
- EL0406:** Power Transformer
- EL0407:** Transformer Cooling System Characteristics
- EL0408:** Types of Transformer Cooling Systems and Their Components
- EL0409:** Transformer Cooling System Operations
- EL0410:** Transformer Troubleshooting Techniques
- EL0411:** Causes of Transformer Failure
- EL0412:** Removal of Transformers From Service
- EL0413:** Safety Hazards Related to Transformers
- EL0414:** Isolation of Plant Main and Auxiliary Transformers
- EL0415:** Grounding of Plant Main and Auxiliary Transformers
- EL0416:** Return of Transformers to Service

## EL05 Freeze Protection

- EL0501:** Types of Heat Trace
- EL0502:** Lesson has been combined with EL0501
- EL0503:** Self-Limiting Cables
- EL0504:** Constant Wattage Heating Cable
- EL0505:** Series Resistance Heating Cables
- EL0506:** Matching of Types to Applications
- EL0507:** Methods of Repair of Freeze Protection Equipment
- EL0508:** Heat Transfer Cement
- EL0509:** Heat Transfer Tape
- EL0510:** Matching of Freeze Protection Equipment Repair to Situation
- EL0511:** Plant Antifreeze Panel Locations
- EL0512:** Testing of Plant Antifreeze Panels
- EL0513:** Methods of Replacing Freeze Protection Equipment
- EL0514:** Lesson has been combined with EL0510

## EL06 Battery Chargers

- EL0601:** Battery Charger Operation
- EL0602:** Principle of Rectification
- EL0603:** Procedure for Placing the Battery Charger in Service
- EL0604:** Procedure for Removing the Battery Charger from Service

## EL07 Motors and Generators

- EL0701:** Operating Characteristics of Various Types of Motors
- EL0702:** Types of Motors
- EL0703:** Alternating Current Generators
- EL0704:** Operational Theory of Induction Motors
- EL0705:** Determination of Appropriate Application of Motors
- EL0706:** Types of Motor Construction
- EL0707:** Induction Motors and Their Functions
- EL0708:** Motor Troubleshooting
- EL0709:** Determination of Faulty Major Component of a Motor System
- EL0710:** Generator Component Troubleshooting
- EL0711:** Procedure to Clean a Motor
- EL0712:** Motor Disassembly
- EL0713:** Motor Reassembly Techniques
- EL0714:** Operational Checks to Perform When a Motor is Returned to Service
- EL0715:** Operating Characteristics of Various Types of Generators
- EL0716:** Generator Applications
- EL0717:** Types of Generator Construction
- EL0718:** Generator Troubleshooting
- EL0719:** Internal Cleaning of Generators
- EL0720:** Generator Disassembly Techniques
- EL0721:** Generator Reassembly Techniques

## EL08 Electrical Control Devices

- EL0801:** Control Device Troubleshooting
- EL0802:** Faults Associated with Control Devices
- EL0803:** Components of Control Devices
- EL0804:** Functions of Control Devices
- EL0805:** Differences between Alternating Current and Direct Current Controllers
- EL0806:** Identification of the Normal Position of a Control Device

## EL09 Low- and Medium-Voltage Circuit Breakers

- EL0901:** Matching of Overload with Selected Type of Load
- EL0902:** Determination of the Actual Current of a Circuit
- EL0903:** Procedure to Place All Plant Breakers in Test Position and Test
- EL0904:** Removal of Arc Chutes on Breakers
- EL0905:** Procedure to Check Contacts on Breakers

## EL10 Inverters

- EL1001:** Inverter Operation
- EL1002:** Components of an Inverter
- EL1003:** Procedure for Placing an Inverter in Service
- EL1004:** Procedure for Removing an Inverter From Service

## EL11 Locating Electrical System Grounds

- EL1101:** Use of Direct Current (DC) Ground Detection Switches
- EL1102:** Operation of DC Breakers
- EL1103:** Identification of Unwanted Circuit Grounds
- EL1104:** Elimination of Unwanted Circuit Grounds
- EL1105:** Equipment Grounding Concepts
- EL1106:** Testing of Proper Equipment Grounds
- EL1107:** DC Ground Detection

## EL12 Limitorque Valves

- EL1201:** Method of Setting Limit Switches
- EL1202:** Method of Setting Torque Switches
- EL1203:** Method of Repairing Limit Switches
- EL1204:** Method of Repairing Torque Switches
- EL1205:** Method of Replacing Limit Switches
- EL1206:** Method of Replacing Torque Switches
- EL1207:** Procedure to Electrically Stroke a Valve
- EL1208:** Procedure to Mechanically Stroke a Valve
- EL1209:** Procedure to Pull an Actuator Off a Valve



Our Instrumentation and Control series contains numerous courses for instrumentation and control technicians.

## IE01 Direct Current

- IE0101:** Electron Theory
- IE0102:** Use of Ohm's and Kirchoff's Laws Relating to Direct Current (DC)
- IE0103:** DC Circuit Troubleshooting
- IE0104:** Evaluation of DC Circuit Performance
- IE0105:** Determination of Circuit Outputs from Specified Inputs
- IE0106:** DC Circuit Repair
- IE0107:** Construction of DC Circuits

## IE02 Alternating Current

- IE0201:** Alternating Current (AC) Theory
- IE0202:** Use of Ohm's and Kirchoff's Laws
- IE0203:** AC Circuit Troubleshooting
- IE0204:** Evaluation of an AC Circuit's Performance
- IE0205:** Determination of AC Circuit Outputs From Specified Inputs
- IE0206:** AC Circuit Repair
- IE0207:** Construction of AC Circuits

## IE03 Semi-Conductors

- IE0301:** Electrical Characteristics of Diodes
- IE0302:** Electrical Characteristics of SCRs and TRIACs
- IE0303:** Semiconductor Circuit Troubleshooting
- IE0304:** Identification of Defective Semiconductors
- IE0305:** Semiconductor Circuit Repair
- IE0306:** Construction of Semiconductor Circuits

## IE04 Electronic Circuits

- IE0401:** Theory of Power Supply Circuits
- IE0402:** Theory of Operational Amplifier Circuits
- IE0403:** Defective Components Found in Power Supplies
- IE0404:** Defective Operational Amplifier Circuits
- IE0405:** Electronic Circuit Troubleshooting
- IE0406:** Evaluation of the Performance of a Power Supply Circuit
- IE0407:** Evaluation of the Performance of an Operational Amplifier Circuit
- IE0408:** Electronic Circuit Repair
- IE0409:** Determination of Feedback Circuits to Achieve Desired Operational Amplifier Gain
- IE0410:** Construction of Electronic Circuits

## IE05 Digital Electronics

- IE0501:** Constructing Digital Circuits
- IE0502:** Digital Numbering Systems
- IE0503:** BCD and ASCII Codes
- IE0504:** Positive and Negative Logic
- IE0505:** Troubleshooting Digital Circuits
- IE0506:** Appropriate Digital Circuit Outputs From Specified Inputs
- IE0507:** Repairing Digital Circuits

## IE06 Instrumentation Measurement Applications

- IE0601:** Identification of Types of Pressure Devices
- IE0602:** Pressure Device Troubleshooting
- IE0603:** Principles of Level Devices
- IE0604:** Level Device Troubleshooting
- IE0605:** Principles of Flow Devices
- IE0606:** Flow Device Troubleshooting
- IE0607:** Principles of Temperature Devices
- IE0608:** Temperature Measuring Device Troubleshooting
- IE0609:** Use of Analyzers

## IE07 Microprocessors

- IE0701:** Introduction to Microprocessor Registers
- IE0702:** Introduction to Troubleshooting Microprocessors
- IE0703:** Introduction to Microprocessors and Memory
- IE0704:** Lesson has been combined with IE0706
- IE0705:** Lesson has been deleted
- IE0706:** Introduction to Microprocessor Interfacing
- IE0707:** Introduction to Programming Microprocessors
- IE0708:** Introduction to Understanding Microprocessors

## IE08 Programmable Logic Controllers

- IE0801:** Major Components of Programmable Logic Controllers
- IE0802:** Concepts of Programmable Logic Controllers
- IE0803:** PLC Status Indicator Lights
- IE0804:** PLC Troubleshooting
- IE0805:** Interpreting and Drafting Ladder Logic with Bit Instructions in PLC Systems

## IE09 Soldering

- IE0901:** Soldering Techniques

## IE10 Control Instrumentation

- IE1001:** Purpose of Square Root Extractors
- IE1002:** Operation of Chart Recorders
- IE1003:** Functions of Electronic Analog Controllers
- IE1004:** Functions of Electronic Pressure Transmitters
- IE1005:** Electronic Control Instrument Troubleshooting
- IE1006:** Span and Range
- IE1007:** Span and Zero Adjustments
- IE1008:** Calibration of Electronic Control Instruments
- IE1009:** Function of a Pneumatic Volume Booster
- IE1010:** Operation of a Pressure Regulator
- IE1011:** Operation of Pressure Switches
- IE1012:** Pneumatic Control Instrument Troubleshooting
- IE1013:** Calibration of Pneumatic Instruments
- IE1014:** Functions of Temperature Transmitters
- IE1015:** Identification of Filled Thermal Systems and Temperature Switches
- IE1016:** Calibration of Temperature Control Instruments
- IE1017:** Operating Characteristics of Valve Positioners
- IE1018:** Calibration of Valve Positioners
- IE1019:** Operating Characteristics of I/P and P/I Transducers
- IE1020:** Calibration of Transducers
- IE1021:** Characteristics of Special Flow Control Instruments
- IE1022:** Solenoid Valves

## IE11 Final Control

- IE1101:** Principles of Control Loops
- IE1102:** Identification of Instruments Used in Measuring Level
- IE1103:** Identification of Instruments Used in Flow Control Loops
- IE1104:** Identification of Instruments Used in Pressure Control Loops
- IE1105:** Construction of a Pressure, Temperature, Flow, or Level Control Loop
- IE1106:** Proportional, Integral, and Derivative Control Action
- IE1107:** Tuning a Typical Control Loop
- IE1108:** Lesson has been combined with IE1105
- IE1109:** Lesson has been combined with IE1107
- IE1110:** Identification of Instruments Used in Temperature Control Loops
- IE1111:** Lesson has been combined with IE1105
- IE1112:** Lesson has been combined with IE1107
- IE1113:** Operation of Cascade and Ratio Control Loops
- IE1114:** Construction of Special Control Loops
- IE1115:** Electronic Control Valves
- IE1116:** Electronic Control Valve Troubleshooting and Repair
- IE1117:** Feedforward Control
- IE1118:** Three Element Level Control

## IE12 Process Control Instrumentation

- IE1201:** Use of Multimeters
- IE1202:** Use of Oscilloscopes
- IE1203:** Power Supplies and Signal Generators
- IE1204:** Temperature Calibrators and Digital Thermometers
- IE1205:** Electrical/Electronic Test Equipment
- IE1206:** Explain the Use of Deadweight Testers
- IE1207:** Explain the Use of Variators, Aspirators Bulbs, and Hand Pumps
- IE1208:** Manometers
- IE1209:** Pneumatic Calibrators
- IE1210:** Mechanical Test Instruments

## IE13 Field Devices

- IE1301:** Major Components of an Oil/Gas Ignitor
- IE1302:** Oil/Gas Ignitor Troubleshooting and Repair
- IE1303:** Major Components of Warm-Up Guns
- IE1304:** Instrumentation Devices on a Warm-Up Gun Troubleshooting and Repair
- IE1305:** Major Instrument Components on a Pulverizer
- IE1306:** Instrumentation Devices on a Pulverizer Troubleshooting and Repair
- IE1307:** Major Instrumentation Components of a Coal Feeder
- IE1308:** Coal Feeder Instrument Troubleshooting and Repair

## IE13 Field Devices (cont'd)

- IE1309:** Pulverizer Inerting System Troubleshooting and Repair
- IE1310:** Major Components of a Flame Scanning System
- IE1311:** Flame Scanner Troubleshooting and Repair
- IE1312:** Auxiliary Air Damper Control Troubleshooting and Repair
- IE1313:** Insert/Retract Mechanism Troubleshooting and Repair
- IE1314:** Impeller Drive Troubleshooting and Repair
- IE1315:** Oil and Gas Valve Control Troubleshooting and Repair
- IE1316:** Major Components of Oil Guns
- IE1317:** Instrumentation Devices on an Oil Gun Troubleshooting and Repair

## IE14 Continuous Emission Monitoring (CEM) Systems

- IE1401:** Basic Operation of the Continuous Emission Monitoring System (CEMS)
- IE1402:** Collect CEMS Data Readings
- IE1403:** Carbon Dioxide Analyzer Calibration
- IE1404:** Nitrogen Oxide Analyzer Calibration
- IE1405:** Sulfur Dioxide Analyzer Calibration
- IE1406:** Opacity Monitor Calibration
- IE1407:** Stack Flowmeter Calibration
- IE1408:** Calibration Gas Bottle Change and Input of New Data in EWS
- IE1409:** Weekly, Monthly, Quarterly, Semiannual, and Annual Preventive Maintenance Procedures
- IE1410:** Parts of the Certified Loop
- IE1411:** Operation of Probe and Sample System
- IE1412:** CEM Probe and Sample System Troubleshooting
- IE1413:** Operation of the Megawatts Transmitters
- IE1414:** Operation of the Gas Flow Transmitters

## IE15 Bailey Pneumatic Meters and Controls

- IE1501:** Procedure for Taking a Meter Out of and Returning It to Service
- IE1502:** Ledoux Bell Meter Disassembly, Cleanup, and Calibration
- IE1503:** Standatrol Inlet and Exhaust Valve Disassembly, Inspection, and Setup
- IE1504:** Uses and Operation of the Bailey Standatrol
- IE1505:** Operation of the Bailey Pneumatic Drives and Positioners

## IE16 Tubing and Fittings

- IE1601:** Tube Bending
- IE1602:** Selection of Proper Tubing Fittings for an Application
- IE1603:** Installation of Tubing Fittings
- IE1604:** Flare Tubing for Flare Fittings
- IE1605:** Installation of Tubing Supports and Hangers
- IE1606:** Selection of Tubing for Specific Applications

## IE17 Fire Protection Instrumentation

- IE1701:** Understanding the Instrumentation Used in the Fire Protection System
- IE1702:** Troubleshoot and Repair Fire Protection Instruments

## Advanced Instrumentation & Control

### AT01 Instrumentation and Control

- Instrumentation Loop Components
- Span and Range Definitions
- Types of Test Equipment

### AT02 Multimeters

- Analog and Digital Displays
- Multimeter Controls
- Measuring Voltage
- Measuring Resistance

### AT03 Oscilloscopes

- Application and Uses
- CRT Display Adjustments
- Oscilloscope Controls
- Signal/Display Characteristics

### AT04 Portable Power Supply

- Features and Controls
- Using a Portable Power Supply
- Signal Generators
- Multifunctional Calibrators

### AT05 Temperature Measurement

- Temperature Measuring Instruments
- Thermocouple Calibrators
- RTD Calibrators
- Digital Thermometers

### AT06 Voltage Testers

- Voltage Testers
- Multimeters
- Meggers

### AT07 Deadweight Testers

- Purpose of Deadweight Testers
- Using a Deadweight Tester

### AT08 Calibrating Other Instruments

- Variator
- Aspirator Bulb
- Hand Pumps

### AT09 Manometers

- Liquid Barometer
- U-Tube Manometers
- Inclined Manometers
- Digital Manometers

### AT10 Pneumatic Calibrators

- Components of Pneumatic Calibrators
- Using a Pneumatic Calibrator

### AT11 Mechanical and Pneumatic Testing and Calibrating

- Types of Test Equipment
- Matching Test Equipment to the Process

### AC01 Process Control Fundamentals

- Process Control
- Process Performance
- Block Diagrams

## AC02 Closed and Open Loop Control Systems

- Closed and Open Control
- Closed Loop Control Advantages
- Feedback Control
- Operation of Closed Loop Control
- Performance of Closed Loop Control
- Process Stability
- Criteria for Closed Loop Control

## AC03 Proportional Control

- Proportional Control
- Relationship to Proportional Controller
- Controller Action
- Proportional Controller Characteristics

## AC04 Proportional Plus Integral Control

- Proportional Plus Integral Control, Part I
- Proportional Plus Integral Control, Part II
- Proportional Plus Integral Control, Part III

## AC05 Proportional Plus Derivative Control

- Proportional Plus Derivative Control
- Proportional Plus Derivative Control Characteristics
- Derivative Time
- Process Response to PD Control

## AC06 Proportional Plus Integral Plus Derivative Control

- Proportional Plus Integral Plus Derivative Control

## AC07 Open Loop Transient Response Tuning

- Open Loop Transient Response Tuning
- Stability
- Controller Tuning
- Open Loop Controller Tuning
- Time Constant Method
- Reaction Rate Method

## AC08 Ziegler Nichols Controller Tuning

- Ziegler Nichols Controller Tuning

## AC09 Frequency Response Controller Tuning

- Frequency Response Controller Tuning
- Notch Tuning, Part I
- Notch Tuning, Part II

## AC10 Advanced Controller Methods

- Advanced Control Methods
- Cascade Control
- Application of Cascade Control
- Process Response to Cascade Control
- Feedback Control
- Ratio Control

## AC11 Final Control Actuators

- Final Control Actuators

## AC12 Final Control Elements

- Final Control Elements

## AI01 Criteria for Control Instruments

- Terminology
- Block Diagrams/Closed and Open Loop Systems
- Interfacing Control Instruments

## AI02 Characteristics of Control Instruments

- Introduction, Part I
- Introduction, Part II

## AI03 Controller and Control Action

- Terminology
- Forward and Reverse Action
- Controller Speeds and Response
- Setpoints and Output
- Analog Controllers
- Digital Controllers

## AI04 Calibration of Control Instruments

- Terminology
- Calibrating Techniques
- Span and Zero Adjustments
- Linearity and Repeatability
- Five Point Calibration Check
- Dead Band and Zero Shift

## AI05 Support Instruments

- Solenoid Valves
- Square Root Extractors
- Pressure Regulators
- Volume Boosters
- Power Supplies
- Temperature and Pressure Switches

## AM01 Pressure Measurement

- Pressure
- Units of Pressure
- Ideal Gas and Pascal's Law
- Low Pressure and Vacuum Measurements

## AM02 Pressure Measuring Instruments

- Manometers
- Deadweight Testers
- Gauges
- Bourdon Tubes
- Diaphragms
- Bellows
- Resistive Elements/Strain Gauges/Load Cells
- Differential Pressure Transmitters

## AM03 Liquid Level Measurement

- Effects of Process Characteristics and Temperature
- Mechanical Devices
- Floats and Buoyancy Devices
- Head Pressure Devices
- Radioactive and Ultrasonic Devices
- Electronic Devices

## AM04 Flow Measurement

- Definitions
- Differential Pressure Devices
- Magnetic Flow Meters
- Ultrasonic and Vortex Flow Meters
- Rotameters and Turbine Flow Meters
- Displacement Meters

## AM05 Temperature Measurements

- Temperature Scales
- Factors Affecting Temperature Measurement
- Thermometers
- Thermocouples and Thermocouple Wells
- Resistance Temperature Detectors
- Bimetallic Elements
- Filled Thermal Systems

## AM06 Analyzers for Process Control

- pH Analyzers
- Conductivity Analyzers
- Dissolved Oxygen Analyzers

The Nalco™ series contains numerous courses that address water/wastewater treatment and process control topics.

- NA01 Cooling Water Basics**
- General Characteristics of Water
  - Major Cooling Systems Types
  - Cooling Water Problems

- NA02 Cooling Towers**
- Cooling Towers Overview
  - Basic Component Description
  - Thermal Performance
  - Problems and Solutions

- NA03 Chillers**
- Chiller Overview
  - Chiller Operations
  - Efficiency Monitoring
  - Problems and Solutions

- NA04 Advanced Cooling Water Problems and Solutions: Corrosion**
- Basic Corrosion Process
  - Factors Affecting Corrosion
  - Inhibiting Corrosion



- NA05 Boiler Basics**
- Boiler System
  - Boiler Types
  - Steam Production

- NA06 Water Tube Boilers**
- Introduction
  - Boiler Construction
  - Operating Principles
  - Boiler Economics
  - Problems and Solutions

- NA07 Boiler Cycle Chemistry**
- Boiler Cycle Chemistry Overview
  - Boiler Corrosion
  - Boiler Deposits
  - Scale Control

- NA08 Advanced Boiler Problems and Solutions**
- Circulation
  - Carryover
  - Application Technology
  - Service

- NA09 Ion Exchange Basics**
- Ion Exchange Overview
  - Basic Chemistry
  - General Problems

- NA10 Sodium Zeolite Softening**
- Sodium Zeolite Softening Chemistry
  - Equipment
  - Operations
  - Problems and Solutions

- NA11 Demineralization**
- Demineralization Overview
  - Ion Exchange Process
  - Operations
  - Problems and Solutions

- NA12 Statistical Process Control (SPC)**
- Basic Concepts
  - Control Charts
  - Overview of Six Sigma

- NA13 Coagulation and Flocculation Basics**
- Coagulation Theory
  - Flocculation Theory
  - Coagulation Problems and Solutions
  - Flocculation Problems and Solutions

- NA14 Basic Types of Wastewater Treatment**
- Primary Treatment
  - Physical and Chemical Treatment Systems
  - Chemical Treatment
  - Problems

- NA15 Wastewater Treatment Equipment**
- Clarifiers
  - Filters
  - Cold Lime Softening Equipment
  - Service

- NA16 Wastewater Treatment Processes**
- Preliminary Treatment
  - Primary Treatment
  - Secondary Treatment
  - Control Concepts for Activated Sludge
  - Advanced Treatment

## Boiler Water Chemistry

Our Boiler Water Chemistry series contains many courses for fossil fuel power plant chemists, lab technicians, and plant operators.

### BC01 Chemistry Fundamentals

- Introduction
- Matter and Energy Concepts
- Atomic Structure
- The Periodic Table
- Chemical Formulas and Equations
- Solutions
- Acids and Bases
- Electrochemistry

### BC02 Corrosion

- Introduction
- Characteristics of Metals
- Factors Affecting the Corrosion Process
- Types of Corrosion and Scales
- Macroscopic Corrosion
- Microscopic Corrosion
- Boiling Water Scaling
- Cold End and Fire Side Corrosion
- Methods to Reduce or Prevent Corrosion and Scale

### BC03 Makeup Water Treatment

- Water Sources
- Clarification
- Filtration
- Water Softening
- Demineralization
- Types of Resin
- Exchanger Performance
- Regeneration
- Resin Performance
- Membrane Technology

### BC04 Boiler Water Treatment

- Introduction
- All Volatile Treatment
- Oxygenated Treatment
- Phosphate Treatment
- Parameters Monitored
- Carryover
- Startup Conditions
- POE Guidelines
- Layup Conditions

### BC05 Cooling Water Guidelines

- Introduction
- Scale Formation
- Corrosion
- Fouling
- Microbiological Fouling
- Closed Loop Cooling Systems
- Open Cooling Water Systems
- Cooling Water Treatment Systems
- Cooling Water Analysis

## Heat Rate & Plant Performance

The Heat Rate and Plant Performance series contains various courses designed for power plant control room operators and performance engineers.

### HR01 Concern for Efficiency

- Efficiency
- Common Terms and Concepts

### HR02 First Law of Thermodynamics and Entropy

- Applications of the First Law of Thermodynamics
- Common Terms and Concepts
- Statements of the Second Law
- Entropy

### HR03 Heat Rate

- Terms and Concepts

### HR04 Energy Transfer and Efficiency

- Feedwater System
- Heat Transfer
- Removing Feedwater Heaters From Service

### HR05 Boiler, Turbine, and Generator Efficiency

- Boiler Efficiency
- Boiler Steam Generation
- Turbine Efficiency
- Turbine Efficiency - Impulse Turbines
- Turbine Efficiency - Reaction Turbines
- Generator Efficiency
- Generator Efficiency - Power Factor, Apparent Power, and Reactive Power

### HR06 Boiler Efficiency

- Boiler Design
- Carbon Ash
- Flue Gas
- Cooling Flue Gas
- Exit Gas

### HR07 Boiler Testing

- ASME Performance Test Codes, Sections 1 to 3
- ASME Performance Test Codes, Sections 4 and 5
- ASME Performance Test Codes, Sections 6 and 7
- ASME Performance Test Codes, Sections 8 and 9

### HR08 Efficiency - Calculations and Air Heater Testing

- Boiler Efficiency Calculations
- Heat Credits and Corrections to Standard Conditions
- Corrected Losses
- Air Heater Testing
- Air Heater Testing and Gas Side Efficiency

### HR09 Turbine Cycle Efficiency

- Main Steam Pressure (Throttle Pressure)
- Main Steam Temperature
- Other Issues

### HR10 Miscellaneous Power Losses and Auxiliary Power Usage

- Steam Traps
- Miscellaneous Losses
- Auxiliary Power

# Coal Handling (Material Handling)

Our Coal Handling (Material Handling) series contains several courses for coal and material handling personnel.

## CY01 Sump Pumps

- CY0101:** Sump Pump Function
- CY0102:** Sump Pump Components
- CY0103:** Power Sources
- CY0104:** Sump Pump Isolation

## CY02 Magnetic Separators

- CY0201:** Function of the Magnetic Separator
- CY0202:** Function of the Major Components of Magnetic Separators
- CY0203:** Identification of the Power Sources (MCC)

## CY03 Coal Yard Fire Protection Systems

- CY0301:** Function of the Fire Protection System in the Coal Yard
- CY0302:** Function of the Major Components of the Fire Protection System in the Coal Yard
- CY0303:** Function of the Fire System Bypass Switch
- CY0304:** Direct Current Power Normal and Alternate Supply
- CY0305:** Fire Protection System Equipment Power Sources
- CY0306:** Hazards Associated with Extinguishing Coal Fires in Open and Enclosed Areas

## CY04 Crushers

- CY0401:** Penn Crusher Operating Limitations as Dictated by Coal Conditions
- CY0402:** Safety Precautions Associated with the Penn Crusher

## CY05 Rotary Car Dumpers

- CY0501:** Equipment Walkdown/Checkoff
- CY0502:** Procedures to Check, Add, and Identify Proper Lubricants for all Components
- CY0503:** Power Supply Locations
- CY0504:** Sump Pump Operation
- CY0505:** Housekeeping Activities
- CY0506:** Deficiencies Specific to This Equipment
- CY0507:** Dust Suppression System Operation
- CY0508:** Rotary Car Dumper Startup and Shutdown Procedures
- CY0509:** Safety Precautions Associated with Equipment
- CY0510:** Basic Dumper/Positioner Operation
- CY0511:** Rotary Dumper Interlocks
- CY0512:** Procedure for Coupling and Uncoupling Railroad Cars
- CY0513:** Observations/Inspections Made During Unloading Operations
- CY0514:** Train Brake System Operation

## CY06 Stacker Reclaimers

- CY0601:** Equipment Walkdown/Checkoff for Stacker Reclaimers
- CY0602:** Procedures to Check, Add, and Identify Proper Lubricants
- CY0603:** Power Supply Locations
- CY0604:** Housekeeping Activities
- CY0605:** Deficiencies Specific to Stacker Reclaimers
- CY0606:** Stacker Reclaimer Startup and Shutdown Procedures
- CY0607:** Safety Precautions Associated with Stacker Reclaimers

## CY07 Water Wagon

- CY0701:** Equipment Prechecks
- CY0702:** Procedures to Check, Add, and Identify Proper Lubricants for All Components on the Water Wagon
- CY0703:** Equipment Deficiencies Specific to the Water Wagon
- CY0704:** Proper Coal Compaction Activities with the Water Wagon
- CY0705:** Safety Precautions Associated with the Water Wagon

## CY08 Rubber-Tired Dozer

- CY0801:** Procedures to Check, Add, and Identify Proper Lubricants for All Components
- CY0802:** Equipment Deficiencies Specific to the Rubber-Tired Dozer
- CY0803:** Proper Startup and Shutdown Procedures
- CY0804:** Safety Precautions Associated with the Rubber-Tired Dozer

## CY09 Backhoe

- CY0901:** Equipment Prechecks on the Backhoe
- CY0902:** Procedures to Check, Add, and Identify Proper Lubricants on the Backhoe
- CY0903:** Equipment Deficiencies Specific to the Backhoe
- CY0904:** Safety Precautions Associated with the Backhoe

## CY10 Conveyor Systems

- CY1001:** Function of the Conveyor System
- CY1002:** Major Components of the Conveyor System
- CY1003:** Identification of Power Sources (MCC)
- CY1004:** Operator Safety Features
- CY1005:** Equipment Safety Features
- CY1006:** Possible Causes of Belt Misalignment

- CY11 Rubber-Tired Scraper**  
**CY1101:** Equipment Prechecks on Rubber-Tired Scrapers  
**CY1102:** Procedures to Check, Add, and Identify Proper Lubricants for all Components  
**CY1103:** Equipment Deficiencies Specific to Rubber-Tired Scrapers  
**CY1104:** Coal Compaction Activities with the Rubber-Tired Scrapers  
**CY1105:** Safety Precautions Associated with Rubber-Tired Scrapers
- CY12 Dust Collection Systems**  
**CY1201:** Equipment Prechecks on Dust Collection Equipment  
**CY1202:** Equipment Deficiencies Specific to Dust Collection Equipment  
**CY1203:** Safety Precautions Associated with Dust Collection Equipment  
**CY1204:** Dust Collection Equipment Operation
- CY13 Track-Type Dozer**  
**CY1301:** Equipment Prechecks on Track-Type Dozers  
**CY1302:** Procedures to Check, Add, and Identify Proper Lubricants for All Components  
**CY1303:** Equipment Deficiencies Specific to the Track-Type Dozer  
**CY1304:** Procedure to Initiate a Work Request on the Track-Type Dozer  
**CY1305:** Safety Precautions Associated with the Track-Type Dozer
- CY14 Bobcat**  
**CY1401:** Equipment Prechecks on the Bobcat  
**CY1402:** Procedures to Check, Add, and Identify Lubricants for All Components  
**CY1403:** Equipment Deficiencies Specific to the Bobcat  
**CY1404:** Safety Precautions Associated with the Bobcat
- CY15 Rubber-Tired Loader**  
**CY1501:** Procedures to Check, Add, and Identify Proper Lubricants for All Components on the Large Rubber-Tired Loader  
**CY1502:** Equipment Deficiencies Specific to the Large Rubber-Tired Loader  
**CY1503:** Startup and Shutdown Procedures of the Large Rubber-Tired Loader  
**CY1504:** Safety Precautions Associated with the Large Rubber-Tired Loader

The OSHA Compliance series contains numerous courses to address the federal safety and HAZMAT issues at power plants.

### OS0101 Arsenic Awareness

- Introduction
- Arsenic Properties
- Properties and Controls
- Safety Practices
- Health Effects
- Respirators
- Protective Clothing
- Safe Work Practices
- Signs and Labels

### OS0201 Asbestos Safety

- Introduction
- Regulated Areas
- Health Effects
- Medical Surveillance and Recordkeeping
- Airborne Asbestos and Removal
- Protective Equipment

### OS0301 Automated External Defibrillator (AED)

- Introduction
- Definitions
- When to use an AED
- Using an AED
- Special Situations
- Summary

### OS0401 Basic CPR (American Heart Association)

- Introduction
- Approaching the Victim
- Airway
- Breathing Victim
- Rescue Breathing
- CPR Review
- Chest Compressions
- Cardiac Chain of Survival

### OS0501 Basic First Aid

- Introduction
- Assess the Victim
- Minor Treatments
- Body Checks
- Burns
- Airway Obstruction
- Fractures
- Objects in the Eye
- Good Samaritan Laws

### OS0601 Bloodborne Pathogen Awareness

- Introduction and Hepatitis B
- HIV
- AIDS
- Control Methods
- PPE
- Vaccination
- Post-Exposure Follow Up
- Tags, Labels, and Bags
- Housekeeping
- Training and Recordkeeping

# OSHA Compliance

## OS0701 Confined Space Module 1

- Introduction
- OSHA Definitions
- Evaluation
- Evaluation, Informing Employees, and Posting Signs
- Preventing Unauthorized Entry
- Reclassifying a Space with Alternate Procedures
- Reclassifying Non Permit-required Spaces to Permit-required
- Host Company's and Contractors' Responsibilities
- Summary

## OS0702 Confined Space Module 2

- Introduction and Permit-required Confined Space Program
- Identify Spaces and Develop Procedures
- Provide Equipment
- Evaluate Space Conditions
- Roles of Attendant and Authorized Entrants
- Implementation of Permit System
- Procedures for Work Termination and Correcting Deficiencies
- Permits: Implementation, Duration and Termination
- Entry Permit

## OS0703 Confined Space Module 3

- Introduction
- Training
- Duties and Duties of Entrants
- Duties of Attendants
- Duties of Supervisors
- Rescue and Emergency Services
- Employee Participation

## OS0801 Cranes Module 1

- Introduction
- Overhead Cranes
- Gantry Cranes
- Overhead Crane Inspection
- Lifting the Load
- Landing the Load
- Boom Cranes
- Capacity and Traveling

## OS0802 Cranes Module 2

- Introduction
- Hand Signals

## OS0901 Electrical Safety

- Introduction
- Definitions
- Voltage Testers
- Training
- Job Briefings
- Training Requirements
- Work Practices and Hazards

## OS1001 Ergonomics General Awareness

- Introduction
- What is Ergonomics
- Neutral Body Position
- Cumulative Trauma Disorders
- Hands and Wrists
- Arms and Shoulders
- Back and Neck
- Lifting
- Sitting and Standing
- Workstations and How You Can Help

## OS1002 Industrial Ergonomics

- Introduction
- Body Position
- Arranging Your Work Area
- Tool Selection

## OS1003 Office Ergonomics

- Introduction
- Setting Up Your Workstation
- Using Your Workstation

## OS1101 Fall Protection

- Introduction and Training Requirements
- Fall Protection Plan
- Fall Arrest Systems
- Fall Prevention
- Equipment Maintenance
- Emergency Rescue Plan

## OS1201 Forklifts: Combustion Engine

- Introduction and Combustion Forklifts

## OS1202 Forklifts: Electric Engine

- Introduction and Electric Forklifts

## OS1203 Forklifts: General Awareness

- Introduction
- Design Information
- Forklift Stability
- Operating Procedures
- General Safety Rules

## OS1301 Hazard Communication

- Introduction
- Program Elements
- Training
- MSDS
- Policy
- Hazcom Application

## OS1401 Hazmat Module 1

- Introduction
- Awareness Level Training
- Operation Level Training
- Site Evaluation and Site Emergency Action Plan

## OS1402 Hazmat Module 2

- Introduction
- Training
- Basic Control Training
- Decontamination
- Operating and Response Procedures

## OS1501 Hearing Conservation Module 1

- Introduction
- Sound
- Ear Structure and Deafness
- Minimizing Exposure
- Hearing Protection
- Ear Plugs
- Ear Caps
- Ear Muffs
- Combining Ear Plugs and Ear Muffs

## OS1502 Hearing Conservation Module 2

- Introduction
- Procedures
- Monitoring
- Hearing Protection
- Training
- Records



## OS1601 Lead Awareness

- Introduction
- Exposure
- Respirators and Other PPE
- Monitoring
- Overexposure

## OS1701 Lockout/Tagout Module 1

- Introduction
- OSHA Terminology
- OSHA General Requirements
- Training
- Tags
- Periodic Inspection
- OSHA Mandated Retraining

## OS1702 Lockout/Tagout Module 2

- Introduction
- Definitions
- Responsibilities
- Authorization
- Procedures
- Compliance Measures

## OS1801 Portable Fire Extinguishers

- Introduction
- Fire Extinguishers
- Use of Extinguishers
- Extinguisher Inspection
- Fire Prevention
- Emergency Action Plan

## OS1901 PPE General Protection

- Introduction
- Hazard Assessment
- Training Requirements

## OS1902 PPE Foot Protection

- Introduction
- Footwear Guidelines

## OS1903 PPE Eye and Face Protection

- Introduction
- Selection of Eye and Face Protection
- Eye/Face Protection Use
- Prescription Eyewear
- Inspection and Maintenance

## OS1904 PPE Hand Protection

- Introduction
- Recommended Use for Glove Types
- General Precautions

## OS1905 PPE Head Protection

- Introduction
- Hard Hat Design and Class
- Hard Hat Care and Maintenance

## OS2001 Respirators Module 1

- Introduction
- Training
- Respirator Use
- Respirator Properties

## OS2002 Respirators Module 2

- Introduction
- Hazardous Atmospheres and Rescues
- Safety
- Training
- Respirator Fit and Use

## OS2003 Respirators Module 3

- Introduction
- Inspection
- Storage
- Canisters and Filters

## OS2101 Scaffold Safety Module 1

- Introduction
- Scaffolding Items
- Safety
- Types of Scaffolding

## OS2102 Scaffold Safety Module 2

- Introduction
- Preparation
- Load Classes
- General Procedures
- Inspecting and Tagging
- Dismantling
- Storing and Handling

# OSHA Compliance

## OS2201 Accessing Medical Records

- Introduction
- General Definitions
- Access to Records
- Preservation of Records

## OS2301 American Red Cross CPR

- Introduction
- Fundamental Skills
- The 3-C's
- Airway and Breathing
- Circulation
- Conscious Choking
- Review

## OS2401 Vehicle Startup Checks and Adjustments

- Introduction
- Pre-Start Checks
- Minimizing Blind Spots
- Adjusting Equipment
- Planning a Safe Route

## OS2402 Safety Concerns Within the Vehicle

- Introduction
- Safety Belts and Air Bags
- Securing Loose Objects
- Child Safety
- Proper Use of Anti-Lock Brakes

## OS2403 Defensive Driving Strategies

- Introduction
- Maintaining a Safe Distance
- Turning and Passing
- Defensive Stops
- Backing Safety
- Vehicle Breakdown Procedures
- Road Rage
- Animal Avoidance

## OS2404 Hazardous Driving Conditions

- Introduction
- Night Driving
- Driving in the Rain
- Hydroplaning
- Driving in Snow and Ice
- Recovering from a Skid

## OS2405 Common Driving Distractions

- Introduction
- Cellular Phones
- Smoking and Eating
- Drinking and Drugs
- Fatigue

## OS2501 Arc Flash Awareness

- Introduction
- The Nature of Arc Flash
- Causes of Arc Flash
- Arc Flash Safety Issues
- Arc Flash Compliance, Regulations, and Standards
- Arc Flash Compliance Overview

# Environmental Compliance

The Environmental Compliance series contains many courses to address DOT and EPA compliance regulations for power plants.

## ENO101 Air Handbook

- Emissions
- Permits
- CEMs
- Unauthorized Discharges
- What Can I Do?
- Conclusion

## ENO201 Asbestos Handbook

- Introduction
- Asbestos Warning
- Handling Asbestos
- Conclusion

## ENO301 DOT General Awareness (Transportation of Hazardous Materials)

- Introduction
- DOT Regulations
- Hazardous Materials
- Shipping Papers
- Hazardous Material Table
- Bills of Lading
- Placards
- Warning Labels
- Conclusion

## ENO302 DOT Function Specific (Loading and Unloading of Hazardous Materials)

- DOT Regulations
- Hazardous Wastes
- Manifests
- Hazardous Wastes Paperwork
- PCBs
- PCBs Paperwork
- Miscellaneous Wastes
- Transporting Waste
- Conclusion

## ENO303 DOT Hazardous Materials Security

- Introduction
- Transportation of Products
- Warning Indicators
- Safe Work Practices
- Emergency Response Information
- Common Emergencies
- Conclusion

## ENO401 Environmental Policy Handbook

- Introduction
- Research and Development
- Management Standard
- Conclusion

## ENO501 Hazardous Materials Handbook

- Introduction
- Chemical Control
- MSDS
- Pesticides
- Storage
- Transporting Materials
- Conclusion

# Environmental Compliance



## EN0601 Hazardous Waste Generation

- Introduction
- Hazardous Waste Characteristics
- Regulations
- Handling Hazardous Waste
- Hazardous Waste Storage
- Exposure to Hazardous Waste
- Hazardous Preventions
- Waste Management
- Cost and Waste Reduction
- Conclusion

## EN0602 Hazardous Waste Handbook

- Introduction
- EPA Listed Waste
- Shipping/Staging Areas
- SPCC
- Drums and Cans
- Conclusion

## EN0701 PCB Handbook

- Introduction
- Health Hazards and Warning Signs
- Classes of PCBs
- Spills and Hazards
- The PCB Mark or Labels
- Clean Up
- Records and Disposal
- Conclusion

## EN0801 Solid Waste Handbook

- Disposal of Wastes
- Types of Waste
- Special Wastes
- Universal Wastes
- Conclusion

## EN0802 Solid Waste Permit

- Introduction to Solid Waste Training
- State Regulation(s)
- The Operational Plan
- Permit and Application Documents
- Conclusion

## EN0803 Spill Control and Countermeasure

- Spill Plans
- Inspections
- Controlling the Spill
- Conclusion

## EN0901 Spill Prevention Control and Countermeasure (SPCC)

- Introduction
- Regulations
- SPCC and Facility Response Plans
- Operational Errors and Equipment Failures
- Leak Prevention
- What To Do If a Leak Occurs
- Conclusion

## EN1001 Storm Water

- Recognize Hazards
- Handling Materials
- Permits
- Best Management Practices
- Good Housekeeping Practices
- Conclusion

## EN1101 Water Handbook

- Introduction
- Types of Discharges
- Sewage Treatment
- Runoff Regulations
- Erosion Control
- Permits
- Conclusion

## EN1201 Waste Management

- Introduction
- Recognizing Hazardous Waste
- OSHA and DOT
- Handling Hazardous Waste
- Hazardous Waste Manifest
- Allowable Storage
- Exposure to Hazardous Waste
- Waste Management
- Cost of Waste
- Waste Reduction
- Conclusion

## EN1301 Waste Water

- Introduction
- The Clean Water Act
- NPDES
- Enforcement of CWA
- Penalties
- Conclusion

# GE Frame 7F & Siemens 501F Combined Cycle Plants

The GE Frame 7F & Siemens 501F Combined Cycle Plants series contains numerous courses covering the technologies installed at many combined cycle power plants.

- CC1 Introduction to Combined Cycle Power Generation
- CC11 Combined Cycle Fundamental Theory and Operation
  - Overview
  - The Gas Turbine (Brayton) Cycle
  - The Steam-Water (Rankine) Cycle
  - Heat Transfer
  - The Combined Cycle
- CC12 Cycle Parameters and Their Impact on Plant Performance
  - Rankine Cycle Parameters and Efficiency
  - Combustion Turbine Parameters and Efficiency
  - Combined Cycle Parameters and Efficiency
- CC13 Benefits of the Combined Cycle
  - Operational Benefits
  - Environmental Aspects
  - Repowering and Economic Aspects
- CC14 Fuels for Combined Cycle Power Plants
  - Gaseous Fuels
  - Liquid Fuels
  - Solid Fuels and Other Considerations

## GE Frame 7F Topics

- CC2G Gas [Combustion] Turbine Generator
- CC21G GE Frame 7F Gas Turbine Generator Introduction
  - Overview
  - Design Considerations
  - Classification of Combustion Turbines
  - Combustion Turbine Characteristics
  - Advanced Combustion Turbine Designs
- CC22GA GE Frame 7F Gas Turbine Main Components (Part 1)
  - Introduction
  - Air Inlet
  - Compressor
  - Combustion
  - Turbine
- CC22GB GE Frame 7F Gas Turbine Main Components (Part 2)
  - Exhaust Section
  - Bearings
  - Gears and Couplings
  - Turbine Base, Support, and Enclosure

- CC23G GE Frame 7F Gas Turbine Generator
  - Overview
  - Construction
  - Excitation
  - Hydrogen and Seal Oil

- CC24GA GE Frame 7F Gas Turbine Support Systems (Part 1)
  - Electrical System
  - Inlet Air Cooling and Heating Systems
  - Exhaust Systems
  - Starting Systems
  - Fuel and Fuel Treatment Systems
  - Fuel Treatment Systems



- CC24GB GE Frame 7F Gas Turbine Support Systems (Part 2)
  - Lubricating Oil Systems
  - Cooling Water/Air Systems
  - Water Wash System
  - Water/Steam Injection System
  - Fire Protection System

- CC25GA GE Frame 7F Gas Turbine Operations and Maintenance Considerations (Part 1)
  - Maintenance Philosophy and Planning
  - Maintenance Features of Combustion
  - Major Factors Affecting Maintenance

- CC25GB GE Frame 7F Gas Turbine Operations and Maintenance Considerations (Part 2)
  - Maintenance Inspections
  - Parts and Manpower Planning and Inspection

- CC26G GE Frame 7F Gas Turbine Performance and Reliability
  - Factors Affecting CT Reliability
  - Performance Improvements
  - Combustion System Improvements
  - Emissions Reductions
  - Control System Reliability Improvements
  - Impact of Operating Modes

# GE Frame 7F & Siemens 501F Combined Cycle Plants



## Siemens 501F Topics \*

### CC2S Combustion Turbine

#### CC21S Siemens 501F Combustion Turbine

- Overview
- Design Considerations
- Classification of Combustion Turbines
- Combustion Turbine Characteristics
- Advanced Combustion Turbine Design

#### CC22S Siemens 501F Combustion Turbine Main Components

##### CC22SA (Part 1)

- Air Inlet
- Compressor
- Combustion
- Turbine

##### CC22SB (Part 2)

- Exhaust Section
- Bearings
- Gears and Couplings
- Turbine Base, Supports, and Enclosure

#### CC23S Siemens 501F Combustion Turbine Generator

- Overview
- Construction
- Excitation

#### CC24S Siemens 501F Combustion Turbine Support Systems

##### CC24SA (Part 1)

- Electrical System
- Air Inlet and Cooling System
- Exhaust System
- Starting System
- Fuel Supply System
- Fuel Oil Water Injection System

##### CC24SB (Part 2)

- Lubrication Oil System
- Cooling Water and Air Systems
- Water Wash System
- Water/Steam Injection System
- Fire Protection System

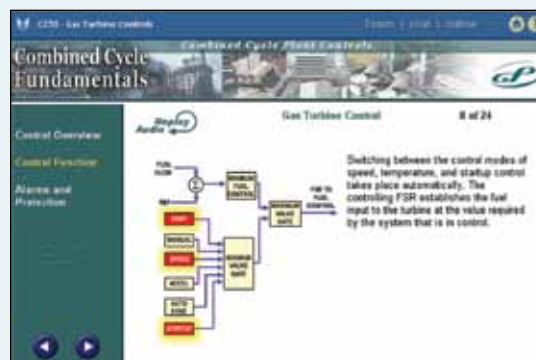
#### CC25S Siemens 501F Operations and Maintenance Considerations

##### CC25SA (Part 1)

- Maintenance Philosophy and Planning
- Maintenance Features of Combustion
- Major Factors Affecting Maintenance

##### CC25SB (Part 2)

- Maintenance Inspections
- Parts and Manpower Planning and Inspection



#### CC26S Siemens 501F Combustion Turbine Performance and Reliability

- Factors Affecting CT Reliability
- Performance Improvements
- Combustion System Improvements
- Emissions Reductions
- Impact of Operating Modes

#### CC27S Siemens 501F TXP Control System

- TXP Overview
- AS620 Automation System
- Simatic Net Bus System
- OM 650 Operation and Monitoring System
- ES 680 Engineering System
- DS 670 Diagnostic System
- 501F Control Using the TXP

\*Formerly Westinghouse 501F and Siemens Westinghouse 501F

## Combined Cycle Plants

### CC3 CC31 Heat Recovery Steam Generator (HRSG) HRSG Overview, Principles of Operation, and Flowpaths

- Overview
- Principles of Operation
- HRSG Flowpaths

### CC32 HRSG Major Components

- Low Pressure Steam Generation Section(s)
- Intermediate Pressure Steam Generation Section
- High Pressure Steam Generation Section

### CC33 HRSG Water Chemistry Control and SCR and Non-SCR NO<sub>x</sub> Control Overview

- HRSG SCR and Non-SCR NO<sub>x</sub> Control Overview
- HRSG Inspections



### CC4 CC41 Steam Turbine Generator Steam Turbine Principles, Components, and Support Systems

- Steam Turbine Principles
- Steam Turbine Centerline Components
- Steam Turbine Valves
- Turbine Lube Oil System
- Hydrogen Seal Oil System

### CC42 Steam Turbine Generator

- Generator Overview
- Generator Construction
- Excitation Systems
- Generator Gas Systems

### CC43A Turbine Starting and Loading Instructions Part I

- Thermal Stress
- Fatigue and Cyclic Life Expenditure
- Fracture Appearance Transition Temperature

### CC43B Turbine Starting and Loading Instructions Part II

#### Starting and Loading Instructions

- Cold Start
- Warm Start
- Hot Start
- Loading Instructions
- General Operating Recommendations
- Operational Limitations

### CC5 Combined Cycle Plant Controls

#### CC51 Gas Turbine Controls

- Control Overview
- Control Function
- Alarms and Protection

#### CC52 Heat Recovery Steam Generator Controls

- Principles of Operation
- Control Philosophy and Application

#### CC53 Steam Turbine Controls

- Overview
- Control Purpose and Function
- Alarm and Protection

#### CC54 Generator Controls

- Electrical Generator Control System
- Generator Operational Limitations
- Generator Capability Curves
- Generator Protection

#### CC55 GE Mark V/VI Control Systems

- Control System Overview
- Hardware and Software
- Basic System Function and Principles
- Operator Interface and Functions
- DCS Functions and Operation
- Types of Displays

### CC6 Integrated Combined Cycle Plant Operation CC61 Startup Considerations

- Normal Startup
- Fast Starts

#### CC62 Operating Modes

- Base Load
- Cycling Duty
- Peak Loading

#### CC63 Abnormal Plant Operations

- Abnormal Plant Operations

#### CC64 Shutdown of Combined Cycle Plants

- Normal Shutdown
- Emergency Shutdown

#### CC65 Layup

- Layup

# Hydroelectric Plants



The Hydroelectric series includes courses that discuss hydraulic theory and expand into various types of dams, structures, and hydroelectric turbines.

## HY01 Introduction to Hydroelectric Generation

### HY0101: Introduction to Hydroelectric Generation

- Introduction
- Hydraulic Principles
- Principles of Conversion
- Bernoulli Principle
- Summary

### HY0102: Construction and Key Features of Dams

- Introduction
- Concrete Dams
- Galleries and Drainage
- Operational Considerations
- Water Control Structures
- Summary

### HY0103: Design and Operational Considerations

- Introduction
- Balancing Operation and the Environment
- System Alteration and Continued Operation
- Summary

## HY02 Hydroelectric Systems – Mechanical

### HY0201: Turbine Hydraulic Systems

- Introduction
- Headgates and Tailgates
- Intake Structures
- Penstocks, Tunnels, and Tailraces
- Summary

### HY0202: Hydroelectric Turbines

- Introduction
- Turbine Types
- Turbine Components
- Summary

### HY0203: Impulse Turbines

- Introduction
- The Pelton Wheel Turbine
- Turbine Construction and Design
- Support Equipment
- Operation of the Impulse Turbine
- Summary

## HY03 Hydroelectric Systems – Electrical

### HY0301: Hydroelectric Generators

- Introduction
- Major Components of the Hydroelectric Generator
- Generator Sub-Systems
- Summary

### HY0302: Hydraulic Turbine Governor System

- Introduction
- Governor System Principles
- Speed Control
- Summary

# Waste-to-Energy Plants

The Waste-to-Energy series includes courses for facilities that use solid waste as a fuel, and discusses the various systems and equipment unique to waste-burning plants.

## WTE01 Refuse Receiving and Handling

- WTE0101:** Municipal Solid Waste as Fuel
- Introduction
  - Refuse Receiving and Handling Overview
  - Sources and Types of Municipal Solid Waste
  - Potential Difficulties of Municipal Solid Waste as a Fuel
  - Receipt of Refuse at Plant Site
  - Summary
- WTE0102:** Refuse Receiving, Handling Layout, and Equipment
- Introduction
  - Floor Components and Layout
  - Front End Loader
  - Cranes and Grapples
  - Feed Chute (Charging) Hoppers
  - Summary
- WTE0103:** Refuse Receiving and Handling Operations
- Introduction
  - Safety Guidelines and Rules
  - Refuse Truck Operator
  - Equipment Operator
  - Crane Operator
  - Summary
- WTE0104:** Refuse Receiving and Handling Summary
- Introduction
  - Unique Characteristics of Refuse as a Fuel
  - Addressing Potential Problems
  - Importance of Communication and Feedback
  - Summary

## WTE02 Refuse Boiler

- WTE0201:** Refuse Fired Boiler Overview
- Boiler Overview
  - Design Considerations
  - Heat Transfer and Convection Areas
  - Summary
- WTE0202:** Refuse Boiler Main Components
- Introduction
  - Economizer
  - Drum
  - Downcomers
  - Waterwalls
  - Generating Bank Section
  - Superheater
  - Boiler Auxiliaries
  - Fans
  - Expellers
  - Riddlings Systems
  - Summary
- WTE0203:** Refuse Boiler Combustion Section
- Introduction
  - Overview - Burning Trash
  - Combustion Control
  - Auxiliary Fuel System
  - Summary

## WTE03 Corrosion

- WTE0301:** Basics of Corrosion and High Temperature Corrosion
- Introduction
  - Corrosion Basics
  - Chemistry of High Temperature Corrosion
  - Summary
- WTE0302:** Controlling Corrosion
- Introduction
  - Protective Oxide
  - Pit Management
  - Proper Combustion
  - Recommendations for Corrosion Control
  - Summary
- WTE0303:** Types of High Temperature Corrosion
- Introduction
  - Pitting Corrosion
  - Crevice Corrosion
  - Stress Corrosion Cracking
  - Stress Assisted Corrosion
  - Erosion/Corrosion
  - Summary
- WTE0304:** Boiler Design and Operational Concerns
- Introduction
  - Constraints to Near Design Operation
  - Component Design Considerations
  - Preferred Condition
  - Summary
- WTE0305:** Practices Affecting Corrosion
- Introduction
  - Operational Concerns
  - Summary



## Wind Farms



The Wind Farm series contains courses on various technologies for wind farm operations.

### WF01 Introduction to Wind Farms

- Introduction
- Wind Farm Principles
- Wind Farm Components
- Wind Component Manufacturers
- Typical Wind Farms
- Summary

### WF02 Zond Wind Farm Technology

- Introduction
- Major Components
- Operator Interface Terminal
- Operation
- Maintenance
- Safety
- Summary

### WF03 Mitsubishi Wind Farm Technology

- Introduction
- Major Components
- Safety Equipment Tests
- Inspections and Maintenance
- Safety
- Summary

## Flue Gas Conditioning

The Flue Gas Conditioning series contains courses for plant personnel who operate and maintain various types of pollution control equipment including scrubbers, SCRs, and SNCRs.

### FG01 Nitrogen Oxide (NO<sub>x</sub>) and Sulfur Oxide (SO<sub>x</sub>) Emissions

- FG0101:** Introduction to Nitrogen Oxide and Sulfur Oxide Emissions
- Introduction
  - Understanding NO<sub>x</sub> and SO<sub>x</sub>
  - Formation of NO<sub>x</sub>
  - Formation of SO<sub>x</sub>

- FG0102:** Environmental Protection Agency (EPA) Compliance Standards
- Introduction
  - EPA Regulatory Requirements
  - EPA Performance Expectations

### FG02 Selective Non-Catalytic Reduction (SNCR)/ Selective Catalytic Reduction (SCR)

- FG0201:** Introduction SNCR/ SCR
- Introduction
  - SNCR/SCR Systems
  - NO<sub>x</sub> Pre/Post Combustion Strategies
  - Auxiliary Systems

- FG0202:** SNCR/ SCR Process
- Introduction
  - SNCR Process
  - SCR Process

- FG0203:** SCR/ SNCR Basic Operation, Maintenance, and Safety
- Introduction
  - SNCR/SCR Basic Operation
  - SNCR/SCR Preventive Maintenance
  - Ammonia Safety

### FG03 Flue Gas Desulfurization

- FG0301:** Flue Gas Desulfurization (FGD)
- Introduction
  - Flue Gas Desulfurization
  - SO<sub>x</sub> Pre/Post Combustion Control Strategies
  - Auxiliary Systems

- FG0302:** FGD Process
- Introduction
  - Wet FGD Process
  - Jet Bubbler FGD Process
  - Dry FGD Process

- FG0303:** FGD Basic Operation, Maintenance, and Safety
- Introduction
  - FGD Basic Operation
  - FGD Maintenance
  - FGD Safety

## NERC Compliance



The NERC Compliance series provides the knowledge you need to promote the reliability of your bulk electric system and comply with NERC standards.

### NSO1 NERC Compliance Awareness

**NSO101:** NERC Compliance Awareness

### NSO2 NERC Cyber Security Standards Overview

**NSO201:** NERC Cyber Security Standards Overview

### NSO3 NERC Standards for Generator Owners and Generator Operators

**NSO301:** Introduction to Power Systems

**NSO302:** Sabotage Reporting

**NSO303:** Disturbance Reporting

**NSO304:** Equipment Ratings and Limitations

**NSO305:** System Reliability

**NSO306:** System Protection Coordination

**NSO307:** Generator Operation for Maintaining Network Voltage Schedules

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Brazos Electric	Midwest Generation
Calpine	Minnesota Power
City of Garland	Mirant
City of Redding	NAES
Cogentrix	Nevada Power
Conectiv	NRG
Constellation Power Generation	OGE
Consumers Energy	Otter Tail Power
Dayton Power & Light	Palm Beach Resource Recovery
Delta Power Services	PPL
Dominion	Primesouth
Duke Energy	PSEG
Dynegy	Seminole Electric
Edison Mission Energy	Southern Operating Company
Exelon	Suez Energy
First Energy Corporation	Tampa Electric
Fluor	Tenaska
FM Global	Tri-State G&T Association
FMPA	TVA
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