

RESOURCE 7

Utility Industry Curricula

Power Plant Engineer/Operator

This Utilities Industry specific skills curriculum provides trainees with the courseware that enables them to perform the tasks associated with a *Power Plant Engineer/Operator*. This print based curriculum has been developed to meet the subject requirements of either an apprenticeship or an organization's skills development program. When combined with on-the-job training, this program will provide trainees with the comprehensive skills and knowledge they will need to perform in this trade area.

The recommended Power Plant Engineer/Operator curriculum covers the primary skill needs for electric (including coal and fossil fuel plants), hydroelectric, steam, and nuclear power plant operations, and substation operations. The curriculum provides the mathematics background needed to understand the principles and operation of the machinery that generates electricity. Scientific, mechanical technologies, and electrical/electronics courses provide a technical foundation for understanding machinery and equipment operation/maintenance used in utilities. The training covers power plant machinery and equipment including generators, motors, switchgear, protective relaying, and electric power generation, transmission, and distribution.

This curriculum, as modified by custom assembling the appropriate courses, applies to utilities positions such as: Dispatcher, Generating Station Operator, Plant Relayman, and Power Plant General Instrument Mechanic. This training is appropriate for both entry level and experienced utilities employees.

Upon completion of this program, students will be able to:

- Perform calculations using algebra, trigonometry, and geometry.
- Understand the meaning of mathematical formulas as applied to mechanics.
- Understand the principles, components and measuring instruments associated with AC and DC electricity.
- Understand the operation and control of the common motors and generators found in utilities.
- Differentiate between distribution and power transformers by construction and application.
- Discuss the application of protective relays to protect motors, generators, buses and transformers.
- Understand the purpose and operation of the various equipment used in electric power generating stations.
- Describe the functions of the equipment used in power distribution stations.
- Explain the principles of operation of the various types of steam generators.
- Describe the methods used to regulate the voltage of distribution systems.

Base Curriculum

Course Title	Course Number
<i>Pre-Technical Foundation Skills</i>	
Trades Safety: Getting Started	186001
Working Safely with Chemicals	186002
Fire Safety.....	186003
Material Handling Safety	186006
Basic Industrial Math.....	Block X21
Addition and Subtraction	186008
Multiplication and Division	186009
Fractions, Percents, Proportions, and Angles	186010
Metric System	186011
Formulas	186012
Introduction to Algebra.....	186013
Practical Measurements	Block X22
Linear and Distance Measurement	186021
Bulk Measurement.....	186022
Temperature Measurement	186023
Energy, Force, and Power	186024
Fluid Measurement	186025
Problem Solving and Troubleshooting	186073
Introduction to Algebra, Geometry, and Trigonometry.....	Block X02
Algebra: Monomials and Polynomials.....	X0201
Algebra: Factoring.....	X0202
Algebra: Addition and Subtraction of Fractions	X0203
Algebra: Multiplication and Division of Fractions	X0204
Algebra: Linear Equations.....	X0205
Algebra: Simultaneous Linear Equations.....	X0206
Algebra: Determinants	X0207
Algebra: Quadratic Equations.....	X0208
Algebra: Exponents	X0209
Algebra: Radicals and Imaginary Numbers	X0210
Applied Geometry	186085
Practical Trigonometry.....	186086
Working Safely with Electricity	4400
Quality Concepts: Tools and Applications	186036
Preventive Maintenance	286085
Preventive Maintenance Techniques.....	286086
Predictive Maintenance	286087
<i>Scientific Principles</i>	
Heat, Part 1	686001
Heat, Part 2	686002
Steam	2620
Elements of Chemistry.....	5011
Engineering Chemistry.....	5012
Heat Transfer	2545

Power Plant Operating Principles

Fundamentals of Power Plant Operation, Part 1	786005
Fundamentals of Power Plant Operation, Part 2	786006
Fundamentals of Power Plant Operation, Part 3	786007
Power Plant Water Treatment, Part 1	786008
Power Plant Water Treatment, Part 2	786009
Power Plant Water Treatment, Part 3	786010
Power Plant Station Power	786011
Power Plant Fuel Flow Paths, Part 1	786018
Power Plant Fuel Flow Paths, Part 2	786019
Power Plant Fuel Flow Paths, Part 3	786020
Power Plant Steam Flow Paths, Part 1	786021
Power Plant Steam Flow Paths, Part 2	786022
Power Plant Steam Flow Paths, Part 3	786023
Power Plant Auxiliary Equipment	786024
Power Plant Instrumentation Systems	786025
Power Plant Boilers and Related Equipment	786026
Conveyor Systems	786027
Combustion Turbines, Part 1	786013
Combustion Turbines, Part 2	786014
Combustion Turbines, Part 3	786015

Mechanical Technologies and Maintenance

Pumps, Part 1	286001
Pumps, Part 2	286002
Pumps, Part 3	286003
Pneumatics, Part 1	286098
Pneumatics, Part 2	286099
Pneumatics, Part 3	286100
Air Compressors, Part 1	286096
Air Compressors, Part 2	286097
Bearings and Seals, Part 1	286093
Bearings and Seals, Part 2	286094
Lubrication, Part 1	286091
Lubrication, Part 2	286092
Mechanical Power Transmission Part 1	286101
Mechanical Power Transmission Part 2	286102
Mechanical Power Transmission Part 3	286103
Mechanical Testing of Materials	2608A-B
Engineering Mechanics, Part 1	286036
Engineering Mechanics, Part 2	286037
Engineering Mechanics, Part 3	286038
Engineering Mechanics, Part 4	286039
Fluid Mechanics, Part 1	286010
Fluid Mechanics, Part 2	286011
Fluid Mechanics, Part 3	286012

Blueprint Reading

Reading Prints and Schematics	Block X25
Introduction to Print Reading	186080
Print Reading Symbols and Abbreviations	186081
Dimensioning and Tolerancing	186082
Print Reading Applications	186083
Building Drawings	186043
Electrical Drawings and Circuits	186044
Electronic Drawings	186045
Hydraulic and Pneumatic Drawings	186046
Piping: Drawings, Materials, and Parts	186047
Welding Symbols	186048
Sheet Metal Basics	186049
Sketching	186050
Reading Shop Prints, Part 1	386043
Reading Shop Prints, Part 2	386044

Electrical/Electronics Principles and Equipment

DC Principles	Block A21
Nature of Electricity	086096

Circuit Analysis and Ohm's Law	086002
Capacitors and Inductors	086003
Magnetism and Electromagnetism	086004
Conductors, Insulators, and Batteries	086005
DC Motors and Generator Theory	086006
AC Principles	Block A22
Alternating Current	086007
Alternating Current Circuits	086008
Inductors in AC Circuits	086009
Capacitors in AC Circuits	086010
Transformers	086011
Alternators	086012
Electrical Energy Distribution	086013
Rectification and Basic Electronic Devices	086014
Analog Circuit Measurement	Block A23
Basic Test Equipment	086025
Troubleshooting with Volt-Ohm-Milliamp Meters (VOMs)	086026
Using Basic Oscilloscopes	086027
Electrical Safety for the Trades	186005
Electrical Equipment	Block A24
Conductors and Insulators in Industry	086070
Working with Conduit	086071
Electrical Boxes	086072
Industrial Enclosures and Raceways	086073
Connecting Electrical Equipment, Part 1	086074
Connecting Electrical Equipment, Part 2	086075
Industrial Fuses	086076
Industrial Circuit Breakers	086077
Plugs, Receptacles, and Lampholders	086078
Industrial Switches	086079
Industrial Relay Ladder Logic	086080
Industrial Relays, Contractors, and Solenoids	086081
Industrial DC Motors	086051
Industrial AC Motors	086052
Controlling Industrial Motors	086053
Electrical Grounding	086E01
Electrical Wiring Practices	086E02
Data, Voice, and Video Cabling	086E16
Component Testers	086062
Digital Test Equipment	086063
Electric Lamps, Part 1	006031
Electric Lamps, Part 2	006032
Electric Heating	006034

Electric and Steam Power Generation Plants – Equipment Operation and Maintenance

Types of Steam Turbines	2505
Steam Turbine Management and Governing	2506
Steam Turbine Calculations	2507
Pressure Vessel and Tank Print Reading	6691
Types of Steam Generators	6632
Steam Generator Design	2598A-B
Pressure Parts for Steam Generators	2588
Steam Generator Settings, Ducts, and Stacks	2587
Condensers	6553
Feedwater Treatment and Equipment	6727
Fuels	5340
Solid and Pulverized Fuel Burning	6473
Testing Solid and Liquid Boiler Fuels	6472
Oil and Gas Firing for Steam Generation	2592
Automatic Combustion Control	2596A-C
Flue Gas Analysis	6810
Steam Boiler Operation and Maintenance	6734
Steam Generator Testing	6802
Principles of the I-C Engine	2525

Electrical Equipment Applications Used in the Utilities Industry – Operations and Maintenance

Transformers.....4040
 DC Machines.....4030A-B
 Transformer Operation.....4041
 Distribution and Power Transformers.....4042
 Instrument Transformers6793
 Storage Batteries4343
 Electric Power Measurements.....4019A-B

Transmission and Distribution of Electric Power

Local Distribution of Electrical Power006038
 Switchgear086092
 Protective Relaying.....6538A-B
 Telemetry.....4048
 Voltage Regulators for Generators4368
 Voltage Regulation of Distribution Systems.....4370
 Electric Power Generating Stations6589A-B
 Electric Power Substations6590A-B
 Transmission Lines4358
 Power Line Calculations6256
 Underground Power Systems006039
 Transformation for Lineworkers.....786E05
 Underground Distribution for Lineworkers.....786E06
 Electrical Power Distribution and Transmission for the
 Technician786E01

Estimated Curriculum Duration: 1,655 hours.
 Number of Exams: 202.

Optional: Hydro-Electric, Nuclear Power Plant Operations

Hydraulic Turbines6718A-C
 Principles and Uses of Nuclear Energy.....6683

Estimated Duration: 40 hours.
 Number of Exams: 4.