CATALOGUE OF INSTRUCTOR-LED TRAINING COURSES

2024

RELIANT ENGINEERING, PA

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Selected Course Offerings for 2024 "At-a-Glance"

For the Electric Utility and Cogeneration Industry. . .

OP-100	How Power Plants Work – Conventional (16 hours)
OP-105	How Power Plants Work – Combined Cycle (16 hours)
OP-110	Comparison of Power Plant Cycles (8 hours)
OP-115	Reading and Interpreting P & IDs Office or Conference Room Setting (8 hours)
OP-120	Reading and Interpreting P & IDs - Plant Setting (16 hours)
OP-200	Introduction to Electricity and Electrical Theory (24 hours)
OP-205	Overview of Electrical Theory (12-hours)
OP-210	Utility Boilers and Auxiliaries (32 hours)
OP-220	Steam Turbines and Auxiliaries (32 hours)
OP-300	Generator Operating Theory (28 hours)
OP-305	Overview of Generator Operation (12 hours)
OP-310	Overview of Heat Rate and Plant Efficiency (16 hours)
OP-320	Boiler Efficiency (8 hours)
OP-330	Turbine Efficiency (8 hours)
OP-340	Balance-of-Plant Equipment Efficiency (8 hours)
OP-350	Combined Cycle Theory and Efficiency (16 hours)
OP-400	Generator Protective Relays (16 hours)
OP-500	Power System Operation (16 hours)

For the Industrial Sector…

IND-100	Fire Tube Boilers (8 hours)
IND-110	Package and Industrial-Size Water Tube Boilers (16 hours)
IND-120	Boiler Accessories (8 hours)
IND-200	Industrial Plant Auxiliary Components (24 hours)

For Operator Certification Review. . .

OC-100	Fifth Class Stationary Engineer (or Equivalent) Review Course (12 hours)
OC-110	Fourth Class Stationary Engineer (or Equivalent) Review Course (16 hours)
OC-120	Third Class Stationary Engineer (or Equivalent) Review Course (18 hours)
OC-130	Second Class Stationary Engineer (or Equivalent) Review Course (20 hours)
OC-140	First Class Stationary Engineer (or Equivalent) Review Course (24 hours)
OC-150	Chief Engineer (or Equivalent) Review Course (36 hours)
OC-160	Stationary Engineer Combination Review Course (40 hours maximum)

***Note*: Courses can be customized to be site-specific and be combined into a larger training program. Academic science, mathematics, pre-engineering, engineering, and business courses are also available.**

Course Descriptions

ELECTRIC UTILITY and COGENERATION FACILITIES

OP-100: How Power Plants Work - Conventional

This is a two-day (16 hours) course that introduces the participant to the Rankine power cycle. The course begins with the "tea kettle and pin wheel" concept, and quickly builds to a typical power plant steam/water cycle. This course provides foundation principles for new operators/engineers/supervisors.

Objectives: At the end of this course the participant will be able to:

1. List the purpose and provide a brief description of the boiler, turbine, and generator.
2. Explain the energy conversions for the boiler-turbine-generator configuration.
3. Explain the purpose and significance of the condenser to the steam/water cycle.
4. Add the condenser and a pump to the boiler-turbine configuration to make a complete Rankine steam/water cycle.
5. Describe the heat inputs and heat rejections associated with the steam/water cycle.
6. Explain regenerative feedwater heating.
7. Describe the (a) direct-contact and (b) U-tube feedwater heater designs.
8. Explain the difference between low-pressure and high-pressure feedwater heaters.
9. Explain the difference between condensate (hotwell) pump and boiler feed pump applications.
10. Explain the purpose for the boiler economizer.
11. Identify (a) the condensate system, (b) boiler feedwater system, (c) boiler water and steam circuits, (d) main steam system, (e) extraction steam system, and (f) turbine exhaust steam.
12. Explain the advantages of utilizing reheat.
13. Briefly describe typical fossil-fuel-firing systems; (a) pulverized-coal, (b) stoker-coal, (c) fuel oil, and (d) natural gas.

OP-105: How Power Plants Work – Combined Cycle

This is a two-day (16 hours) course that introduces the participant to the Brayton/Rankine power cycles. The course begins with the "tea kettle and pin wheel" concept, and quickly builds to the combination of Brayton and Rankine power cycles. This course provides foundation principles for new operators/engineers/supervisors.

Objectives: At the end of this course the participant will be able to:

1. List the purpose and provide a brief description of the combustion turbine (CT), heat recovery steam generator (HRSG), steam turbine (ST), and generator.
2. Explain the energy conversions for the CT-HRSG-ST-generator configuration.
3. Explain the purpose and significance of the condenser to the ST water and steam cycle.
4. Add the condenser and a pump to the boiler-turbine configuration to make a complete ST water and steam cycle.
5. Describe the heat inputs and heat rejections associated with the ST water and steam cycle.
6. Explain the difference between condensate (hotwell) pump and boiler feed pump applications.
7. Explain the purpose of the HRSG economizer.
8. Identify (a) the condensate system, (b) boiler feedwater system, (c) HRSG water and steam circuits, (d) high pressure (HP) steam, (e) intermediate pressure (IP) steam, (f) low pressure (LP) steam, and (g) ST exhaust steam.
9. Explain the advantages of utilizing reheat.
10. Describe the fuel gas system to include supply, pressure reduction, conditioning, and firing rate control.

OP-110: Comparison of Power Plant Cycles
This is a 16-hour course that can be presented as an addendum to OP-100 or as a stand-alone course. This course is useful for project developers, finance managers, and new engineers.

During this course comparison is made between types of power plants and their cycles:

Plant Cycle	Comparison Parameters
Combined Cycle (Brayton-Rankine) Traditional Fossil Fuel Rankine Cycle Refuse Firing (Mass Burn and RDF) Hydroelectric Renewable Energy Plants	Advantages, Disadvantages, and Efficiencies Construction Time Payback Period Regulatory Requirements Risk Analysis Overview

OP-115: Reading and Interpreting P & IDs (Office or Conference Room Setting)
This eight-hour course presents the basics for reading piping (or process) and instrumentation diagrams beginning with symbols/abbreviations and leading to the interpretation of systems from simple to complex.

OP-120: Reading and Interpreting P & IDs (Plant Setting)
This 16-hour course presents the basics for reading piping (or process) and instrumentation diagrams beginning with symbols/abbreviations and leading to the interpretation of systems from simple to complex. The systems used in practice

sessions are traced in the field to compare actual equipment to P & ID components, symbols, and flow paths.

OP-200: Introduction to Electricity and Electrical Theory

This is a 24-hour course that introduces the participant to the electrical theory required to understand power plant electrical systems. Beginning with atomic structure of matter, this course fully develops the concepts of voltage, current, resistance, inductance, and capacitance. Also covered are the types of electrical power (apparent, true, and reactive), and the power triangle.

Objectives: At the end of this course the participant will be able to:

1. Explain the source of electric charge.
2. Explain current, voltage, and resistance as they relate to electric charge.
3. Explain (a) complete circuit, (b) open circuit, and (c) short circuit.
4. Explain the relationship between voltage, current, and resistance using Ohm's Law.
5. Define true power and explain how it is calculated.
6. Explain the difference between direct current (DC) and alternating current (AC).
7. Define and explain the behavior of capacitance.
8. Describe the DC response of a purely capacitive circuit.
9. Describe the relationship between electricity and magnetism.
10. Define and explain the behavior of inductance.
11. Describe the DC response to a purely inductive circuit.
12. Describe the AC response of (a) a resistive circuit, (b) a capacitive circuit, and (c) an inductive circuit.
13. Define inductive and capacitive reactance.
14. Describe the origin of reactive power (a) in capacitive circuits – LEADING and (b) in inductive circuits – LAGGING.
15. Define apparent power.
16. Explain the relationship between true power, reactive power, and apparent power (the power triangle).
17. Define power factor.
18. Correlate the power triangle to a simple utility generator reactive capability curve.

OP-205: Overview of Electrical Theory

This is a 12-hour course that is an abridged version of OP-200.

OP-210: Utility Boilers and Auxiliaries

This 32-hour course covers the design and operation of a utility boiler including circulation (once-through, pump-assisted, and natural), construction and provisions for expansion, water and steam circuits, blowdown and blowoff, air and gas systems, fuel-firing systems (coal, oil, and natural gas), and environmental control systems.

Objectives: At the end of this course the participant will be able to:

1. Describe the three types of water circulation found in utility boilers.
2. Explain in general how utility boilers are constructed and the provisions for expansion.
3. Describe the purpose of (a) the economizer, (b) the steam drum, (c) waterwalls, (d) risers, (e) superheaters and (f) reheaters.
4. Explain continuous blowdown and why it is used.
5. Explain boiler blowoff and when it is used.
6. Explain the purpose of (a) forced draft, (b) natural draft, (c) induced draft, and (d) balanced draft.
7. Describe a typical balanced draft air and gas system to include (a) forced draft fan, (b) air heater (regenerative and recuperative), (c) induced draft fan, and (d) stack.
8. Describe a typical pulverized fuel burning system.
9. Describe a typical light fuel oil burning system.
10. Describe a typical natural gas burning system.
11. List and briefly describe (a) electrostatic precipitator, (b) baghouse, (c) dry scrubber, (d) wet scrubber, and (e) SCR system.

OP-220: Steam Turbines and Auxiliaries

This 32-hour course covers the design and operation of a utility steam turbine including operating theory, classifications, construction, steam flow path description, major steam valves, auxiliary valves, gland steam system, turbine drains, lubricating oil system, hydraulic fluid system, and control overview.

Objectives: At the end of this course the participant will be able to:

1. Describe the theory of how thermal energy is converted into mechanical energy.
2. List and describe the parameters by which steam turbines are classified.
3. Describe how a utility turbine is supported and the provisions for expansion.
4. Describe how a utility turbine is assembled.
5. Describe the steam flow path through a utility steam turbine from the first stage to the exhaust.
6. Describe the (a) main steam stop valves, (b) control valves, (c) reheat stop valves, (d) intercept valves, and extraction reverse-current (non-return) valves.
7. Describe the (a) packing blowdown valve, (b) equalizing valve, and (c) ventilator valve.
8. Explain the operation of the gland steam seal system and describe its components.
9. Explain the purpose and operation of the turbine drains.
10. Explain the operation of the lubricating oil system and describe its components.
11. Explain the operation of the hydraulic fluid system and describe its components.

12. Explain generally how speed and load are controlled on a utility steam turbine.
13. Explain the operation of the hydraulic trip header, and how it relates to the stop valves, control valves, reheat stop and intercept valves, and the extraction reverse-current (non-return) valves via the air relay dump valve.
14. List the events that can trip the turbine.

OP-300: Generator Operating Theory

This 28-hour course covers the design and operation of a utility generator including operating theory, construction, stator (armature) circuits, rotor (field) circuits, cooling, field excitation systems (rotating exciter and static types), voltage regulation, reactive capability limits and the reactive capability curve, and V-curve (General Electric generators).

Objectives: At the end of this course the participant will be able to:

1. Describe how mechanical energy is converted into electrical energy.
2. Describe the construction of the stator to include stator frame, stator core, stator bars, end-windings, grounded WYE, and phase leads.
3. Describe the construction of the rotor to include forging, field windings, brushes, and exciter.
4. Describe rotor (field) excitation systems to include (a) static excitation (SCR bridge) system and (b) rotating-exciter-based system.
5. Describe the relationship between steam flow and generator megawatt output.
6. Describe the methods of voltage regulation and explain the correlation between voltage regulation and generator megavar output.
7. Describe the flow path of cooling gas through the generator.
8. Explain the cooling capability limits of the generator as they relate to (a) true power, (b) lagging vars, and (c) leading vars.
9. Describe a generator reactive capability curve and explain its interpretation.
10. Describe the V-curve (General Electric generators) and explain its interpretation.

OP-305: Overview of Generator Operation

This 12-hour course is an abridged version of OP-300.

OP-310: Overview of Heat Rate and Plant Efficiency

This is a 16-hour course that introduces participants to power plant thermodynamics from a heat rate and efficiency perspective. A heat balance diagram for a coal-fired power plant cycle is used as the model.[1]

Objectives: At the end of this course, the participant will be able to:

1. Explain the difference between heat and temperature.

[1] This course can be customized using a plant-specific heat balance diagram.

2. Explain latent heat and sensible heat.
3. Define the terms; (a) latent heat of vaporization, and (b) latent heat of condensation.
4. Define the thermodynamic terms; (a) enthalpy, (b) entropy, (c) saturation, (d) sub-cooling, (e) specific volume, and (f) density.
5. Define the British thermal unit (Btu) and explain its effects (a) while heating sub-cooled liquid, (b) while generating steam, and (c) while superheating steam.
6. Describe the (a) saturation-pressure table, (b) saturation-temperature table, and (c) superheated steam table.
7. Explain how to navigate the three steam tables listed above.
8. Define the term heat rate.
9. Describe how feedwater efficiency is calculated using the heat balance diagram.
10. Explain how feedwater efficiency affects heat rate.
11. Describe how pump efficiency is calculated using the heat balance diagram.
12. Describe how superheat and reheat affect turbine efficiency and heat rate.
13. Describe how condenser vacuum affects turbine efficiency and heat rate.

OP-320: Boiler Efficiency
This eight-hour course describes the effects of boiler problems on the boiler and overall plant efficiency and heat rate.

Objectives: At the end of this course the participant will be able to explain the impact on boiler and plant efficiency as it relates to:

1. Stack Temperature
2. Excess Air
3. Main Steam Pressure
4. Main Steam Temperature
5. Reheat Steam Temperature
6. Waterwall Fouling
7. Superheater Fouling
8. Reheater Fouling
9. Economizer Fouling
10. Air Heater Fouling
11. Improperly Positioned FD Fan Inlet Vanes
12. Burner Malfunction
13. Superheat Spray Malfunction
14. Reheat Spray Malfunction
15. Changes in Pulverizer Fineness

OP-330: Turbine Efficiency
This eight-hour course describes turbine efficiency fundamentals, how turbine efficiency is determined, and the parameters that can affect turbine efficiency.

Objectives: At the end of this course, the participant will be able to:

1. Describe the energy that flows into and out of the turbine.
2. Compute turbine efficiency using the (a) heat balance method and (b) the enthalpy-drop method.
3. Explain the effects of blade chemical deposits and solid particle erosion on turbine efficiency.
4. Explain the effects of seal wear on turbine efficiency.
5. Explain the effects of main steam temperature changes on turbine efficiency.
6. Explain the effects of hot reheat steam temperature changes on turbine efficiency.
7. Explain the effects of main steam pressure changes on turbine efficiency.
8. Explain the effects of turbine backpressure changes on turbine efficiency.
9. Explain the effects of superheat and reheat attemperation on turbine efficiency.
10. Describe optimum control valve operation for an efficient turbine.
11. Explain the effects of extraction steam operation on turbine efficiency.
12. Explain the effects of gland seal steam system operation on turbine efficiency.

OP-340: Balance-of-Plant Equipment Efficiency
This eight-hour course explains how the efficiencies of the condenser, feedwater heaters, and main cycle (condensate and boiler feed) pumps affect the overall cycle plant efficiency and the heat rate.

Objectives: At the end of this course the participant will be able to:

1. Describe the energy flows into and out of the condenser.
2. Explain the method for calculating efficiency of the condenser.
3. List the parameters that affect condenser performance.
4. Describe the effect of circulating water system operation on condenser performance.
5. Describe the effects of condenser fouling on condenser vacuum and plant efficiency.
6. Describe the effects of air in-leakage on condenser vacuum and plant efficiency.
7. Describe the method of determining overall feedwater heater performance.
8. Describe the effects of terminal temperature difference and drain cooler approach on feedwater heater performance.
9. Describe the effects of (a) improper venting, (b) abnormal drips level, and (c) a tube leak on condenser performance.
10. Describe a pump curve and its interpretation.
11. Explain the significance of net positive suction head (NPSH) as it relates to centrifugal pumps (especially those handling saturated liquids).
12. Explain how adequate NPSH is provided in (a) condensate pumps, (b) boiler feed pumps, and (c) condenser circulating water pumps.
13. Describe how pump wear can affect efficiency.

OP-350: Combined Cycle Theory and Efficiency

This 16-hour course describes various types of combined cycle efficiencies as they compare to traditional Rankine cycle efficiency and Brayton (simple-cycle gas turbine) efficiency.

Objectives: At the end of this course the participant will be able to:

1. Review the theory of operation for the (a) Rankine cycle, (b) Brayton cycle, and (c) combined cycle.
2. Describe the efficiency of a simple-cycle gas turbine with single-stage combustion as a function of gas turbine inlet and exhaust temperatures.
3. Describe the efficiency of a combined cycle with single-stage combustion as a function of gas turbine inlet and exhaust temperatures (unfired HRSG).
4. Describe the efficiency of a simple-cycle gas turbine with sequential combustion as a function of gas turbine inlet and exhaust temperatures.
5. Describe the efficiency of a combined cycle with sequential combustion as a function of gas turbine inlet and exhaust temperatures (unfired HRSG).
6. Explain the effects of (a) live steam pressure, (b) live steam temperature, (c) HRSG design parameters, and (d) feedwater preheating on a single-pressure combined cycle unit (unfired HRSG).
7. Explain the effects of (a) live steam pressure, (b) live steam temperature, (c) HRSG design parameters, and (d) feedwater preheating on a dual-pressure combined cycle unit (unfired HRSG).
8. Explain the effects of (a) live steam pressure, (b) live steam temperature, (c) HRSG design parameters, and (d) feedwater preheating on a triple-pressure combined cycle unit with and without reheat (unfired HRSG).
9. Describe the changes in combined cycle efficiency and steam turbine output when the HRSG has supplemental firing.
10. Describe the relative efficiency of the gas turbine and combined cycle as a function of air temperature.
11. Describe the relative power output of the gas turbine and combined cycle as a function of (a) air temperature, (b) elevation above sea level, and (c) relative humidity.
12. Describe the effect of gas turbine water and steam injection on relative combined cycle power output and efficiency.
13. Explain the effect of condenser pressure on steam turbine output for a (a) single pressure, (b) dual pressure, and (c) triple pressure combined cycle unit (unfired HRSG).
14. Explain the effect of condenser cooling medium temperature on condenser pressure for (a) air-cooled condensers and (b) water-cooled condensers.

OP-400: Generator Protective Relays

This 16-hour course describes the zones of protection, protective relays, and the faults that these relays guard against for utility generators.

Objectives: At the end of this course the participant will be able to:

1. Explain the difference between plunger type and induction disk relays.
2. Describe generator differential protection against phase-to-phase faults.
3. Describe generator overcurrent and overvoltage protection.
4. Describe generator loss of field protection and the damaging effects of operating the generator with loss of excitation.
5. Describe generator neutral ground protection against ground faults.
6. Describe generator reverse power protection against motorizing.
7. Describe generator negative phase sequence protection against line faults.

OP-500: Power System Operation
This 16-hour course describes the basics of power grid operation.

Objectives: At the end of this course the participant will be able to:

1. Explain the economics involved with operating power systems.
2. Explain the elements of power system control to include frequency control, automatic generation control, interconnected operation, and modes of tie-line operation.
3. Briefly explain how energy is accounted for in interconnected operations to include measurement of energy, metering, VAR flows, and interconnected energy accounting.
4. List and describe the factors that affect power system reliability.
5. List and describe the factors that affect power system stability.
6. Describe generator reverse power protection against motorizing.

INDUSTRIAL SECTOR

IND-100: Fire Tube Boilers

This is an eight-hour course that introduces the participant to the construction and theory of operation for different types of fire tube boilers including horizontal return tubular (HRT), Scotch-marine (wet and dry back), and cast-iron sectional. Vintage boilers including vertical and locomotive type are described briefly. Half of the course duration focuses on the boiler accessories (fittings), checks conducted by the operator, and safety.

Objectives: At the end of this course the participant will be able to:

1. Describe construction, water/steam flow, combustion, and combustion gas flow of the following boilers: HRT, dry back Scotch marine, wet back Scotch marine, cast-iron sectional, vertical, and locomotive.
2. Describe and explain the purpose of the following boiler accessories: pressure gauge, safety valves, fusible plugs (where applicable), gauge cocks, water column, gauge glass, low water cut off (LWCO), continuous blowdown, and boiler blow-off valves.
3. Explain why it is important to blow down the gauge glass and LWCO column.
4. Explain the purpose of the slow drain test.
5. Explain the causes of fire side and water side explosions, and how these are prevented.

IND-110: Package and Industrial-Size Water Tube Boilers

This 16-hour course introduces the participant to various configurations of the water tube boiler to include, package type, field-erected single drum, and field-erected two drum boilers. Main systems are presented including boiler feedwater, boiler water/steam circuits, boiler outlet steam, boiler blowdown, combustion air, flue gas, and methods of fuel firing.

Objectives: At the end of this course the participant will be able to:

1. Describe the construction and principle of operation of the package boiler and explain why it is referred to as “package”.
2. Describe the construction and principle of operation for the field-erected two drum boiler.
3. Describe the construction and principle of operation for the field-erected single drum boiler.
4. Explain the purpose for the boiler feedwater system and list the typical major components.
5. Explain the purpose for the water/steam circuits (including superheaters) and describe a typical flow path.

6. Explain the purpose for the combustion air system and list the typical major components.
7. Explain the purpose for the flue gas system and list the major components.
8. Explain the purpose for the boiler blowdown system and list the major components.
9. Briefly describe the methods of fuel-firing to include stokers, natural gas, fuel oil, and pulverized coal.

IND-120: Boiler Accessories

This eight-hour course covers the fittings and accessories on all boilers that are required by Section I of the ASME Boiler and Pressure Vessel Code.

Objectives: At the end of this course the participant will be able to:

1. Describe a pressure gauge as used on a boiler along with the ASME regulation for design, mounting, gauge face, and siphons.
2. Describe the safety valve as required by ASME and list the regulations associated with this device.
3. Explain the difference between a safety valve and a relief valve.
4. Explain the purpose of the water column as installed on a boiler.
5. Explain the different methods for displaying and controlling boiler water level to include gauge glass (mica and glass designs), bi-color gauge glass, Eye-Hye® gauge glass, fiber-optic gauge glass, and typical level controller.
6. List the mounting and number requirements for the placement of level monitoring and controlling equipment.
7. Describe the common types of blowoff valves and explain the requirements for sizing and placement of these components.
8. Describe the common types of LWCO devices and the requirements for placement and operation.
9. Describe the non-return valve and explain the requirements for its use.

IND-200: Industrial Plant Auxiliary Components

This 32-hour course introduces participants to theory and principles of operation for major plant components including pumps, compressors, valves, fittings, separators, and steam traps.

Objectives: At the end of this course the participant will be able to:

1. List and describe the two major classifications of pumps.
2. Explain the theory of operation for a typical single-stage centrifugal pump and describe its basic construction.
3. Describe the undesirable phenomenon of cavitation in centrifugal pumps, its causes, and methods of prevention.
4. List and explain the parameters found on a centrifugal pump curve.

5. Explain the theory of operation for reciprocating and rotary positive displacement pumps.
6. List and describe the following valves and their applications: (a) gate valve, (b) globe valve, (c) check valve(s), (d) butterfly valve, (e) ball valve, (f) plug valve, (g) needle valve, (h) non-return valve, and (i) air-operated regulator valve.
7. Describe and explain the purpose of the following fittings: (a) y-type strainers, (b) tees, and (c) reducers/expanders.
8. List the various types of in-line separators and explain the application and theory of operation for each.
9. List and describe the major types of steam traps and the parameters that determine how each type of trap is used.
10. Describe the consequences of faulty steam traps.
11. Explain the diagnostic methods used to detect malfunctions in the various types of steam traps.

OPERATOR CERTIFICATION PREPARATION

OC-100: Fifth Class Stationary Engineer Review Course

This is a 12-hour course that prepares candidates to take a Fifth Class Stationary Examination or its equivalent. The preparation portion of the course includes review of the following subject material: Water Glass, Water Column, Safety Valves, Steam Pressure Gauge, Feedwater Control, Blowdown Systems, Boiler Non-Return Valves, Stays, Boiler Types, Abnormal Operation, Water Treatment, Feedwater Heaters, Combustion Theory, Boiler Settings, Operation of Fuel-Burning Equipment, Refrigeration, Compressed Air systems, Pumps, Injectors, Steam Turbines, HVAC, Pollution Control Equipment, Mathematics, Basic Electricity, and Plant Safety.

12 Instruction Hours

OC-110: Fourth Class Stationary Engineer Review Course

This is a 16-hour course that prepares candidates to take a Fourth-Class Stationary Engineer Examination or its equivalent. The preparation portion of the course includes review of the following subject material: Water Glass, Water Column, Safety Valves, Steam Pressure Gauge, Feedwater Control, Blowdown Systems, Boiler Non-Return Valves, Stays, Boiler Types, Abnormal Operation, Water Treatment, Feedwater Heaters, Combustion Theory, Boiler Settings, Operation of Fuel-Burning Equipment, Refrigeration, Compressed Air systems, Pumps, Injectors, Steam Turbines, HVAC, Pollution Control Equipment, Mathematics, Basic Electricity, and Plant Safety.

16 Instruction Hours

OC-120: Third Class Stationary Engineer Review Course

This is an 18-hour course that prepares candidates to take a Third-Class Stationary Engineer Examination. The preparation portion of the course includes review of the following subject material: Water Glass, Water Column, Safety Valves, Steam Pressure Gauge, Feedwater Control, Blowdown Systems, Fusible Plugs, Non-Return Valves, Stays, Boiler Types, Abnormal Operation, Water Treatment, Feedwater Heaters, Combustion Theory, Boiler Settings, Operation of Fuel-Burning Equipment, Refrigeration, Compressed Air systems, Pumps, Heat Engines, Air Conditioning, Pollution Control Equipment, Electrical Equipment, Plant Safety.

18 Instruction Hours

OC-130: Second Class Stationary Engineer Review Course

This is a 20-hour course that prepares candidates to take a Second-Class Stationary Engineer Examination or its equivalent. The preparation portion of the course includes review of the following subject material: Draft, Combustion Theory, Boiler Types and Construction Details, Boiler and Furnace Maintenance, Boiler Feedwater System, Water Treatment, Feedwater Heaters, Boiler Fittings, Operation of Fuel-Burning Systems, Pump Descriptions, Steam Turbines, Condensers, Balance-of-Plant Accessories, HVAC,

Compressed Air Systems, Mathematics, Electrical Equipment and Systems, Pollution Control Equipment, Plant Safety.
20 Instruction Hours

OC-140: First Class Stationary Engineer Review Course
This is a 24-hour course that prepares candidates to take a First-Class Stationary Engineer Examination or its equivalent. The preparation portion of the course includes review of the following subject material: Steam Generators, Boiler Construction, Boiler Settings, Boiler Inspection and Testing, Types of Steam Power Plants, Combustion, Fuel-Burning Equipment, Pumps, Feedwater Heaters, Water Treatment, Steam Turbines, Condensers, Balance-of-Plant Accessories, Technical Definitions, Mathematics, HVAC, Refrigeration, Compressed Air Systems, Electricity, Lubrication, Chemistry and Physics.
24 Instruction Hours

OC-150: Chief Engineer Review Course
This is a 36-hour course that prepares candidates to take a Chief Engineer Examination or its equivalent. The preparation portion of the course includes review of the following subject material: Fuels, Combustion, Draft, Steam Generators, Types of Steam Power Plants, Feedwater Heaters, Superheaters, Attemperators, and Economizers, Air Heaters, Water Treatment, Boiler Construction and Settings, Boiler Inspection and Testing, Fuel-Burning Equipment, Fuel Handling, Boiler Efficiency, Piping, Steam Turbines, Condensers, Balance-of-Plant Equipment, Mathematics, HVAC, Refrigeration, Compressed Air Systems, Electricity, Lubrication, Physics, Mechanics, Chemistry, Technical Drawings, Management, Maintenance Programs, Economics, Property Improvement, Supervision, Technical Writing.
36 Instruction Hours

OC-160: Stationary Engineer Combination Review Course
Course duration is up to 40 hours. Topics covered and instruction hours are contingent upon the mix of license levels specified by the customer.
Up to 40 Instruction Hours