What We Are About

ASOPE performs the following major functions:

1. Establishes and maintains uniform qualification standards for the profession of Power Engineers.

2. Promotes safety in the operation of power generating equipment.

3. Encourages the enforcement and compliance to all codes, laws, and acts assuring the protection of health, life and property, i.e., the Occupational Safety and Health Act of 1970, Public Law 91-596, and the accepted engineering practice standards of the Boca International Mechanical Code.

4. Assists licensing agencies to determine the competence of professional Power Engineers through investigations and examinations that test the qualifications of candidates for licenses issued under the rules of ASOPE.

5. Assists States and Municipalities to establish power engineer licensing agencies and to act as a clearinghouse to facilitate reciprocity between licensing agencies.

6. Maintains a registry of all authorized ASOPE examination agencies and examiners.

7. Develops and keeps current uniform terms and definitions, updating terminology and eliminating obsolete terms.

8. Promotes the education of Power Engineers.

9. Publishes a standard curriculum for education and guideline for study requirements.

10. Acts as an advisor to educational entities engaged in teaching power engineering and technology to promote the education of the Power Engineer

History

ASOPE was conceived and organized by engineers and professionals who were and are members of other licensing agencies. These persons realize the necessity of maintaining a purely third party agency, that is not affiliated with any labor organization or other organization to avoid a conflict of interest.

These persons recognized the need for improved professional standards and testing methods that help provide competency in the diverse field of Power Engineering and help assist individuals seeking to advance in the profession of Power Engineering.

These persons realized the Power Engineer today is a person who practices the profession of Power Engineering in a more diverse field than the previous traditional boiler or steam engine operator. The Power Engineer Today may be charged with facility or building operation and maintenance including boiler and boiler auxiliary equipment operation and maintenance including HVAC, refrigeration, water, steam, air, and electrical systems and controls.

The Power Engineer may also operate maintain power boilers, turbines and generators that are connected to a grid for electrical power and co-generation of steam and electric.

While the basic principles of power engineering are the same, the magnitude of the application of varies significantly between facility and power plant operation and maintenance

ASOPE Power Engineer License Competency Program

The ASOPE Competency program was designed for persons working in the diverse profession of Power Engineering.
The ASOPE competency program is open to anyone in the profession of power engineering. Participation in the competency program is voluntary.
The ASOPE program provides an individual with the means of measures designed to advance in all matters related to the safe, efficient management of energy.

The program objective is to provide the recognition and promotion of high professional standards in the field of Power Engineering demonstrated through competency testing.

Only ASOPE Approved Examination Agencies and approved examiners administer the competency examinations.

Training and Examination

ASOPE is not a training provider. ASOPE will provide standardized curriculum and also act as an advisor to educational entities engaged in teaching power engineering and technology to promote the education of a Power Engineer. ASOPE may contract training with a training entity that agrees to base training on ASOPE approved curriculum.

ASOPE has contracted a training organization to provide training based on curriculum approved by ASOPE. Only ASOPE approved and authorized Training Organizations and Examination Agencies may use the American Society of Power Engineers name, logo and/or trademark. Please contact ASOPE or view this web page to find ASOPE approved training providers.

American Society of Power Engineers
Power Engineer Competency License Program

The American Society of Engineers has three license program categories. The first is the Main Power Engineer Competency license program, the second is the Supplementary Power Engineer Competency license program and the last is The Hobbyist and Specialty Power Engineer Competency license program.

1. Main Power Engineer Competency License Program

The ASOPE Main Power Engineer Competency license program consists of Facilities, Power Plant and Combustion Turbine simple and combined cycle classifications.

"A person who is looking to start their career in the Power Engineering profession may start at the Facility Operating Engineer 3rd Class level, which is designed as an entry point for the person with minimal experience. As the person gains experience, they can continue to progress to Facility Operating Engineer First Class. If the person desires to progress further in the profession of Power Engineering, they may cross over to the classification of Power Plant Operating Engineer at the Facility Operating Engineer First Class level. The person may elect to use the experience gained as a Facility Operating Engineer Second Class to cross over to the classification of Power Plant Operating Engineer 3rd class. If a person proves they meet the qualification for a particular classification and grade of license the person may take the examination for that classification and grade with out taking the lower grade examination for the classification.

It is possible a person may also start their career in Combustion Turbines. This part of the program is designed for entry level to start at the Simple Cycle Combustion Turbine Operating Engineer 3rd class and progress through the various steps of the simple cycle and combined cycle combustion turbine program. A person could use their experience gained as a Simple Cycle CT Plant Operating Engineer second class to cross over to Combined Cycle CT Plant Operating Engineer Third Class.

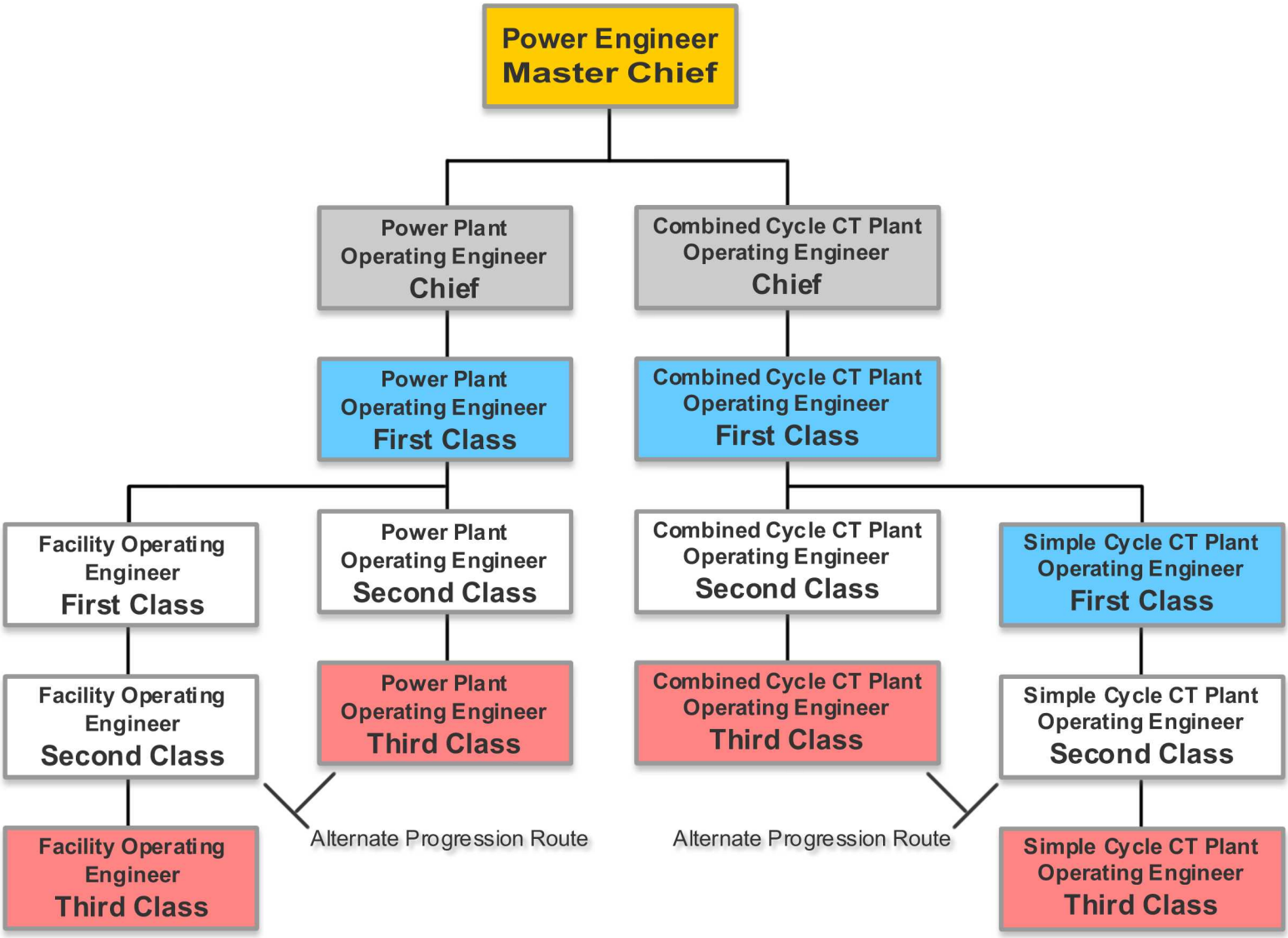
2. Supplementary Power Engineer Competency License Program

The ASOPE Power Engineer Supplementary Competency License Program consists of the classifications of Refrigeration, Diesel and Hydro. These license classifications are not used for progression in the Main Competency license program but have their own separate progression and are used also as supplements to the Main Power Engineer Competency license program.

3. Hobbyist and Specialty Power Engineer Competency License Program

The ASOPE Hobbyist and Specialty Power Engineer Competency License Program is designed for the Power Engineer operating and maintaining Traction Engines, Vintage Engines and Locomotive Engines. These classifications of Power Engineering are stand alone for each classification and are not used for progression in the Main Competency or the Supplementary Competency License Programs.
This program also recognizes the power engineer who through their career worked to promote the profession of the Power Engineer.

Main Power Engineer Competency License Progression Flowchart



Power Engineer Master Chief

Qualifications

Minimum age - Adult
Education - High School Diploma / GED or equivalent
Experience – eight years. Required to hold both Power Plant Operating Engineer Chief and Combustion Turbine Combined Cycle Chief one year minimum each.
Examination - Written (Oral or Practical when necessary)
Prime Mover Horsepower (unsupervised) - Unlimited
Maximum Boiler Size (unsupervised) HP - Unlimited BHP - LP - Unlimited BHP
Refrigeration or Air Conditioning (unsupervised) –Unlimited tons

Curriculum at the Minimum

The following areas are in addition to the Minimum Curriculum for the Power Plant Operating Engineer Chief and the Combustion Turbine Combined Cycle Chief .

- Power Plant Safety
- Power Plant Math-Science
- Power Plant Water Chemistry
- Power Plant Waste Water Treatment
- Power Plant Electrical Generation and Transmission
- Power Plant Instrumentation and Control Systems
- Power Plant Environmental Equipment
- Power Plant Combustion By Products Removal and Disposal
- Power Plant Pressure Vessel Inspection
- Power Plant Personnel Management
- Power Plant Computer Management
- Power Plant Efficiency
- Facility Project Management
- Facility Building Maintenance
- Facility HVAC

Power Plant Operating Engineer
Chief

Qualifications
Minimum age - Adult
Education - High School Diploma / GED or equivalent
Experience - Five years
Examination - Written (Oral or Practical when necessary)
Minimum time in previous grade – One year
Prime Mover Horsepower (unsupervised) - Unlimited
Maximum Boiler Size (unsupervised) HP - Unlimited BHP - LP - Unlimited BHP
Refrigeration or Air Conditioning (unsupervised) –Unlimited tons

Curriculum at the Minimum:

- Power Plant Safety
- Power Plant Steam Generator Construction and Types
- Power Plant Water Chemistry
- Power Plant Condensate and Feedwater Treatment and Equipment
- Power Plant Steam Generator Combustion Air and Flue Gas System and Equipment
- Power Plant Steam Generator Fuel System and Equipment
- Power Plant Water-Steam Heating System and Equipment
- Power Plant Steam Generator Fittings and Accessories
- Power Plant Instrumentation
- Power Plant Compressed Air System and Equipment
- Power Plant Combustion and Combustion Equipment
- Power Plant Electricity
- Power Plant Math-Science
- Power Plant Turbine Construction and Associated Equipment
- Power Plant Condenser and Circulating Water System and Equipment
- Power Plant Extraction Steam and Heaters and Associated Equipment
- Power Plant Air Conditioning / Refrigeration
- Power Plant Environmental Equipment
- Power Plant Combustion Byproduct Disposal and Removal
- Power Plant Backflow Prevention
- Emergency Diesel Systems and Associated Equipment
- Power Plant Personnel Management
- Power Plant Computer Management
- Power Plant Preventative Maintenance
- Power Plant Steam Generator Inspection
- Power Plant Boiler Testing

Power Plant Operating Engineer
First Class

Qualifications
Minimum age - Adult
Education - High School Diploma / GED or Equivalent
Experience - Four years
Examination - Written (Oral or Practical when necessary)
Minimum time in previous grade - One year or one year in grade as a Facility Operating Engineer 1st class.
Maximum Prime Mover Horsepower (Unsupervised) - 7500
Maximum Boiler Size (Unsupervised) HP - 1500 BHP / LP Unlimited BHP
Maximum Refrigeration or Air Conditioning (Unsupervised) - 5000 tons

Curriculum at the Minimum

- Power Plant Safety
- Power Plant Advanced Steam Generator Construction
- Types of Steam Generators
- Power Plant Advanced Steam Generator Water Chemistry
- Power Plant Advanced Condensate and Feedwater Treatment
- Power Plant Advanced Steam Generator Combustion Air and Flue Gas System and Equipment
- Power Plant Advanced Steam Generator Fuel System and Equipment
- Power Plant Piping Systems
- Power Plant Advanced Steam Generator Fittings and Accessories
- Power Plant Advanced Instrumentation
- Power Plant Compressed Air and Hydraulic Systems
- Power Plant Advanced Combustion and Combustion Equipment and Equipment
- Power Plant Advanced Steam System to Steam Accessories
- Power Plant Advanced Electricity
- Power Plant Advanced Math-Science
- Power Plant Advanced Steam Turbine Construction and Operation and Equipment
- Power Plant Advanced Condenser and Circulating Water System and Equipment
- Power Plant Advanced Extraction Steam Heaters Systems and Equipment
- Power Plant Advanced Air Conditioning / Refrigeration
- Power Plant Advanced Environmental Equipment and Equipment
- Power Plant Combustion Byproduct Disposal and Removal System and Equipment
- Emergency Diesel Systems and Associated Equipment
- Power Plant Backflow Prevention
- Power Plant Personnel Management
- Power Plant Computer Management
- Power Plant Preventative Maintenance

Power Plant Operating Engineer
Second Class

Qualifications

Minimum age - 20
Education - High School Diploma, GED or Equivalent
Experience - Three years
Examination - Written (Oral or Practical when necessary)
Minimum time in previous grade – One Year
Maximum Prime Mover Horsepower (Unsupervised) - 2500
Maximum Boiler Size (Unsupervised) HP - 600 BHP / LP Unlimited BHP
Maximum Refrigeration or Air Conditioning (Unsupervised) – 1000 tons

Curriculum at the Minimum

- Power Plant Safety
- Power Plant Intermediate Steam Generator Construction and Types
- Power Plant Intermediate Steam Generator Water Chemistry
- Power Plant Intermediate Condensate and Feedwater Treatment
- Power Plant Intermediate Steam Generator Combustion Air and Flue Gas System and Equipment
- Power Plant Intermediate Steam Generator Fuel System and Equipment
- Power Plant Intermediate Water-Steam Heating System
- Power Plant Intermediate Steam Generator Fittings and Accessories
- Power Plant Intermediate Instrumentation
- Power Plant Compressed Air System and Equipment
- Power Plant Intermediate Combustion and Combustion Equipment
- Power Plant Intermediate Steam System to Steam Accessories
- Power Plant Intermediate Electricity
- Power Plant Intermediate Math-Science
- Power Plant Intermediate Turbine Construction and Operation
- Power Plant Intermediate Condenser and Circulating Water System and Equipment
- Power Plant Intermediate Extraction Steam Heaters Systems
- Power Plant Intermediate Air Conditioning / Refrigeration
- Power Plant Intermediate Environmental Equipment
- Power Plant Combustion Byproduct Disposal and Removal Systems and Equipment
- Power Plant Backflow Prevention
- Power Plant Intermediate Personnel Management
- Power Plant Intermediate Computer Management
- Power Plant Intermediate Preventative Maintenance

Power Plant Operating Engineer
Third Class

Qualifications
Minimum age - 19
Education - High School Diploma, GED or equivalent. Completion of The Primedia Interactive Plant Operations CD-Rom or Web based Training or equivalent plant operations training.
Experience - Two years or One year time in grade as a Facility Operating Engineer 2nd class may be used for the 2 years experience for Power Plant Operating Engineer 3rd class
Examination - Written (Oral or Practical when necessary)
Maximum Prime Mover Horsepower (Unsupervised) - 1500
Maximum Boiler Size (Unsupervised) HP - 400 BHP / LP - Unlimited BHP
Maximum Refrigeration or Air Conditioning (Unsupervised) - 600 ton

Curriculum at the Minimum:

- Power Plant Safety
- Power Plant Basic Steam Generator Construction
- Types of Steam Generators
- Power Plant Basic Steam Generator Water Chemistry
- Power Plant Basic Condensate and Feedwater Treatment and Equipment
- Power Plant Basic Steam Generator Combustion Air and Flue Gas System and Equipment
- Power Plant Basic Steam Generator Fuel System and Equipment Power Plant Basic Water-Steam Heating System
- Power Plant Basic Steam Generator Fittings and Accessories and Equipment
- Power Plant Basic Instrumentation
- Power Plant Compressed Air System
- Power Plant Basic Combustion and Combustion Equipment and Equipment
- Power Plant Basic Steam System to Steam Accessories
- Power Plant Basic Electricity
- Power Plant Basic Math-Science
- Power Plant Basic Steam Turbine Construction
- Power Plant Basic Condenser and Circulating Water System and Equipment
- Power Plant Basic Air Conditioning
- Power Plant Basic Environmental Equipment

Facility Operating Engineer
First Class

Qualifications

Minimum age - Adult
Education - High School Diploma, GED or equivalent
Experience - Two years
Minimum time in previous grade - One year.
Examination - Written (Oral or Practical when necessary)
Maximum Prime Mover Horsepower (Unsupervised) - 1000 Hp
Maximum Boiler Size (Unsupervised) HP - 300 BHP / LP Unlimited BHP
Maximum Refrigeration or Air Conditioning (Unsupervised) 500 ton

Curriculum at the Minimum

- Advance Mathematics
- Advanced Electrical Equipment Diagnostics
- Facility Motor Operation and Maintenance
- Facility Lighting Efficiency
- Advanced Fuels Combustion and Efficiency
- Gas and Oil Fuel Systems Operation and Maintenance
- Boiler and Steam System Operation
- Steam System Efficiency
- Advanced Boiler Construction
- Intermediate Physics and Chemistry
- Advanced Boiler Maintenance
- Advanced Burner Safety and Operating Control Systems
- Heat Engines
- Heat Recovery Systems
- Facility Water Usage and Efficiency
- Emergency Diesel Generator Operation and Maintenance
- Pump and Valve Maintenance
- Facility Energy Efficiency
- Facility Building Heating and Cooling Systems Control Optimization
- Facility Refrigeration Systems Operation and Maintenance
- Air Compressor Operation and Maintenance
- Facility Pneumatic and Electrical Controls Operation and Maintenance
- Facility Air Quality Control
- Safety and Environmental codes
- Facility Maintenance Management Systems

Facility Operating Engineer
Second Class

Qualifications

Minimum age - 19
Education - High School Diploma, GED or Equivalent.
Experience 1 year
Note: One year time in grade as a Facility Operating Engineer 2nd class may be used for the 2 years experience for the Power Plant Operating Engineer 3rd class
Minimum time in previous grade - One year
Maximum Boiler Size (Unsupervised) HP - 110 BHP / LP - 450 BHP
Maximum Refrigeration or Air Conditioning (Unsupervised) 100 ton

Curriculum at the Minimum

- Intermediate Mathematics
- Intermediate Electrical Theory AC and DC. and Electrical Equipment
- AC and DC Motors
- Intermediate Heat Transfer and Fluid Flow
- Advanced Combustion Theory
- High Pressure and Low Pressure Boilers Types and Construction
- High and Low Pressure Boiler Safety Fixtures
- Gas and Oil Fuel Systems Maintenance and Operation
- Boiler and Steam System Operation
- Advanced Burner Safety and Operating Control Systems
- Boiler Inspection and Maintenance
- Steam and Hydronic Systems
- Boiler Water and Feedwater Treatment
- Facility Potable, Cooling and Make-up Water Systems Piping and Valves
- Facility Boiler Auxiliary Systems
- Basic Steam Turbine types and Operation
- Basic Steam Engine Operation
- Steam Plant Accessories
- Steam Heat Exchangers and Condensers
- Pump Types and Operation
- Facility Plant Thermal Efficiency
- Facility Intermediate Building Heating and Cooling Systems
- Facility Refrigeration Systems
- Air Compressors
- Facility Pneumatic and Electrical Controls Operation and Maintenance
- Facility Air Pollution and Ecology
- Facility Plant Safety
- Facility Maintenance Management Systems

Facility Operating Engineer
Third Class

Qualifications
Minimum age - 18
Education - High School Diploma, GED or equivalent
Experience - 6 months or 3 credit hour of Boiler Training or equivalent Power Engineering Training
Examination – Written (Oral or Practical when necessary)
Maximum Boiler Size (unsupervised) LP - 150 BHP
Maximum refrigeration or Air Conditioning (unsupervised) 100 ton

Curriculum at the Minimum

- Basic Mathematics
- Low Pressure Boilers Types and Construction
- Basic Boiler Fittings
- Safety and Relief Valves
- Basic Combustion Theory
- Fuels and Burner Types
- Steam and Hydronic Boilers
- Thermal fluid heaters
- Facility Valve Identification
- Basic Operation and care of Oil and Gas Burners
- Boiler Safety and Operating Controls
- Basic Boiler Operation
- Dangerous Boiler Conditions
- Facility Basic Steam Systems and Accessories
- Basic Electrical Theory
- General Industry Safety
- Facility Basic Potable. Makeup and Cooling Water Systems
- Facility Basic Preventive Maintenance
- Facility Basic Heating and Cooling Systems

Combined Cycle Plant Operating Engineer
Chief

Minimum age - Adult
Education - High School Diploma / GED or Equivalent
Experience - Five years
Examination - Written (Oral or Practical when necessary)
Minimum time in previous grade - One year
Maximum Prime Mover Horsepower (Unlimited)
Maximum Boiler Size (Unsupervised) - Unlimited BHP
Maximum Refrigeration or Air Conditioning (Unlimited) -

Curriculum at the Minimum:

- Suitability for Peaking and Black Start
- The Aero Jet Engine
- Gas Generator
- Free turbines
- Multi-shaft Arrangements
- Shaft Speeds
- Auxiliary Systems
- Compressed Air Starting
- Start-up and Operating Procedures
- Controls
- Operator-Maintenance Coordination
- Types of Maintenance: Running, Predictive and Preventive
- Operator Observations, Abnormalities and Defect Reports
- On-line and Off-line Maintenance
- Pressures and Temperatures
- Performance Testing
- Vibration Analysis
- Pre-planned Maintenance and Scheduled Outages
- Inspections: Combustion Equipment, Hot Gas Path and Major Overhaul
- Heat Contained in Exhaust Gas
- Heat Recovery
- Control of Exhaust Gas Temperature
- GT Load
- Inlet Guide Vanes
- Auxiliary Burners and fuels
- Typical Combined Cycle Configurations
- Steam Turbines for Combined Cycle
- HRSG Steam Bypass to Condenser
- Start-Up and Control of Combined Cycle Unit
- Generator Construction
- Hydrogen and Air Cooling
- Excitation Systems
- Control of MVARS
- Synchronizing

- Parallel Operation
- Auxiliary Power Supplies
- Generator Protection
- Electrical Transmission and Distribution Systems
- General Industrial Safety
- Environmental Regulations and Protection
- General Management
- Refrigeration

Combined Cycle CT Plant Operating Engineer
First Class

Minimum age - Adult
Education - High School Diploma / GED or Equivalent
Experience - Four years
Examination - Written (Oral or Practical when necessary)
Minimum time in previous grade - One year or one year in grade as a Simple Cycle Operating Engineer 1st class.
Maximum Prime Mover Horsepower (Unsupervised) - 7500
Maximum Boiler Size (Unsupervised) HP - 1500 BHP / LP Unlimited BHP
Maximum Refrigeration or Air Conditioning (Unsupervised) - 5000 tons

Curriculum at the Minimum:

- Suitability for Peaking and Black Start
- The Aero Jet Engine
- Gas Generator
- Multi-shaft Arrangements
- Shaft Speeds
- Auxiliary Systems
- Compressed Air Starting
- Start-up and Operating Procedures
- Controls
- Operator-Maintenance Coordination
- Types of Maintenance: Running, Predictive and Preventive
- Operator Observations, Abnormalities and Defect Reports
- On-line and Off-line Maintenance
- Pressures and Temperatures
- Performance Testing
- Vibration Analysis
- Pre-planned Maintenance and Scheduled Outages
- Inspections: Combustion Equipment, Hot Gas Path and Major Overhaul
- Examination by Borescope
- Heat Contained in Exhaust Gas
- Heat Recovery
- Control of Exhaust Gas Temperature
- GT Load
- Inlet Guide Vanes
- Auxiliary Burners
- Typical Combined Cycle Configurations
- Steam Turbines for Combined Cycle
- HRSG Steam Bypass to Condenser
- Start-Up and Control of Combined Cycle Unit
- Generator Construction
- Hydrogen and Air Cooling
- Excitation Systems
- Control of MVARS

- Synchronizing
- Parallel Operation
- Auxiliary Power Supplies
- Generator Protection
- Basic Management Skills
- Electrical Transmission and Distribution Systems
- General Industrial Safety
- Environmental Regulations and Protection.

Combined Cycle CT Plant Operating Engineer
Second Class

Qualifications
Minimum age - 20
Education - High School Diploma, GED or Equivalent
Experience - Three years
Examination - Written (Oral or Practical when necessary)
Minimum time in previous grade – One Year
Maximum Prime Mover Horsepower (Unsupervised) - 2500
Maximum Boiler Size (Unsupervised) HP - 600 BHP / LP Unlimited BHP
Maximum Refrigeration or Air Conditioning (Unsupervised) – 1000 tons

Objectives:

- Start-Up Prerequisites
- Start-Up Procedure
- Purge Control
- Ignition
- Load Changes
- Governor Control
- Exhaust Temperature Control
- Shutdown Procedure
- Turning Gear
- Operating Hazards
- Mechanical, Thermal, and Combustion
- Monitoring Conditions
- Indications and Logging Information
- Alarms/Annunciators
- Permissive Conditions and Relays
- Protection Devices
- Control Equipment
- Computer Controlled Systems
- Heat Transfer
- Natural Circulation
- Forced Circulation
- Typical HRSG Construction
- Economizer
- Evaporator
- Superheater
- Steam Fundamentals
- Superheat, Reheat, Steam Temperature Control
- Multi-pressure HRSG's
- Dampers
- Monitoring Gas Temperatures
- Condensate and Feedwater System and Controls
- Make-up, Boiler Water Chemical Control and Additives
- Advanced Electricity

- Advanced Refrigeration
- Basic Steam Turbines
- Environmental Limits
- Generator Electrical Theory
- General Industry Safety

Combined Cycle CT Plant Operating Engineer
Third Class

Qualifications
Minimum age - 19
Education - High School Diploma, GED or equivalent. Completion of The Primedia Gas Turbine Interactive CD-Rom or Web based Training or equivalent plant operations training.
Experience - Two years or One-year time in grade as a Simple Cycle CT Plant Operating Engineer second class
Examination - Written (Oral or Practical when necessary)
Maximum Boiler Size (Unsupervised) HP - 400 BHP / LP - Unlimited BHP
Maximum Refrigeration or Air Conditioning (Unsupervised) - 600 ton

Curriculum at the Minimum:

- Gas Turbine Cycles
- Single and Two Shaft Arrangement
- Exhaust Heat Recovery
- Combined Cycle
- Compressors
- Axial Flow
- Centrifugal Flow
- Compressor Stall at Startup
- Combustion Arrangements
- Turbine Construction
- Blade Cooling
- Turbine Efficiency
- Exhaust Frame Assembly
- Gas Turbine Starting.
- Oil Systems
- Combustion System
- Fuel System
- Oil, Gas and Air Systems
- Cooling
- Sealing
- Atomizing
- Purge
- Primary Air Inlet System
- Environmental Limits
- Heat Transfer
- Natural Circulation
- Forced Circulation
- Typical HRSG Construction
- Economizer
- Evaporator
- Superheater
- Steam Fundamentals
- Superheat, Reheat, Steam Temperature Control

- Multi-pressure HRSG's
- Dampers
- Monitoring Gas Temperatures
- Condensate and Feedwater System and Controls
- Make-up, Boiler Water Chemical Control and Additives
- Basic Electricity
- Basic Refrigeration
- Environmental Concerns
- General Industrial Safety

Simple Cycle CT Plant Operating Engineer
First Class

Qualifications
Minimum age - Adult
Education - High School Diploma / GED or Equivalent
Experience - Four years
Minimum time in previous grade – 2 Years
Examination - Written (Oral or Practical when necessary)
Maximum Refrigeration or Air Conditioning (Unsupervised) - 5000 tons

Curriculum at the Minimum:

- Suitability for Peaking and Black Start
- The Aero Jet Engine
- Gas Generator
- Free Turbine
- Multi-shaft Arrangements
- Shaft Speeds
- Auxiliary Systems
- Compressed Air Starting
- Start-up and Operating Procedures
- Controls
- Operator-Maintenance Coordination
- Types of Maintenance: Running, Predictive and Preventive
- Operator Observations, Abnormalities and Defect Reports
- On-line and Off-line Maintenance
- Pressures and Temperatures
- Performance Testing
- Vibration Analysis
- Pre-planned Maintenance and Scheduled Outages
- Inspections: Combustion Equipment, Hot Gas Path and Major Overhaul
- Examination by Borescope
- Generator Construction
- Hydrogen and Air Cooling
- Excitation Systems
- Control of MVARS
- Synchronizing
- Parallel Operation
- Auxiliary Power Supplies
- Generator Protection
- Basic Management Practices
- Electrical Transmission and Distribution Systems
- General Industrial Safety
- Environmental Regulations and Protection.

Simple Cycle CT Plant Operating Engineer
Second Class

Qualifications
Minimum age - 20
Education - High School Diploma, GED or Equivalent
Experience - Two years

> **Note:** One year time in grade as a Simple Cycle CT Plant Operating Engineer second class may be used for the 2 years experience for the Combined Cycle CT Plant Operating Engineer 3rd Class

Minimum time in previous grade – One Year
Examination - Written (Oral or Practical when necessary)
Maximum Refrigeration or Air Conditioning (Unsupervised) – 1000 tons

Curriculum at the Minimum:

- Gas Turbine Cycles
- Single and Two Shaft Arrangement
- Exhaust Heat Recovery
- Combined Cycle
- Compressors
- Axial Flow
- Centrifugal Flow
- Compressor Stall at Startup
- Combustion Arrangements
- Turbine Construction
- Blade Cooling
- Turbine Efficiency
- Exhaust Frame Assembly
- Gas Turbine Starting Devices
- Oil Systems
- Combustion System
- Fuel Systems and Type Combustors Nozzles/Burners
- Oil, Gas and Air Systems
- Cooling Systems
- Sealing Systems
- Purge Systems
- Primary Air Inlet System
- Environmental Limits
- Generator electrical theory
- Basic Refrigeration
- General Industry Safety

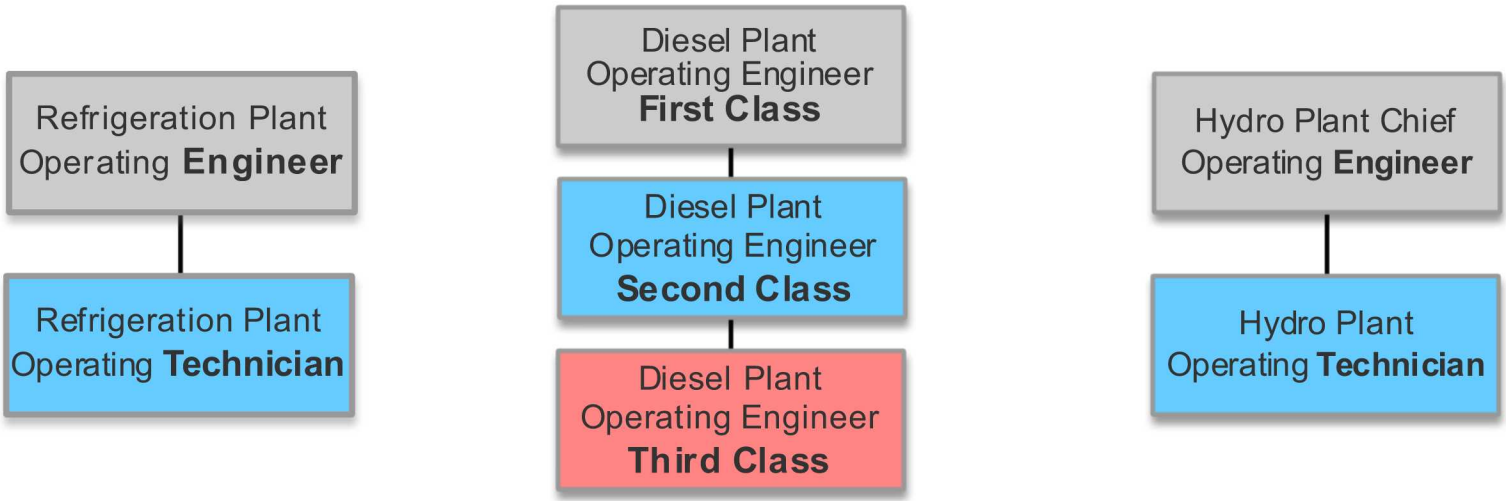
Simple Cycle CT Plant Operating Engineer
Third Class

Qualifications
Minimum age - 19
Education - High School Diploma GED or equivalent. Completion of The Primedia Gas Turbine Interactive CD-Rom or Web based Training or equivalent plant operations training.
Experience - One Year Simple Cycle CT operations and/or maintenance Examination - Written (Oral or Practical when necessary)
Maximum Refrigeration or Air Conditioning (Unsupervised) - 600 ton

Curriculum at the Minimum:

- Gas Turbine Cycles
- Single and Two Shaft Arrangement
- Exhaust Heat Recovery
- Combined Cycle
- Compressors
- Axial Flow
- Centrifugal Flow
- Compressor Stall at Startup
- Combustion Arrangements
- Turbine Construction
- Blade Cooling
- Turbine Efficiency
- Exhaust Frame Assembly
- Gas Turbine Starting Devices
- Oil Systems
- Combustion System
- Fuel Systems and Type Combustors Nozzles/Burners
- Oil, Gas and Air Systems
- Cooling Systems
- Sealing Systems
- Purge Systems
- Primary Air Inlet System
- Environmental Limits
- Basic Electricity
- Basic Refrigeration
- Turbine and generator safety devices
- General plant safety
- Environmental Concerns.

Supplementary Competency License Progression Flowchart



Refrigeration and HVAC Operating Engineer

(For Supervisors and Service Managers)

Qualifications

Minimum age - Adult
Education - High School Diploma, GED or equivalent
Experience - Two years as a Refrigeration and HVAC Technician or AS Degree Air Conditioning and Supervise one or more Technicians. and Hold EPA CFC License
Minimum Time in Previous Grade - 2 years
Examination - Written (Oral or Practical when necessary)
Maximum Prime Mover Horsepower (Unsupervised) - unlimited
Maximum Refrigeration or Air Conditioning (Unsupervised) unlimited

Curriculum at the Minimum

- Thermodynamics, Heat Transfer Theory
- Principles of heat and temperature measurement
- States of Matter
- Gas Laws
  Boyle's Law, Charles' Law, Dalton's Law, General Principles of Perfect gases
- Safe Handling, Transportation, and Disposal of Refrigerants, Manufacturer Certification R410A
- Hydrocarbon Refrigerant Oils
- Ammonia (Refrigerant)
- Lithium Bromide (Absorbent)
- Principles of Pressure and Pressure Measurement
- Refrigeration Cycle (Compression/Hydrocarbon Refrigerants)
- Hydrocarbon Refrigerant
- EPA Universal Certified for
- Refrigeration System Components
  Evaporators and Condensers, Heat Exchangers
- Compressors (Electric Motor or Engine-Driven)
  Reciprocating, Screw, Scroll, Rotary-Helical, Centrifugal
- Metering Devices (Direct Expansion/Hydrocarbon Refrigerants)
  Capillary Tube, Orifice, Expansion Valves (TXV, AXV, TAXV)
  Hot Gas Bypass Valves, Condenser Pressure Regulating Valves
- Air Conditioning Systems
  Package Systems (Gas/Electric, Heat Pump, Oil/Electric, Etc.), Window Units, Portal Units (Thru-The-Wall), Rooftop Units (HVAC, Vav), Unitary Systems (Split Systems), Condensing Units, Air Handling or Fan Coil Units, Refrigerant Piping, Line Sizing, Installation
- Heat Pump Systems
  Air Source, Water Source, Ground Source, Supplemental or Cascade
- Cooling Towers /Evaporative Coolers
- Thermal Storage Systems
- Refrigeration Systems (Commercial)
  Coolers and Freezers (Walk-In, Reach-In, Display), Refrigerated Air Dryers and Ice Machines
- Psychometrics

- Temperature and Humidity Control Systems
- Air Filtration and Duct Cleaning
- Air Quality Measurement And Control
  CO^2, Co, O2, 0 & Contaminant Testing
- Fans
- Pumps (Water/Fluids)
- HVAC Electrical Fundamentals
- HVAC Electrical Components
  Wiring Insulation And Sizing, Fuses, Breakers, Starters – Low Voltage (480 Volts Or Less), High Voltage (208 Through 4,800 Volts Or More), Automated Switchgear, Current Sensing Meters and Motor Control
- Electromechanical Controls
- Pneumatic Controls
- DDC Controls For Building Automation
- Computer Literacy
  Identify And Work With Existing Applications (Excel, Word, Powerpoint, Access, Outlook)
- Electric Transformers
- DC Power Supplies And Converters
- Ups Systems
- Variable Frequency Drives
- Electric Motors (AC And DC)
- Engine Driven Suppressers and Pumps
- Troubleshooting ACR Electrical Systems
  Personal Protective Equipment, Lockout/Tagout Practices, Meter Categories, Test Procedures, Electrical Diagrams, Schematic (Ladder) Diagrams, Pictorial Diagrams, Installation Diagrams, Fundamentals Of Electrical Trouble Shooting, Trouble Shooting Electrical Components.
- ACR System Service
  System Base Lining, Service Equipment And Practices, System Start-Up, Operational Checks. Preventive Maintenance and Mechanical Troubleshooting

Refrigeration and HVAC Operating Technician

Qualifications

Minimum age - Adult
Education - High School Diploma, GED or equivalent
Experience - Two years or AS Degree Air Conditioning and hold EPA CFC License
Examination - Written (Oral or Practical when necessary)
Maximum Prime Mover Horsepower (Unsupervised) - unlimited
Maximum Refrigeration or Air Conditioning (Unsupervised) unlimited

Curriculum at the Minimum

- First Law Of Thermodynamics
- Second Law Of Thermodynamics
- Heat Transfer Theory
- Principles Of Heat And Temperature Measurement
- States Of Matter
- British Thermal Unit
- Specific Heat, Sensible Heat, Latent Heat & Superheat
- Gas Laws
- Pressure
- Compression Refrigeration Cycle
- Refrigerants And Refrigerant Oils, Refrigerant Safety, Refrigerant Types, New Azeotropic Refrigerants, Including R-410A, Section 608 Clean Air Act
- Refrigeration System Components
  Evaporators, Compressors, Condensers, Metering (Expansion) Devices
- Refrigeration System Accessories
  Three Position Service Valve, Schraeder Port, Receiver, Filter-Drier, Sight Glass With Moisture Indicator, Suction Accumulator, Crankcase Heater, Crankcase Pressure Regulator, Evaporator Pressure Regulator.
- Air Conditioning (Comfort Cooling) System
  Package Systems, Packaged Terminal (Pt Ac) Units, Rooftop Units, Unitary Systems Line Sets, Refrigerant Piping, Determining System Charging Requirements, Heat Pump Systems, Air-Source, Water-Source, Ground-Source, Supplemental Heating And Cooling.
- Refrigeration Systems
  Commercial Refrigeration Systems, Refrigerated Display And Storage, Frozen Display And Storage, Refrigerated Air Dryers, Ice-Making Equipment And Ice Cream Making Equipment
- Psychometrics (Study Of Air – The Soul of Air Conditioning)
- HVAC Electrical Fundamentals
  Electrical Safety, Power Calculation, Power Factor, Electrical Circuits
- Electrical Components of ACR Systems
  Wiring, Circuit Protective Devices, Fuses, Circuit Breakers, Component Protective Devices, Overloads, Control Devices, Motors, and Transformers
- Troubleshooting ACR Electrical Systems
  Personal Protective Equipment, Lockout-Tagout Practices, Meter Categories, Test Procedures, Electrical Diagrams, Schematic (Ladder)

Diagrams, Pictorial Diagrams and Installation Diagrams

- ACR System Service System
  Baselining, Data Collection, Service Equipment and Practices, System Start-Up, Preoperational And Operational Checks, Preventive Maintenance and Mechanical Troubleshooting
- Computer Word Document Processing and Spreadsheet Usage
- Water Treatment Theory, Operation and Control
- HVAC System Controls, Technology and Controller Action
- Equipment Protection
- System-Level Control
- System Optimization
- Sequences of Operation
- Selection of Controlled Devices
- Building Management
- Responding to Comfort Complaints
- Time-of-Day Scheduling
- Centralized Alarms and Diagnostics
- Remote Access
- Preventive Maintenance
- Reports
- Integration With Other Systems

Diesel Plant Operating Engineer
First Class

Qualifications

Minimum age - Adult
Education - High School Diploma / GED or Equivalent
Experience - Four years Maximum Refrigeration or Air Conditioning (Unsupervised) unlimited

Curriculum at the Minimum

- Refrigeration Systems Operation and Maintenance
- Switchgear
- Synchronizing and Load Control
- Voltage Control and Excitation
- MW and MVARS
- Governor Characteristics
- Stopping and Starting Procedures
- Excitation Systems Cooling;
- Monitoring Engine Operation
- Operating Guidelines
- Control Systems
- Protection Devices
- Station Service A.C. Power Supply
- D.C. Power Supply
- Station Battery
- Plant Local and Remote Control Systems
- Maintenance Planning
- Electrical Generation, Distribution and Transmission safety
- General Maintenance Practices
- Environmental Regulations

Diesel Plant Operating Engineer
Second Class

Qualifications
Minimum age - 20
Education - High School Diploma, GED or Equivalent
Experience - Three years
Minimum time in previous grade – One Year
Examination - Written (Oral or Practical when necessary)
Maximum Refrigeration or Air Conditioning (Unsupervised) – 1000 tons

Curriculum at the Minimum:

- Fuel Storage and Preparation
- Fuel Injection System
- Starting System
- Lube Oil System
- Governor System
- Primary and Secondary Cooling Systems
- Exhaust System
- Heat Recovery Systems
- Turbo Chargers
- Generator Construction
- Power Generation
- Principles of A.C. Generation Speed and Frequency
- HVAC Systems
- Compressed Air Systems
- Spill Prevention and Countermeasures
- Diesel Engine Operational Safety

Diesel Plant Operating Engineer
Third Class

Qualifications
Minimum age - 19
Education - High School Diploma, GED or Equivalent.
Experience – Two years
Examination - Written (Oral or Practical when necessary)
Maximum Refrigeration or Air Conditioning (Unsupervised) - 600 ton

Curriculum at the Minimum:

- Basic Thermodynamics
- Basic Measuring Instruments
- Fuels
- Operating Fundamentals
- Two-Stroke and Four-Stroke Cycles
- High Speed Engines
- Low Speed Engines
- Engine Construction And Layout
- Diesel Engine Components
- Valve Arrangements
- Typical Operating Efficiencies
- Basic HVAC Cycle
- General Industrial Safety
- Basic Electrical Theory
- Environmental Effects

Hydroelectric Plant Chief Operating Engineer

Qualifications
Minimum age - Adult
Education - High School Diploma / GED or equivalent
Experience - Five years
Examination - Written (Oral or Practical when necessary)
Minimum time in previous grade – One year
Prime Mover Horsepower (unsupervised) - Unlimited

Curriculum at the Minimum:

- General Safety
- Catchments Area
- Average Inflow
- Environmental Aquatic Effects
- Water Level Regulation
- Seasonal Inflow
- Long-Term Records
- Predictions
- Seasonal Control Curve
- Monitoring and Control of Headworks, Dams, Gates, Spillways, Canals, Forebay, Tailrace
- Generation, Transmission and Distribution
- Interconnected Power System
- Power System Security
- Load Dispatcher's Duties
- Frequency Control
- Economic Generation Dispatch
- AGC - Automatic Generation Control
- Characteristics of Generation (Fossil, Nuclear and Hydro)
- System Voltage Control
- Production of Reactive Power
- Pumped Storage
- Switchyard Layout and Equipment
- Features of Transformers, Circuit Breakers and Disconnects
- Station Service Supply
- Black Start Capability
- Auxiliary Power Distribution
- D.C. Power Supply and Application
- Critical A.C. Supply
- Uninterruptible Power Supplies
- Operational Safety Requirements
- Clearance Procedures
- Operating Parameters
- Sensors, Indicators, Recorders
- Alarms
- Excitation Control
- Power Factor
- Active and Reactive Power

- Generator Protective Devices
- Generator Electrical Protection Relays
- Digital Controls
- SCADA
- Power Plant Personnel Management
- Power Plant Computer Management
- Power Plant Preventative Maintenance
- General Management

Hydroelectric Plant Operating Technician

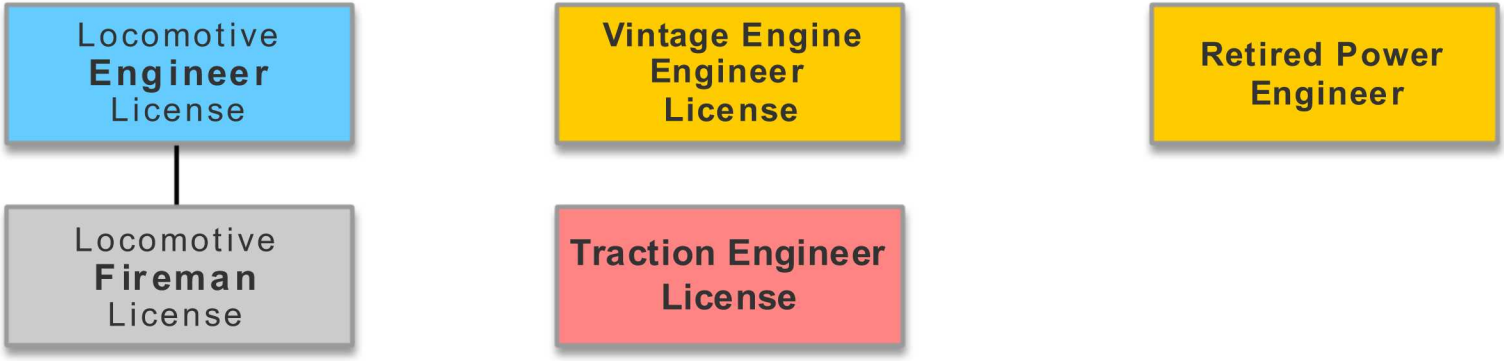
Qualifications
Minimum age - Adult
Education - High School Diploma / GED or equivalent
Experience – Two Years
Examination - Written (Oral or Practical when necessary)
Minimum time in previous grade – One year
Prime Mover Horsepower (unsupervised) - Unlimited

Curriculum at the Minimum:

- General Safety
- Hydraulic Principles
- Available Head
- Available Flow
- Conversion to Power
- Power Station Layout
- Principal Components
- Pump Storage Plants
- Service Water Systems
- Fire Protection Systems
- Compressed Air Systems,
- Dewatering Arrangements
- Drains and Sumps
- Oil Systems
- Common Elements of Auxiliary Equipment
- Effect of Head on Turbine Design
- Types of Turbines (Pelton, Francis, Kaplan)
- Characteristics of Different Turbines
- Function of Major Components
- Bearings and Lubrication Systems
- Draft Tube Setting and Tail Race
- Penstocks
- Shut-Off Valves
- Gates
- Surge Protection
- Turbine Runner Cavitation
- Anti-Cavitation Arrangements
- Generation Principles
- Bearings and Lubrication System
- Air Brake System
- Stator Cooling
- Number of Poles
- Speed and Frequency
- Rotor Field
- Stator Winding
- Stator Leads
- Neutral Grounding

- Isolated Phase Bus
- Excitation Systems
- Synchronizing
- Operating Parameters
- Sensors, Indicators
- Recorders
- Alarms
- Hydraulic Governors
- Governor Regulation
- Speed and Power Output Controls
- Gate Limiter
- Over Speed Protection
- Other Protective Devices
- Water Level Control and Regulation
- Effects On Environment

Hobbyist and Specialty Competency License Progression Flowchart



Locomotive Firemen

Qualifications
Minimum age - 18
Experience - proof of 25 hours of steam locomotive firing or attestation by two currently licensed steam locomotive firemen or steam locomotive Engineers as to applicant's experience and Competency.
Note: a valid state license or certificate is acceptable for proof of experience.
Examinations - Written (oral or practical where necessary)

Curriculum at the Minimum:

- Basic math and science
- Basic combustion theory
- Proper firing procedure
- General construction of a Locomotive boiler
- Boiler safety devices
- Boiler fittings and accessories
- Operation and testing of the water glass
- Operation and testing of the water column
- Operation and testing of gauge cocks
- Corrective measures for low water conditions
- Pre Trip inspection for leaks
- Railroad signals
- Railroad safety
- Faugh will

Steam Locomotive Engineer under 100 Tons

Qualifications
Minimum age - 21
Experience - proof of 50 hours of actual steam locomotive operation or attestation by two qualified
Steam Locomotive Engineers as to the applicant's experience and Competency.
Note: experience may be demonstrated by holding a valid state issued or railway issued steam locomotive Engineer's license or certificate.
Examination - written (oral or practical where necessary)

Curriculum at the Minimum:

- Basic math and science
- Basic combustion theory
- General construction of a Locomotive boiler
- Basic boiler maintenance
- Boiler safety devices
- Boiler fittings and accessories
- Corrective measures for low water conditions
- Locomotive construction
- Steam engine operating cycle
- Valve maintenance
- Bearing maintenance and lubrication
- Water glass test and operation
- Water column test and operation
- Gauge cock test and operation
- Pre trip Boiler Inspection
- Pre trip Machinery Inspection
- Railroad signals
- Railroad safety
- Breaks
- Proper use of sand

Vintage Engine Engineer

Qualifications
Minimum age - 18
Experience - Proof of 25 hours of actual traction engine operation or stationary Engine and high pressure boiler operation or attestation by two (2) currently licensed traction engine or vintage engine engineers to the applicant's experience and competency.
Note: Experience and Education may be waived if the applicant is holding a valid State issued license for operation of traction engines and high pressure boilers.
Examination - Written (Oral or Practical when necessary)

Curriculum at the Minimum:

- Basic math and science
- Basic combustion theory
- Most common types of vintage boilers
- Boiler safety devices
- Boiler fittings and accessories
- Corrective action for low water conditions
- Proper firing procedures
- Basic feed water chemistry
- Steam engine construction
- Steam engine operating cycle
- Basic valve setting
- Common types of valve gear
- Valve maintenance
- Bearing maintenance and lubrication
- Governor operation and maintenance
- Proper use of water glass, water column and gauge cocks
- Steam engine safety
- Public safety involving operation of boilers and engines

Traction Engine Engineer

Qualifications

Minimum age - 18

Education - Graduate of a Traction Engine School

Experience - Proof of 25 hours of actual traction engine operation or attestation by two (2) currently licensed Traction Engine Engineers to the applicant's experience and competency.

Note: Experience and Education may be waived if the applicant is holding a valid State issued license for operation of traction engines and boilers.

Examination - Written (Oral or Practical when necessary)

Curriculum at the Minimum:

- Basic Math-Science
- Basic Combustion Theory
- Types of Traction Engine Boilers
- Construction of Traction Engine Boilers
- Traction Engine Boiler Maintenance
- Boiler Safety Devices
- Boiler Fittings and Accessories
- Traction Engine Boiler Combustion Air and Flue Gas System
- Traction Engine Boiler Fuels and Fuel Systems
- Traction Engine Feed Water System
- Feed Water Chemistry Control
- Corrective Actions for Low Water Level Conditions
- Traction Engine Safety
- Steam Engine Construction
- Steam Engine Operating Cycle
- Valve Maintenance
- Bearing Maintenance and Lubrication
- Governor Operation and Maintenance
- Clutch Operation and Maintenance
- Steering Gear
- Lining up on the belt

Power Engineer
Retired

Qualifications
Minimum age -55 years and proof of retirement.

Experience - Must show proof of municipal, state, federal or other approved license with 10 years experience. If a person has not held any type Power Engineer, Stationary Engineer or Boiler license, the person may apply for an retired Power Engineers license if the person has 10 years experience. A detailed resume indicating duties and responsibilities including type and rating of equipment operated and attested to by two licensed persons or two qualified power operations persons.

Examination - None