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# Operator Certification Standardsfor Fossil Fuel Fired Plants

## Survey of State and Regional Requirements

# Operator Certification Standards for Fossil Fuel Fired Plants

Survey of State and Regional Requirements

**TR-114259**

Interim Report, December 1999

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ORGANIZATION(S) THAT PREPARED THIS DOCUMENT

**EPRI Simulator and Training Center**

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# CITATIONS

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# REPORT SUMMARY

The Environmental Protection Agency has only started addressing the issue of certification for fossil fuel power plant operators within the last two years. This report, which includes data collected from research of state and local authorities that currently require power plant operators to be certified or licensed, is the first phase of a certification program for Fossil Fuel Fired Power Plants. The report also addresses the possible future shortage of skilled workers needed by the power plants and the positive impact certification could have on filling operator positions.

### Background
In today's fossil plants the power plant operator needs to possess a large quantity of verifiable skills and knowledge. With today's aging and shrinking workforce power plants across the nation will soon experience the loss of many of their most knowledgeable personnel. Many of the younger replacement workers may join the growing trend of changing careers every five to seven years. This rapid turnover will force companies to hire workers that may not have all of the required skills needed to maintain a safe and productive plant. A comprehensive skills and knowledge certification program will play a major part in ensuring that the power plants in the future will be able to hire people that have demonstrated their abilities to perform the job that is required.

### Objective
To survey state, city, and county certification standards for fossil fuel plant operators; to evaluate the effectiveness of current certification programs and the prospects for future certification/licensing programs; to outline an improved certification program and the steps needed to implement it nationwide.

### Approach
The project team surveyed state, city, and county certification standards for fossil fuel plant operators and evaluated the effectiveness of current certification programs. The team proposed a program for the development of improved certification standards and analyzed the possible benefits of such standards in hiring suitable new personnel and avoiding accidents and environmental problems.

### Results
Most of the regulatory mandated fossil fuel power plant operator testing in force across the nation today uses a written test to judge whether an individual has the skills and knowledge to handle the operations of a multi-million dollar power plant. Skill testing is minimal. In nine states and over forty major cities only a written test is required to be a certified power plant operator. In the majority of these cities and states, applicants must have a certain number of years of experience in a certain position or job title before becoming eligible to take a test. However,

most experience requirements are quite general. The applicant's experience can be in maintenance, material delivery, or even sweeping the floor. These vague qualifications contrast strongly with what we require from airline pilots, doctors, or firemen, who must first demonstrate their skills in an array of simulated situations before being allowed to use their knowledge to save lives.

Knowledge and skill testing, conducted before an Operator Certification Certificate is issued, is the only way to ensure that the person running the multi-million dollar complex is prepared to handle a large number of the problems that may present themselves in the month and years to come. The use of simulators allows the operator to practice and experience many of the unknowns that he or she could be faced with in the future. Simulator testing as well as knowledge testing will help ensure that the person at the controls has the needed qualifications to be a Certified Operator.

## EPRI Perspective

An analysis of the current city and state requirements is currently being performed by the EPRI Simulator and Training (S&T) Center to determine the impact of certification programs in different locations. The EPRI S&T Center is working to define a certification program that will not only test operators with a pen and paper exam but will also gauge their problem solving skills and ability to handle a crisis by using power plant simulators and real life situations. Savings to power plants, insurance companies, and eventually consumers will come from the reduction and prevention of accidents, an increase in efficiency, and a decrease in insurance costs. Additional benefits will be realized through training of power plant operators to recognize the government requirements and restriction of environmental controls and maintain the plant within acceptable limits.


## TR-114259

## Keywords

Certification and licensing
Training
Fossil fuel power plants
Skill training
Simulators
Regulation

# ABSTRACT

Certification of Fossil Fuel Power Plant Operators has not received the attention and/or the government regulations of the Nuclear Industry. The Environmental Protection Agency has only started addressing the issue of certification for the fossil industry within the last two years.

This report is the first phase for developing a certification program for Fossil Fuel Fired Power Plants. Contained in this report is the data collected from research of state and local authorities that currently require power plant operators to be certified/licensed.

This report will also show future predictions dealing with the shortage of skilled workers needed by the power plants and the positive impact certification could have on filling operator positions. This report will address power plant accidents and accident prevention using qualified and skilled workers.

# CONTENTS

# 1
# IS OPERATOR CERTIFICATION FOR PROGRAMS OR INDIVIDUALS?

A majority of the regulatory mandated Power Plant Operator testing accomplished across the nation today currently uses a written test to judge whether an individual has the skills and knowledge to handle the operations of a multi-million dollar power plant. In today's school systems testing of knowledge is the main measurable factor. Skill testing is minimal and has very little bearing on whether a student is advanced to the next grade or repeats his or her current grade level again. In today's plants the Power Plant Operator needs to possess a large quantity of verifiable skills and knowledge. With today's aging and shrinking workforce many power plants across the nation will soon experience the loss of many of their most knowledgeable personnel. Many of the younger replacement workers may join the growing trend of changing careers every five to seven years. This may force companies to hire workers that may not have all of the required skills needed to maintain a safe and productive plant. A comprehensive skills and knowledge certification program will play a major part in ensuring that the power plants in the future will be able to hire people that have demonstrated their abilities to perform the job that is required.

The majority of apprenticeships, trade schools and in-plant training programs focus on skill and knowledge education to prepare a power plant operator for the majority of the operator's responsibilities. Most of these programs require that the operator trainee complete a minimum number of hours directly working at the controls of the power plant. Many of these programs also include skills testing along with the knowledge test. This type of education is designed to give and fully evaluate the trainee for the required skills and knowledge necessary to be certified as a Power Plant Operator.

In nine states and over forty major cities only a written test is required to be a certified Power Plant Operator. In the majority of these cities and states a number of years in a certain position or job title is required before you are eligible to take a test. In most cases the experience is validated by a testimonial from the individual's supervisor or someone of authority. Most experience requirements do not specify what the individual must have experienced. This experience could have been in maintenance, material delivery or even sweeping the floor.

Before an airline pilot, doctor, or fireman, are to be allowed to use their knowledge to save lives they must first demonstrate their skills in an array of simulated situations. This gives the public and the certification agency reassurance that these individuals have the necessary skills to perform their jobs correctly and accurately. The majority of today's automobile drivers attended a driver's education course that was equipped with driving simulators. This allowed them to practice their skills before being allowed to drive a car and possibly endanger the lives of others.

If the driver's education student could not pass the simulator portion of the course they were not issued a license.

Power plant operators are ultimately responsible for the complete operation of the plant. Their job is to institute certain operational procedures and respond to problems as they arise. In times of trouble the operator must be able to ascertain the problem and its cause. At that moment an operator must make a split second decisions on correcting the problem. Many problems not corrected immediately could create a situation that could cost millions of dollars in damage, personal injuries and even deaths.

With the still uncertain effects of deregulation many of the owners of these plants are abandoning the ideas of building new efficient power plants to replace the old. Many companies feel the continued use of the old plants is cost-effective and in the best interest of the company's future. Through continued operation of the old power plants, materials and equipment will continue to deteriorate. This will ultimately lead to an increase in breakdowns, unscheduled power outages and possible accidents. If not before, now is the time for each power plant to ensure that their operators are fully trained and qualified to handle the majority of problems as they arise and to be able to identify signs of posing problems.

Knowledge and skill testing, before an Operator Certification Certificate is issued, is the only way to ensure that the person running the multi-million dollar complex is prepared to handle a large number of the problems that may present themselves in the month and years to come. The use of simulators allows the operator to practice and experience many of the unknowns that he or she could be faced with in the future. Simulator testing as well as knowledge testing will help ensure that the person at the controls has the needed qualifications to be a Certified Operator.

Purchasing simulators for the use in testing is expensive. The simulator may be generic and not specific to any one plant. The main purpose of the simulator is to test the applicant's skill activities such as proper procedures for start-up, shut downs and handling emergencies. The cost of the four major explosions that have occurred in the first five months of 1999 is still being tabulated. This also included several workers injured and four deaths. If just one of these accidents could have been avoided through operator training and certification the cost savings to the company from just the damage could have paid for several simulators.

# 2
# OVERVIEW

The primary purpose of any certification program is to ensure that employees have the skill, knowledge and ability to perform critical tasks correctly. In the case of power plant operators they must possess the ability to perform routine tasks as well as manage crisis situations. Several methods are utilized to assess operator knowledge, skill and ability. Each method addresses a specific facet of human performance. Currently the traditional method of measuring knowledge is done with paper and pencil exams. Unfortunately, this method fails to measure a significant portion of the total skill set required to properly manage power plants under a wide range of conditions.

Companies assume that "if the operator has the knowledge, then he or she must also have the skills." However, over the last five years, statistics have shown that the major cause of accidents in fossil fuel power plants has been the result of operator error. These accidents have cost power companies and insurance companies thousands of dollars in repairs, lost revenue, medical costs and family settlements.

Power companies across the United States have used a wide range of criteria for the selection of operators. Clearly, this selection criteria has not ensured that operators have the proper training and skills needed. Recognizing and correcting a problem before it becomes a major incident is an ability that should be required of all operators. But how are these types of skills tested? How can a power company be confident that its plant operators possess those skills? As long as the plant is producing power, it is very likely that management will not be proactive in seeking additional training. They often wrongly assume that the operators have all the skills necessary to be fully qualified.

An analysis of the current city and state requirements is currently being performed by the EPRI Simulator and Training (S&T) Center to determine the impact of certification programs in different locations. The EPRI S&T Center is working to define a certification program which will not only test operators with a pen and paper exam but will also gauge their problem solving skills and ability to handle a crisis by using power plant simulators and real life situations. Savings to power plants, insurance companies and eventually consumers will come from the reduction and prevention of accidents, an increase in efficiency and decrease insurance costs. Additional benefits will be realized through training of power plant operators to recognize the government requirements and restriction of environmental controls and maintain the plant below the acceptable limits.

# 3
# CURRENT STATUS

At least ten states have adopted some form of certification requirements for fossil fuel plant operators. State requirements can vary from verbal testing to pencil and paper exams and most states lack requirements for continuing education for re-certification. Virginia has adopted a certification requirement, which allows cities to establish certification requirements for their area. The state performs the testing and issues the required license. However, as of this time, not one city has adopted any requirements.

Approximately forty-four cities, in states other than Virginia, have adopted some form of certification for power plant operators. The requirements vary from boiler operator to power plant control operator. Each city has developed a set of criteria for each classification with some cities committed to some or all of the following: educational requirements, on the job training, written test and/or performance testing. Any type of standardization for evaluating a person's job performance is totally lacking. The use of power plant simulators as a method of determining the skill level of a power plant operator does not appear in any of the city or state requirements. Adherence to some of these city requirements is a voluntary action on the part of the power company.

In 1990, a change to the Environmental Protection Agency's Clean Air Act required the EPA to develop a model state program for the training and certification of solid waste incineration unit operators and high-capacity fossil fuel-fired plant operators. In August of 1993, the EPA distributed a model state training program for municipal waste combusters (MWC), and medical waste incinerators (MWI). After the distribution of these materials the EPA contracted with the American Society of Mechanical Engineers (ASME) to develop and manage a nationwide certification program for MWC and MWI operators.

In October 1992, the EPA initiated development of a training program for operators of high capacity fossil fuel-fired plants. On October 6, 1993, the EPA announced the availability of a draft student handbook, prepared as part of a training course for operators of high capacity fossil fuel-fired plants. Again, the EPA contracted with the ASME to develop and manage a nationwide certification program. The final draft of the certification requirements was distributed in January 1999.

Under section 129 of the EPA's Clean Air Act the following statements are included: "This notice is not a rule making action to require anyone to implement any training program. The individual states may make determinations whether or not to require operator training and certification and may also decide whether the EPA's model training program or another training program is appropriate."

*Current Status*

These voluntary guidelines are broken down into different classifications based on fuel and boiler design. The obvious shortcoming of these guidelines is the lack of safety knowledge required by the operator, balance of plant, impact of the boiler operations, efficiency and in-depth environmental issues. Applicants can receive their certification with the use of a pencil and paper test only. The applicants are only tested for knowledge and are not required to demonstrate skills or even a plant walk through exam.

The states and cities that have adopted certification program(s) have obviously done so to prevent accidents, prevent an interruption of public services and protect plant personnel from injury. Once laws have been established these laws require enforcement. Many agencies do not have the manpower or time to duly enforce the certification requirements and leave the policing up to the power plant management. Many of these laws do not have a penalty for the use of unlicensed operators. Therefore, some power plants are not concerned with certification requirements and may indeed place a person in the operator's position without the proper training and experience.

# 4
# FUTURE PREDICTIONS

With the shrinking workforce and increased competition, many companies, including our nation's power plants, will be facing a critical shortage of skilled workers. It is predicted that between now and the year 2006 an average of 1040 new power plant operators will be need each year. In the next ten years, it is very possible that our power plants will be struggling to find qualified operators to run the plants. By the year 2020, the workforce of people between the ages of 20 –35 years of age will be equal to the number of people retired. Power plants across the nation will be expanding their search for qualified operators throughout the country and possibly around the world.

If the current certification by some cities and states or the lack of certification remains in effect, the majority of power plants in the future will be without an avenue to determine the skill level of the power plant operator. Training requirements, and the cost associated with this training, will increase in an attempt to get qualified operators. Without certified operators, accident rates will increase, cost of insuring the plant/equipment will increase and ultimately the cost of energy to the customer will escalate.

With the fossil power industry implementation of a certification program, it is very possible that process plants, production plants and others will look at adopting certification requirements as well.

# 5
# SOLUTION

Many power companies across the country have the need for a certification program. Several EPRI member utilities have requested that a certification program be developed and instituted by December 2000. Some initial steps must be taken to begin developing a certification program. Review of existing areas is nearly complete and the next step is to complete a job task analysis. This identifies the terminal and enabling objectives of each function of the operator position. After identifying what an operator should be able to do and know, a test bank will be created. To ensure operators have the necessary skills, knowledge, and abilities, the test will need to be knowledge and performance based.

Training materials will be developed including booklets, computer based training and videos. These training materials will be available for purchase by individuals that choose not to attend a registered apprenticeship program or a secondary educational institution. Regional training courses will also be scheduled and conducted to present critical information that will be required to successfully complete the certification exam.

Power producers across the country will soon learn the value of adopting and promoting a knowledge and performance based certification program. The program will be designed to meet or exceed any existing program and with the use of power plant simulators will be the only certification program that will be able to determine if a person has all the necessary skills and abilities to be classified as a certifiable power plant operator.

Each state and/or the federal government will follow the lead of the power producers and enact legislation requiring certification for power plant operators. States, cities or counties will adopt local resolutions that recognize the certification program as the licensing agent for operators. The states, cities or counties will become sponsors and be responsible for ensuring that each individual has the necessary education and/or experience to qualify for the certification exam. The governing body will collect a sponsoring fee for performing this task and for future recertifications. The operator requesting to take the exam will need this sponsorship endorsement before they will be examined.

The examination may be available in testing centers across the United States. Power plants, owners/operators will benefit from being part of the test system. By being part of the testing system, the owners/operators will have the ability to update information, as it becomes available. Owners/operators will also have direct access to a testing simulator that can be used by the plant personnel. Some portion of the exam revenues will be returned to the owners/operators to cover the cost of delivering the applicant exam. The test will be developed as an encrypted web-based program. The student will be examined for both their knowledge and skills using the Internet. By the use of standardized questioning, interactive computer based programs and power plant simulators the student will be evaluated in scenarios that will closely represent the actual

function of the power plant operator. Upon completion of the test, the applicant's responses will automatically be downloaded, returned to the grading center and graded. This will allow operators to be examined on a regular basis and at intervals that can meet the demand.

# 6
# MEASURABLE BENEFITS

1. Through the cooperative efforts of EPRI and Zurich Services Corp., power plants can recoup the cost of training through reduced insurance expenditures and the reduction of accidents.

2. Operators will have a certification that will be transferable from one state to another. Power plants can then be assured that operators have the skills necessary to fill the position and little additional training will be necessary.

3. Operators will be required to complete continuing education classes. This will allow power plants to develop and implement courses that will be directed toward educating operators on plant specific items and maintaining continuing operator competencies.

4. The power industry will have direct input to the design, development and implementation of the certification program.

5. Revenue from training materials, regional seminars, examination fees and re-certification exam fees will continue to support and evolve the certification program.

# 7
# IMPLEMENTATION STEPS

The following five-step process will be used to create an operator certification program:

- Analysis
- Design
- Development
- Implementation
- Evaluation

## Analysis Stage

The Analysis stage will have three sub-categories, Administrative Analysis, Job and Task Analysis and Training Analysis.

1. Administrative Analysis will explore what is currently required and who is requiring it. The EPRI Simulator and Training Center is currently performing this step. The majority of the certification program requirements in states, cities and counties throughout the United States will be reviewed. The review will look at requirements, testing procedures, cost, enforcement, delivery methods and measurable outcomes. Power plants and government agencies will be contacted in this phase to solicit additional information on preventable accidents, government regulations, as well as, interest and support of instituting a national certification program.

2. Job and Task Analysis will catalog and evaluate the needed skills, knowledge and abilities of a power plant operator. There have been many job task analyses conducted by different firms. This completed documentation will be incorporated into the research and will reduce the amount of time it will take to complete this process. It is important in this phase to determine what basic knowledge an operator should possess and what skills they should have to be certified.

3. Training Analysis will investigate the proper avenues for delivering the training needed to prepare an operator for the exam. This will include evaluating the training programs of different organizations, delivery methods, cost and availability of quality training programs. Existing training programs will be evaluated to ensure that the content meets the identified expectations of a certified operator.

## Design Stage

The Design stage will define time schedules, development cost, delivery cost, educational resources, delivery and verification methods, and the application process. Responsibilities for the EPRI S&T Center and Zurich Services Corp. will be detailed and completion timelines will be identified. Upon completion of the design stage an overview of the complete program will be established. Before completing the design stage a commitment from all interested parties must be in place.

## Development Stage

In the development stage a bank of test questions will be developed and generic power plant simulator models will be constructed. Training materials will be developed addressing the knowledge and skills that will be examined. The delivery system identified in the design phase will be constructed and tested for security as well as for the ability to track all pertinent information. This stage of the process will require a concerted effort to market and develop personal relationships with government institutions, state and local governments, and public and private training schools, and organizations.

## Implementation Stage

Implementation is the stage where it will be necessary to test and verify the final testing products. Test cases will need to be developed to ensure security and complete functionality of the testing system. Testing centers will be established and training for the testing officials will be scheduled and completed. Advertising the attributes of using this nationwide certification program will become an important part of this phase.

## Evaluation Stage

The evaluation stage will identify any unforeseen problems and make the necessary adjustments to correct them. Also included in this phase will be an evaluation of the program to determine if goals have been met. The evaluation process is an ongoing portion that must be constantly looking toward improvement.

Upon completion of the initial certification program, development for the operator re-certification program will begin. Re-certification training materials and tests need to be available within one year of introducing the original certification program.

# 8
# EXPECTED OUTCOME

The certification program will provide a standardized system for determining the education and skills of our current and future power plant operators. With this certification our nation's power plants will be able to assure the general public that their electricity will continue to flow and the controls of their local power plant are within experienced hands.

Power plants will embrace the certification program based on the prospect of decreasing or preventing costly accidents. With certification of their operators the cost of training can be justified with cost savings from accident reduction/prevention, reduced operating costs and decreased insurance costs. Power plant operators will find benefit in this program because of the increased knowledge that will be acquired, a better understanding of their job requirements and the nationwide certification would offer them expanded employment and advancement opportunities.

Cities, states and/or the federal government will view this program as a positive step taken by the utility industry to make their plants a safer place of employment and a large step toward controlling the cost of power to the general public. Cities and/or states will be able to develop an income source for sponsoring individuals for the certification exam. This income source will continue with the re-certification requirement for each license issued.

This certification program will be the only one in the nation to offer knowledge and performance testing for power plant operators. This program also has the potential of being adopted by to other countries around the world.

# 9
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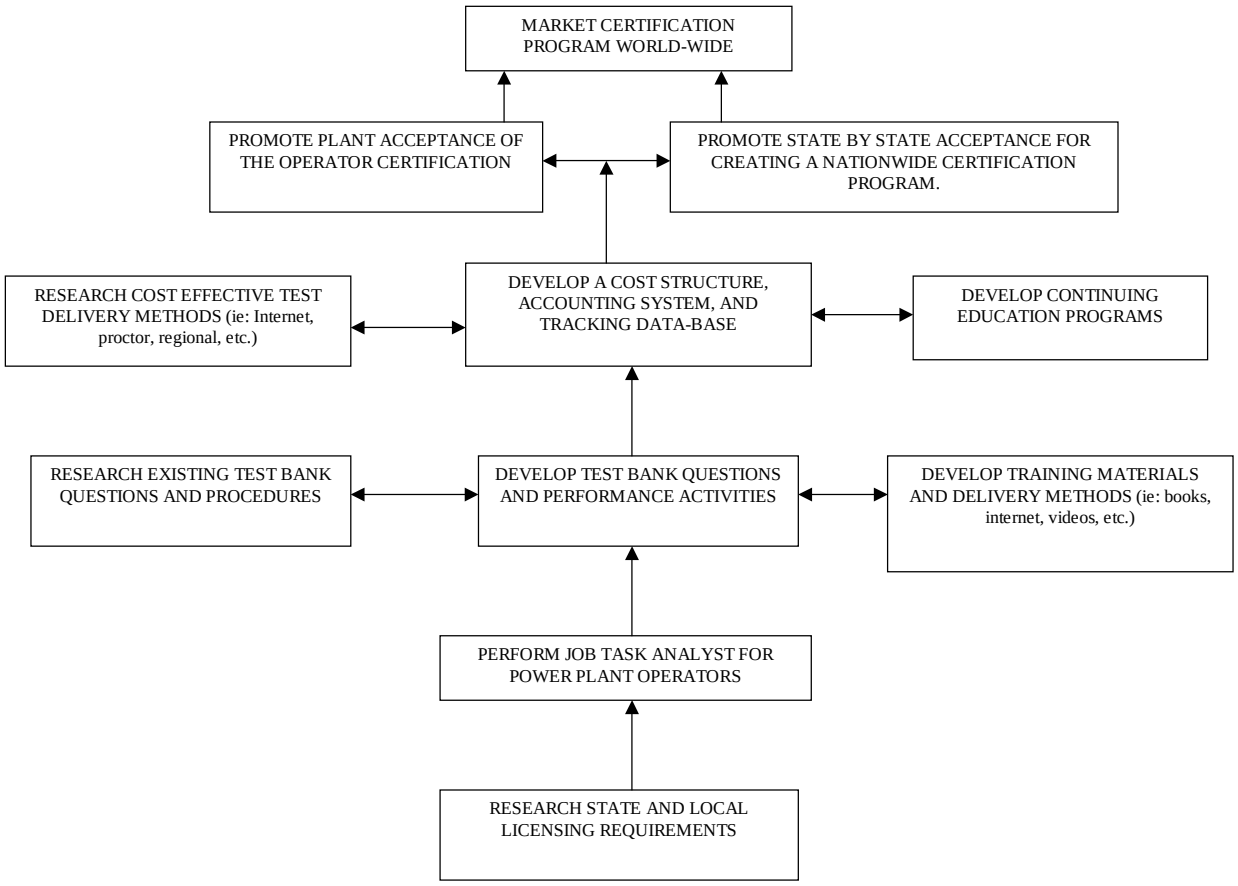
# A
# CERTIFICATION PROCESS ORGANIZATION CHART



# B
# STATE LICENSING OVERVIEW

*State Licensing Overview*

| Contacted | States | State Certification Required | Local Certification Required | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Alabama | | | | | | | | |
| | Alaska | | | | | | | | |
| x | Arizona | NO | | | | | | | |
| x | Arkansas | YES | | | | | | | |
| x | California | NO | YES | Los Angeles | | | | | |
| x | Colorado | NO | YES | Denver | Pueblo | | | | |
| x | Connecticut | NO | YES | New Haven | | | | | |
| x | Deleware | NO | YES | Wilmington | | | | | |
| | District of Columbia | YES | | | | | | | |
| x | Florida | | | | | | | | |
| | Georgia | | | | | | | | |
| x | Hawaii | | | | | | | | |
| | Idaho | | | | | | | | |
| x | Illinois | NO | YES | Chicago | Elgin | | | | |
| x | Indiana | NO | YES | Evanston | | | | | |
| x | Iowa | NO | YES | Des Moines | Sioux City | | | | |
| x | Kansas | | | | | | | | |
| x | Kentucky | | | | | | | | |
| x | Louisiana | NO | YES | New Orleans | | | | | |
| x | Maine | YES | | | | | | | |
| x | Maryland | NO | YES | Baltimore | | | | | |
| x | Massachusetts | YES | | | | | | | |
| x | Michigan | NO | YES | Dearborn | Detroit | Grand Rapids | Saginaw | | |
| x | Minnesota | YES | | | | | | | |
| x | Mississippi | | | | | | | | |

| Contacted | States | State Certification Required | Local Certification Required | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Missouri | YES | YES | Kansas City | St. Joseph | St. Louis | | | |
| | Montana | YES | | | | | | | |
| x | Nebraska | NO | YES | Omaha | | | | | |
| | Nevada | | | | | | | | |
| | New Hampshire | | | | | | | | |
| x | New Jersey | YES | | | | | | | |
| | New Mexico | YES | | | | | | | |
| x | New York | NO | YES | Buffalo | Mount Vernon | New York City | Niagara Falls | Rochester | White Plains |
| x | North Carolina | | | | | | | | |
| x | North Dakota | | | | | | | | |
| x | Ohio | YES | | | | | | | |
| x | Oklahoma | NO | YES | Oklahoma City | Tulsa | | | | |
| x | Oregon | | | | | | | | |
| x | Pennsylvania | NO | YES | Erie | Pittsburgh | | | | |
| x | Rhode Island | NO | YES | Providence | Woonsocket | | | | |
| x | South Carolina | | | | | | | | |
| x | South Dakota | | | | | | | | |
| x | Tennessee | NO | YES | Memphis County | Shelby County | | | | |
| x | Texas | NO | YES | Houston | | | | | |
| x | Utah | NO | YES | Salt Lake City | | | | | |
| x | Vermont | | | | | | | | |
| x | Virginia | | | | | | | | |
| x | Washington | NO | YES | Seattle | Spokane | Tacoma | | | |
| | West Virginia | NO | YES | Huntington | | | | | |
| x | Wisconsin | NO | YES | Kenosha | Milwaukee | Racine | Beloit | | |
| | Wyoming | | | | | | | | |

# C
# CITY AND COUNTY LICENSING REQUIREMENTS

## Arkansas

The Arkansas Boiler Safety Law, Act 494 was enacted in 1961.

| | |
|---|---|
| Number of Licenses | 1 |
| Types of Licenses | Boiler Operator |

### *License Requirements*

*Boiler Operator*

"All boilers subject to the provisions of this Act shall either (1) be continuously monitored by a mechanical or electronic device approved by the Director of the Arkansas Department of Labor, or (2) be checked at least once each hour when a plant is in operation or when any public building is occupied, provided such boilers are equipped with approved-type automatic appliances. Boilers that are manually operated must be under constant attendance whenever they are in use for any purpose. Boilers fifty (50) horsepower and over, as rated by the manufacture, and boilers used in hospitals, hotels, schools, theatres, and office buildings, but not limited to, must be under regular attendance by a licensed operator who holds a certificate of competency issued by the Boiler Inspection Division.

| | |
|---|---|
| Exam Cost | $16.00 |
| Renewal Cost | $12.00 |
| Renewal Frequency | Yearly |
| Type of Exam | Written or Verbal |
| Time limit | N/A |
| Passing Score | N/A |

## District of Columbia

| | |
|---|---|
| Number of Licenses | 6 |
| Types of Licenses | Class One<br>Class Two<br>Class Three<br>Class Four<br>Class Five<br>Class Six |

### *License Requirements*

*Class One*

All boilers and unlimited refrigeration

*Class Two*

All boilers over 15 psi up to 700 hp. Also includes unlimited refrigeration.

*Class Three*

All boilers under 15 psi up to 400 hp. Also includes unlimited refrigeration.

*Class Four*

Stationary boilers under 15 psi not greater than 25 hp.

*Class Five*

Miniature boiler engineer—for laundry or dry cleaners. Boilers under 15 psi not greater than 25 hp.

*Class Six*

Steam and hot water heating boilers under 15 psi and not greater than 200 hp.

Boilers exceeding 15 psi need a licensed operator in the boiler room. Boilers nor exceeding 15 psi can be checked once every 24 hours.

| | |
|---|---|
| Exam Cost | N/A |
| Renewal Cost | N/A |
| Renewal Frequency | N/A |
| Type of Exam | Written |
| Time Limit | N/A |
| Passing Score | N/A |

## Maine

| | |
|---|---|
| Code Section Chapter 10 02-174 | Qualification for Boiler Operators and Engineers |
| Number of Licenses | 6 |
| Types of Licenses | First-class engineer<br>Second-class engineer<br>Third-class engineer<br>Fourth-class engineer<br>Low-pressure boiler operator<br>High-pressure boiler operator |

### *License Requirements*

*First-class Engineer*

The holder of a First Class Engineer's License may operate, supervise or have charge of a plant of unlimited steam capacity.

An applicant for a First Class Engineer's License examination must have two years operating experience as a holder of Second Class Engineer license.

An applicant for a First Class Engineer's License must be a high school graduate or have equivalent education.

One year of schooling in the field of boiler operation in a school approved by the Board is equivalent to six months of operating experience.

Two years experience is 2,000 hours of boiler operating experience.

*Second-class Engineer*

The holder of a Second Class Engineer's License may operate a boiler up to the capacity of the license of the engineer in charge and supervise a plant of not more than 200,000 lbs./hr.

An applicant for a Second Class Engineer's License examination must have two years operating experience as a holder of Third Class Engineer license.

An applicant for a Second Class Engineer's License must be a high school graduate or have equivalent education.

One year of schooling in the field of boiler operation in a school approved by the Board is equivalent to six months of operating experience.

Two years experience is 2,000 hours of boiler operating experience.

*Third-class Engineer*

The holder of a Third Class Engineer's License may operate a boiler up to the capacity of the license of the engineer in charge and supervise a plant of not more than 100,000 lbs./hr,

An applicant for a Third Class Engineer's License examination must have one year operating experience as a holder of Fourth Class Engineer license.

An applicant for a Third Class Engineer's License must be a high school graduate or have equivalent education.

One year of schooling in the field of boiler operation in a school approved by the Board is equivalent to six months of operating experience.

One year experience is 1,000 hours of boiler operating experience.

*Fourth-class Engineer*

The holder of a Fourth Class Engineer's license may operate a boiler up to the capacity of the license of the engineer in charge and supervise a plant of not more than 50,000 lbs/hr.

An applicant for a Fourth Class Engineer's License examination must have one year operating experience as a holder of high pressure boiler operator license.

An applicant for a Fourth Class Engineer's License must be a high school graduate or have equivalent education.

One year of schooling in the field of boiler operation in a school approved by the Board is equivalent to six months of operating experience.

One year experience is 1,000 hours of boiler operating experience.

*Low-pressure boiler operator*

The holder of a low pressure operator's license may operate a heating plant with steam boilers not exceeding 15 psi or hot water and hot water supply boilers not exceeding 160 psi or 2500 F, respectively.

*High-pressure boiler operator*

The holder of a high pressure boiler operator license may operate a boiler up to the capacity of the license of the engineer in charge and supervise a plant of not more than 20,000 lbs/hr.

An applicant for a high pressure boiler operator examination must have six months experience as a high pressure boiler operator under a permit.

In the event of a lack of qualified personnel in the plant in which the applicant is employed, the committee may waive the operating experience requirements of the applicant for examination for the next higher grade of license. Any such license issued must be limited to that plant.

Satisfactory completion of an approved high pressure boiler operator's technical training course approved by the Board shall be considered three months experience.

Six months experience is 500 hours of boiler operating experience.

| | |
|---|---|
| Exam Cost | $100.00—Boiler engineers and high pressure operators<br>$ 30.00—Low pressure boiler operators |
| License Fees | $100.00—Boiler engineers and high pressure operators<br>$ 30.00—Low pressure boiler operators |
| Renewal Cost | $100.00—Boiler engineers and high pressure operators<br>$ 30.00—Low pressure boiler operators |
| Renewal Frequency | 3 Years |
| Type of Exam | N/A |
| Time Limit | N/A |
| Passing Score | N/A |

## Massachusetts

Chapter 146: Section 49. Classes of licenses and work permitted

| | |
|---|---|
| Number of Licenses | 5 |
| Types of Licenses | First-class engineer<br>Second-class engineer<br>Third-class engineer<br>First-class fireman<br>Second-class fireman |

### *License Requirements*

*First-class Engineer*

A person must be a citizen or furnish proof of having filed a declaration of his intention to become a citizen of the United States, must furnish evidence as to his previous training and experience and must have been employed for not less than three years as an engineer in charge of a steam plant or plants having at least one engine or turbine of over one hundred and fifty horsepower, or must have held and used a second class engineer's license in a second class plant for not less than one and one half years, or in a first class plant as assistant engineer for one and one half years or held and used and equivalent license in the United States merchant marine for three years or have held and used and equivalent license from another state for three years.

*Second-class Engineer*

A person must be a citizen or furnish proof of having filed a declaration of his intention to become a citizen of the United States, must furnish evidence as to his previous training and experience and must have been employed for not less than three years as an engineer in charge of a steam plant or plants having at least one engine or turbine of not less than fifty horse power for not less than two years or held and used an equivalent license in the United States merchant marine for two years or have held and used and equivalent license from another state for two years or must have held and used a third class engineer's license either as an engineer, assistant engineer, control room operator or a fireman for not less than one year, or must be a person who has held and used a special license to operate a first class plant for not less than two years, except any person who is a United States citizen and served three years as an apprentice to the machinist or boiler making trade in stationary, marine or locomotive engine or boiler works and who has been employed one year in connection with the operation of a steam plant or any person who has a bachelor of science degree from any duly recognized school of engineering, who has been employed for one year in connection with the operation of a steam plant, shall be eligible for examination for a second class engineer's license.

*Third Class Engineer*

A person must be a citizen or furnish proof of having filed a declaration of his intention to become a citizen of the United States, must furnish evidence as to his previous training and

experience and must have been employed in a boiler or steampower plant as a steam engineer, fireman, control room operator, watertender auxiliary operator or engineer's assistant for not less than one and one half years, or held and used and equivalent license in the United States merchant marine for one year or used a current third class steam license issued by another state for one year or must have held and used a first class fireman's license for not less than one year.

### *Fireman's Licenses*

*First Class*

To be eligible for examination for a first class fireman's license, a person must furnish evidence as to his previous training and experience and must have been employed in a boiler or steam power plant as a steam engineer, fireman, control room operator, watertender auxiliary operator or engineer's assistant for not less than one year, or he must have held and used a second class fireman's license for not less than six months.

*Second Class*

To be eligible for examination for a second class fireman's license, a person must furnish evidence as to his previous training, and, except students attending all day state aided vocational high schools in the steam engineering course or students performing the duties of a first or second class fireman at said school, be at least eighteen years of age; provided, however, that no such license issued shall be used in employment by the holder thereof unless he is at least eighteen years of age.

| | |
|---|---|
| Exam Cost | $50.00 |
| Renewal Cost | N/A |
| Renewal Frequency | N/A |
| Type of Exam | Multiple Choice Questions |
| Time Limit | 3 Hours |
| Passing Score | N/A |

## Minnesota

| | |
|---|---|
| Code Section VR 425-01-64 | Standard for Boiler and Pressure Vessel Operator Certification |
| Number of Licenses | 10 |
| Types of Licenses | SEE NEXT PAGES |
| Exam Cost | $100.00—Boiler engineers and high-pressure operators<br>$ 30.00—Low pressure boiler operators |
| License Fees | $100.00—Boiler engineers and high-pressure operators<br>$ 30.00—Low pressure boiler operators |
| Renewal Cost | $100.00—Boiler engineers and high-pressure operators<br>$ 30.00—Low pressure boiler operators |
| Renewal Frequency | 3 Years |
| Type of Exam | N/A |
| Time Limit | N/A |
| Passing Score | N/A |

## Montana

| | |
|---|---|
| Code Section 50-74-304 | Requirements for engineer's license |
| Number of Licenses | 5 |
| Types of Licenses | First-class engineer<br>Second-class engineer<br>Third-class engineer<br>Low-pressure engineer<br>Agricultural-class engineer |

### *License Requirements*

*First-class Engineer*

An applicant for a first-class engineer's license must be 18 years of age or older and:

1. Must have at least 3 years' full-time experience in the operation of a boiler and steam-driven machinery in this classification under an engineer holding a valid first-class license, is required to successfully pass a written examination prescribed by the department, and must be found competent to operate a boiler and steam-driven machinery in this classification by the department;

2. Shall hold a valid second-class engineer's license, must have at least I year's full-time experience in the operation of a boiler and steam-driven machinery in this classification under an engineer holding a valid first-class license, is required to successfully pass a written examination prescribed by the department, and must be found competent to operate a boiler and steam-driven machinery in this classification by the department; or

3. Shall hold a valid third-class engineer's license, must have at least 2 year's full-time experience in the operation of a boiler and steam-driven machinery in this classification under an engineer holding a valid first-class license, is required to successfully pass a written examination prescribed by the department, and must be found competent to operate a boiler and steam-driven machinery in this classification by the department.

*Second-class Engineer*

An applicant for a second-class engineer's license must be 18 years of age or older and:

1. Must have at least 2 years' full-time experience in the operation of a boiler and steam-driven machinery in this classification under an engineer holding a valid second-class or first-class license, is required to successfully pass a written examination prescribed by the department, and must be found competent to operate a boiler and steam-driven machinery in this classification by the department; or (b) shall hold a valid third-class engineer's license, must have at least I year's full-time experience in the operation of a boiler and steam-driven machinery in this classification under an engineer holding a valid second-class or first-class

license, is required to successfully pass a written examination prescribed by the department, and must be found competent to operate a boiler and steam-driven machinery in this classification by the department.

*Third-class Engineer*

An applicant for a third-class engineer's license must be 18 years of age or older, must have at least 6 months' full-time experience in the operation of a boiler in this classification under an engineer holding a valid third-class or higher license, is required to successfully pass a written examination prescribed by the department, and must be found competent to operate a boiler in this classification by the department.

*Low-pressure Engineer*

An applicant for a low-pressure engineer's license must be 18 years of age or older, must have at least 3 months' full-time experience in the operation of a boiler in this classification under an engineer who holds a valid low-pressure or higher license, is required to successfully pass a written examination prescribed by the department, and must be found competent to operate a boiler in this classification by the department.

*Agricultural-class Engineer*

An applicant for an agricultural-class engineer's license must be 18 years of age or older, is required to successfully pass a written examination prescribed by the department, and must be found competent to operate a boiler in this classification.

| | |
|---|---|
| Exam Cost | $50.00 |
| Renewal Cost | N/A |
| Renewal Frequency | N/A |
| Type of Exam | Multiple Choice Questions |
| Time Limit | 3 Hours |
| Passing Score | N/A |

## New Jersey

| | |
|---|---|
| Code Section | NJSA 34:7,NJAC 12:90 |
| Number of Licenses | 4 |
| Types of Licenses | Boiler Operator, Black Seal<br>First-class engineer, Gold Seal<br>Second-class engineer, Red Seal<br>Third-class steam engineer, Blue Seal |

### *License Requirements*

*Boiler Operator*

Low Pressure: Three months experience as a helper, apprentice or assistant to a licensed operator; or, intensive training for 30 full working days by a licensed operator.

High Pressure: Three months experience as a helper, apprentice or assistant to a licensed operator, or, six weeks of experience during which a licensed operator gave intensive training. The chief engineer must provide verification of training. If the applicant has six months experience as a low-pressure boiler operator only 30 days of intensive training is required.

In-charge: A licensed low-pressure operator is eligible for an in-charge rating after three months of actual service.

Special: For boilers up to and including 100 horsepower. For this endorsement 30 days experience is required.

*First-class Engineer*

A valid New Jersey 2nd grade license and one-year's subsequent experience as a chief engineer in a plant requiring supervision by a 2nd grade engineer;

Or

A 2nd grade license for two years and two years of subsequent experience as an operating engineer in a plant requiring supervision by a 1st grade engineer.

*Second-class Engineer*

Must hold a valid New Jersey 3rd grade license and have at least one year's subsequent practical experience in the operation of equipment requiring supervision by a 2nd grade or 1st grade engineer.

*Third-class Engineer*

Must have a valid New Jersey High Pressure Boiler Operator-in-charge license and at least six months subsequent experience in the operation of equipment requiring supervision by a third class steam engineer, or as an assistant in the operation of equipment requiring a 3rd class license for shift operation.

| | |
|---|---|
| Exam Cost | $25.00 |
| Renewal Cost | $20. |
| Renewal Frequency | 3 Years |
| Boiler Operator | |
| Type of Exam | N/A |
| Passing Score | 60% |
| First-class Engineer | |
| Type of Exam | Written with 18 essay questions |
| Passing Score | 80% |
| Second-class Engineer | |
| Type of Exam | 30 multiple choice or 25 multiple choice and 5 essay questions |
| Passing Score | 70% |
| Third-class Engineer | |
| Type of Exam | 30 multiple choice |
| Passing Score | 60% |

## New Mexico

Boiler Rules and Regulations Section 14 NMAC 9.20

Boiler Rules and Regulations Section 14 NMAC 9.29

| | |
|---|---|
| Number of Licenses | 3 |
| Types of Licenses | Boiler Operator Trainee<br>Boiler Operator Low Pressure<br>Boiler Operator High Pressure |

### *License Requirements*

*Boiler Operator Trainee*

Shall not operate any devices except under direct observation of a Boiler Operator

*Boiler Operator Low Pressure*

Experience: Six months operating experience on the type(s) of plant to be licensed on, and pass the Low-Pressure examination.

Limitations: May operate steam boilers and direct-fired pressure vessels up to 15 psi, and hot water boilers up to 160 psi and/or 250 degrees F

*Boiler Operator High Pressure*

Experience: Have at least six- (6) months verifiable operating experience on the type(s) of plant to be licensed on, and pass the prescribed examination.

Limitations: May operate high-pressure boilers (15 psi and greater), steam boilers and direct-fired pressure vessels up to 15 psi, and hotwater boilers up to 160 psi and 250 degrees F. As per Manufacture’s Instructions

Note: Constant attendance of a boiler with automatic controls is not required. However, there shall be a properly licensed individual responsible for the safe operation of such equipment. Such individual shall be responsible for maintaining a daily inspection/tour log.

Any boiler that is not considered an automatic boiler and located in a publicly owned place of public assembly shall have a full-time, licensed Operator. The Boiler Operator shall not leave the operating floor for more than 10 minutes at any one time without leaving on duty an Operator with the same classification as the Boiler Operator.

| | |
|---|---|
| Exam Cost | N/A |
| Renewal Cost | N/A |
| Renewal Frequency | N/A |
| Type of Exam | N/A |
| Time Limit | N/A |
| Passing Score | N/A |

## Ohio

Ohio Administrative Code, Section 4101:11-1-03

Ohio Administrative Code, Section 4101:11-1-04

| | |
|---|---|
| Number of Licenses | 5 |
| Types of Licenses | Low-pressure boiler operator's license<br>Boiler operator's License<br>Third-class engineer's license<br>Second-class engineers license<br>First-class engineer's license |

### *License Requirements*

*Low Pressure Boiler Operator*

Applicants must have one of the following experience qualifications:

1. 600 hours practical experience as a steam engineer, oiler, boiler operator, boiler operator's helper, or boiler repair person experienced with duties that pertain to steam boiler operation.

2. 300 hours practical experience as a steam engineer, oiler, boiler operator, boiler operator's helper, or boiler repair person experienced with duties that pertain to steam boiler operation and 300 hours of boiler construction and/or boiler maintenance experience.

3. 300 hours practical experience as a steam engineer, oiler, boiler operator, boiler operator's helper, or boiler repair person experienced with duties that pertain to steam boiler operation and the successful completion of a thirty-six hour course in an approved program teaching steam boiler operation and boiler maintenance.

*High Pressure Boiler Operator*

Applicants must have one of the following experience qualifications:

1. 1200 hours practical experience as a steam engineer, oiler, boiler operator, boiler operator's helper, or boiler repair person experienced with duties that pertain to steam boiler operation.

2. 600 hours practical experience as a steam engineer, oiler, boiler operator, boiler operator's helper, or boiler repair person experienced with duties that pertain to steam boiler operation and 600 hours of boiler construction and/or boiler maintenance experience.

3. 600 hours practical experience as a steam engineer, oiler, boiler operator, boiler operator's helper, or boiler repair person experienced with duties that pertain to steam boiler operation and the successful completion of a sixty-hour course in an approved program teaching steam boiler operation and boiler maintenance.

*Steam Engineer*

Applicant must have one of the following experience qualifications:

1. 1800 hours practical experience as a steam engineer, oiler, boiler operator, boiler operator's helper, or boiler repair person experienced with duties that pertain to the operation of steam reciprocating engine, turbine or boiler.

2. 900 hours practical experience as a steam engineer, oiler, boiler operator, boiler operator's helper, or boiler repair person experienced with duties that pertain to the operation of steam reciprocating engine, turbine or boiler and 900 hours of steam engine, turbine or boiler construction and/or maintenance experience.

3. 900 hours practical experience as a steam engineer, oiler, boiler operator, boiler operator's helper, or boiler repair person experienced with duties that pertain to the operation of steam reciprocating engine, turbine or boiler and the successful completion of a ninety-six hour course in an approved program teaching steam engineering and power plant maintenance.

   Note: When the Division of Industrial Compliance receives the completed application, the applicant's experience and training will be evaluated. If the applicant is found qualified for examination, a test will be scheduled and the applicant will be notified by mail.

| | |
|---|---|
| Exam Cost | $50.00 |
| Renewal Cost | N/A |
| Renewal Frequency | N/A |
| Type of Exam | Multiple Choice Questions |
| Time Limit | 3 Hours |
| Passing Score | N/A |

## Virginia

| | |
|---|---|
| Code Section VR 425-01-64 | Standard for Boiler and Pressure Vessel Operator Certification |
| Number of Licenses | 2 |
| Types of Licenses | Class-1 Boiler Operator<br>Class-2 Boiler Operator |

### *License Requirements*

*Class-1 Boiler Operator*

Two years experience as an operator of a high-pressure boiler beyond that experience which is required for a Class-2 Operator.

*Class-2 Boiler Operator*

At least two years experience as a boiler operator or an assistant boiler operator, fireman or oiler, in a high pressure steam plant of more than 75 boiler horsepower;

Or

Four years of such experience in a plant of not less than 50 boiler horsepower.

Substitution of a degree in mechanical engineering from an accredited college, university or school of technology or successful completion of an approved boiler operator apprenticeship program or a U.S. military training course may be permitted for one year of the required experience.

| | |
|---|---|
| Exam Cost | Established by the local jurisdiction |
| Renewal Cost | N/A |
| Renewal Frequency | N/A |
| Type of Exam | Written |
| Time Limit | N/A |
| Passing Score | N/A |

Note: The State of Virginia has an ordinance that provides for local jurisdictions to adopt a boiler certification program. Currently no city or county has passed such an ordinance.

# D
# CITY/LOCAL LICENSING BREAKDOWNS

## California

### *Los Angeles, California*

*Classes of licenses*

| | |
|---|---|
| Steam engineer unlimited | Unlimited with turbines with turbine endorsement |
| Steam engineer unlimited | Unlimited |
| Steam engineer | Not exceeding 500 hp (aggregate) |
| Boiler operator | Not greater than 35 hp (aggregate) |

*Examinations:* Written

*Attendance*

Boilers over 15 psi need a licensed operator in the boiler room. The operator cannot be absent for more than 10 minutes at a time, and during this ten minutes, he/she must be in visual distance or within earshot of the boiler if the boiler is equipped with a sound alarm.

## Colorado

### *Denver, Colorado*

*Classes of licenses*

Stationary engineer

*Examinations:* Written

*Attendance*

Boilers, appurtenances, steam pumps, steam turbines and steam engines under 10 hp and 15 psi, and water heating systems where the water temperature does not exceed 250 degrees F in the system, do not need a licensed operator.

The code states that a licensed operator must be present at times of operation. However, the Boiler and Elevator Inspection Department has issued a memorandum which states that once every hour, the operator can punch a time clock installed near the boiler.

*City/Local Licensing Breakdowns*

### *Pueblo, Colorado*

*Classes of licenses*

| | |
|---|---|
| A-Class, Chief Engineer | Five years of experience |
| B-Class, Chief Engineer | Two years of experience |
| C-Class, Boiler Operator | High pressure boilers without machinery |
| *Examinations* | Written |

*Attendance*

Automatically fired low pressure hot water boilers (having a temperature not exceeding 250 degrees F), low pressure steam boilers (having a pressure not greater than 15 psi), and locomotives under ICC regulations do not need a licensed operator.

Attendance is left up to the reasonable discretion of the operator.

## Connecticut

### *New Haven, Connecticut*

*Classes of licenses*

Engineer fireman

*Examinations:* Oral

*Attendance*

Boilers used for heating or team generation purposes under 15 psi do not need a licensed operator. The operator must be within visual distance of the boiler.

## Delaware

### *Wilmington, Delaware*

*Classes of licenses*

| | |
|---|---|
| First | Unlimited boiler room plus other pressure vessels |
| Second | Unlimited boiler room plus other pressure vessels |
| Third | Unlimited boiler room plus other pressure vessels |
| Fireman | Unlimited boiler |
| *Examinations:* | Written |

*Attendance*

Boilers under 25 psi do not need a licensed operator. Operator must be within sight of the sight glass.

## Illinois

### *Chicago, Illinois*

*Classes of licenses*

Stationary engineer

*Examinations:* Written

*Attendance Requirements*

Boilers over 10 psi, steam, or 160 lbs. Water do not need a licensed operator. The operator must be within eyesight of the gauge glass.

### *Elgin, Illinois*

*Classes of engineers*

Stationary engineer
Boiler tender Below 15 psi

*Examinations:* Written

*Attendance requirements*

Boiler not greater than 15 psi do not need a licensed operator. The operator must be on the premises.

## Indiana

### *Evanston, Indiana*

*Classes of licenses*

The city issues a permit to operate as a stationary engineer, which can be obtained by:
1. getting licensed through Chicago
2. getting licensed through NIULPE
3. getting the licensee's company to vouch for him/her. This permit is site-specific.

*Examinations:* Written safety examination

*Attendance*

Attendance is required of boilers 15 psi or more.

## Iowa

### *Des Moines, Iowa*

*Classes of licenses*

| | |
|---|---|
| First class engineer | Boilers over 15 psi and unlimited hp |
| Second class engineer | Boilers not greater than 200 plant hp |
| Third class engineer | Boiler not greater than 25 hp |
| Fireman, first class | Low pressure heating plant not over 75 plant hp |
| Fireman, second class | Low pressure heating plant not over 50 plant hp |

*Examinations:* Written (oral if examinee is illiterate)

*Attendance*

Left up to the operator's reasonable discretion.

### *Sioux City, Iowa*

*Classes of licenses*

| | |
|---|---|
| First class | Unlimited |
| Second class | Low pressure boilers not exceeding 400 hp and high pressure boilers not exceeding 200 hp |
| Third class | Low pressure boilers not exceeding 200 hp and high pressure boilers not exceeding 100 hp |
| Fourth class | Low pressure boilers not exceeding 100 hp and high pressure boilers not exceeding 25 hp |

*Examination:* Written exam administered by a private company

*Attendance requirements*

Low pressure vessels under 50 hp do not need a licensed operator (with the exception of all hand-fired equipment).

Engineers must be on the general premises when the boiler is in operation and when the purpose of the building is being fulfilled.

When plans for an inspection and remote monitoring system have been submitted to and approved by the manager of inspection services division, then the hydronic heating equipment shall be exempt from requiring an operator present.

## Louisiana

### *New Orleans, Louisiana*

*Classes of licenses*

| | |
|---|---|
| First-class engineer | Unlimited boilers, steam engines and internal combustion engines |
| Second-class engineer | Boilers up to 150 hp and steam engines and internal combustion engines up to 150 hp |
| Third-class engineer | Boilers, steam engines and internal combustion engines up to 75 hp |
| Special engineers certificate | Boilers generating not more than 19 hp |

*Examinations:* Written

*Attendance*

Hot water boilers under 2,000,000 Btu input and operating at pressure not exceeding 125 psi and temperatures not exceeding 210 degrees F do not need a licensed operator, provided they are protected with necessary approved safety devices and are automatically controlled. (For multiple units in a single location, aggregate Btu input of boilers shall not exceed 3,000,000. In calculating Btu input, boilers nor exceeding any of the following are exempted: Heat input of 200,000 Btu per hour; water temperature of 200 degrees F; nominal water containing capacity of 120 gallons and equipped with safety devices in accordance with ASME code.)

## Maryland

### *Baltimore, Maryland*

*Classes of licenses*

| | |
|---|---|
| First class | Unlimited |
| Second class | Not exceeding 500 hp |
| Third class | Not exceeding 30 hp |

*Examinations:* Written

*Attendance*

Note: The state of Maryland issues the license, but only the city requires it. Attendance required for a high pressure boiler, except for those used in dry cleaning (10-20 hp).

## Michigan

### *Dearborn, Michigan*

*Classes of licenses*

| | |
|---|---|
| First class stationary engineer | Unlimited boilers plus hoisting and portable machinery. |
| Second class stationary engineer | Not greater than 25,000 sq. ft. heating surface, additive, or prime movers of 250 hp. |
| Third class stationary engineer | Not greater than 10,000 sq. ft. heating surface (aggregate) or prime movers of 250 hp |
| Fourth class stationary engineer | Hoisting portable boilers and privately owned track locomotive equipment, excluding locomotive boilers on railroad trunk lines. |
| High pressure boiler operator | Less than 5,000 sq. ft. heating surface (aggregate). |
| Low pressure boiler operator | Not greater than 15 psi (steam) or 160 psig (liquid) or and with a liquid temperature not greater than 250 degrees F. Less than 5,000 sq. ft. heating surface (aggregate). |
| *Examinations:* | Written, administered by a private company |

*Attendance*

Operator must be in the room with boiler, engine, turbine or auxiliaries.

Boilers not requiring attendant:

1. Boilers under 15 psi with 300 sq. ft. or less of heating surface

2. Hot water heating and hot water supply boilers under 160 psig with 500 sq. ft. or less of heating surface.

3. Direct fired continuous coil water heaters under 160 psig used for purposes other than space heating whose self-contained capacity does not exceed 120 gallons and whose heating surface does not exceed an aggregate total of 750 sq. feet, additive.

Operators of miniature boilers (inside diameter of shell doesn’t exceed 16 in.; volume does not exceed 5 cubic feet; heating surface not greater than 20 sq. ft, pressure not greater than 100 psig) do not need licenses

Operator must stay in boiler room.

### *Detroit, Michigan*

*Classes of licenses*

| | |
|---|---|
| First-class engineer | Unlimited |
| Second-class engineer | All pressures, up to 20,000 sq. ft. heating surface |
| Third-class engineer | All pressures, up to 4000 sq. ft. |
| High pressure operator | All pressures, up to 4000 sq. ft. |
| Low pressure operator | Not over 15 psi, up to 5000 sq. ft. |
| Miniature boiler operator | Not over 15 psi, up to 20 sq. ft. |
| *Examinations:* | Engineers have written exams. Operators have oral exams. |

*Attendance*

Boilers under 15 psi when heating surface does not exceed 300 sq. ft. do not need a licensed operator. Hot water heating and supply boilers not exceeding 1,000 sq. ft. heating surface need to stay on the premises.

Operators of boilers exceeding 1,000 sq.ft. need to stay within visual and auditory distance of the boiler.

### *Grand Rapids, Michigan*

*Classes of licenses*

| | |
|---|---|
| Boiler Engineer | Unlimited |
| Boiler Operator | Shift engineer |
| *Examinations:* | Written |

*Attendance*

Boilers under 10 hp and 15 psi are exempt from having to have a licensed operator. Up to boiler operator to reasonably assess attendance needs.

### *Saginaw, Michigan*

*Classes of licenses*

0-15 hp
15-100 hp
100-250 hp
250-500 hp
500-1,000 hp

*Examinations:* N/A

*Attendance*

Boilers under 200,000 btu do not need a licensed operator. Boiler operators must remain on the premises.

## Missouri

### *Kansas City, Missouri*

*Classes of licenses*

| | |
|---|---|
| Operating engineer | All steam generating boilers, steam engines, internal combustion engines, turbines, condensers, compressors, generators, motors, blowers, fuel-burning equipment, refrigeration systems and all auxiliary apparatus |
| Plant operating engineer | Unlimited (Can supervise only one plant or system of plants with similar equipment.) |
| Fireman | Up to 100 psi for purpose of driving machinery and to operate other steam tanks or steam boilers carrying less than 125 psi. |
| Plant fireman | Up to 100 psi for purposes of driving machinery and other steam tanks or stream boilers carrying less than 125 psi. (Can supervise only one plant or system of plants with similar equipment.) |

*Examinations:* Written

*Attendance*

Boilers under 15 psi and 10 hp do not require licensed operator. Boiler operator must be on-call, but does not need to stay on the premises.

### *St. Louis, Missouri*

*Classes of licenses*

| | |
|---|---|
| Stationary engineer, Class1 | Any boiler generating saturated or superheated steam above 212 degrees F in excess of 15 psig having a rated heating surface in excess of 1,500 sq. ft. of hot water or any other liquid, or any boiler generating saturated or superheated steam or any high temperature liquid above 212 degrees F in excess of 300 psig, regardless of rated heating surface shall require a Class 1 engineer. |

| | |
|---|---|
| | Unlimited boilers and associated power plant components such as steam turbines, engines, air compressors, ammonia systems, pumps and feed water heaters, electric generators and other equipment. |
| Stationary engineer, Class 2 | Boilers not falling into the Class 1 categories. |

*Examinations*

Stationary engineers unlimited have both an oral and written component to the exam.
Class 2 stationary engineers have an oral exam.
Boiler operators have a field exam.

*Attendance*

Boilers not exceeding 15 psi or 160 psig water, not over 250 degrees F, or under 100 sq. ft. rated heating surface (total input to a single header) do not need a licensed operator.

Attendance of a stationary engineer is required only during the times designated as normal working, or occupied hours, by the majority of the building occupants.

High pressure boilers require an operator in the same building as the boiler. If the engineer moves around the building, the boiler requires a sound alarm.

## Nebraska

### *Omaha, Nebraska*

*Classes of Engineers*

| | |
|---|---|
| First-grade engineer | Unlimited |
| Second-grade engineer | All boilers plus steam prime movers less than 100 hp (aggregate) |
| Third-grade engineer | All boilers |
| *Examinations:* | Written |

*Attendance*

Boilers not exceeding 15 psi steam or 160 psig water which do not exceeding 750 sq. ft. heating surface, do not require an operator. Steam plants over 15 psi which are under 500 sq. ft. heating surface do not require an operator. Operator must not stay out of visual distance of the boiler for more than 2 hours.

# New York

## *Buffalo, New York*

*Classes of Engineers*

| | |
|---|---|
| Chief engineer | Unlimited |
| First-class engineer | Plant not exceeding 150 hp |
| Second-class engineer | Plant not exceeding 100 hp |
| Special engineer | Boilers not exceeding 50 hp (aggregate) and 125 psi |
| *Examination:* | Written |

*Attendance*

Miniature boilers (not exceeding 16 in. diameter of shell, 42 in. overall length of outside to outside of heads at center, 20 sq. ft. of water heating surface and 100 psi) do not need a licensed operator. Engineers must remain on the general premises when boiler is in operation.

## *Mount Vernon, New York*

*Classes of licenses*

| | |
|---|---|
| First class Fireman | Not exceeding 15 psi |
| *Examination:* | Written |

*Attendance*

Licensing is required only for fireman, who must remain on the premises.

## *New York, New York*

*Classes of engineers*

Stationary engineer

| | |
|---|---|
| *Examination:* | Written and oral |

*Attendance*

Boilers over 15 psi and 10 hp need a licensed operator. The operator must be within visual and auditory distance at all times of operation.

## *Niagara Falls, New York*

*Classes of engineers*

| | |
|---|---|
| Chief engineer | Unlimited |
| First class engineer | Not greater than 500 hp, one plant |
| First class Fireman | Not greater than 300 hp, one plant |
| Second class fireman | Not greater than 75 hp, one plant |
| Special engineer or fireman | Particular, one plant |
| Owner of steam engine | Not greater than 10 hp, one plant |
| Turbine engine operator | Steam turbine or turbines used for process work only, one plant |
| *Examinations:* | Written |

*Attendance requirements*

Heating boiler exception for those less than 5 hp and 15 psi. “No stationary engineer or fireman shall be absent from the steam boiler or steam engine operated by him for a space of time exceeding twenty (20) minutes, or to be farther distant from such steam boiler or steam engine than one hundred (100) feet while it is working under pressure.”

## *Rochester, New York*

*Classes of Engineers*

| | |
|---|---|
| Chief engineer | Unlimited |
| First class engineer | Not greater than 1500 hp (aggregate) |
| Second class engineer | Not greater than 500 hp (aggregate) |
| Third class engineer | Not greater than 100 hp (aggregate) |
| Custodian | Boilers for heating in an apartment building, where boilers exceed 50 hp (aggregate) |
| Watchman | Operate boilers at an establishment that is not in productive operation |
| *Examinations:* | Oral or written, or a combination |

*Attendance requirements*

Boilers under 50 hp and 15 psig in residential buildings or in any other establishment not greater than 40 hp (aggregate), do not need a licensed operator. “Whenever a boiler is in use and the premises are in productive operation, a licensed stationary engineer shall be on the premises and shall be responsible for the operation of such boiler.”

### *White Plains, New York*

*Classes of licenses*

| | |
|---|---|
| Chief engineer | Unlimited |
| First class stationary engineer | Up to 500 hp |
| Second class stationary engineer | Up to 100 hp |

*Examinations:* Written

*Attendance*

Boilers under 15 psi do not need a licensed operator. Operator must be on the premises.

## Oklahoma

### *Oklahoma City, Oklahoma*

*Classes of licenses*

| | |
|---|---|
| First-class operator | Unlimited |
| Second-class operator | Not greater than 15 psi (steam) or 125 lbs. (water) or 100 hp |

*Examinations:* Written

*Attendance*

For boilers under 30 hp, a licensed operator is not needed. With a boiler in excess of 100 psi, the operator must be on the premises or on-call with one–hour availability.

### *Tulsa, Oklahoma*

*Classes of engineers*

| | |
|---|---|
| First class | Unlimited |
| First class limited | Boilers not greater than 15 psi and less than 250 degrees F (plus unlimited air conditioning) |
| Steam specialist | All boilers, engines, pumps and apparatus of unlimited size and pressure |
| Third class | Heating boilers not greater than 15 psi (steam) or 160 psi (water) and less than 250 degrees F. |

*Examinations:* Written

*Attendance*

Operator must be on general premises

## Pennsylvania

### *Erie, Pennsylvania*

*Classes of licenses*

| | |
|---|---|
| Chief stationary engineer | Unlimited |
| Second class | Up to 400 hp |
| Water tender | Up to 200 hp, additive, and 150 psi |

*Examinations:* Written

*Attendance:*

Boilers in private dwellings, or with a safety valve setting under 15 psi or 60 hp (aggregate), do not require a licensed operator.

If boiler is between 60 and 149.9 hp (aggregate), a licensed operator must be on call and boiler must be checked daily. If the building is occupied by school children and/or incapacitated individuals, the operator must be in the building when it is occupied and the machinery is in operation. The boiler must be checked every two hours.

If the boiler is over 150 hp (aggregate) and is used for heating purposes only, the operator must be in the building when the machinery is in operation. The boiler must be checked every two hours. If the boiler is also used for steam processes, the operator must check the boiler every hour or more “if deemed necessary by the operator.”

### *Philadelphia, Pennsylvania*

*Classes of engineers*

| | |
|---|---|
| Grade A | Unlimited boilers |
| Grade C | Hoisting engineer |
| Grade D | Boilers under 15 psi |

*Examinations:* Written, administered by a private company

*Attendance:*

Attendance is left up to the operator’s reasonable discretion.

### *Pittsburgh, Pennsylvania*

*Classes of engineers*

| | |
|---|---|
| Stationary engineer | Unlimited |
| *Examinations:* | Written |

*Attendance:*

Boilers under 15 psi do not need a licensed operator. Operator must remain on the premises.

## Rhode Island

### *Providence, Rhode Island*

*Classes of licenses*

| | |
|---|---|
| Stationary engineer | Unlimited stationary engines of prime movers, refrigeration machinery, steam or hot water boilers, diesel generators, air conditioning machinery, hydraulics systems, gas generators or steam turbines. |
| Boiler operator | Boilers not exceeding 100 hp or unlimited machinery as a shift engineer |
| *Examinations:* | Written, oral or practical according to the chief's discretion. |

*Attendance:*

Exemptions: railroad boilers, hoisting engines of any pressure equipment, or boilers used for the purpose of temporary heat in a building during construction or repairs. Boilers under 30 hp are exempt from having a licensed engineer.

Operator must be on the premises in the vicinity of the boiler room. If boiler is equipped with an electronic alarm, the operator can be in "a remote area," provided that visible and audible alarms are at the site and that the Director of Chief Mechanical Inspector approves of the plans. Between 6 P.M. and 6 A.M., the licensed operator does not need to be on site.

### *Woonsocket, Rhode Island*

*Classes of engineers*

Stationary engineer

| | |
|---|---|
| *Examinations:* | Written |

*Attendance:*

Boilers under 30 hp do not need a licensed operator. Operator must be on the premises.

## Tennessee

### *Memphis and Shelby Counties, Tennessee*

*Classes of licenses*

| | |
|---|---|
| First class | Unlimited |
| Third class | Not greater than 50 hp |
| *Examinations:* | Written; administered by a private company |

*Attendance:*

Boilers under 100 sq. feet heating surface, internal combustion engines or compressors under 20 hp or 1,000 sq, ft. radiation do not need a licensed operator.

Operators must stay on the premises and be able to get to the boiler within 20 minutes.

## Texas

### *Houston, Texas*

*Classes of licenses*

| | |
|---|---|
| Stationary engineer | Unlimited |
| Second-class engineer | Not exceeding 6,696,000 btu's |
| Third-class engineer | Not exceeding 1,674,000 btu's |
| Boiler operator | All low pressure boilers; high pressure boilers not over 30 hp. |
| *Examinations:* | Written |

*Attendance:*

Boilers not exceeding 15 psi and 30 hp do not need a licensed operator. The operator must remain on the premises.

A second grade engineer can serve as a relief for a first grade engineer (and a third class engineer can for a second-class engineer), but the higher grade engineer must operate the boiler for some portion of the day.

## Utah

### *Salt Lake City, Utah*

*Classes of licenses*

| | |
|---|---|
| Steam engineer unlimited | Any steam or hot water plant |
| Steam engineer limited | Any steam or hot water plant not exceeding 300 hp (10,200,000 Btu) |
| Boiler operator, high pressure | Any steam or hot water boiler not exceeding 75 hp (2,555,000 Btu). Any high pressure boiler as a shift engineer. |
| *Examinations:* | Written |

*Attendance:*

Licensed operators are not needed for residential heating boilers in buildings not exceeding four dwelling units, boilers and pressure vessels under 10 hp (340,000 Btu) or under 15 psi, boilers or plants under jurisdiction of ICC. In case of unforeseen circumstances, a steam engineer with a lower grade of license, or without a license, may operate for up to 30 days, provided a building official is notified and an application is submitted for a provisional license.

Operator must be on the premises.

## Washington

### *Seattle, Washington*

*Classes of Engineers*

| | |
|---|---|
| First grade steam engineer | Unlimited |
| Second grade steam engineer | Up to 1500 hp Steam engine, 300,000,000 Btu/hr boilers and unlimited on small power boilers |
| Third grade steam engineer | Up to 250 hp steam engine, 50,000,000 Btu/hr. boilers and unlimited on small power boilers |
| Fourth grade boiler fireman | Up to 20,000,000 Btu/hr. boilers and small power boilers with a combined Btu/hr not greater the 20,000,000 |
| Small power boiler fireman | Less than 350 Btu/hr. output |
| Fifth grade boiler fireman | Up to a 5,000,000 Btu/hr boilers and one small power boiler. |
| Special | Plant specific steam engines |
| *Examinations:* | Oral and written |

*Attendance:*

Low pressure hot water boilers, low pressure steam boilers and hot water supply boilers having inputs less than 2,500,000 btu per hour are exempt from licensing requirement. Any boiler with an input less than 100,000 btu per hour and a maximum pressure not exceeding 100 psi is exempt from the licensing requirement. All hot water heaters are exempt from the licensing requirement.

For nonautomatic boilers, the engineer must stay in the room, leaving for not more than 20 minutes. For automatic boilers and small power boilers and power steam boilers with less than 100,000 btu per hour input with automatic burners and supply controls:

1. Low pressure hot water heating boilers, low pressure steam heating boilers, hot water supply boilers of 2,500,000 to 5,000,000 btu per hour input require a twice-daily check;

2. Low pressure hot water heating boilers, low pressure steam heating boilers, hot water supply boilers over 5,000,000 btu per hour input require a twice-daily check;

3. Power hot water boilers and power steam boilers with a capacity over 100,000 btu per hour input require a check every two hours;

4. Small power boilers require a twice-daily check. (Twice-daily check—the first check shall not be made less than eight hours after the last recorded check of the previous day; the second check shall be made not less than six hours after the first.)

## Washington

### *Spokane, Washington*

*Classes of licenses*

| | |
|---|---|
| First class engineer | Any steam plant |
| Second class engineer | Steam plant not exceeding 8,000,000 Btu |
| Third class engineer | Steam plant not exceeding 4,000,000 Btu or any low pressure plant for heating purposes |
| Fireman | Steam boilers used for power not exceeding 1,000,000 Btu or 15 lb. Steam boiler or hot water boiler used for heating purposes not exceeding 4,000,000 Btu, or with special permission of the Boiler Inspector, operate up to three low-pressure plants where steam pressure doesn't exceed 15 psi used for steam heating purposes only. |

*Examinations:* Written

*Attendance:*

Boilers under 15 psi and hot water heaters under 400,000 btu are exempt from having a licensed operator. Operator must check the boiler at least once a week.

### *Tacoma, Washington*

*Classes of licenses*

| | |
|---|---|
| Class 1 | Unlimited |
| Class 2 | Up to 300,000,000 btu |
| Class 3 | Up to 20,000,000 btu |
| Class 4 | Up to 5,000,000 btu |
| *Examinations:* | Classes 1 and 2: Written and oral |

Classes 3 and 4: Written

*Attendance:*

Boilers under 100,000 btu and over 15 psi do not need a licensed operator.

Boilers under 1,000,000 btu and under 15 psi do not need a licensed operator.

Nonautomatic boilers must have an attendant in the room while the boiler is in operation.

Automatic boilers: If boiler is a power boiler, under 15 psi and over 20,000,000 btu need to be checked at two-hour intervals. If boiler is between 5,000,000 and 20,000,000 btu, boiler needs to be checked every 6 hours. If boiler is between 2,500,000 and 5,000,000 btu, boiler must be checked twice a day, at eight-hour intervals.

## West Virgina

### *Huntington, West Virgina*

*Classes of licenses*

| | |
|---|---|
| First class engineer | Unlimited |
| First class fireman | Serves under the authority of the first class engineer |
| *Examination:* | Written |

*Attendance:*

Boilers under 16 psi do not need a licensed operator. Operator must remain on the premises.

## Wisconsin

### *Kenosha, Wisconsin*

*Classes of licenses*

| | |
|---|---|
| First class | Unlimited |
| Second class | Not exceeding 1,000 hp |
| Third class | Not exceeding 600 hp |

*Examinations:* Written and oral

*Attendance:*

A licensed operator is not required for miniature boilers (under 15 psi, 16in. diameter, 5 cu. Ft. in volume) and for hot water boilers not exceeding 150 degrees F. The operator must be on the premises.

### *Milwaukee, Wisconsin*

*Classes of licenses*

| | |
|---|---|
| First class engineer | Over 450 hp |
| Second class | 110—450 hp |
| Third class | Up to 110 hp |
| Fireman, High pressure | Over 15 psi, up to 110 hp |
| Fireman Low pressure | Under 15 psi, up to 110hp |

*Examinations:* Written

*Attendance:*

Hot water boilers, boilers under 15 psi and under 30 hp do not need a licensed operator. An operator must stay in the boiler room for a boiler over 15 psi when the boiler is in operation. (An exception to this rule is an electronically monitored boiler, in which case plans for the system and for a preventive maintenance schedule must be approved by the boiler inspection department.) An operator must check a boiler under 15 psi twice a day.

### *Racine, Wisconsin*

*Uses the following NIULPE classes of licensing*

| | |
|---|---|
| Chief engineer | Unlimited |
| First class engineer | Not exceeding 1500 hp |
| Second class engineer | Not exceeding 500 hp |
| Third class engineer | Low pressure: Unlimited hp<br>High pressure: not exceeding 200 hp |
| Fourth class engineer | Low pressure: not exceeding 150 hp<br>High pressure: not exceeding 25 hp |

*City/Local Licensing Breakdowns*

*Examinations:* Written

*Attendance:*

Manually controlled boilers require full-time attendance in the boiler room. Automatically controlled high-pressure boilers require full-time attendance in the boiler room when any other person is in the building. Automatically controlled; low-pressure boilers require a daily check.

In cases of temporary absence, a lower grade engineer may substitute, but for not more than 30 days.

# E
# CANADA LICENSING REQUIREMENTS

In 1975 Canada's provinces determined that a country wide regulation needed to be established for boiler operators. The changes that have taken place since 1975 have strengthened and placed major restrictions on who and how each applicants will receive a certificate of competency. The engineer's certification is broken down into five classifications. In addition to the five engineer's licenses Canada also has classifications for a Fireman, Special Oilwell Operator, Building Operator A, Building Operator B, and Special Boiler Operator.

To qualify to take an exam each applicant must meet some part of an extensive list of required educational and experience requirements. Each applicant taking an exam for the first through the third class license has the option of taking part or all of the exams offered. Fourth and Fifth class exams require the applicant to take all of the prescribed parts of the exam. When multiple exams are accomplished the applicant must have a minimum score on each exam to be classified as passing and all scores will be averaged to be considered for the passing percentage. The following is a brief description of information that will be contained in each engineer's exam.

## Fifth Class License

| | |
|---|---|
| Length of Exam | 3 ½ Hours |
| Type of Exam | Multiple Choice |
| Passing Score | 65% |

*Materials covered in the exam*

| | |
|---|---|
| Act and Codes | Applied Science |
| Safety | Welding and Plumbing |
| Pumps, Piping and Valves | Boiler Details |
| Boiler Fittings | Fuels and Combustion |
| Boiler Controls | Boiler operation, maintenance and water treatment |

Heating Systems and Human Comfort
Refrigeration and Air conditioning; Systems and Auxiliaries
Refrigeration and Air conditioning Controls; Air Compression
Electricity

## Fourth Class License

| | | |
|---|---|---|
| Length of Exam | Part A | 3 ½ Hours |
| | Part B | 3 ½ Hours |
| Type of Exam | Part A | Multiple Choice |
| | Part B | Multiple Choice |
| Passing Score | 60% | |

*Materials covered in the exam*

*Part A*

| | |
|---|---|
| Applied Mathematics | Elementary Mechanics and Dynamics |
| Elementary Thermodynamics | Mechanical Drawing, Administration |
| The Safety Codes Act | Codes |
| Workplace Hazardous Materials | Plant Safety |
| Plant Fire Protection | Environment |
| Material and Welding | Piping and Valves |
| High Pressure Boiler Design | High Pressure Boiler Parts and Fittings |
| High Pressure Boiler Operation | Feedwater Treatment |

*Part B*

| | |
|---|---|
| Prime Movers and Engines | Pumps and Compressors |
| Lubrication | Electricity |
| Controls, instrumentation and computers | Heating Boilers |
| Heating Systems | Heating Boiler and Heating System Controls |
| Auxiliary Building Systems | Vapour Compression Refrigeration |
| Absorption Refrigeration | Air Conditioning |
| Air Conditioning Systems | Boiler Maintenance |
| Types of Plants | |

## Third Class License

| | | | |
|---|---|---|---|
| Length of Exam | Part A | Section One | 3 ½ Hours |
| | Part A | Section Two | 3 ½ Hours |
| | Part B | Section One | 3 ½ Hours |
| | Part B | Section Two | 3 ½ Hours |
| Type of Exam | Part A | Section One | Multiple Choice |
| | Part A | Section Two | Multiple Choice |
| | Part B | Section One | Essay, Sketch and Describe Exam |
| | Part B | Section Two | Multiple Choice |
| Passing Score | 60% | | |

*Materials covered in the exam*

*Part A Section One*

| | |
|---|---|
| Applied Mathematics | Applied Mechanics |
| Thermodynamics | Applied Science |

*Part A Section Two*

| | |
|---|---|
| Industrial Legislation | Codes |
| Boiler Calculations | Fuels and Combustion |
| Piping | Electrotechnology |
| Electrical Calculations | Control Instrumentation |
| Fire Prevention and Plant Safety | Types and Arrangements of Industrial Plants |

*Part B Section One*

| | |
|---|---|
| Boilers | Boiler Operation and Maintenance |
| Boiler Control Systems | Heating and Air Conditioning |
| Feedwater Treatment | Pumps |
| Welding | |

*Part B Section Two*

| | |
|---|---|
| Prime Movers | Air Compressors |
| Refrigeration | Lubrication |

## Second Class License

| | | | |
|---|---|---|---|
| Length of Exam | Part A | Section One | 3 ½ Hours |
| | Part A | Section Two | 3 ½ Hours |
| | Part A | Section Three | 3 ½ Hours |
| | Part B | Section One | 3 ½ Hours |
| | Part B | Section Two | 3 ½ Hours |
| | Part B | Section Three | 3 ½ Hours |
| Type of Exam | Part A | Section One | Essay |
| | Part A | Section Two | Essay |
| | Part A | Section Three | Essay |
| | Part B | Section One | Essay |
| | Part B | Section Two | Essay |
| | Part B | Section Three | Essay |

Passing Score 70%

*Materials covered in the exam*

*Part A Section One*

| | |
|---|---|
| Applied Mechanics | A.S.M.E. Code, Section 1, Calculations |
| Water Treatment | |

*Part A Section Two*

| | |
|---|---|
| Thermodynamics | Fuels and Combustion |

*Part A Section Three*

Boilers
Control Instrumentation
Piping
Pumps

*Part B Section One*

Prime Movers
Fire Prevention and Plant Safety

*Part B Section Two*

Industrial Legislation
Types and Arrangements of Industrial Plants
Refrigeration and Air Conditioning
Mechanical Drawing

*Part B Section Three*

Electrotechnology
Lubrication
Metallurgy and Welding

## First Class License

| | | | |
|---|---|---|---|
| Length of Exam | Part A | Section One | 3 ½ Hours |
| | Part A | Section Two | 3 ½ Hours |
| | Part A | Section Three | 3 ½ Hours |
| | Part A | Section Four | 3 ½ Hours |
| | Part B | Section One | 3 ½ Hours |
| | Part B | Section Two | 3 ½ Hours |
| | Part B | Section Three | 3 ½ Hours |
| | Part B | Section Four | 3 ½ Hours |
| Type of Exam | Part A | Section One | Essay |
| | Part A | Section Two | Essay |
| | Part A | Section Three | Essay |
| | Part A | Section Four | Essay |
| | Part B | Section One | Essay |
| | Part B | Section Two | Essay |
| | Part B | Section Three | Essay |
| | Part B | Section Four | Essay |
| Passing Score | 70% | | |

*Materials covered in the exam*

*Part A Section One*

Applied Mechanics
A.S.M.E. Codes, Calculations

*Part A Section Two*

Thermodynamics

*Part A Section Three*

Boilers
Piping
Control Instrumentation

*Part A Section Four*
Fuels and Combustion
Pumps
Water Treatment

*Part B Section One*
Prime Movers
Fire Prevention and Plant Safety

*Part B Section Two*
Metallurgy
Welding
Lubrication
Testing of Materials
Power Plant Erection and Developments

*Part B Section Three*
Industrial Administration
Types and Arrangements of Industrial Plants
Refrigeration and Air Conditioning

*Part B Section Four*
Electrotechnology
Nuclear Power Production
Compressors

# *F*

# WORK PROCESSES SCHEDULE FOR THE TRADE CLASSIFICATION OF POWER PLANT OPERATOR (UTILITIES)

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**DOT CODE: 952.382-018**

**AIMS SYMBOL: 0440**

**11/96**

Demonstrate knowledge and skills for qualifying as Journeyman. Applicable Job Qualification Requirements will be used as a guide in performing tasks and demonstrating knowledge in the following areas. Actual work time must be recorded in the Work Experience Log.

| SKILL AREA | HOURS |
|---|---|
| ***A. Operation and Maintenance of Turbine Auxiliaries*** | ***1000*** |

Control operation of and maintain condensate pumps, circulating pumps, lube-oil coolers; generator air coolers; air ejectors, condensers, low-pressure heaters, lube-oil filters, lube-oil purifiers (centrifuge), and auxiliary oil pumps.

| | |
|---|---|
| ***B. Oiling*** | ***500*** |

Boiler feed pumps; high pressure heaters; low pressure heaters; draft fans; open heaters; closed heaters; aerators; miscellaneous pumps, steam and electric driven; air compressors evaporators.

| | |
|---|---|
| ***C. Water Testing (Boiler)*** | ***1000*** |

Perform tests on raw water. Test boiler water for hardness and oxygen content. P and M alkalinity readings. Test for phosphate content and sulfate content. Determine carbonate-sulfate ratio. Test for total chloride content. Determine total solids concentration. Take pH readings. Determine amount of chemical(s) needed to bring low reading up to predetermined normal; when to blow boilers; mixing and standardizing /normalizing testing solutions; and circulating cooling water.

### *D. Turbine Operation* *1000*

Recognize normal readings on instruments; steam pressure and vacuum gauges; oil pressures and temperatures; condenser vacuum, barometer; steam and water flow meters. Prepare turbine and auxiliaries for starting and bringing up to speed.

### *E. Switchboard Operation* *1000*

Use and interpret readings on switchboard instruments, watt-hour meters, voltmeters, voltage regulators, power factors, frequency meters, synchroscope; use of remote-control switches, hand-operated disconnects, oil circuit breakers; substation layout and switching. Synchronize incoming turbine.

### *F. Operate Boiler Room* *1000*

Use and interpret boiler room instruments, draft gauges, pressure gauges, CO indicators, recorders, proper combustion; use of super-heaters; induced and forced draft fans; boiler feed pumps; feed water regulators.

### *G. Logs and Log Entries* *400*

Prepare and interpret logs and log entries. Record malfunctions of equipment, instruments, or controls on log sheet.

### *H. Safety* *100*

Conform to prescribed safety procedures.

### *Total* *6000*

Applicable Navy Rating(s): Boiler Technician (BT)
Gas Turbine Systems Technician, Mechanical (GSM)
Machinist's Mate (MM)

Applicable Navy School(s): Any Navy school(s) related to the trade totaling 432 or more hours of classroom instruction.

# G
# NATIONAL BOARD INCIDENT REPORTS 1992-1998

## 1993 National Board Incident Report

**Power Boilers**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 14 | 3 | |
| Low Water Cut Off | 277 | 5 | |
| Limit Controls | 47 | 7 | |
| Improper Installation | 6 | | |
| Improper Repair | 13 | 30 | |
| Faulty Design or Fabrication | 17 | 11 | 3 |
| Operator Error or Poor Maintenance | 84 | 6 | 1 |
| Burner Failure | 43 | 1 | |
| SUBTOTALS | 501 | 63 | 4 |

**Heating Boilers Steam**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 4 | | |
| Low Water Cut Off | 869 | | |
| Limit Controls | 50 | 2 | |
| Improper Installation | 17 | | |
| Improper Repair | 20 | 1 | |
| Faulty Design or Fabrication | 15 | | |
| Operator Error or Poor Maintenance | 146 | 4 | |
| Burner Failure | 27 | 1 | |
| SUBTOTALS | 1148 | 8 | 0 |

*National Board Incident Reports 1992-1998*

**Heating Boilers Water (Includes Hot Water Supply)**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Valve | 10 | | 1 |
| Low Water Cut Off | 260 | | |
| Limit Controls | 43 | 4 | 2 |
| Improper Installation | 12 | 2 | |
| Improper Repair | 6 | | |
| Faulty Design or Fabrication | 19 | | |
| Operator Error or Poor Maintenance | 102 | 1 | |
| Burner Failure | 15 | 3 | |
| SUBTOTALS | 467 | 10 | 3 |

**Unfired Pressure Vessels**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 26 | 1 | |
| Limit Controls | 24 | 2 | |
| Improper Installation | 15 | 10 | |
| Improper Repair | 24 | | |
| Faulty Design or Fabrication | 11 | 8 | 4 |
| Operator Error or Poor Maintenance | 161 | 3 | 2 |
| SUBTOTALS | 261 | 24 | 6 |
| TOTALS | 2377 | 102 | 13 |

## 1994 National Board Incident Report

**Power Boilers**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 4 | | |
| Low Water Cut Off | 192 | | |
| Limit Controls | 39 | | |
| Improper Installation | 14 | | |
| Improper Repair | 20 | | |
| Faulty Design or Fabrication | 20 | | |
| Operator Error or Poor Maintenance | 135 | 8 | 2 |
| Burner Failure | 43 | 1 | 1 |
| SUBTOTALS | 465 | 9 | 3 |

**Heating Boilers Steam**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 14 | | |
| Low Water Cut Off | 812 | | |
| Limit Controls | 26 | 1 | |
| Improper Installation | 31 | | |
| Improper Repair | 17 | 1 | |
| Faulty Design or Fabrication | 13 | | |
| Operator Error or Poor Maintenance | 159 | 1 | |
| Burner Failure | 27 | 3 | |
| SUBTOTALS | 1098 | 6 | 0 |

*National Board Incident Reports 1992-1998*

**Heating Boilers Water (Includes Hot Water Supply)**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 28 | | |
| Low Water Cut Off | 236 | 1 | |
| Limit Controls | 19 | | |
| Improper Installation | 52 | 3 | |
| Improper Repair | 20 | | |
| Faulty Design or Fabrication | 15 | | |
| Operator Error or Poor Maintenance | 142 | 5 | |
| Burner Failure | 28 | 2 | |
| SUBTOTALS | 540 | 11 | 0 |

**Unfired Pressure Vessels**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 31 | 1 | |
| Limit Controls | 16 | | |
| Improper Installation | 25 | 6 | |
| Improper Repair | 18 | | |
| Faulty Design or Fabrication | 16 | 4 | 1 |
| Operator Error or Poor Maintenance | 281 | 8 | 4 |
| SUBTOTALS | 387 | 19 | 5 |
| TOTALS | 2490 | 45 | 8 |

## 1995 National Board Incident Report

**Power Boilers**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 4 | | |
| Low Water Cut Off | 186 | | |
| Limit Controls | 16 | | |
| Improper Installation | 7 | | |
| Improper Repair | 34 | | 2 |
| Faulty Design or Fabrication | 10 | | |
| Operator Error or Poor Maintenance | 216 | 4 | 4 |
| Burner Failure | 54 | | |
| SUBTOTALS | 527 | 4 | 6 |

**Heating Boilers Steam**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 12 | | |
| Low Water Cut Off | 918 | | |
| Limit Controls | 24 | | |
| Improper Installation | 19 | | |
| Improper Repair | 12 | | |
| Faulty Design or Fabrication | 23 | | |
| Operator Error or Poor Maintenance | 177 | 3 | |
| Burner Failure | 58 | 3 | |
| SUBTOTALS | 1243 | 6 | |

*National Board Incident Reports 1992-1998*

**Heating Boilers Water (Includes Hot Water Supply)**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 9 | | |
| Low Water Cut Off | 226 | | |
| Limit Controls | 29 | | |
| Improper Installation | 17 | | |
| Improper Repair | 30 | | |
| Faulty Design or Fabrication | 40 | 1 | |
| Operator Error or Poor Maintenance | 197 | | |
| Burner Failure | 49 | | 1 |
| SUBTOTALS | 597 | 1 | 1 |

**Unfired Pressure Vessels**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 15 | 7 | 1 |
| Limit Controls | 9 | 2 | |
| Improper Installation | 12 | | |
| Improper Repair | 14 | | |
| Faulty Design or Fabrication | 27 | 4 | |
| Operator Error or Poor Maintenance | 168 | 52 | 5 |
| SUBTOTALS | 245 | 65 | 6 |
| TOTALS | 2612 | 76 | 13 |

# 1996 National Board Incident Report

**Power Boilers**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 1 | | |
| Low Water Cut Off | 356 | | |
| Limit Controls | 16 | | |
| Improper Installation | 5 | | |
| Improper Repair | 6 | | |
| Faulty Design or Fabrication | 8 | | |
| Operator Error or Poor Maintenance | 125 | 8 | 2 |
| Burner Failure | 40 | | |
| SUBTOTALS | 557 | 8 | 2 |

**Heating Boilers Steam**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 5 | | |
| Low Water Cut Off | 490 | | |
| Limit Controls | 27 | 1 | |
| Improper Installation | 14 | | |
| Improper Repair | 7 | | |
| Faulty Design or Fabrication | 14 | | |
| Operator Error or Poor Maintenance | 125 | 18 | |
| Burner Failure | 59 | 21 | 2 |
| SUBTOTALS | 741 | 40 | 2 |

*National Board Incident Reports 1992-1998*

**Heating Boilers Water (Includes Hot Water Supply)**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 5 | 1 | |
| Low Water Cut Off | 112 | | |
| Limit Controls | 24 | | |
| Improper Installation | 15 | | |
| Improper Repair | 3 | | |
| Faulty Design or Fabrication | 20 | | |
| Operator Error or Poor Maintenance | 221 | 5 | |
| Burner Failure | 70 | 2 | |
| SUBTOTALS | 470 | 8 | |

**Unfired Pressure Vessels**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 5 | 1 | |
| Limit Controls | 8 | 1 | |
| Improper Installation | 20 | 2 | |
| Improper Repair | 7 | 12 | 3 |
| Faulty Design or Fabrication | 27 | 3 | 2 |
| Operator Error or Poor Maintenance | 252 | 3 | 1 |
| SUBTOTALS | 319 | 22 | 6 |
| TOTALS | 2087 | 78 | 10 |

# 1997 National Board Incident Report

**Power Boilers**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Tube Sheet Crack | 52 | 0 | 0 |
| Safety Relief Valve | 0 | 0 | 0 |
| Low Water Condition | 220 | 0 | 0 |
| Limit Controls | 8 | 0 | 0 |
| Improper Installation | 5 | 0 | 0 |
| Improper Repair | 3 | 0 | 0 |
| Faulty Design or Fabrication | 16 | 6 | 0 |
| Operator Error or Poor Maintenance | 94 | 15 | 2 |
| Burner Failure | 53 | 3 | 2 |
| SUBTOTALS | 451 | 24 | 4 |

**Heating Boilers Steam**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 9 | 0 | 0 |
| Low Water Condition | 331 | 1 | 0 |
| Limit Controls | 139 | 1 | 0 |
| Improper Installation | 13 | 0 | 0 |
| Improper Repair | 52 | 0 | 0 |
| Faulty Design or Fabrication | 48 | 0 | 0 |
| Operator Error or Poor Maintenance | 161 | 3 | 0 |
| Burner Failure | 56 | 1 | 0 |
| SUBTOTALS | 809 | 6 | 0 |

*National Board Incident Reports 1992-1998*

**Heating Boilers Water (Includes Hot Water Supply)**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 11 | 0 | 0 |
| Low Water Condition | 647 | 1 | 0 |
| Limit Controls | 11 | 1 | 0 |
| Improper Installation | 16 | 0 | 0 |
| Improper Repair | 5 | 0 | 0 |
| Faulty Design or Fabrication | 55 | 0 | 0 |
| Operator Error or Poor Maintenance | 97 | 2 | 1 |
| Burner Failure | 61 | 0 | 0 |
| SUBTOTALS | 903 | 4 | 1 |

**Unfired Pressure Vessels**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Misc. Unfired Pressure Vessel | 82 | 0 | 0 |
| Cause Unknown (still under investigation) | 1 | 0 | 2 |
| Safety Relief Valve | 8 | 2 | 0 |
| Limit Controls | 7 | 2 | 1 |
| Improper Installation | 12 | 23 | 3 |
| Improper Repair | 6 | 1 | 0 |
| Faulty Design or Fabrication | 35 | 7 | 1 |
| Operator Error or Poor Maintenance | 141 | 6 | 6 |
| SUBTOTALS | 292 | 41 | 13 |
| TOTALS | 2455 | 75 | 18 |

# 1998 National Board Incident Report

**Power Boilers**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Valve | 2 | 2 | 0 |
| Low Water Condition | 128 | 0 | 0 |
| Limit Controls | 7 | 0 | 0 |
| Improper Installation | 5 | 1 | 0 |
| Improper Repair | 9 | 0 | 0 |
| Faulty Design or Fabrication | 5 | 0 | 0 |
| Operator Error or Poor Maintenance | 84 | 3 | 0 |
| Burner Failure | 32 | 2 | 0 |
| SUBTOTALS | 272 | 8 | 0 |

**Heating Boilers Steam**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Valve | 0 | 0 | 0 |
| Low Water Condition | 339 | 1 | 0 |
| Limit Controls | 28 | 0 | 0 |
| Improper Installation | 48 | 0 | 0 |
| Improper Repair | 4 | 0 | 0 |
| Faulty Design or Fabrication | 14 | 0 | 0 |
| Operator Error or Poor Maintenance | 283 | 1 | 0 |
| Burner Failure | 23 | 3 | 0 |
| SUBTOTALS | 739 | 5 | 0 |

**Heating Boilers Water (Includes Hot Water Supply)**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Relief Valve | 4 | 0 | 0 |
| Low Water Condition | 182 | 0 | 0 |
| Limit Controls | 54 | 0 | 0 |
| Improper Installation | 155 | 0 | 0 |
| Improper Repair | 11 | 0 | 0 |
| Faulty Design or Fabrication | 71 | 0 | 0 |
| Operator Error or Poor Maintenance | 332 | 0 | 0 |
| Burner Failure | 38 | 6 | 0 |
| SUBTOTALS | 847 | 6 | 0 |

**Unfired Pressure Vessels**

| OBJECT EXPERIENCING INCIDENT | ACCIDENTS | INJURIES | DEATHS |
|---|---|---|---|
| Safety Valve | 5 | 1 | 0 |
| Limit Controls | 10 | 0 | 0 |
| Improper Installation | 10 | 0 | 0 |
| Improper Repair | 6 | 7 | 3 |
| Faulty Design or Fabrication | 15 | 3 | 1 |
| Operator Error or Poor Maintenance | 107 | 1 | 5 |
| SUBTOTALS | 153 | 12 | 9 |
| TOTALS | 2,011 | 31 | 9 |

# H
# FASTEST GROWING OCCUPATIONS AND OCCUPATIONS IN DECLINE

*Data in this section was provided by the Bureau of Labor Statistics (BLS).*

## Fastest Growing Occupations

**Overall**
Listed below are the 25 occupations projected to grow the fastest during the 1996-2006 time period. Click on an occupation to learn more about it, including state data.

| Occupation | Employment | | Percent change* |
|---|---|---|---|
| | 1996 | 2006 | |
| Computer engineers | 215,700 | 451,000 | 109% |
| Systems analysts, electronic data processing | 505,500 | 1,025,100 | 103% |
| Personal and home care aides | 202,500 | 373,900 | 85% |
| Physical and corrective therapy assistants and aides | 84,500 | 150,900 | 79% |
| Home health aides | 494,700 | 872,900 | 77% |
| Electronic pagination system operators | 30,400 | 52,800 | 74% |
| Medical assistants | 224,800 | 391,200 | 74% |
| Physical therapists | 114,500 | 195,600 | 71% |
| Occupational therapy assistants and aides | 15,700 | 26,400 | 69% |
| Paralegal personnel | 112,900 | 189,300 | 68% |
| Occupational therapists | 57,400 | 95,300 | 66% |
| Teachers, special education | 407,000 | 647,700 | 59% |
| Human services workers | 177,800 | 276,300 | 55% |
| Data processing equipment repairers | 79,700 | 121,500 | 52% |

| Occupation | Employment | | Percent change* |
|---|---|---|---|
| | 1996 | 2006 | |
| Medical records technicians | 87,300 | 131,800 | 51% |
| Speech-language pathologists and audiologists | 87,300 | 131,500 | 51% |
| Amusement and recreation attendants | 288,100 | 426,100 | 48% |
| Dental hygienists | 132,800 | 196,800 | 48% |
| Physician's assistants | 63,800 | 93,500 | 47% |
| Adjustment clerks | 401,300 | 583,900 | 46% |
| Respiratory therapists | 81,800 | 119,300 | 46% |
| Emergency medical technicians | 149,700 | 217,100 | 45% |
| Engineering, mathematical, and natural sciences managers | 342,900 | 498,000 | 45% |
| Manicurists | 43,100 | 62,400 | 45% |
| Bill and account collectors | 268,600 | 381,100 | 42% |

* Note: The national average percent change is between 10 and 20%.

## Occupations in Decline

### Overall

Listed below are the 25 occupations with the largest decline in employment during the 1996-2006 time period. Click on an occupation to learn more about it, including state data.

| Occupation | Employment | | Percent Change |
|---|---|---|---|
| | 1996 | 2006 | |
| Paste-up workers | 14,900 | 3,700 | -75% |
| Strippers | 26,200 | 6,500 | -75% |
| Typesetting and composing machine operators and tenders | 13,700 | 3,400 | -75% |
| Station installers and repairers, telephone | 36,600 | 9,700 | -74% |
| Hand compositors and typesetters | 6,500 | 3,200 | -50% |
| Peripheral EDP equipment operators | 33,200 | 16,600 | -50% |
| Central office operators | 48,200 | 25,600 | -47% |

| Occupation | Employment | | Percent Change |
|---|---|---|---|
| | 1996 | 2006 | |
| Directory assistance operators | 33,200 | 17,600 | -47% |
| Data keyers, composing | 17,800 | 9,900 | -45% |
| Motion picture projectionists | 8,400 | 4,600 | -45% |
| Shoe sewing machine operators and tenders | 11,100 | 6,500 | -42% |
| Credit authorizers | 16,300 | 10,000 | -39% |
| Proofreaders and copy markers | 26,100 | 16,100 | -39% |
| Farm and home management advisors | 16,100 | 9,900 | -38% |
| Photoengravers | 4,800 | 3,100 | -36% |
| Letterpress setters and set-up operators | 13,900 | 9,000 | -35% |
| Electric meter installers and repairers | 11,600 | 7,700 | -34% |
| Roustabouts | 27,800 | 18,400 | -34% |
| Textile machine setters and set-up operators | 41,000 | 26,900 | -34% |
| Welfare eligibility workers and interviewers | 109,300 | 75,600 | -31% |
| Computer operators, except peripheral equipment | 257,900 | 181,000 | -30% |
| Railroad brake, signal, and switch operators | 17,800 | 12,800 | -28% |
| Sewing machine operators, garment | 452,800 | 334,500 | -26% |
| Electrocardiograph technicians | 14,800 | 11,200 | -24% |
| Credit checkers | 42,500 | 33,100 | -22% |

# I
# QFO OVERVIEW

In October 1992, the EPA initiated development of a training program for operators of high capacity fossil fuel-fired plants. On October 6, 1993, the EPA announced the availability of a draft student handbook, prepared as part of a training course for operators of high capacity fossil fuel-fired plants. Again, the EPA contracted with the ASME to develop and manage a nationwide certification program. The final draft of the certification requirements was distributed in January 1999.

There are six classes of available certification, which depend on the type of fossil fuel being fired and on the firing method(s).

Class A certification applies to operators of fossil plants burning pulverized fuel.

Class B applies to operators of fossil plants burning oil or gas or a combination of oil and gas in a single burner.

Class C applies to operators of fossil plants that burn oil or gas or a combination of oil and gas in a multiple burner.

Class D applies to operators of stoker fired fossil plants.

Class E applies to operators of fluidized bed fossil plants.

Class F applies to operators of auxiliary fired heat recovery steam generators

The QFO certification is not site specific and is issued to the operator for use at different facilities provided the class for certification is comparable with the equipment to be operated.