

THE EXTERNSHIP PROGRAM



2022 Program Guide

Career Development for Operating Engineers



Helping people build careers.

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THE EXTERNSHIP PROGRAM OVERVIEW

The Externship Program provides the ultimate starting point for those looking to start a career in the plant operations industry. The flagship program of our school, we've made significant improvements for 2022. This unique course provides the combination of advanced classroom training with actual real-world working experience at the same time. The program is designed to establish professional fundamentals using habit-forming on-the-job training. We cover all the best practices for a successful plant professional, including preparing you completely for the NJ Black Seal High Pressure engineer license exam, helping you with job placement, and continuously supporting your career.

No experience around a boiler is required to enroll in this program. This is because students or "Externs" will receive their experience during the program by completing hands-on (on-site) experience working under the direction of our operations team at various high pressure steam or thermal plants. The passing of a very basic general aptitude exam is required prior to enrollment.



EXTERNSHIP STUDENT JOURNEY

1



Setup your accounts for training. This is for both online training and hands-on.

2



Attend weekly Zoom classes. We will host in-person classes if possible.

3



Qualify for site training. With basic knowledge, schedule a shift.

4



Begin hands-on training. Claim shifts and events in the app.

5



Apply classroom theory into your hands-on experience. Get certified in our online safety courses.

6



Improvement of professional identity. Prepare for job hunting. We will polish your resume and help share it.

7



Prepare for Black Seal High Pressure state exam. You'll practice to be prepared for exam day.

8



Complete our final evaluation, pass exam, get licensed, and graduate!

LEARNING *BEST PRACTICES*



AND APPLYING THEM *HANDS-ON*



B101: CAREER ORIENTATION



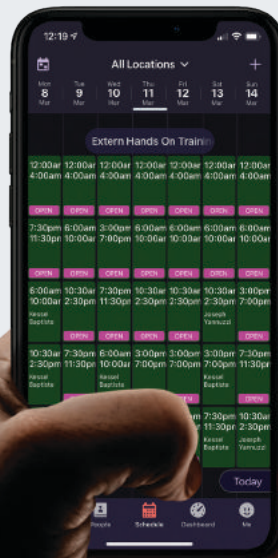
WE'LL LEARN

- **Student Introduction**
- **Becoming a Plant Professional**
- **Plant Basics and Principles**
- **The Habits of a Great Operating Professional**
- **The tools of your Externship**
- **Your Online Training Portal & Safety Training**
- **Qualifying for Hands-On Training**

COURSE DETAILS

This course is an introduction to the Externship Program and the industry of plant operations in general. Before diving into the technical topics of operation, students must first learn how to maximize their learning through this program. The program is a self-paced program designed for the adult learner. The program includes live webinar lessons (with the expectation for in-person lessons once COVID safety allows), hands-on training for real-world experience, and online training portals to cover all aspects of career development and allow you to study on-demand.

This course will outline how to be successful in creating a career in the stationary engineering/operations industry. We teach you how to become a stand-out professional rather than simply an operator. Strategies for career opportunities and how to maximize your hands-on training is covered. We discuss the most critical steps in having a successful career, including lessons learned from our experiences. Learn to be consistent and create the right industry habits.



- ✓ Punctual
- ✓ Clear Communicator
- ✓ Great Record-Keeper
- ✓ Strong Safety Mindset
- ✓ Great Time-Management
- ✓ Continuous Learning
- ✓ Keeps Plant Clean & Presentable
- ✓ Ability to Solve Problems
- ✓ Always Prepared
- ✓ Help Others (Leadership Skills)

B103: INTRO TO BOILERS



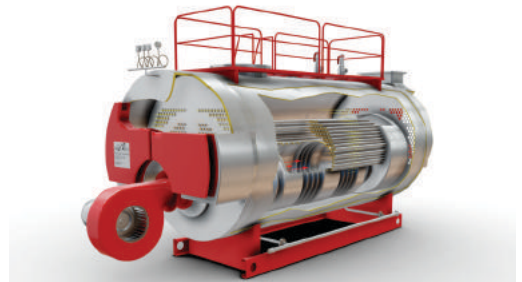
WE'LL LEARN

- *Heat and Energy Fundamentals*
- *What is a Boiler? How Does it Work?*
- *Types of Boilers*
- *4 Main Systems of a Boiler*
- *Boiler Safety and Protection Devices*
- *Learning On Your Own: Best Resources Out There*

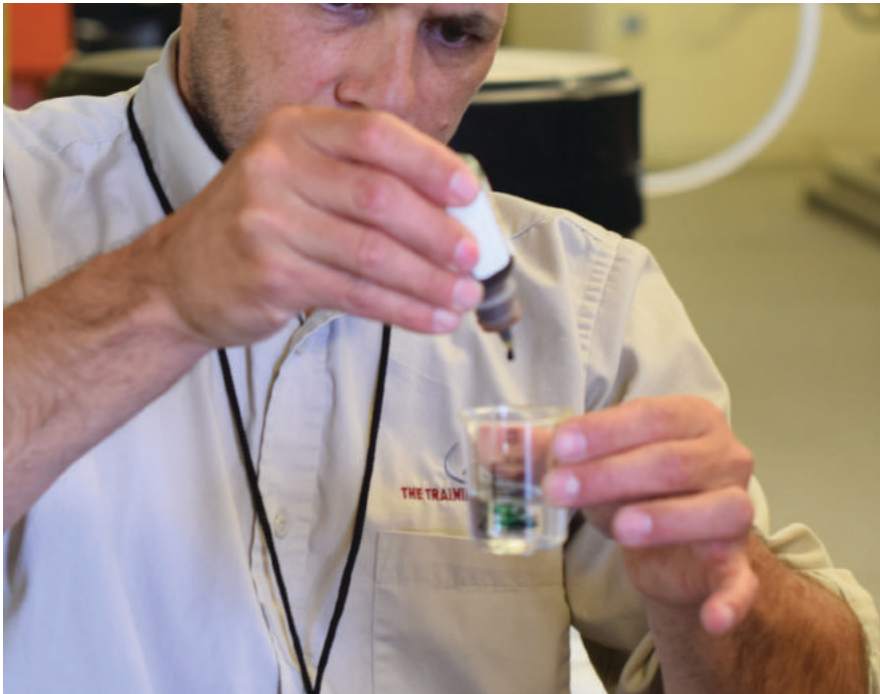
COURSE DETAILS

This course is an introduction to the primary piece of equipment for stationary engineers: the boiler. We begin by learning some important thermodynamic fundamentals, specifically heat theory and the various energy principles that directly apply in the boiler room. With a true understanding of heat, we'll build a boiler from the ground-up (interactively) and discover the engineered logic behind the equipment.

Students will learn how a boiler works, know its fundamental process, and learn about the 4 main systems that interconnect to maintain the plant process. We'll cover general boiler room safety, including the key protection devices on the boiler, which protect us during normal operation. The class will guide you through a historical progression of where the industry started vs where we are today. The student will learn feedwater rules, basic chemistry needs, blowdown systems, and level protection systems. The students will take lessons from this class and apply them during their hands-on training experience. Students will be assigned some reading and on-site training exercises to follow-up on these boiler fundamentals.



B104: FEEDWATER & CHEMISTRY



WE'LL LEARN

- *The Importance of Water*
- *Feedwater Control*
- *Tracing the Feedwater System*
- *Feedwater Components/Types*
- *Intro to Water Chemistry*
- *Conducting a Water Chemistry Analysis*

COURSE DETAILS

Understanding the feedwater system and water chemistry program is of paramount importance when it comes to plant operation. Here you will learn the importance of water chemistry and the impact a water chemistry program has on the lifespan of a boiler and the plant. Regardless of what system you are operating, any great operator should have a solid understanding of water chemistry. The learning experience is a compliment to the hands-on training experience that occurs at the facility, where you get a real-world learning experience by conducting analysis and tracing a drop of water as it moves through the system. The feedwater system, and the components that make it work, are covered in detail.



B105: STEAM AND HYDRONIC SYSTEMS



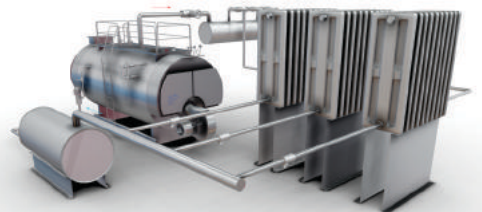
WE'LL LEARN

- *Pressure and Temperature Fundamentals*
- *Steam vs Hydronic (Hot Water) Systems*
- *Tracing a Hydronic System*
- *Tracing a Steam System*
- *Steam Fittings (Valves)*
- *Steam Accessories (Traps)*

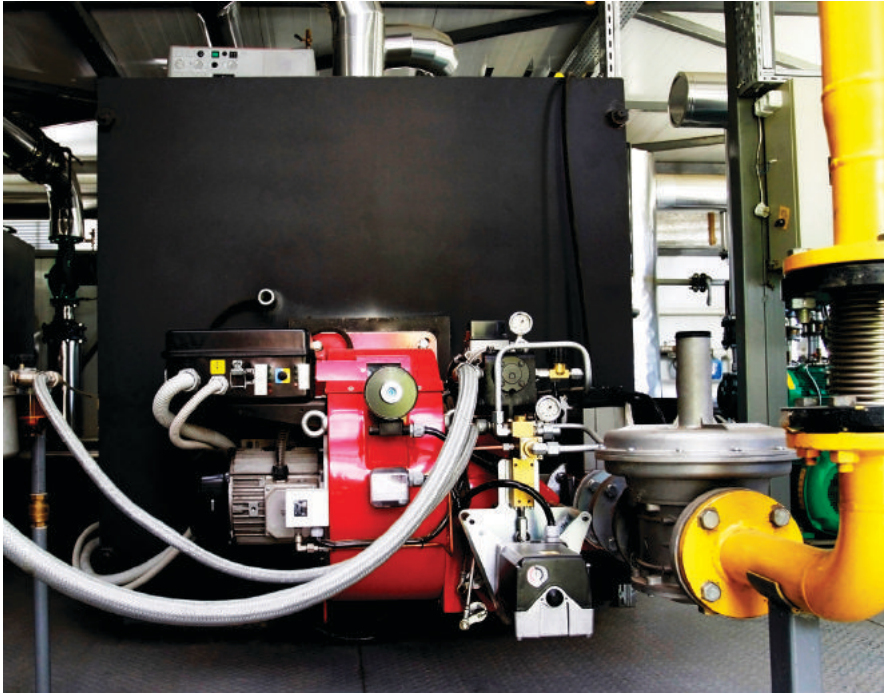
COURSE DETAILS

This course is essential for an operator's understanding of the different types of steam produced in boiler systems and the valves and fittings used to control it. We will discuss the relationship between pressure and boiling point, saturated steam vs superheated steam. We distinguish system differences between steam and hydronic systems and how each application is applied in their perspective facility.

Using dynamic presentation graphics, we will actually build a basic boiler room's steam system and illustrate how the process works. As operators, we must manage the various problems that could occur in the steam cycle, including carryover and maintaining dry steam.



B106: FUEL AND COMBUSTION



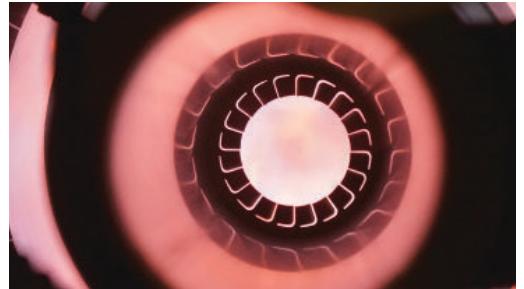
WE'LL LEARN

- *Fuel Fundamentals*
- *Tracing the Fuel System*
- *The Burner*
- *Boiler Combustion*
- *Boiler Start-Up and Shutdown (Sequence of Operation)*

COURSE DETAILS

With a general understanding of how a boiler works, we now learn the fundamentals of burning fuel for combustion in our boiler. It starts with breaking down the different types of fuels being used in various plants and their specific characteristics. Using dynamic animations, your instructor will build a fuel-oil and natural gas system as it comes into the plant and to the boiler's burner. Combustion fundamentals are discussed with a focus on boiler combustion theory. The equipment, valves, and fittings involved in the fuel and combustion process are broken down for easy understanding.

We'll learn the importance of controlling the fuel-to-air ratio in the combustion process in order to maintain complete combustion. If we had incomplete combustion in our plant, students will know the signs and how to correct the issue. The final topic of the course walks students through the sequence of operation, or starting-up of the boiler properly as an operator. This part of the lesson is a fundamental process that can be applied to different types of boilers from small to large, and everything in between. Specific protection devices like the flame scanner, burner control, ignition, purge, and other devices will be covered. We'll cover the common boiler alarms and the steps involved to look for failures, or responding to alarms.



B107: DRAFT AND CONTROL SYSTEMS



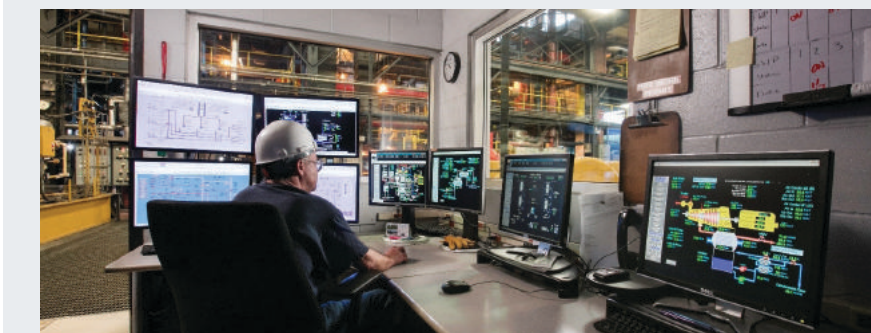
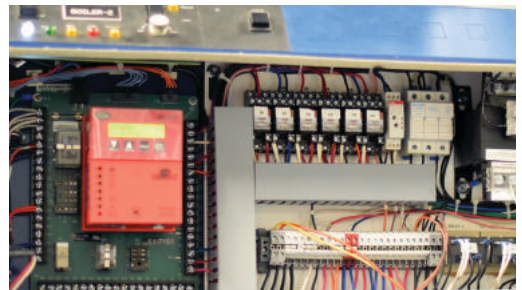
WE'LL LEARN

- *Draft Fundamentals*
- *Tracing the Draft System*
- *Draft Components*
- *Instrumentation and Controls*
- *Flame Safeguard System (BMS)*

COURSE DETAILS

B107 provides an understanding of boiler draft and control systems through a study of the various fittings and systems installed with the equipment. We cover the draft system and all of its functions in the boiler's process, including combustion air, combustion gas, and emissions control.

When it comes to control systems, we start by teaching how a fundamental process control loop works. From there we can apply these various control loops to the boiler's programmer or "brains". We also break down the differences between BMS (Burner Management System) and BPCS (Boiler Process Control Systems). We'll learn about the flame safeguard system in the most common boilers and the interlocks we sometimes experience in boiler operation.

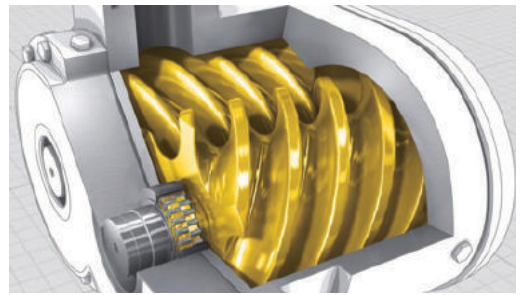
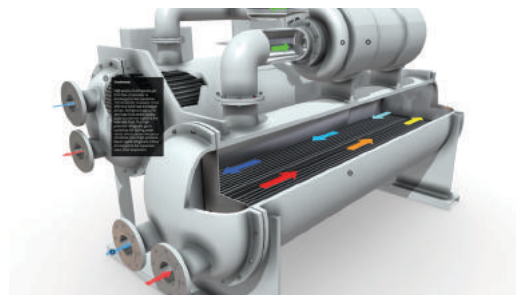


B108: REFRIGERATION BASICS



WE'LL LEARN

- *Refrigeration Fundamentals*
- *The Vapor-Compression Cycle*
- *Centrifugal Chillers*
- *Understanding Refrigerants*
- *Types of Refrigeration Plants*
- *Learning On Your Own: Best Resources Out There*

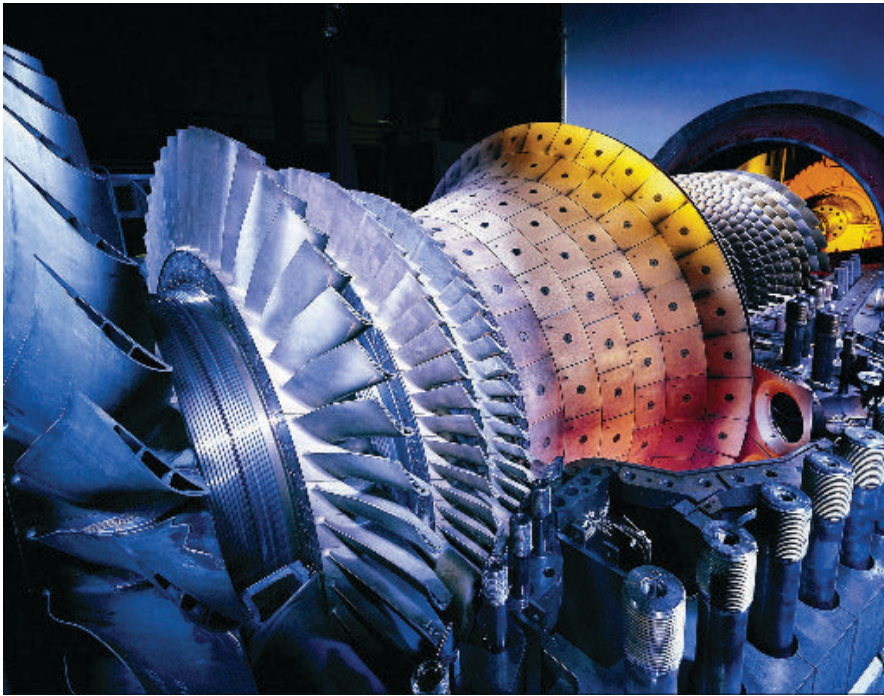


COURSE DETAILS

In B108, we learn the fundamentals of refrigeration. We learn how the vapor compression refrigeration cycle, how it works, how chillers and chilled-water systems work. We build-out a couple different (common) refrigeration systems, breaking down what each component does. Students will understand how their HVAC, a centrifugal chiller, and related systems operate at a fundamental level. The process is described through highly animated graphics that connect specific system components operation to practical system use in large facilities.



B109: POWER GENERATION BASICS



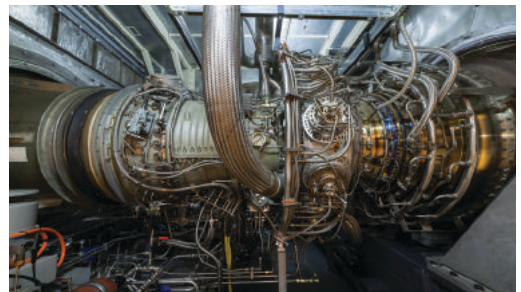
WE'LL LEARN

- *Power Generation Fundamentals*
- *Power Plant Systems (Cycles)*
- *The Gas Turbine*
- *Major Components and Accessories*
- *How to Learn in a Large Plant*
- *Learning On Your Own: Best Resources Out There*

COURSE DETAILS

In the 9th core class, we learn the power generation systems and major components. The class will start off with a general discussion on the current industry landscape and the direction the industry is heading. The lesson's technical content focuses on major equipment operation including the gas turbine, steam turbine, condenser, accessory systems for major components, heat recovery steam generators (HRSG), and putting those systems together to describe their interconnection.

The specifics of each major component is described and the course will prepare the students for the full 1-day power generation course with a tour of a large power plant. Throughout the course, the instructor will introduce the student to multiple industry situations designed to share experience to enhance the learning experience. Experience is a tough teacher and passing along industry events and the 200+ years of industry experience from the Course Directors increases the students common knowledge and their ability to speak the industry language.



B110: PROBLEM SOLVING



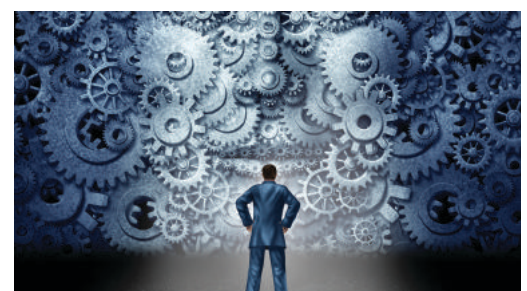
WE'LL LEARN

- *Intro to Problem Solving*
- *General Troubleshooting Method (Framework)*
- *Upstream Problem Solving*
- *Defensive Habits (Avoiding Problems)*

COURSE DETAILS

While normal operating conditions in a plant can be rather smooth and stress-free, problems do occur. The question is, how will you handle it? A very deliberate, obvious gauge on a great power plant employee is how he or she performs their duties when problems occur in the facility. Multi-million dollar power plants are wise to staff themselves and rely on people of specific characteristics, which we will discuss.

Successful problem solving, or troubleshooting, depends on logic and knowledge. That means it can be trained. We cover the various types of learning that contributes to our troubleshooting skills and then introduce a 7-step framework, or flowchart, that we can apply to a broad class of problems. By the end of this class, students will immediately be able to apply these frameworks and strategies to solving various problems. Great problem solvers are able to put theory, process, and general control knowledge to identify where the problem started and what fix is needed. Students will now be able to approach issues in an unbiased, intelligent manner.



B111: STATE EXAM PREP 1



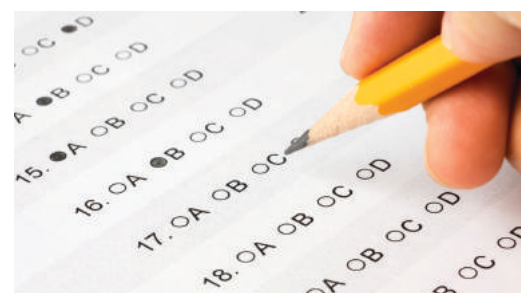
WE'LL LEARN

- *Overview of the NJ BOHP Exam*
- *Heat Theory and Boiler Horsepower*
- *Calculations*
- *Fuel, Draft, Controls*
- *Online Quiz Examples (Study Help)*

COURSE DETAILS

This class will put together everything we learned from our core classes and hands-on experience. We now connect core lessons to the state exam subject materials and general stationary engineering subjects. A focus on system operation with regulatory guidance from NJ Department of Labor licensing, ASME, NFPA, and general permitting. The class will be focused to prepare the student for taking their material learned and apply that knowledge to a practical examination.

Course materials covered will include boiler startup, shut-down and general operation in automatic. Maintenance, inspections, and testing frequency will be discussed. Inspection preparation and maintenance practices are critical subjects that have to be known and the student must be able to demonstrate knowledge for their state examination.



B112: STATE EXAM PREP 2



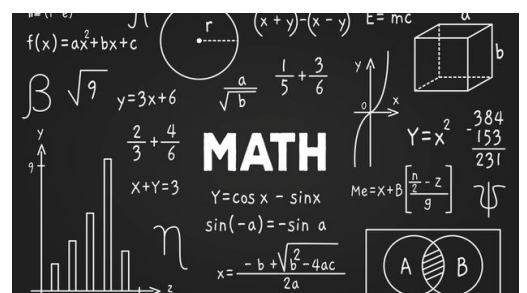
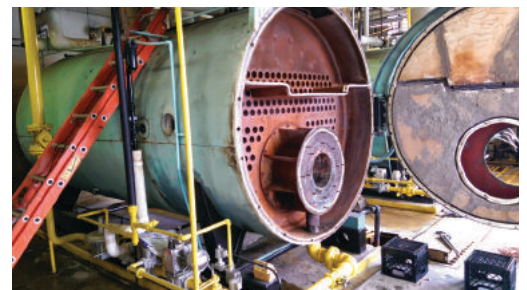
WE'LL LEARN

- *Feedwater System*
- *Steam System*
- *ASME and NJ Boiler Code (12:90)*
- *Valves, Combustion, Process*
- *Black Seal Math*

COURSE DETAILS

Core components of the lesson go back to core subjects within B103 - B107 and blending those lessons with state related questions as we did in B111. The student will learn boiler design, ASME code, regulatory factors, heating systems vs steam systems, piping, pipe fittings and valves, hazardous operating conditions, specific water chemistry topics, boiler lay-up both dry and wet, nitrogen blanketing, and corrosion prevention.

Examples of proper logging are reviewed and demonstrated showing different scenarios. Additional areas of focus will include hydrostatic testing, internal inspections, proper safety control testing, general repair requirements, maintenance practices, and state inspection frequency. The course will cover 12:90 Boilers, Pressure Vessels and Refrigeration Code, ASME Care and Handling of Power Boilers, and core NFPA standards that apply to the boiler room. The student will also be introduced to key industry websites and ways to stay tuned into changes and expert advisory recommendations.



B113: STATE EXAM PREP 3



WE'LL LEARN

- *Heat and Energy Fundamentals*
- *What is a Boiler? How Does it Work?*
- *4 Main Systems of a Boiler*
- *Boiler Safety and Protection Devices*
- *Learning On Your Own: Best Resources Out There*

COURSE DETAILS

This class is a test preparation session, focusing on test-taking strategies. The students will be engaged through live questions that are answered as a group, with feedback given on responses explaining the difference between right and wrong responses. Our goal is to generate confidence in our students ability to take tests, which will apply to future tests that are related to this industry.

The course will describe the state application process and final testing. This is all about building confidence in the test and removing anxiety that resides within everyone taking a state exam. At the conclusion of this session, we should be in our final preparations for state licensing.





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LEARNING *BEST PRACTICES*

AND APPLYING THEM *HANDS-ON*
