

## **SECOND CLASS FIREMAN**

Types, purpose, operation, of the following: Fire Tube boilers, water tube boilers, package boilers, forced-flow steam generators, steam drum internals, water column, gauge glass, try cocks, safety valves, check valves, relief valves, valves, gauges, soot blowers, dampers, superheaters, economizers and air preheaters. Fundamentals of heat transfer and circulation of water in various boiler types; including the properties of steam. Arrangement of blowoff piping in various boilers. Blowoff valve sequencing in various boilers. Purpose for boiler blow down. Purpose of steam traps. Proper operation of valves for opening and closing. Proper procedure for establishing boiler water level, light-off and going on line with other boilers on a header system.

Proper procedure for boiler out of service operation such as: shutdown, draining, isolation, cleaning. The preparation of a boiler for inspection. Proper procedure for startup of boiler auxiliaries such as: motor-driven boiler feed pumps, reciprocating steam pumps, draft fans, etc. and their normal operation. Purpose and operation of safety valves. Procedure for removing and installing manhole and handhole plates. On line operation for abnormal conditions such as: oil in boiler, low water, high water, water carryover, leaks, etc. Types and operation of oil and gas burners as used in H.P. boilers. A basic knowledge of combustion flame safety equipment.

Understanding of the principals of combustion. Operation and testing of low water cutoff. Ability to do simple math. Knowledge of first duties on taking over a shift; including State operators logbook. Knowledge of opacity restrictions and smoke density devices required by 310 CMR 7.00. Understanding of lockout / tag out procedures. Understanding of MSDS. Confined space entry. Knowledge of ASME Code Section VII. Knowledge of what the license permits them to do. This information is contained in Chapter 146 of the General Laws and in 522 CMR 2.00.

Understanding ASME Section 7

Questions concerning the plant in which the applicant is presently employed or where they have been employed in the past may be asked during the oral portion of the examination.

## **FIRST CLASS FIREMAN**

All of that pertaining to the foregoing grade. A knowledge of low-pressure steam and vacuum heating systems, feedwater heaters including deaerators and single feedwater control level systems, as well as feedwater treatment and testing. Boiler water sampling, testing and treatment as well as control of steam contamination. Operation & knowledge of small non-condensing turbines. Proper procedure for replacing packing on valves and pumps. Knowledge of the effects of foaming, priming, scale, oil, etc. on the operation of boilers. Laying up of boilers, both wet and dry. Lubricants and lubrication methods for various types of lubricators and their uses on various boiler auxiliaries. Knowledge of the various types of safety valves and relief valves. Safe operating procedures for boilers and auxiliaries covering startup, normal operation, emergency conditions and shutdown. Knowledge of automatic boiler operating controls including safety devices required by 522 CMR 16.00. Knowledge of combustion and combustion by-products. A knowledge of fuel and their proper storage. Types and testing of steam traps.

Knowledge of licensing and inspection laws in Massachusetts including Section 46. Boiler horsepower determination using Chapter 146. Knowledge of steam tables. Knowledge of CMR's 522. Knowledge of CMR's 310. Operation & regeneration of Water softeners, knowledge of steam reducing valves and flue gas analysis equipment. Operation of reciprocating pumps.

Operation & maintenance of centrifugal pumps. Knowledge of what the license permits them to do. This information is contained in Chapter 146 of the General Laws and in 522 CMR 2.00

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### THIRD CLASS ENGINEER

All of that pertaining foregoing grades: Types, purpose, operation of the following: Non-condensing steam turbines, impulse blading, reaction blading, velocity-compounding, pressure compounding, journal bearings, forced feed lubrication, reduction gears, shaft seals, throttle-trip valves, emergency governors, overpressure protection devices. Understanding of causes of vibrations and critical speeds in turbines. Turbine horsepower determination as per Chapter 146. Knowledge of direct acting centrifugal and electronic type speed governors. A knowledge of water treatment. The effect of scale, sludge and other contaminants in boilers. An understanding of water side and fire side corrosion and its prevention. A thorough knowledge of positive and non-positive displacement pumps. A knowledge of heating systems using outside air admission. Methods of removing scale and oil from boilers. Knowledge of boiler safety valve code requirements; including capacity determination, permissible mountings, set pressures, stamping, etc. Ability to order a safety valve and checking safety valve capacity three ways. A knowledge of gagging a safety valve. A knowledge of power plant repairs, including the procedure for making welded and mechanical repairs in accordance with state laws. A thorough knowledge of boilers, boiler control systems both combustion and feedwater. Understanding of code jurisdictional limits for piping drum type boilers as required by ASME Code, Section I PG-58. Typical fuel oil and gas piping arrangements. Knowledge of two and three element feedwater level control systems. Knowledge of bearings used in turbines. Knowledge of indicators, recording devices, and associated instrumentation for monitoring and controlling combustion process. Knowledge of safety controls to prevent unsafe boiler conditions. Knowledge of flue gas analysis and boiler efficiency. Skill in math and simple algebra. Knowledge of surface and air-cooled condensers. Basic methods of superheat temperature control. Safety rules for entering boilers for inspection. Basic steam and water cycle for a condensing turbo generator. Procedure to hire a boiler repair and other licensed contractors. Understanding of ASME Code Section I & National Board Code as it applies to the normal duties and responsibilities of a Third Class Engineer. Complete understanding of "Responsibilities of being a Chief Engineer." A knowledge of Gen.. Laws Chapter 146, knowledge of CMR's 522 & 310, knowledge of B31.1 piping code, knowledge of Gas Turbines. Knowledge of Piping and Instrumentation Drawings (P&ID's)

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## **SECOND CLASS ENGINEER**

All of that pertaining to the foregoing grades. A complete knowledge of the construction of all types of boilers and accessories, also the rules formulated by the Board of Boiler Rules, as well as Section I, IV and VII of the ASME Code. Ability to calculate safe working pressure of any boiler using open codebook. Types, purpose and operation of surface condensers, air ejector equipment, and condensate removal equipment. A thorough knowledge of safety valves, their installation and operation. Knowledge of the chemistry of combustion. Knowledge of the local, state and national environmental laws pertaining to power plants. Theory, operation and maintenance of steam turbines, both condensing and noncondensing and their governors. Knowledge of steam tables and mollier charts. Calculation of boiler efficiencies. Thorough knowledge of feedwater treatment. Ability to parallel AC generators. A knowledge of electricity. Ability to solve algebraic equations. Procedure to hire a boiler repair and other licensed contractors. Hiring asbestos removal contractors. Knowledge of hazardous chemical procedures. Lubricating programs. Training programs. Oil spill procedures, viscometers. Knowledge of confined space entry procedures. OSHA Training Requirements. Function of ASME, National Board & Board Of Boiler Rules. Operation of demineralizers. Sections of ASME Code, National Board Code and Board of Boilers Rules as they apply to the normal duties and responsibilities of a Second Class Engineer. Ability to size pumps, drivers and control valves.

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## **FIRST CLASS ENGINEER**

A more advanced knowledge of that pertaining to the foregoing grades, including steam and gas turbine repairs. Types, purpose, calculation of the following: power plant cycles, thermodynamic and mechanical losses in steam turbines, etc. Ability to supervise repairs on all plant machinery. Knowledge of power plant efficiencies. A knowledge of power plant physics and chemistry of combustion. A knowledge of automatic control systems for plant systems. Knowledge of polishing effluents from plant, as well as environmental laws. A thorough knowledge of power plant emissions monitoring and control. A knowledge of power plant environmental regulations including wastewater treatment and solid waste handling. A knowledge of basic knowledge of metallurgy and nondestructive examination. A knowledge of the installation, operation, maintenance and repair of turbines, condensers, boilers, and related auxiliaries including oil purification systems. Basic operation of a generator and plant electric systems. Familiarity with psychometric charts.

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