



# REFERENCE SYLLABUS

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For

**FIFTH CLASS  
POWER ENGINEER'S**

**CERTIFICATE of COMPETENCY  
EXAMINATION**

October 2012



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**GENERAL INFORMATION**

**Introduction:**

This syllabus has been approved by the Standardization of Power Engineers Examinations Committee (SOPEEC) and the Association of Chief Inspectors (ACI).

This Syllabus is intended to assist candidates studying for the Fifth Class Engineer's Certificate of Competency Examination.

The requirements to qualify for a Fifth Class Engineer's examination are outlined in the Safety Codes Act, Power Engineers Regulations.

**Recommended Study Programme:**

It is mandatory, that before undertaking a Fifth Class Engineer's examination, the candidate must complete a Fifth Class Power Engineering course offered through a technical institute.

In addition to the foregoing course, it is recommended that the candidate becomes familiar with the publications listed in the reference material for Power Engineering Students and Examination Candidates posted on the SOPEEC web site.

**Application to Undertake Examination:**

A candidate must submit an application and the prescribed fee at least twenty-one (21) days before the date of examination.

**Examination Instructions:**

The examination consists of one (1) examination paper with 150 multiple-choice questions, 3 ½ hours duration.

To pass a 5<sup>th</sup> Class Power Engineer's certificate of Competency examination, a candidate must obtain at least 65% of the total marks allotted.



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A candidate is allowed to use, and may be provided, the following items in the examination room:

- A non-technical English language dictionary provided by the local jurisdiction;
- Handbook of Formulae and Physical Constants, Steam Tables and Refrigeration Tables are normally provided;
- ASME Boiler & Pressure Vessel Codes except for Sections VI and VII;
- The 2007 ASME Boiler & Pressure Vessel Code Academic Extract and Supplement produced by PanGlobal Training Systems;
- ASME/ANSI B31.1 Pressure Piping Code and B31.3 Process Piping Code;
- CSA B51, Boiler, Pressure Vessel and Pressure Piping Code;
- CSA B52, Mechanical Refrigeration Code;
- Extract for CSA B51 and CSA B52 Codes;
- Act and Regulations for the examining Jurisdiction;
- Pens and pencils;
- Non-programmable calculator <sup>see important note</sup> and  
(Normally, the above items are useful for all classes of examination.)
- Drawing instruments and drawing templates.

**Note**

- The candidate must provide picture ID to the Examiner prior to the examination.
- No cell phone or any electronic communication devices are allowed to be brought into the examination room.
- The items referenced above must be shown to the examiner for approval.
- No other reference material is allowed.
- **Important:** If your calculator is programmable, you must reset it in the company of the examiner so that the examiner is sure that all memories are clear. Or the examiner may request that you remove the battery to erase all memory. This may be done during your examination time, so be aware that you may have less time to complete your exam. If the memories do not clear by resetting the calculator or by removing the battery, the calculator shall not be used. Also, if your calculator fails to function after reset or battery removal, the examiner is not responsible and you may be at a significant disadvantage.
- The information in the 1983 Edition of the ASME Boiler and Pressure Vessel Code Academic Extract is outdated. Using this 1983 Edition of the ASME Extract for any power engineering examination is not recommended. Besides using the 2007 Edition of the ASME Academic Extract and Supplement, candidates may use the current edition of the ASME Code.

Contact your local jurisdiction to find out the details.



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**3½ Hours  
Multiple Choice Examination**

**A. Administration and Mechanical Drawing**

- i. Log Books, technical communication and plant diagrams

**B. Act and Codes**

- i. An understanding of the applicable Jurisdictional Legislation and applicable regulations.
- ii. Introduction to CSA and ASME Codes for Power and Heating Boilers

**C. Applied Science**

- i. Areas and volumes of solids
- ii. Simple machines
- iii. Introduction to mechanics
- iv. Introduction to thermodynamics
- v. Thermodynamics and properties of steam
- vi. Thermodynamics and properties of refrigeration

**D. Safety**

- i. Fire safety: classes of fires, types and operation of extinguishers
- ii. Building and occupant safety
- iii. Confined space entry
- iv. Safe storage of flammables
- v. WHMIS classification of controlled products
  - a. Labeling of Controlled Products
  - b. Material Safety Data Sheets
- vi. Personal safety equipment
- vii. Occupational health and safety legislation
- viii. Housekeeping
- ix. Artificial respiration/acceptable methods; CPR; treatment for electric shock
- x. Safe work systems



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**3½ Hours  
Multiple Choice Examination**

**E. Welding and Plumbing**

- i. Welding terms and inspection
- ii. Hot water heaters: operation and maintenance
- iii. Building water supply systems: operation, maintenance, safety
- iv. Sanitary drainage systems: repair, safety

**F. Pumps, Piping and Valves**

- i. Types of Pumps
- ii. Pump components
- iii. Pump operation and maintenance
- iv. Piping materials and connections
- v. Piping: expansion, support, insulation and drains
- vi. Types and operation of steam traps
- vii. Introduction to valves: types and applications

**G. Boiler Details**

- i. Materials used in construction
- ii. Basic boiler terminology
- iii. Watertube, tubular, firetube, cast-iron sectional and modular heating boilers
- iv. Electric boilers
- v. High pressure boilers: components, operation, maintenance, repair, inspections, knowledge of power plant auxiliary equipment



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**3½ Hours  
Multiple Choice Examination**

**H. Boiler Fittings**

- i. Basic fittings for steam heating boilers
- ii. Operation and testing of boiler safety valve, boiler gauge glass and water column
- iii. Basic fittings for hot water boilers

**I. Fuels and Combustion**

- i. Types of fuels, combustion principles, draft and flue gas analysis
- ii. Gas burners for boilers
- iii. Oil burners for boilers
- iv. Draft: natural, induced and forced
- v. Boiler and furnace explosions

**J. Boiler Controls**

- i. Low water fuel cutoffs; operation and testing
- ii. Heating boiler feedwater controls
- iii. Heating boiler operating controls
- iv. Heating boiler combustion controls
- v. Boiler programmable controls and safety interlocks

**K. Boiler operation, maintenance and water treatment**

- i. Hot water heating boilers: start-up, operation and shut-down
- ii. Steam heating and power boilers: start-up, operation, shut-down
- iii. Testing safety devices
- iv. Cause and prevention of boiler explosions
- v. Boiler maintenance and preparation for inspection
- vi. Replacement of tubes and stays



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**3½ Hours  
Multiple Choice Examination**

- vii. Boiler cleaning
- viii. Boiler lay up
- ix. Boiler water treatment basic chemistry, monitoring and testing
- x. Boiler hydrostatic testing and safety precautions

**L. Heating Systems and Human Comfort**

- i. Heat gains and losses
- ii. Steam heating equipment
- iii. Steam heating systems and operation
- iv. Hot water heating systems equipment and operation
- v. Steam to hot water convertor
- vi. Ventilation fans and air filters
- vii. Infrared and electric heating
- viii. Humidification
- ix. Electric controls for heating systems

**M. Refrigeration and Air conditioning; Systems and Auxiliaries**

- i. Refrigerants; CSA B-52, safety
- ii. Compression Refrigeration Systems
- iii. Refrigeration compressors
- iv. Heat exchangers for refrigeration systems
- v. Cooling towers
- vi. Refrigeration system auxiliaries
- vii. Elementary air conditioning systems and auxiliaries



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**3½ Hours  
Multiple Choice Examination**

- N. Refrigeration and Air conditioning Controls**
- i. Refrigeration cycle controls
  - ii. Compression refrigeration system pre start-up checks
  - iii. Compression refrigeration system operation and shut-down
  - iv. Refrigeration system metering devices and capacity controls
- O. Air Compression**
- i. Types of air compressors
  - ii. Components of air compressors
  - iii. Auxiliaries used with air compressors
  - iv. Operation and maintenance of air compression systems
  - v. Thermoil Systems
  - vi. Micro-turbine Co-generation
- P. Electricity**
- i. Emergency generators: start-up, operation, shut-down, safety
  - ii. Introduction to electricity
  - iii. Lighting systems: incandescent, fluorescent
  - iv. Electrical safety, simple circuits, switches and fuses