



REFRIGERATION ENGINEER'S SYLLABUS

GENERAL INFORMATION

This Syllabus is intended to assist candidates in their preparation for writing an examination. It contains the recommended body of knowledge required. It is strongly advised that, before undertaking this Examination, the candidate completes an appropriate study course and is familiar with operation of boilers in general. These courses are offered by various educational institutions in Saskatchewan.

EXAMINATION INFORMATION

- Exam Type:** 150 question multiple choice
Writing Time: 3.5 hrs
Exam Materials: *The Boiler and Pressure Vessel Act, 1999*
The Boiler and Pressure Vessel Regulations (effective Jan 1, 2007)
CSA B52-03 Boiler, Pressure Vessel and Pressure Piping Code
Non programmable calculator
Passing Grade: 65%

To apply to write this examination the following forms must be filled in as complete as possible and submitted to the ministry with the fee required 21 days prior to the scheduled sitting.

- ***LIB-2010 Application for Power Engineering Exams***
- ***LIB-0003 Client Authorization Payment Form***

The most current and up to date forms can be found on the ministries website at the link below:

<http://www.cps.gov.sk.ca/Boiler-and-Pressure-Vessel-Safety-forms>

The forms and payment can be faxed, mailed, or dropped off in person to the addresses below. If mailing please ensure it's received by our offices 21 days prior to the scheduled sitting.

Manager of Examination & Certification
Boiler and Pressure Vessel Safety
330 – 1855 Victoria Avenue
REGINA SK S4P 3T2

Manager of Examination & Certification
Boiler and Pressure Vessel Safety
952 – 122 3rd Avenue N
SASKATOON SK S4P 3T2

Please be aware that candidates failing to obtain a passing grade will be required to wait 30 days before they will be eligible to reapply for examination.



SYLLABUS INFORMATION

The Boiler and Pressure Vessel Act & Regulations and Reference Codes

1. A general knowledge of *The Boiler and Pressure Vessel Act and Regulations*.
2. Operator staffing requirements refrigeration plants.
3. Duties of an operator or owner as specified by *The Boiler and Pressure Vessel Act*
4. An awareness of the purpose and importance of the CSA and ASME Codes.

Applied Science

1. Basic thermodynamics (laws and definitions, heat transfer, temperature scales, thermometers and pyrometers, linear and volumetric expansion, basic thermodynamic calculations).
2. Thermodynamics of Refrigeration (fundamentals, basic refrigeration systems, refrigerant tables, miscellaneous terms).
3. Basic Mechanics (mass, force, acceleration, velocity, gravity, work, pressure and force, power and energy).

Welding

1. Welding terms, methods, equipment, classifications and characteristics.
2. Weld faults.
3. Weld testing (dye penetrant, radiographic, ultrasonic).

Pumps, Valves, and Piping

1. Theory of pumping, definitions and common terms.
2. Types of pumps, their characteristics, and applications (reciprocating; centrifugal; rotary; turbine).
3. Pump operation and maintenance (priming; cavitation; flexible couplings; mechanical seals; gland packing procedures; general operation; trouble shooting).
4. Piping materials and methods of connection.
5. Valve types, their composition, application, and servicing (pressure reducing, check, plug, ball, butterfly, needle, globe and gate valves).

Lubrication

1. Principles of combustion and heat transfer.
2. Purpose and principles of lubrication.
3. Classes of lubricants, properties and selection.

Air Compression

1. Steam heating boiler feed water controls (various arrangements, low water fuel cut-offs with combined function, Hartford loop, condensate tank level controls).
2. Air compression principles, equipment, operation and maintenance.
3. Types of compressors, intercoolers and aftercoolers, receivers, dryers, installation and operating controls.



Electricity

1. Electrical theory.
2. Reading and understanding metering devices and basic calculations (volts, amps, watts, kilowatt hours).
3. Trouble shooting (short circuits, grounds, static electricity, motor problems).
4. Electrical equipment (fuses, circuit breakers, motors, transformers, approved appliances).

Plant Safety

1. Electrical safety.
2. Elementary knowledge of artificial respiration, choking treatment maneuvers, and prevention of shock.
3. Fire prevention and protection (classification of fires; extinguisher types; application and operation; sprinkler systems; fire and smoke alarms).
4. Elevator and fan safety.
5. General and personal safety precautions.

Refrigeration

1. Chlorinated hydrocarbons (origins, benefits and hazards, toxic effects, disposal methods).
2. Refrigerant characteristics (identification, classification, thermo and physical properties).
3. Compression refrigeration systems (operating principles, basic, direct, indirect, and packaged systems).
4. Absorption refrigeration systems (operating principles, lithium bromide and ammonia systems).
5. Classification and application of refrigeration compressors (parts and function, compression ratio, volumetric efficiency, capacity).
6. Classification and application of evaporators and condensers (dry, flooded, bare tube, plate surface, fin tube and shell and tube evaporators, water cooled, air cooled and evaporative condensers).
7. Operation and maintenance of cooling towers (natural, forced and induced draft, water treatment, corrosion, biological fouling, and wood deterioration).
8. Operating principles and classifications of refrigeration metering devices and capacity control (automatic and thermostatic expansion valves, low pressure and high pressure float valves, capillary tubes, suction throttling, hot gas by-pass, cylinder unloading and by-pass, compressor speed control, evaporator dampers and sectional evaporators).
9. Cycle controls (temperature, pressure and humidity activated controls, thermostats, solenoid valves, condenser cooling water regulating valves, evaporator pressure regulating valve, low and high pressure cut-off, flow switch, oil system protection devices).
10. Refrigeration accessories (pressure gauges, accumulators, oil separators, strainers and dryers, sight glasses, heat exchangers, pressure relief devices, piping, tubing and valves, distributor, vibration absorber, purge and charging valves, emergency discharge).
11. Compression and absorption refrigeration systems, operation and maintenance (leak testing, evacuating, charging, purging, adding and draining oil, start-up and shut-down procedures, preventative maintenance, trouble shooting, Code requirements, log sheets, crystallization, equilibrium, concentration and dilution in a lithium bromide system).



Psychometry

1. Definitions and terms.
2. Psychometric chart, its purpose and use.
3. Comfort conditions and air conditioning factors which affect it.

Air Conditioning

1. Purpose of air conditioning and definition of terms.
2. Categories and operating principles of air handling systems (unitary, central and combined systems).
3. Categories, operating principles and comparisons of heat recovery systems (run around system, thermal wheel, heat pipe and heat pump).
4. Operating controls (dampers, pre-heater, heating, humidity, dehumidity, cooling, fan and complete control systems).
5. Coil types (circulation, fin surfaces, air venting).
6. Coil operation (control valves steam coil piping and trapping, use of glycol).

End

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