



SAFETY CODES COUNCIL



the pressure equipment safety authority

REFERENCE SYLLABUS

for

WELDING EXAMINER

**CERTIFICATE OF COMPETENCY
EXAMINATION**

AB-94
2008-09

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EXAMINATION

FORM AB-94
REVISION 3
DATE 2008/09
PAGE 2 OF 8

GENERAL INFORMATION

INTRODUCTION:

This Syllabus is intended to assist candidates in preparing for the Welding Examiner Certificate of Competency examination in accordance with the Pressure Welders Regulation (A/R 169/2002), Section 15.

ELIGIBILITY:

To qualify to take the Welding Examiner Certificate of Competency examination, a candidate must satisfy at least one of the following eligibility requirements.

CERTIFICATIONS/DESIGNATIONS:

1. P.Eng. with a B.Sc. in Metallurgy, Welding or Mechanical Engineering
2. First Class Power Engineer's Certificate of Competency
3. CET with a Diploma in Materials or Mechanical Engineering Technology
4. Diploma in Welding Engineering Technology
5. Grade "A" or "B" Pressure Welder (See Note 1)
6. CSA W178.2 Welding Inspector Level III
7. Safety Codes Officer – Boiler Discipline
8. Other Equivalent Qualifications (See Note 2)

Note 1: Candidates who have successfully completed Papers 1 and 2 of the Grade "A" Pressure Welder's examination may be granted credit for these same papers on the Welding Examiner's Certificate of Competency examination.

Note 2: Other qualifications may be considered under provisions that allows the Administrator to accept equivalencies. The candidate must have relevant experience, which would include involvement in the pressure equipment industry related to fabrication, inspection, repair, welding, design, quality control or operation. The candidate would also have suitable academic qualifications in recognized courses in welding, materials, ASME Codes and NDE.



the pressure equipment safety authority

REFERENCE SYLLABUS
for
WELDING EXAMINER
CERTIFICATE OF COMPETENCY
EXAMINATION

FORM AB-94
REVISION 3
DATE 2008/09
PAGE 3 OF 8

EXAMINATION INSTRUCTIONS

Overview:

The examination consists of four (4) papers, which are described in the following pages of this syllabus. The examination is closed book except for the unmarked publications as provided for in Rule No. 2 and is composed of multiple choice and short answer questions.

Application to Undertake Examination:

The candidate shall make application on the form established by the Administrator. The application and the prescribed fee must be submitted to the Administrator at least 21 days prior to the examination date.

Rules:

1. The candidate must show picture I.D. at the examination.
2. Candidates will be allowed to bring the following items for the examination:
 - a. ASME Codes
 - b. Safety Codes Act and Regulations
 - c. CSA B51 Boiler, Pressure Vessel and Pressure Piping Code
 - d. National Board Inspection Code
 - e. Non-programmable Calculator
 - f. Drawing Instruments

Note: All reference items are the responsibility of the candidate and must be shown to the ABSA Examiner for review.
3. The time allowed for completing each paper is three and a half (3.5) hours
4. To pass the examination, a candidate must obtain at least 70% of the allotted marks for each paper.

Cancellation:

If a candidate does not attend, or fails to cancel at least five (5) business days prior to, the examination, the examination fee will be forfeited. However, in situations such as medical emergencies or deaths in immediate family and provided the candidate provides evidence acceptable to the Administrator, the fee will be credited to a future examination date.

Failure:

If a candidate fails any paper of the examination, the candidate may be disqualified by the Administrator from writing any other examination paper for a period up to 3 months. If a candidate fails any paper twice in any period of time, the candidate may be required to provide relevant educational upgrading acceptable to the Administrator before being permitted to write that particular examination paper.

CERTIFICATE ISSUANCE

After a candidate has successfully completed the four (4) examination papers, satisfactory eye examination results (20/30 correctable vision) must be submitted to the Administrator before a certificate of competency will be issued. The candidate's eye examination results shall be determined by an ophthalmologist, optometrist, or other recognized professional and the eye examination conducted within a period of one (1) year of submission to the Administrator.



the pressure equipment safety authority

REFERENCE SYLLABUS
for
WELDING EXAMINER
CERTIFICATE OF COMPETENCY
EXAMINATION

FORM AB-94
REVISION 3
DATE 2008/09
PAGE 4 OF 8

Welding Processes and Filler Metals
First Paper
3.5 Hours

1. Welding Processes (Weighting 50%)

Principles of operation, applicable equipment, relevant process variables (such as gases, power sources, techniques, joint designs, welding symbols, etc.), and common weld discontinuities (causes and corrective actions) of the following arc welding processes:

- a. Shielded Metal Arc Welding (SMAW)
- b. Gas Metal Arc Welding (GMAW manual and mechanized)
- c. Flux Cored Arc Welding (FCAW)
- d. Gas Tungsten Arc Welding (GTAW manual and mechanized-orbital)
- e. Submerged Arc Welding (SAW)

2. Cutting Processes (Weighting 15%)

Principles of operation, equipment, application and metallurgical effects of the following metal cutting processes:

- a. Oxygen cutting
- b. Air-Carbon-arc cutting and gouging
- c. Plasma-arc cutting
- d. Carbon-arc cutting

3. Filler Metals (Weighting 35%)

The nomenclature, classification, manufacture, properties, applications, composition, grouping and designations of electrodes, welding wires and fluxes. The welding processes would be those listed in the above paragraph. The filler metals would be as referenced in ASME Section II-Part C and include the following:

- a. Carbon Steel Electrodes
- b. Low Alloy Steel Electrodes, Rods and Fluxes
- c. Stainless Steel Covered and Bare Electrodes
- d. Nickel and Nickel Alloy Covered and Bare Electrodes
- e. Tungsten Electrodes

4. Reference Material

- a. AWS Handbook Volume 2 (8th Edition) or (9th Edition – Part 1)
- b. ASME Section II-Part C (2001 or 2004 or 2007 Editions)



the pressure equipment safety authority

REFERENCE SYLLABUS
for
WELDING EXAMINER
CERTIFICATE OF COMPETENCY
EXAMINATION

FORM AB-94
REVISION 3
DATE 2008/09
PAGE 5 OF 8

Metallurgy and Materials
Second Paper
3.5 Hours

- 1. Properties and Structure of Metals (Weighting 20%)**
 - a. Crystalline structures
 - b. Grains (formation, shape and size)
 - c. Yield strength, tensile strength, ductility, hardness and toughness
 - d. Thermal conductivity
- 2. Steel Manufacturing (Weighting 35%)**
 - a. Categories of Steel and Iron
 - i. Pig iron, cast iron, carbon steel, alloy steel and high alloy steel
 - b. Steel Making Processes
 - i. Blast Furnace
 - ii. Bessemer Converter
 - iii. Basic Oxygen Steel Making
 - iv. Ladle Refining
 - v. Electric Arc Furnace
 - vi. Electric Induction Furnace
 - c. Mill Operations
 - i. Casting, hot working, forging, rolling and heat treatment
 - d. Alloying Elements
 - i. Effects of alloying elements
 - ii. Alloyed versus residual elements
 - iii. Iron-iron carbide diagram
 - e. Weldability of Steels
 - i. Qualities and factors affecting weldability
- 3. Welding Metallurgy (Weighting 35%)**
 - a. Weld Metal
 - i. Solidification (principles, modes and conditions affecting modes)
 - ii. Zones (Weld metal, unmixed, partially melted, HAZ, unaffected base metal)
 - iii. Microstructure and grain size changes
 - b. Temperature
 - i. Peak, pre-weld, cooling end points, time at temperature
 - ii. Cooling rate
 - iii. Post weld heat treatment effects
- 4. Material Specifications (Weighting 10%)**
 - a. ASME and ASTM standards
 - b. Chemical and physical properties for commonly used construction materials
 - c. Carbon steel, low alloy steels and stainless steels
 - d. SA/A-106, SA/A-516, SA/A-333, SA/A-387 and SA/A-312
- 5. Reference Material**
 - a. Welding Metallurgy (Linnert Volume I)
 - b. ASME Section II-Part A (2001 or 2004 or 2007 Editions)
 - SA Specifications: 106, 312, 333 387 and 516



the pressure equipment safety authority

REFERENCE SYLLABUS
for
WELDING EXAMINER
CERTIFICATE OF COMPETENCY
EXAMINATION

FORM AB-94
REVISION 3
DATE 2008/09
PAGE 6 OF 8

Quality Control and Weld Evaluation
Third Paper
3.5 Hours

1. Quality Control (Weighting 30%)

- a. Concepts, goals, purpose, scope
- b. Roles and responsibilities/duties of personnel
- c. Elements of a Quality Control manual (Performance Qualification Testing of Pressure Welders)
- d. Relationship to Codes and Regulations
- e. Accredited Organizations
- f. Testing standards and procedures

2. Non-Destructive Examination (Weighting 35%)

The applications, examination processes, requirements, uses, benefits, limitations, personnel qualifications, physical weld defects and acceptance criteria of the following NDE methods as detailed in ASME Section V:

- a. Visual examination
- b. Radiographic examination
- c. Ultrasonic examination
- d. Liquid penetrant examination
- e. Magnetic particle examination

3. Weld Examination (Weighting 35%)

Candidates will examine and assess physical coupons for weld defects and acceptability standards referenced in ASME Section IX and B 31.3. These samples may include: guided bend test specimens, weld specimens and radiographs.

4. Reference Material

- a. Classroom Training Handbooks Nondestructive Testing (General Dynamics)
 - i. Radiographic testing CT-6-6 second edition
 - ii. Ultrasonic testing CT-6-4 second edition
 - iii. Liquid penetrant CT-6-2 fourth edition
 - iv. Magnetic particle CT-6-3 second edition
- b. ABSA sample Quality Control Manual for the Performance Qualification Testing of Pressure Welders
- c. ASME SECTION V, and IX (2001, or 2004, or 2007 Editions)
- d. ASME B31.3 Chapter VI (2002, or 2004, or 2006 Editions)



the pressure equipment safety authority

REFERENCE SYLLABUS
for
WELDING EXAMINER
CERTIFICATE OF COMPETENCY
EXAMINATION

FORM AB-94
REVISION 3
DATE 2008/09
PAGE 7 OF 8

Regulations and Codes
Fourth Paper
3.5 Hours

1. Pressure Equipment Safety Regulation and CSA B51 (Weighting 5%)

- a. Scope, purpose, responsibilities, requirements
- b. Registration of welding procedures
- c. Relationship to ASME Codes

2. Pressure Welders Regulation (Weighting 10%)

Requirements, responsibilities, qualifications, performance qualification cards and certification with respect to the Pressure Welders and Welding Examiners.

3. ASME Section IX-Part QW Welding (Weighting 65%)

- a. Section IX (2001 or 2004 or 2007 Editions)
 - i. Organization, testing, acceptance criteria, variables, forms, welding data
 - ii. Introduction, Articles I, II, III, IV and Appendices
- b. Preparation and evaluation of welding procedures
 - i. Welding procedure specification (WPS)
 - ii. Procedure qualification record (PQR)
 - iii. Welding processes to include: SMAW, GMAW, FCAW, GTAW and SAW
- c. Performance qualification testing
 - i. Welder performance variables
 - ii. Welding processes to include: SMAW, GMAW, FCAW, GTAW and SAW
 - iii. Performance qualification tests, examinations and performance limitations
 - iv. ABSA Forms AB-76A and AB-76B

4. ASME Sections I, VIII, B31.1, B31.3 and National Board Inspection Code (Weighting 20%)

Referenced sections in these construction codes pertaining to welding requirements

- a. ASME Section I – Part PW (2001 or 2004 or 2007 Editions)
- b. ASME Section VIII Division I-Parts UG, UW, UCS, UHA, UHT (2001 or 2004 or 2007 Editions)
- c. ASME B31.1-Chapter V (2001 or 2004 or 2007 Editions)
- d. ASME B31.3-Chapter V (2002 or 2004 or 2006 Editions)
- e. National Board Inspection Code-Part RD only (2001 or 2004 Editions)
Or
National Board Inspection Code – Part 3 (section 2 only) (2007 edition)



the pressure equipment safety authority

REFERENCE SYLLABUS
for
WELDING EXAMINER
CERTIFICATE OF COMPETENCY
EXAMINATION

FORM AB-94
REVISION 3
DATE 2008/09
PAGE 8 OF 8

ABSA OFFICE LOCATIONS

Edmonton (Head Office)	9410 – 20 Avenue Edmonton, Alberta T6N 0A4 Tel. (780) 437-9100 Fax (780) 437-7787
Calgary	Tower 3, #590 1212-31 Avenue, N.E. Calgary, Alberta T2E 7S8 Tel. (403) 291-7070 Fax (403) 291-4545
Grande Prairie	#203, 10109 - 97 Avenue Grande Prairie, Alberta T8V 0N5 Tel. (780) 538-9922 Fax (780) 538-9400
Lethbridge	#300, 515-7 Street, South Lethbridge, Alberta T1J 2G8 Tel. (403) 394-1011 Fax (403) 327-2483
Medicine Hat	#103, 346 - 3rd Street S.E. Medicine Hat, Alberta T1A 0G7 Tel. (403) 529-3514 Fax (403) 529-3632
Red Deer	#304, 4406 - Gaetz Avenue Red Deer, Alberta T4N 3Z6 Tel. (403) 341-6677 Fax (403) 341-3377
Fort McMurray	30B Suncor Energy Industrial Campus Keyano College 160 MacKenzie Boulevard Ft McMurray, AB T9H 4B8 Tel. (780) 714-3067 Fax (780) 714-2380
Internet Address	http://www.absa.ca

Note: Please contact the ABSA Education and Certification Department at (780) 437-9100 ext. 3327 or toll free 1-877-433-8910 or email welders@absa.ca