



CERTIFICATION BOARD FOR INSPECTION PERSONNEL

**Standard of Proficiency
for the Certification of Welding Inspectors**

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STANDARD OF PROFICIENCY FOR THE CERTIFICATION OF WELDING INSPECTORS

FOREWORD

This Standard of Proficiency defines the requirements for the issue of certificates of competence to Welding Inspectors and Senior Welding Inspectors performing **and or controlling** welding inspection of equipment **or structures**.

The current Health and Safety in Employment Act and regulations made under this Act and other New Zealand legislation require Inspector's performing fabrication and welding inspection of equipment and structures to hold a certificate of competence.

Certification and re-certification in accordance with this Standard of Proficiency confirms at the time of examination and re-examination the qualifications, training, and experience of Welding Inspector's.

The qualifications described by this Standard of Proficiency have been prepared for registration at level 4 for CWI and 5 for SWI, on the NZQA framework.

This standard of proficiency must be read in conjunction with the *General Section - Standards of Proficiency for the Certification of Inspectors*.

1 SCOPE AND GENERAL

1.1 Scope

This Standard of Proficiency covers the certification of Welding Inspector's performing welding inspection of pressure equipment, structures or any other fabricated item requiring joining by welding.

1.2 Certificates of competence

The certificates of competence which may be granted are:

- (a) Welding inspector (CWI)
- (b) Senior welding inspector (SWI)

2 CERTIFICATION PROCESS

Candidates seeking certification shall satisfy the relevant requirements of the (CBIP) Standard of Proficiency for the Certification of Inspectors, General Section by completing:

- (a) The Pre-requisite Training, Qualifications and Experience in Section 3 below for either:
 - CWI certificate of competency, or
 - SWI certificate of competency
- (b) The Examinations in 4 below for either:
 - CWI certificate of competency, or
 - SWI certificate of competency

3 PRE-REQUISITE TRAINING, QUALIFICATIONS AND EXPERIENCE

Candidates shall have completed **and** have evidence of training, qualifications and experience and shall include this evidence with their Application for Examination / Certification (the relevant documentation is described in the (CBIP) Standards of Proficiency for the Certification of Inspectors - General Section.

3.1 CWI certificate of competence

3.1.1 Qualifications

Candidates shall either:

- (a) Hold or have held one or more of the following:
A=certificate or qualification in welding, supervision or engineering **and** recognised by CBIP, or
- (b) Hold **a** trade certificate in fabrication & welding, or university degree, diploma or certificate in engineering, metallurgy, or non-destructive testing that is relevant to welding inspection and recognised by CBIP.

3.1.2 Training and experience

A candidate should undertake a formal course in welding inspection recognised by CBIP.

A candidate, who has undertaken a recognised formal training course, shall also submit documentary evidence that he/she has had a minimum of three years experience in a related field to welding inspection.

A candidate who has not undertaken a recognised formal training course shall submit documentary evidence which indicates that he/she has had a minimum of five years experience in a related field of welding inspection.

Note: - Related fields to welding inspection can be considered as fabrication involving welding, in service welding repairs, welding supervision or weld engineering and be recognised by CBIP.

3.2 SWI certificate of competence

3.2.1 Qualifications

Candidates shall either:

- (a) Have held a welding inspector's certificate for not less than two years, or
- (b) Hold a university degree, diploma or certificate in engineering, metallurgy, or non-destructive testing and had training and experience that is relevant to welding inspection and which CBIP recognises as an alternative to the pre-requisite training and experience in 3.2.2 below

3.2.2 Training and experience

The minimum experience requirements are:

- With CBIP recognised training 5 years experience prior to application.

A candidate shall submit documentary evidence that he/she has had a minimum of five years experience in a related field of welding fabrication, in service welding repairs or similar experience.

- Without approved training 7 years experience prior to application.

A candidate shall submit documentary evidence which indicates that he/she has had a minimum of seven years experience in an appropriate field of welding fabrication or in-service inspection experience recognised by CBIP.

4 EXAMINATIONS

4.1 CWI certificate of competence

The examinations for a CWI certificate of competence are comprised of the following papers, which should be taken in the order shown:

- (a) Paper A: Standards and codes
- (b) Paper B: Principles of welding
- (c) Paper C: Welding inspection

4.1.1 Paper A

Is an open book examination (Choice of Standard / Code as noted below).

The examination will cover inspection of welded components, welding procedures, standards, codes, specifications, drawings, mechanical testing, destructive and non-destructive testing, quality assurance procedures and reporting.

Candidates may elect to use either ASME IX, AS/NZS 1554.1, AS 3992 or BS-EN ISO 15614-1 or other standard/code.

Note:- application to use another standard / code must be made at least eight weeks prior to the date of application and be approved by CBIP.

The examination is comprised of:

- Twenty multi-choice questions on the elected standard/code.
- Visual inspection and reporting on a welded sample.
- Review and reporting on a radiograph or radiographs.
- Review, critique and comment on a welding procedure specification.

4.1.2 Paper B

Is a closed book examination.

The examination will cover the fundamental principles of welding processes, welding fabrication, as-built packages, NDE methods, mechanical properties of materials, heat treatment, and duties as detailed in Appendix B, Tables 3.1.

The examination is comprised of:

- Fifty multi-choice, and
- Two written questions from a selection of three.

4.1.3 Paper C

Is a closed book examination.

The examination will cover the application of welding inspection knowledge including interpretation and causes of weld discontinuity, symbols, welding procedures and drawings, welding fabrication, as-built packages and on-the-job calculations.

The examination is comprised of:

- Fifty multi choice and
- Two written questions from a selection of three.

4.2 SWI certificate of competence

The SWI Paper Is a closed book examination.

The examination will cover, to a more advanced level, the welding inspection and process knowledge outlined for the Modules A, B and C for the CWI examinations:

The examination is comprised of:

- 20 general knowledge multi-choice questions
- Review, critique and comment on a welding procedure specification.
- Review and comment on two radiographs (Candidates holding a current radiographic interpreters certification from CBIP or other equivalent qualification recognised by CBIP may be exempt from this part of the paper)
- Scrutinising, assessing and commenting on two NDE inspection reports.
- Review and comment on an inspection and test plan (ITP) for a welded fabrication.
- Review and allocate welding symbols and processes to a fabricated item.

4.3 Knowledge requirements

The knowledge requirements underlying the examination modules for CWI and SWI certificates of competence are given in Appendix B, Tables 3.1 and 3.2.

4.4 Recognition of other qualifications and exemptions.

Application for recognition of qualifications and exemptions shall be made in accordance with the CBIP Standards of Proficiency for the Certification of Inspectors - General Section.

4.5 Periodic renewal and recertification

Certificates of competence held by CWI & SWI inspectors are subject to periodic renewal and recertification in accordance with CBIP Standards of Proficiency for the Certification of Inspectors - General Section.

The examination for recertification is comprised of the following papers:

CWI

- (a) Paper A: A closed book examination comprised of fifty multi-choice questions based on Papers B and C papers of the CWI certificate of competence.

- (b) Paper B: An open book examination requiring review and critique of a welding procedure specification to ASME IX, BS EN ISO 15614-1, AS/NZS 3992 or AS/NZS 1554.1

SWI

- 20 general knowledge multi-choice questions
- Review, critique and comment on a welding procedure specification.
- Review and comment on one radiographs (Candidates holding a current radiographic interpreters certification from CBIP or other equivalent qualification recognised by CBIP may be exempt from this part of the paper)
- Scrutinising, assessing and commenting on one NDE inspection reports.
- Review and comment on an inspection and test plan (ITP) for a welded fabrication.

APPENDIX A

Sample Examination Questions (Informative)

- 1 Name and sketch four types of weld joints.
- 2 Discuss the Manual Metal Arc Welding process.
- 3 Discuss the qualities required in a Welding Inspector.
- 4 What is the difference between a tack weld and a stitch weld?
- 5 Discuss the use of the Schaeffler Diagram.
- 6 Discuss the principle of magnetic particle inspection.
- 7 An E71T-1 electrode classification is for which welding process?
 - (a) P.A.W.
 - (b) S.M.A.W.
 - (c) S.M.A.W.
 - (d) G.M.A.W
 - (e) F.C.A.W.
- 8 The root pass or initial bead of a weld deserves special attention because:
 - (a) The x-ray may not expose defects that are too deep.
 - (b) The first pass is more likely to crack than later passes.
 - (c) When preheat is required this is the only pass affected.
 - (d) The slag, being thinner on the first pass, can be more easily trapped.
- (e) The ripple is always more pronounced on the first passes and can lead to defects later on.
- 9 Why is pre-cleaning of the item more important for liquid penetrant testing as compared with magnetic particle inspection?
- 10 What is PQR used for in welding?
- 11 Draw the welding symbol for a full penetration tee joint butt single bevel with a 6mm fillet on one side and a backing run on the root side of the weld.
- 12 Which of the following electrode classifications indicates a horizontal position electrode of the highest strength?
 - (a) E6010
 - (b) E6013
 - (c) E7024
 - (d) E7018
 - (e) E7048
- 13 Repaired weld undercut might be deduced from which of the following conditions?
 - (a) Crater shape and appearance.
 - (b) Weld contour and reinforcement
 - (c) Spatter
 - (d) Weld ripples
 - (e) Slag appearance

- 14 When would the side bend test be preferred over the face bend for a double-v groove weld?
- 15 From the NDT methods listed below, which method would be the best for detecting scattered porosity below the surface of the weldment?
 - (a) Visual
 - (b) Radiographic
 - (c) Ultrasonic
 - (d) Magnetic Particle
 - (e) Liquid Penetrant
- 16 Write a description of the source or sources of hydrogen associated with the welding process.
- 17 Discuss "arc blow" in association with welding
- 18 What is HAZ cracking
- 19 Discuss the welding inspections you would carry out during welding.
- 20 What is a weld "macro" and where would it generally be used?
- 21 Discuss the storage requirements of stainless sheet material and any cleaning requirements prior to the welding of 316L sheet material 3m x 1m x 10mm
- 22 What is meant by the terms work hardening or cold work.

APPENDIX B

Outline of Knowledge Requirements (Informative)

Candidates shall clearly demonstrate their ability to perform the following functions. Elements of competency and associated performance criteria of Welding Inspectors and Senior Welding Inspectors are given in Table 3.1 and Table 3.2 respectively.

Table 3.1
Elements of Competency and Performance of Welding Inspectors

Element	Performance Criteria
Plan and prepare for inspection before welding	<ul style="list-style-type: none"> (a) Clearly understand the scope of inspection required, and the responsibilities of individuals and conditions for such inspection. (b) Use, interpret and apply major national and international welding / fabrication standards, codes and specifications used in New Zealand and have a basic understanding of engineering critical assessment. (c) Verify that the welding / fabrication will be carried out in accordance with the design drawings, applicable procedures, codes, standards , specifications and documents which may include the purchasers and inspection body requirements. (d) Verify that the design approval, if required, has been received and ensure that the inspection and test plans, programme requirements are reviewed, analysed, developed, and modified [if required] and approved. (e) Verify that the specified materials and welding consumables will be used. (f) Verify inspection programme, timing and any pre-welding and inspection regards forming, dimensions, fit-up, pre-weld NDT, weld preparation Will be carried out in accordance with given requirements and procedures. (g) Verify that acceptable welding procedures and approved welders are employed for production. (h) Have an appreciation of common welding processes SMAW, GTAW, SAW, FCAW (both gas shielded and non gas shielded) & GMAW. (i) Witness welder qualification and welding procedure qualification tests including the preparation and identification of materials. (j) Ensure materials are marked and/or stamped as required by the standards. (k) Ensure any required destructive tests or non-destructive tests are planned to be carried out to ensure compliance. (l) Prepare inspection reports that embrace the duties of a Welding Inspector.

<p>Conduct inspection of welding</p>	<ul style="list-style-type: none"> (a) Maintain inspection records. (b) Ensure material identification is maintained. (c) Ensure the inspection requirements of the specification, code, standard, drawings or contract are followed and a statement of confirmation is issued. (d) Ensure materials, welder qualifications and procedures, inspections and tests including destructive and non-destructive testing are recorded, are acceptable and documented and that copies are made available, as required to the manufacturer, purchaser and the Inspection Body or client. (e) Ensure that the welders and welding procedures are in compliance and any specified pre-heat/PWHT and inter-pass temperature requirements are met and maintained. (f) Ensure all materials and consumables are stored/handled correctly. (g) Ensure compliance with quality assurance and quality control procedures of the Inspection Body and controller/client. (h) Verify that cutting, forming and machining of materials, tube expansion, blanking and protection of machined surfaces are correct and done to acceptable procedures. (i) Identify welding and material flaws and any non-conformance and assess corrective action. (j) Perform dimensional inspection of welded parts. (k) Ensure welding and assembly is correct. (l) Ensure any remedial or repair work is identified in writing and that corrective action is carried out. (m) Ensure bolting is correct. (n) Witness tests required by the code, standard or specification or inspection procedure. (o) Verify that any required heat treatment is conducted in accordance with suitable approved procedure, code, standard or specification requirements and is correctly documented. (p) Ensure any required destructive tests or non-destructive tests are carried out to ensure compliance. (q) Witness any required tests for compliance to code, standard or specification to acceptable procedures. (r) Ensure any flange faces, weld preparations and any seal or mating faces are protected. (s) Ensure any required preservation treatment/protection is correct.
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Report on inspection	<p>(a) Inspection records and reports are made and processed in accordance with documented procedures.</p> <p>(b) Ensure the inspection and test plan or required documentation is completed, and signed by the inspector</p> <p>(c) When performing inspections ensure that all contract Conditions are reported upon at completion.</p>
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Table 3.2
Elements of Competency and Performance of Senior Welding Inspectors

Element	Performance
Plan and prepare for inspection, conduct inspection and report on inspection	<p>(a) Carry out the duties listed in Table 3.1 for a Welding Inspector.</p> <p>(b) Supervision and on job training of Welding Inspectors and trainees.</p> <p>(c) Evaluate results of non-routine inspections, destructive and non-destructive tests in accordance with the relevant standard, code or specification.</p> <p>(d) Assess the suitability of destructive, non-destructive testing methods and welding methods proposed or used.</p> <p>(e) Prepare appropriate written instructions, quality plans, inspection and test plans and specifications.</p> <p>(f) Verify the validity of personnel qualification and/or certification relevant to the welding and inspection.</p> <p>Assist in establishing acceptance criteria where these are not available or appropriate.</p> <p>(i) Maintain comprehensive inspection records covering welding, inspection and testing and authorise issue of relevant certification regards welding.</p> <p>(j) Investigation and reporting of welding connected defects including trends and recommended rectification and/or improvement.</p>