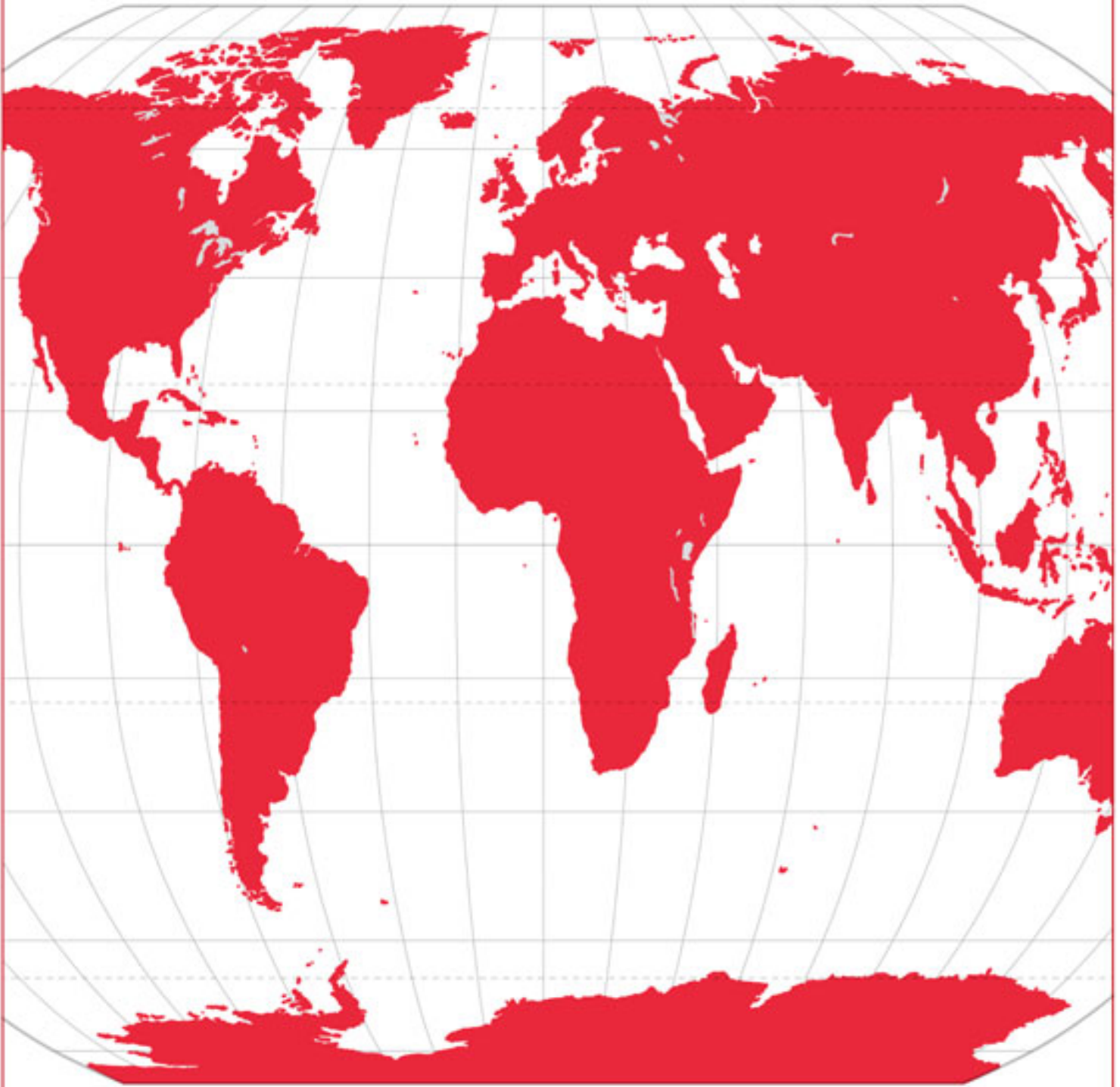




**Minimum Requirements for the Education,
Examination and Qualification**





MINIMUM REQUIREMENTS FOR THE EDUCATION, TRAINING, EXAMINATION,
AND
QUALIFICATION OF PERSONNEL

INTERNATIONAL WELDING INSPECTION PERSONNEL

(IWIP)

Approved July 2008

This is a reduced version; it is not the full Guideline

**For more information regarding the Qualification System,
the IAB/EFW Combined Secretariat or the National ANB
should be contacted**

(see in the IIW and/or EWF sites the ANB contacts)

Guideline of the International Institute of Welding

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Preface

This document is based upon the European Welding Inspection Personnel Guideline as developed by the European Federation for Welding, Joining and Cutting (EFW), through an Agreement first signed in 19 July, 1997, at the Annual Meeting of the International Institute of Welding in San Francisco, California, USA and which has been renewed and further developed since then.

Any EWF ANB is permitted to issue EWF diplomas equivalent to IIW ones that have been issued by the same ANB.

Copies of this document are available from the IIW IAB Secretariat or their designated distributor.



Section I: Minimum requirements for the education and training of International Welding Inspection Personnel

1. Introduction

This guideline for the education of International Welding Inspection Personnel to be employed in the job function of Inspector has been devised by members of the Working Group A3b of International Authorisation Board (IAB) of the International Institute of Welding (IIW). It is designed to provide the core education in welding and inspection technology required by those responsible for performing inspection tasks at various levels. It is possible that additional training and/or experience may be required beyond the core education to meet the requirements of specific applications or job functions.

Section 1 of this guideline covers the minimum requirements for education and training, agreed upon by all national welding societies within the IIW, in terms of themes, keywords and times devoted to them. It will be revised periodically by the WG A3b to take into account any changes that may affect the “state of the art”. Students having successfully completed this course of education will be expected to be capable of applying welding inspection technology as covered by this guideline. Section 2 of this document covers examination and qualification.

2. Levels of Inspection Personnel

This Guideline sets out the education for three levels of personnel, as follow:

COMPREHENSIVE (IWI-C): A candidate completing the “Comprehensive” level of training under this programme shall possess an intimate knowledge of welding and inspection theory and application. This knowledge base will enable the candidate to understand and effectively apply the knowledge in the areas of:

- Non-destructive, mechanical testing and visual welding inspection techniques
- Review and application of welding instructions, welding procedure specifications and qualified welding procedures.
- Material specifications
- Consumable specifications
- Engineering drawings, joint fit up and workmanship tolerances
- Preparation and application of welding procedure specifications,.
- Preparation and implementation of inspection procedures and acceptance criteria
- Quality Control Programmes
- Welding equipment functionality and application/limitations
- International and national welder qualification programmes
- Identification of weld imperfections associated with pre-production, fabrication and post fabrication
- Inspection requirements based on national specifications or codes

STANDARD (IWI-S): A candidate completing the “Standard” level of training under this programme shall possess an advanced knowledge of welding and inspection theory and application. This knowledge base will enable the candidate to understand and apply the knowledge in the areas of:

- Non-destructive, mechanical testing and visual welding inspection techniques



- Application of welding instructions, welding procedure specifications and qualified welding procedures.
- Material specifications
- Consumable specifications
- Engineering drawings, joint fit up and workmanship tolerances
- Welding procedure specifications and welding instructions and qualified of procedures
- Inspection procedures and acceptance criteria
- Welding equipment functionality and applications/limitations
- International and national welder qualification programmes
- Identification of weld imperfections associated with pre-production, fabrication and post fabrication
- Inspection requirements based on national specifications or codes

BASIC (IWI-B): A candidate completing the “Basic” level of training under this program shall possess a general knowledge of welding and inspection application and theory. This knowledge base will enable the candidate to effectively understand the following topics:

- Non-destructive, mechanical testing and visual inspection techniques
- Material specifications
- Consumable specifications
- Engineering drawings, joint fit up and workmanship tolerances
- Welding procedure specifications
- Inspection procedures and acceptance criteria
- Identification of weld imperfections associated with pre-production, fabrication and post fabrication

3. Standard Routes to Qualification

This Guideline provides two principal routes to qualification, as follows:

- 3.1 **Route 1** is for those fulfilling the access conditions defined in Fig. 1 at the relevant level. Candidates may decide, after self-assessment on the basis of prior learning and/or experience, whether to take the Welding Technology Module first, or proceed directly to the intermediate examination through the Approved Training Body (ATB) assessment. A pass in the intermediate examination is required before taken the Welding Inspection Module examination.
- At the description of the ANB, and only for students attending the full standard courses training, the Welding Technology Module exam (intermediate examination) can be performed at the same day of the Welding Inspection Technology Module exam.
- 3.2 **Route 2** is for those already holding an existing IIW qualification who may proceed direct to the Welding Inspection Module at the relevant level.

The routes to qualification are summarised in Fig. 1 “Standard Route” and in Fig. 2 there are presented other routes “Routes no. 2, 3 and 4”. The figures in brackets are the recommended minimum number of teaching hours specified for each education module. A teaching hour will contain at least 50 minutes of direct teaching time.

For IWI-S only the Guideline recognises the current situation in several countries, by providing entry for inspectors not meeting the full specified access conditions but having at least 5 years authenticated experience in general engineering inspection (Route 3). Such inspectors may decide through self-assessment whether to complete the 40 hours



of Basic Technology Module 0 first or to proceed directly to the intermediate examination following the Module 0. The Welding Technology Module WT II is mandatory for Route 3.

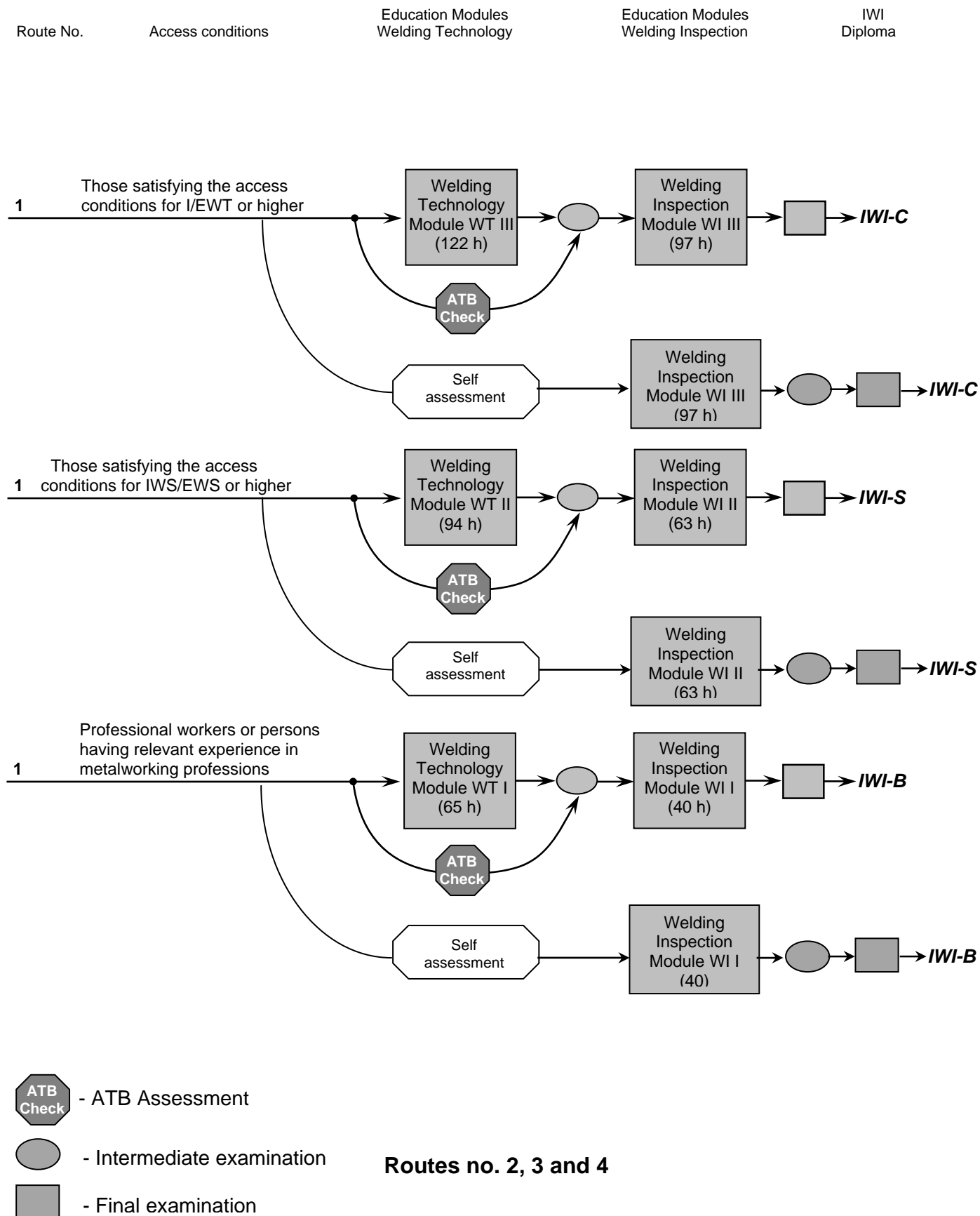
The Guideline also provides for the experienced IWI-B to progress to IWI-S via Route 4 as shown in Fig. 2. The candidate may decide whether or not to take Module 0 or WT II on the basis of self-assessment and after ATB assessment. His/her knowledge will be checked by intermediate examinations and a failure will require that the candidate take a respective omitted module.

For all routes, if the candidate fails an intermediate examination, having exercised an option to proceed directly to that examination, he/she must take the omitted training module before re-sitting the examination failed. Welding Inspection Module examination can only be taken after passing intermediate examination of Welding Technology Module (see last sentence for route 1).

The rules for the conduct of final examinations by the Authorised National Body are prescribed in Section 2 of this Guideline. The intermediate examinations are mandatory and are the responsibility of the ATB to ensure that those entering the next module have achieved the required level of knowledge.



Figure 1. Standard Route no. 1





Route No.
Access cond.

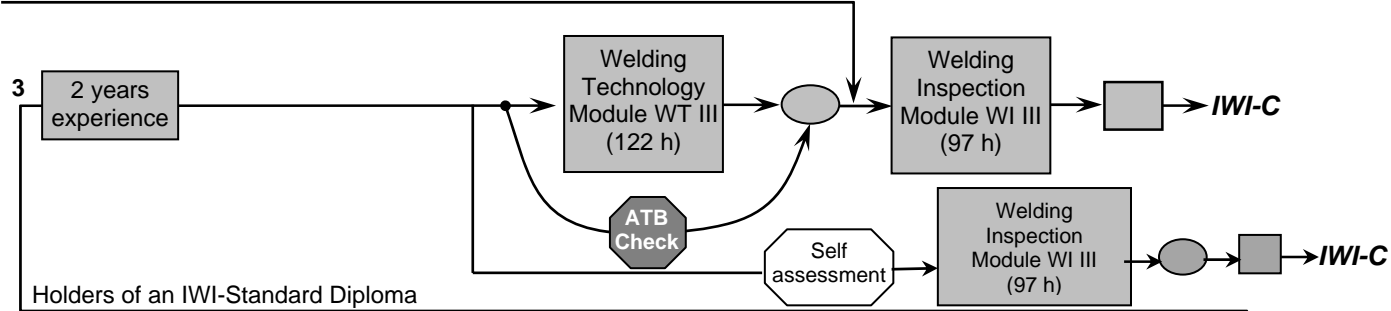
Basic Technology
Module

Education Modules
Welding Technology

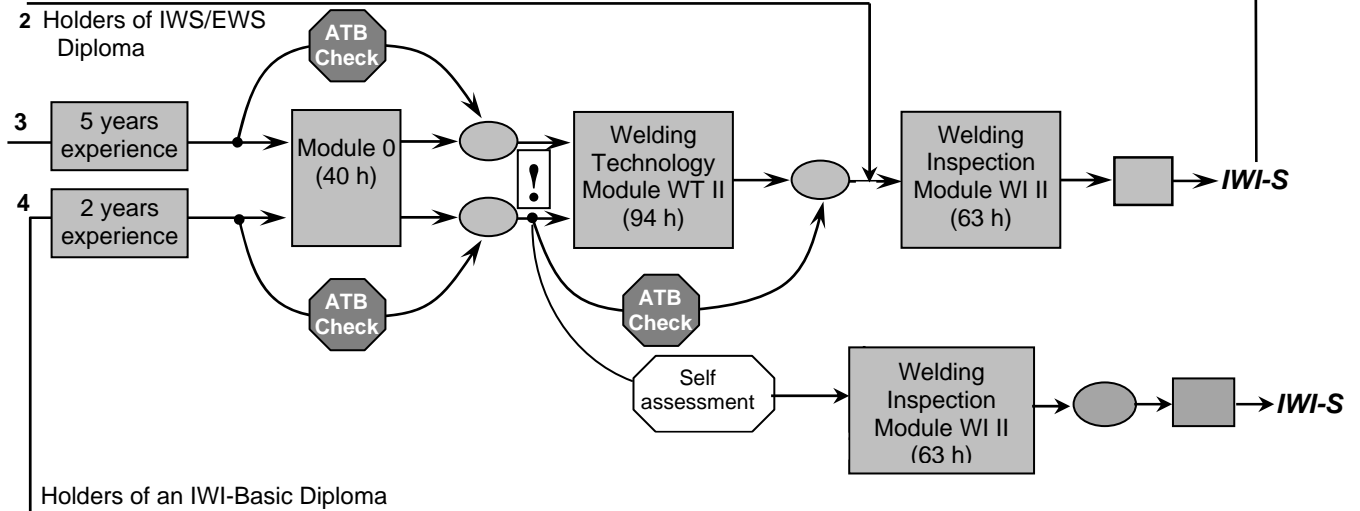
Education Modules
Welding Inspection

IWI
Diploma

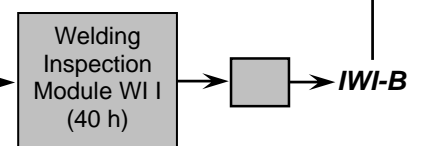
2 Holders of IWT/EWT Diploma



2 Holders of IWS/EWS Diploma



2 Holders of IWP/EWP Diploma



- A single examination but module WT II is compulsory for Route 3, optional for Route 4.



- ATB Assessment



- Intermediate examination



- Final examination

Standard education IWI-S. Route 3: Inspectors with at least 5 years experience in general engineering inspection.

4. Alternative route to qualification (Fig. 3)

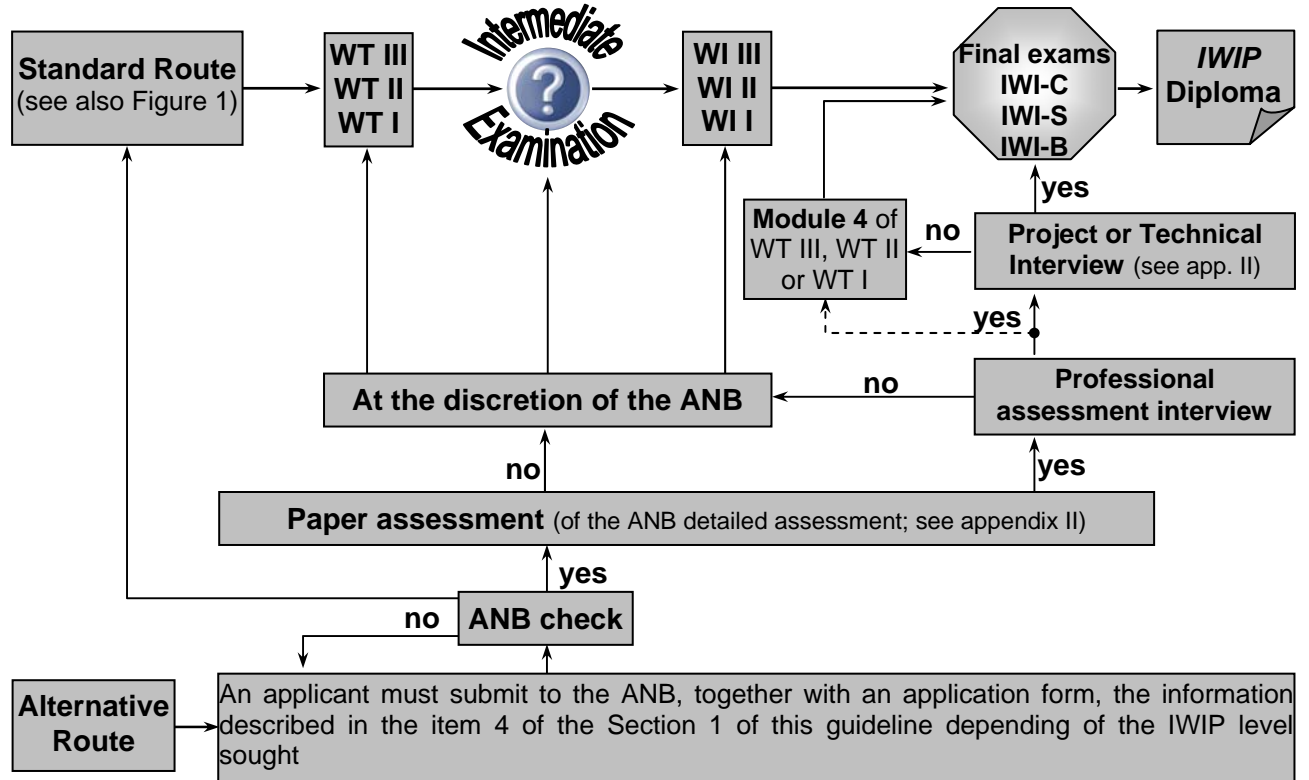


Figure 3. Alternative versus Standard Routes for IWIP qualifications

An applicant must submit the following documentation to the ANB with the application form:

IWI-C:

- IWT/EWT diploma or evidence of satisfying the access conditions for IWT/EWT.
- A curriculum vitae (CV)/ resume containing the following professional information:
 - Evidence of at least three years job function in welding and inspection at the technologist level (in a period of 4 years before application)
 - A justification of the candidate’s experience, training, and education to become IWI-C (may include other test results)

IWI-S:

- IWS/EWS diploma or evidence of satisfying the access conditions for IWS/EWS.
- A curriculum vitae (CV)/ resume containing the following professional information:
 - Evidence of at least two years job function in welding and inspection at the specialist level (in a period of 3 years before application)
 - A justification of the candidate’s experience, training, and education to become IWI-S (may include other test results)

IWI-B:

- IWP/EWP diploma or evidence of satisfying the access conditions for IWP/EWP.
- A curriculum vitae (CV)/ resume containing professional information:
 - Evidence that the candidate was working in welding and inspection at the practitioner level during last two years before application.
 - A justification of the candidate’s experience, training, and education to become IWI-B (may include other test results)



The ANB shall determine, by paper check, if the application is suitable for further detailed assessment.

5. Distance Learning Programs

Distance Learning Programs can be implemented in accordance with IAB-195-2004 Guideline under ANB control.

6. Recognition of NDT certification

Those having certification in NDT in accordance with ISO 9712, EN 473 or equivalent recognised by the ANB may be granted exemption from the NDT parts of the modules for Welding Inspection on a method by method basis, but not from the final examination. The approval of such arrangements is at the discretion of the ANB.

It is recommended that NDT Level 2, 3 Certification should apply to Module Welding Inspection II and Welding Inspection III. NDT Level 1 certification should apply to Module Welding Inspection II.

7. Definitions

7.1 Education and training: A process of instruction in relevant theory and practice that takes the form of courses to an approved syllabus and periods of practical work under qualified supervision (but shall not include the use of specimens used in the practical examination). All educational courses leading to the award of qualification covered by this Guideline shall be approved by the Authorised National Body.

7.2 Qualification: A demonstration, conducted by the Authorised National Body, involving an examination of the knowledge and skill related to specified criteria. Success in this examination leads to the issue, by the ANB, of an appropriate diploma.

7.3 Relevant inspection experience: The period during which the candidate performed welding inspection as his main activity under qualified supervision including personal application of inspection to materials, parts or structures but not including tests performed during training courses.

7.4 Certification: The procedure leading to a written testimony of an individual's competence demonstrated by examination and assessment of experience and subsequent surveillance to confirm that the competence has been retained. This does not form part of the Guideline and is normally the subject of an independent certification scheme.

8. The Inspector's role

The inspector's role begins well before welding starts, continues during the welding operation, involves action after welding is completed, and is finished only when the results are properly reported. As part of the quality system, inspection activities are defined in an inspection and test plan, which clearly describes what is required. The inspector is frequently responsible for producing documents that ensure traceability of the components and related fabricating action.

Prior to welding, the inspector must be assured that the materials are correct and that the shop has approved welding procedures and appropriately qualified welders. Written procedures and competent operators are important to the production of a quality-welded product, but the actual



execution of the weld is also a critical point for the inspector. Once the inspector is satisfied that all is in order for the welding to proceed, the task becomes one of witnessing and monitoring. There are two basic interests at this point: ensuring that the written procedures are being followed; and, of course, watching for any physical signs of non-conformance of the final product.

The inspector's responsibilities are to verify base metals and welding consumables, observe the fit-up and preparation for the weld, and watch the welding operation itself. Once the welding is completed, a new series of inspection tasks begin, which starts with executing an inspection program according to an approved procedure, keeping track of the status of examination and testing and selecting specific welds for further NDT or mechanical testing.

Heat treatment (such as preheating, post-heating and post-weld heat treatment) can be a critical parameter in a welding operation and the inspector is often required to ensure that it has been done properly. Heat treatment must be carried out following an approved written procedure. The inspector must know enough about the technique, the equipment and the reports to have confidence in the results.

8.1 Reports

When preparation, production and inspection are over, the inspector must collate the observations, checklists, and results into a report that is structured to meet the needs of the client, a jurisdiction, or a code. This report is the document of reference, which could allow the tracing of a production parameter that proves after years of service to be contributing to a failure. It allows the tracing of responsibility to a specific supplier or contractor.

One or more interim reports might well be necessary to show progress during a long or complicated construction project. Reports must detail the inspection stages, parameters, and results, including corrective actions if required. It is important to recognise quality related problems into a contract as early as possible. Interim reports and observations are extremely valuable as they provide engineering and production personnel with information they might not otherwise be aware of. The inspector's observations might highlight quality problems that could, perhaps, be remedied by design or production changes if found early enough. The inspector should remember to quantify observations where possible.

Typical duties of a welding inspector are as follows:

- 1) Interpretation of drawings and specifications;
- 2) Verification of procedure (WPS) and welder or welding operator qualifications;
- 3) Verifying the application of approved welding procedures;
- 4) Selection of production test samples;
- 5) Interpretation of test results;
- 6) Preparation of reports and keeping of records;
- 7) Preparation of inspection procedures;
- 8) Check the correct application of NDT methods.

The authority to stop work or call for immediate remedial action to resolve a quality problem is particularly important in defining the responsibility of the inspector.

8.2 Certification system

This Guideline is intended to provide a curriculum for the education of Welding Inspectors only, and does not imply that the individual is competent to complete the job



functions of a Welding Inspector. Relevant certification programmes for the certification of Welding Inspectors must be used to verify the competency and detail job functions.

9. Syllabus

It is not obligatory to follow exactly the order of the modules and topics given in this Guideline, and choice in the arrangement of the syllabus is permitted.

However, caution must be exercised by the ANB to ensure that any changes in the order of presentations of the Welding Technology modules and in the Welding Inspection modules do not alter the points of entry intended in Figs. 1 and 2.

Note:

This guideline is divided in two main modules they are:

- Welding Technology (WT)
- Welding Inspection (WI)

Each main module is divided in three (3) levels, corresponding the IWIP qualification levels

Main Modules	Modules Levels	IWIP Qualification Levels
Welding Technology - WT	WT III	IWI-C
	WT II	IWI-S
	WT I	IWI-B
Welding Inspection Technology - WI	WI III	IWI-C
	WI II	IWI-S
	WI I	IWI-B



Section I: Theoretical and Practical Education,
(Only the main Syllabus Themes)

Welding Technology Modules

WT III – Is applied for the Comprehensive Level

WT II – Is applied for the Standard Level

WT I – Is applied for the Basic Level

	WT III	WT II	WT I
1. Welding processes and equipment	25	13	11
1.1 General introduction to welding technology			
1.2 Oxy-gas welding and related processes			
1.3 Electrotechnics a review			
1.4 The arc			
1.5 Power sources for arc welding			
1.6 Introduction to Gas-shielded arc welding			
1.7 Tungsten-inert gas welding			
1.8 MIG / MAG and Flux Cored welding			
1.9 Manual Metal arc welding			
1.10 Submerged-arc welding			
1.11 Resistance welding			
1.12 Other welding processes			
1.13 Cutting and other edge preparation processes			
1.14 Surfacing			
1.15 Fully Mechanised processes and robotics			
1.16 Brazing and soldering			
1.17 Joining processes for plastics			
1.18 Joining processes for advanced materials			
2. Materials and their behaviour during welding	52	41	25
2.1 Manufacture and designation of steels			
2.2 Testing materials and the weld joint			
2.3 Structure and properties of pure metals			
2.4 Alloys and phase diagrams			
2.5 Iron-Carbon alloys			
2.6 Heat treatments of base materials and welded joints			
2.7 Structure of the welded joint			
2.8 Plain carbon- and Carbon-manganese steels			
2.9 Fine-grained steels			
2.10 Thermomechanically treated steels			
2.11 <u>Cracking phenomena in steels</u>			
2.12 <u>Application of structural and high strength steels</u>			
2.13 Low-alloy steels for very low temperature applications			
2.14 Low alloy creep resistant steels			



2.15	Introduction to Corrosion			
2.16	High-alloyed (stainless) steels			
2.17	Introduction to Wear			
2.18	Protective layers			
2.19	High alloy creep resistant and heat resistant steels			
2.20	Cast irons and steels			
2.21	Copper and copper alloys			
2.22	Nickel and Nickel alloys			
2.23	Aluminium and Aluminium alloys			
2.24	Other metals and alloys			
2.25	Joining dissimilar materials			
2.26	Metallographic examinations			
3.	Construction and design	21	17	12
3.1	Fundamentals of the strength of materials			
3.2	Basics of weld design			
3.3	Design principles of welded structures			
3.4	Joint design			
3.5	Introduction to Fracture mechanics			
3.6	Behaviour of welded structures under different types of loading			
3.7	Design of Welded structures with predominantly static loading			
3.8	Behaviour of welded structures under dynamic loading			
3.9	Design of dynamically loaded welded structures			
3.10	Design of thermodynamically loaded welded structures			
3.11	Design of structures in Aluminium and its Alloys			
3.12	Reinforcing-steel welded joints			
4.	Fabrication, applications engineering	24	23	17
4.1	Introduction to quality assurance in welded constructions			
4.2	Quality control during manufacture			
4.3	Welding stresses and distortion			
4.4	Plant facilities. welding jigs and fixtures			
4.5	Health and safety			
4.6	Measurement, control and recording in welding			
4.7	Non-destructive testing (introduction to WI module)			
4.8	Economics			
4.9	Repair-welding			
4.10	Fitness for purpose			
4.11	Case Studies			
Total Recommend hours for Welding Technology Modules:		122	94	65

Note: The above syllabus follows the content of that adopted for the core Guideline Personnel with Responsibility for Welding Coordination. Items which do not apply to welding inspection personnel are allocated 0 hrs, this will be mention on the complete guideline.



Welding Inspection Modules

WI III – Is applied for the Comprehensive Level

WI II – Is applied for the Standard Level

WI I – Is applied for the Basic

	WI III	WI II	WI I
1. General introduction to welding inspection	3	3	2
1.1 Scope of activity			
1.2 Terms and definitions			
2. Testing	1	1	1
2.1 Mechanical tests on welded joints			
3. Weld Imperfections	7	5	3
3.1 Types of imperfections			
3.2 Evaluation of imperfections			
4. Testing methods	31	25	18
4.1 Review of testing methods			
4.2 Visual inspection			
4.3 Liquid penetrant testing			
4.4 Magnetic particle testing			
4.5 Radiographic testing			
4.6 Ultrasonic testing			
4.7 Other NDT methods			
4.8 Critical review of selection of NDT methods			
4.9 Other test methods			
4.10 Reporting			
5. Quality Assurance	3	3	1
5.1 Principles and levels			
6. Management of inspection function	3	3	0
6.1 Management of inspection function			
7. Practical work	49	23	15
7.1 Radiographic interpretation			
7.2 Mechanical testing			
7.3 Visual inspection			
7.4 Metallographic			
7.5 Penetrant and magnetic			
7.6 Ultrasonic			
Total Recommend hours for Welding Inspection Modules:	97	63	40



Theoretical education: Basic technology “Module 0”

This module is only applied for certain applicants who want to be engage on the Standard level training (see figure 2).

1. Introduction	2
2. Units	2
3. Technical Calculation	7
4. Technical Drawing	12
5. Basics of Electrotechnology	2
6. Basics of Chemistry	2
7. Basics of Materials	5
8. Metal Products	2
9. Machining of Materials	2
10. Technical Mechanics	2
11. Calculation of strength	2
Total Recommend hours for Basic Technology “Module 0”:	40

Note: This 40 hour course follows the syllabus of Module IWS-0, but only insofar as engineering knowledge required by the International Welding Inspection Specialist level is concerned.



Appendix II

ANB detailed assessment

After the candidate has fulfilled the requirements of the ANB check, he will be admitted to the ANB detailed assessment.

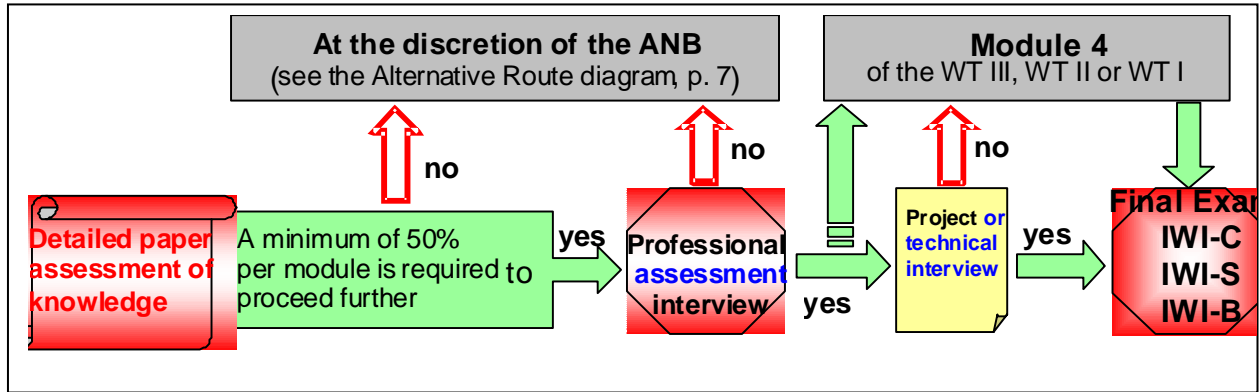


Figure 4: ANB detailed assessment

The full ANB detailed assessment shall contain:

- a detailed paper assessment of knowledge (checklist with points)
- a professional assessment interview designed to test understanding and ability to reason in the field of welding and the syllabus of the standard course and
- a project or a technical interview to test logical application of knowledge

The sequence of this assessment shall be determined by the ANB. It is at the discretion of the ANB to terminate the assessment and send the candidate back or into the standard route.

If he/she has a diploma of IIW (IWE, IWT, IWS, or IWP) and valid certificates of ISO 9712 cover the syllabus of the Welding Inspection Modules of the present guideline he/she can proceed to professional assessment interview for equivalent level of qualification without detailed paper assessment.

After fulfilling all of the requirements for a (detailed assessment) and b (Professional assessment interview) and c.1 (Project) or c.2 (Technical Interview) of the ANB detailed assessment, the candidate will be admitted to the final examination.