

**IIW Guideline for
International Welding Engineers, Technologists,
Specialists and Practitioners**



PERSONNEL WITH QUALIFICATION FOR WELDING COORDINATION

Minimum Requirements for the Education, Examination and Qualification



IAB-252r1-11/SV-00



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

(as described in ISO 14731 and other International and National Standards)

International Welding Engineer (IWE)

International Welding Technologist (IWT)

International Welding Specialist (IWS)

International Welding Practitioner (IWP)

Prepared and issued by the IAB-International Authorisation Board
Under the authority of the IIW-International Institute of Welding

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

**For more information regarding the Qualifications System, the IAB/EFW
Combined Secretariat or the National ANB should be contacted
(see in the IIW site the ANB contacts)**

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Preface

This document is based upon the European Welding Engineer/ Technologist/ Specialist/ Practitioner Guidelines as developed by the European Federation for Welding, Joining and Cutting (EFW), through an Agreement first signed 19 July, 1997, at the Annual Meeting of the International Institute of Welding (IIW) in San Francisco, California, USA and which has been renewed and further developed since then. It has been established in that Agreement that the International Welding Engineer/ Technologist/ Specialist/ Practitioner Diploma is equivalent to the European Welding Engineer/ Technologist/ Specialist/ Practitioner Diploma.

The International Institute of Welding IIW has delegated the responsibility for the management of the qualification and certification systems to the International Authorisation Board (IAB).

This guideline for the international education, training, examination and qualification of welding personnel has been prepared, evaluated and formulated by Group A “Education, Training and Qualification” of the IAB.

Any EWF Authorised National Body 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 EWF/IAB Secretariat or the national ANB.

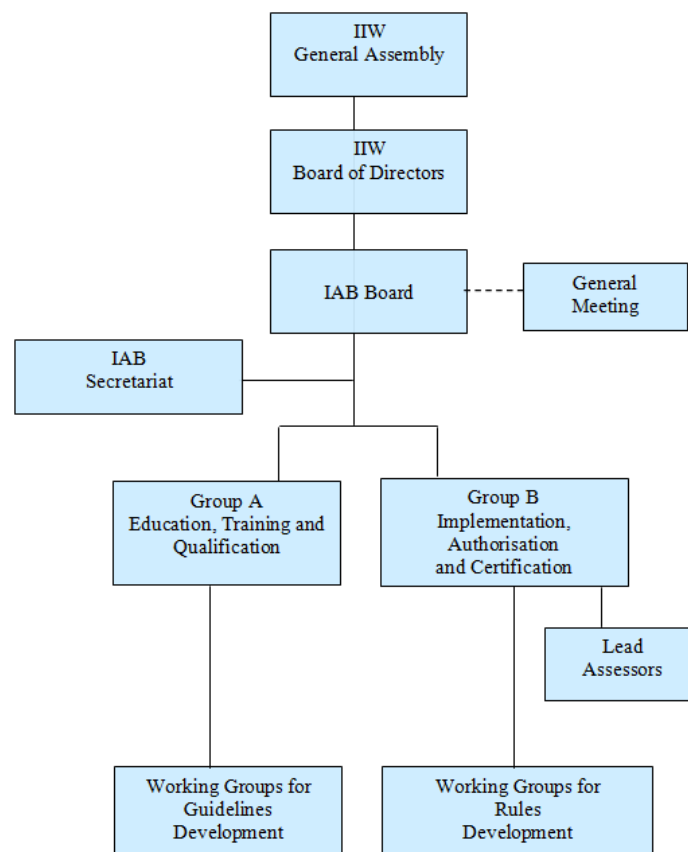


Figure 1: Organisation of the IAB

**MINIMUM REQUIREMENTS FOR THE EDUCATION, TRAINING, EXAMINATION AND QUALIFICATION OF PERSONNEL****1. Introduction**

Section I of the guideline covers the minimum requirements for education and training, which have been agreed upon by all IAB - ANBs, in terms of objectives, scope, expected results, and the teaching hours to be devoted to achieving them. It will be revised periodically by IAB Group A to take into account changes to reflect the "state of the art". Students successfully completing a course of education and examinations will be expected to be capable of applying the technology required in welding engineering at a level consistent with the qualification diploma.

Section II of the guideline covers the rules for examination and qualification.

The modular course contents are given in the following structure (overview):

Modules of theoretical education and fundamental practical skills	Teaching hours*							
	IWE		IWT		IWS		IWP	
	MT	P1	MT	P1	MT	P1	MT	P1
1. Welding processes and equipment	90	35	81	35	48	13	29	13
2. Materials and their behaviour during welding	115	39	96	37	56	19	23	12
3. Construction and design	62	14	44	13	24	4	6	0
4. Fabrication, applications engineering	114	0	81	0	54	0	28	0
Sub-total	381	88	302	85	182	36	86	25
Fundamental practical skills (Part 2)	60		60		60		60	
Total	441		362		242		146	

* Teaching hours are the minimum for the Standard Route, see 2.4;

MT = Module Total (Part 1 + Part 3);

P1 = Part 1;

Figures under P1 are given for the Standard Route (see 4.1).

It is to be noted that the overall structure of the syllabus for all levels (IWE, IWT, IWS, and IWP) is similar, but some topics are not considered in all levels of qualification. These topics are indicated by 0 hours in this guideline. The depth to which a topic is dealt with is indicated by the number of hours allocated to it in the guideline. This will be reflected in the scope and depth of the examination.

2. Routes to Qualification

Three distinct routes to gaining the qualifications described in this document have been agreed.

1. The Standard Route
2. The Alternative Route
3. Distance Learning Programs

2.1 The Standard Route

The Standard Route requires attendance at IAB approved courses designed to meet all the requirements in this Guideline. This is the route (Route 1 in diagrams 1, 2, 3, and 4) recommended by IAB as offering the fastest, most comprehensive manner in which the syllabus may be covered.

The Standard Route also allows a limited amount of prior learning (Part 1 of each qualification course, see Section I) to be taken into account, for example during University or College courses or by distance learning (Route 2 in diagrams 1, 2, 3, and 4). This prior learning shall be approved by the ANB.



2.2 The Alternative Route

The Alternative Route is aimed at individuals who may already have experience of the job function at a particular level without holding the appropriate qualification diploma. These individuals will have already gained full or part knowledge of the syllabus defined in this guideline and can demonstrate their capability to proceed to examination either directly without compulsory attendance at an ANB approved training course or by attending only part of such a course.

2.3 Distance Learning Programs

The Part 1 theory module may be taught in Distance Learning Programs under control of the ANB.

When the Part 1 and Part 3 theory modules are combined or the Part 3 theory module is taught separately the requirements of the latest edition of the Distance Learning Guideline IAB 195 shall be followed.

2.4 Teaching hours

The meaning of the teaching hours is the following:

Standard Route:	minimum number of hours devoted to the subject
Alternative Route:	recommended number of hours devoted to the subject
Distance Learning:	recommended number of hours devoted to the subject
Part 1:	maximum number of hours devoted to the subject in Part 1

A "teaching hour" shall contain at least 50 minutes of direct teaching time.

3. General Access Conditions

In a separate document (Directory of Access Conditions, Doc. IAB-020-see latest edition) the defined access conditions approved by Group B "Implementation and Authorisation" of the IAB are given in detail for all countries participating in the IAB system. Applicants not fulfilling the access conditions may follow the course as guests, but entry to the related examination is not permitted.

The following general conditions shall be applied to all courses:

1. Students who have successfully passed the intermediate examination of Part 1 of the course are allowed to attend Part 2 and Part 3 of the course;
2. The implementation of the access conditions is the responsibility of the ANB.

In following parts of section 3 and in Special Requirements in section 4 of the guideline, diagrams are used for schematic illustration of the text. It should be noted that it is the text which is binding

3.1 International Welding Engineer IWE

It is agreed that entry to the program should be on a postgraduate level. Participants should have a primary degree in an engineering discipline or its equivalent recognised by the national government and assessed by the ANB. Therefore, it would be expected that participants should have at least a Bachelor degree at university level with a minimum study of 3 years, e.g.:

- a relevant qualification from an accredited program in accordance with the Washington Accord for professional qualification of engineers, or
- a First Cycle Bologna Framework engineering qualification, or



- an engineering qualification at EQF Level 6,
- or equivalent.

In case of co-operation arrangements, e.g. with universities, according to which the IWE Part 1 of the curriculum structure (see Section I) is presented under careful control of the ANB, the participant is allowed to enter the IWE course through the Route 2 (see item 2.1 and the diagram 1 below).

The following additional conditions shall be observed for the different routes through the IWE course:

1. Students who have authenticated evidence that they have passed the examinations in all subjects of their Bachelor engineering degree studies but still have to complete a thesis are allowed to attend Part 2 and Part 3 of the IWE course and the corresponding written parts of the final examination;
2. Students shall present their degree diploma to the Board of Examiners before being allowed to take the final oral examination for IWE.

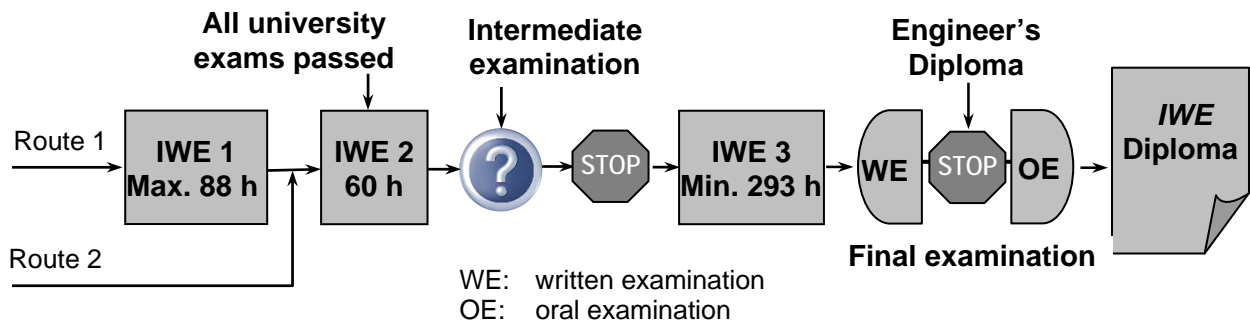


Diagram 1

3.2 International Welding Technologist IWT

It is agreed that entry to the program via route 1 and 2 should be on the basis of a higher technical education below that required for the International Welding Engineer. Participants should have a primary degree in an engineering discipline, e.g.

- a relevant qualification from an accredited program in accordance with the Sydney Accord for professional qualification of engineering technologists, or
- a Short Cycle Bologna Framework engineering qualification, or
- an engineering qualification at EQF Level 5,
- or equivalent.

In case of co-operation arrangements, e.g. with technical colleges, according to which the IWT Part 1 of the curriculum structure (see Section I) is presented under careful control of the ANB, the participant is allowed to enter the IWT course through the Route 2 (see item 2.1 and the diagram 2 below).

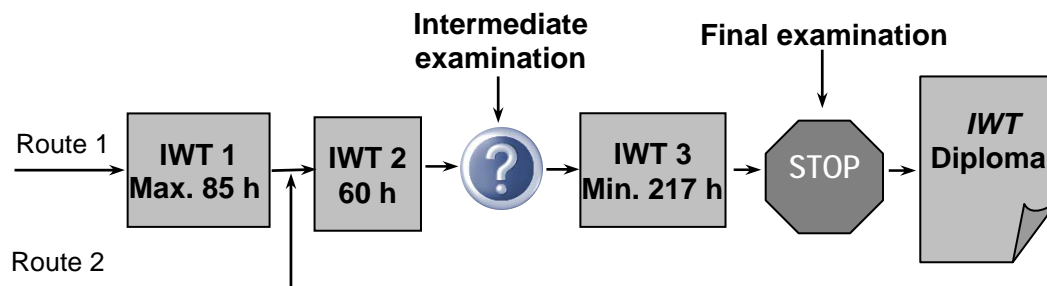


Diagram 2

3.3 International Welding Specialist IWS

It is agreed that entry to the program through the Routes 1 and 2 should be on the basis of a specific technical education below that required for the International Welding Technologist but higher than a professional worker, e.g. a relevant qualification from an accredited program

- in accordance with the Dublin Accord for the professional qualification of engineering technicians, or
- an engineering qualification at EQF Level 4,
- or equivalent.

In case of co-operation arrangements, e.g. with technical colleges, according to which the IWS Part 1 of the curriculum structure (see Section I) is presented under careful control of the ANB, the participant is allowed to enter the IWS course through the Route 2 (see item 2.1 and the diagram 3 below).

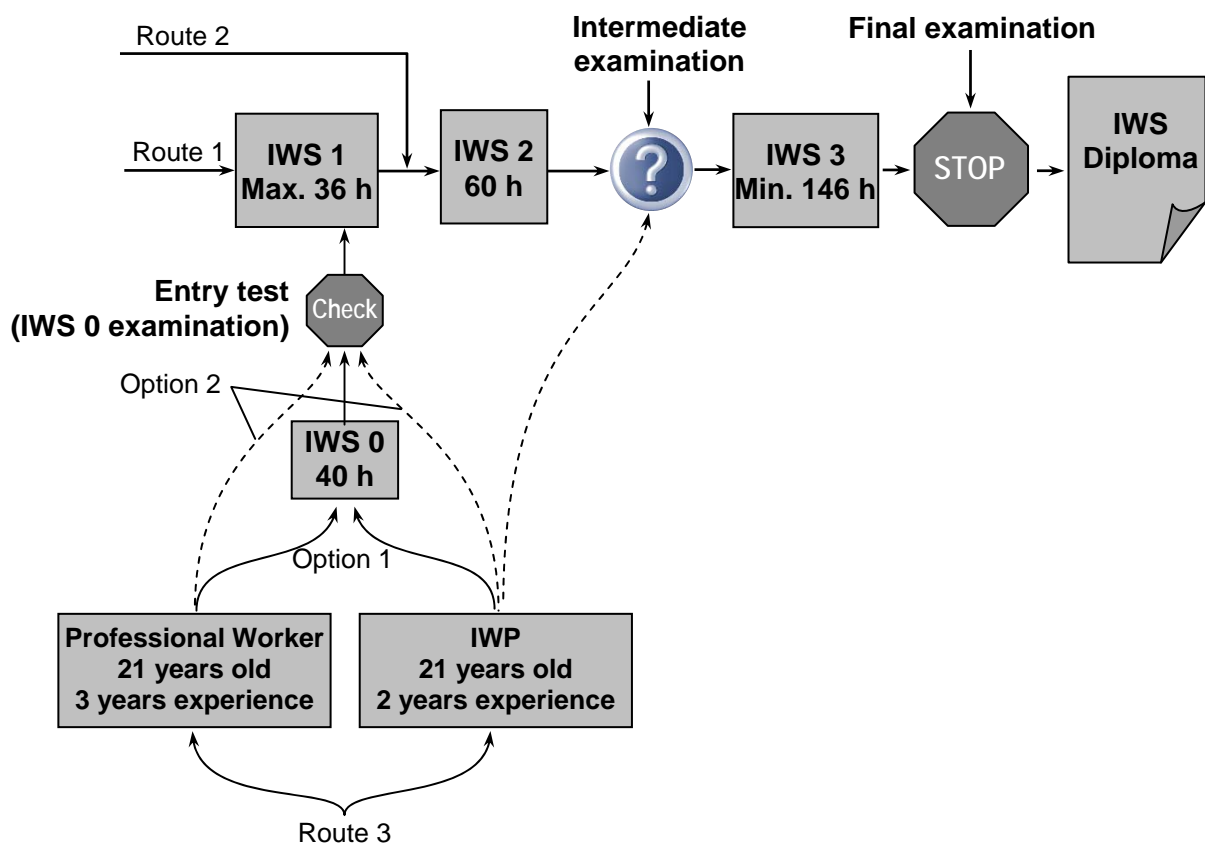


Diagram 3

The following additional conditions shall be observed for the different routes through the IWS course:

1. Route 1 and 2: a minimum of 2 years job related experience is required; the recommended minimum age for entry into the education is 20 years.
2. Route 3: For the access to the module IWS Part 0 the minimum requirements are:
 - International Welding Practitioner (IWP) and minimum 2 years experience (see on above diagram option 1)
 - Qualification of a professional worker (with diploma after examination) in metalworking professions at EQF Level 3, or equivalent and minimum 3 years experience in welding related activities,



- the recommended minimum age is 22 years to start the education National definitions for a professional worker are given in the Directory of Access Conditions (see on above diagram 3 option 1).
3. A qualified professional worker (as stated above) or an IWP Diploma holder not fulfilling the IWS National Access Requirements should be allowed to go directly to the IWS Part 0 examination if they can prove that they have achieved the knowledge prescribed by the IWS Part 0 (see on above diagram option 2).
4. If the IWP Diploma holder fulfils the IWS National Access Requirements, he may skip the entry test (IWS Part 0 examination) and IWS Part 1 and only perform the IWS Part 1 intermediate exam (see on above diagram 3 option 3). At the discretion of the ANB a partial or full exemption from Part 2 may be granted.

3.4 International Welding Practitioner IWP

In order to enter the International Welding Practitioner course, participants are required to be skilled in practical welding and to have had experience as a welder in industry. The course is intended to build theoretical knowledge and practical welding skills.

In case of co-operation arrangements, e.g. with technical colleges, according to which the IWP Part 1 of the curriculum structure (see Section I) is presented under careful control of the ANB, the participant is allowed to enter the IWP course through the Route 2 (see item 2.1 and the diagram 4 below).

The following standard access conditions are applicable to the IWP course. Applicants are required to

1. Hold a valid welder qualification certificate ISO 9606 H-L045 ss nb in one of the welding processes listed in 5.1 of ISO 9606, or equivalent, e.g. EN 287-1 H-L045 ss nb, or ASME IX 6G.
- or hold a valid welder qualification as a plate welder for the following conditions: PE ss nb or PC and PF ss nb, according to ISO 9606 at least in one process, and/or other national equivalent in the IIW member country.
2. The recommended minimum age to enter the education is 21 years including 2 years of experience as a welder.

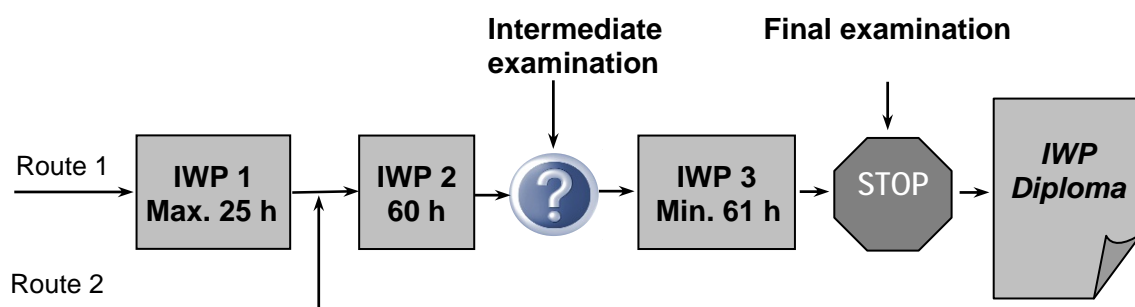


Diagram 4



4. Special Requirements

4.1 Standard Route

Applicants (excluding guests) shall satisfy the ANB access conditions. If the ANB decides that the access conditions are adequately met, the applicants are then required to attend a training course conducted by an Approved Training Body (ATB) giving as a minimum the hours of instruction detailed in this Guideline as teaching hours. There will be written and oral examinations (where applicable) for the award of the applicable IIW Diploma.

The maximum amount of hours of the lectures, which can be included in Part 1 are given in the table included in Section I above. The definition of the elements of the syllabus which are included in Part 1 is the responsibility of the ANB.

It is not obligatory to follow exactly the order of the topics given in this guideline and choice in the arrangement of the syllabus is permitted, with the exception that **training must conclude with Module 4 “Fabrication, applications engineering” in Part 3.**

The depth to which each topic is dealt with is indicated by the number of hours allocated to it in the guideline. This will be reflected in the scope and depth of the examination.

The rules for the conduct of the final examination by the ANB are prescribed under Examination and Qualification in this guideline (Section II).

4.2 Alternative Route

An applicant shall submit an application form to the ANB together with the documents indicated in the items 4.2.1, 4.2.2, 4.2.3 and 4.2.4 for a paper assessment.

The ANB shall conduct a paper assessment of the documentation submitted to ensure the applicant meets the Access Conditions for the alternative route (see the list of access conditions, doc IAB-020-see latest edition) and to evaluate the applicant's practice of related job function in welding. The result of this assessment shall determine if the applicant is suitable for further detailed assessment (Appendix III).



4.2.1 International Welding Engineer IWE

- A copy of a diploma showing graduation in an engineering subject complying with the Access Conditions.
- A curriculum vitae (CV) - resume containing professional information:
 - evidence of at least 4 years job function in welding at the level of an engineer (in a period of 6 years before application);
 - justification of candidate's experience, training, and education to become IWE (may include other test results).

Applicants who satisfy the Access Conditions AND already hold an IWT diploma should be considered under the Alternative Route

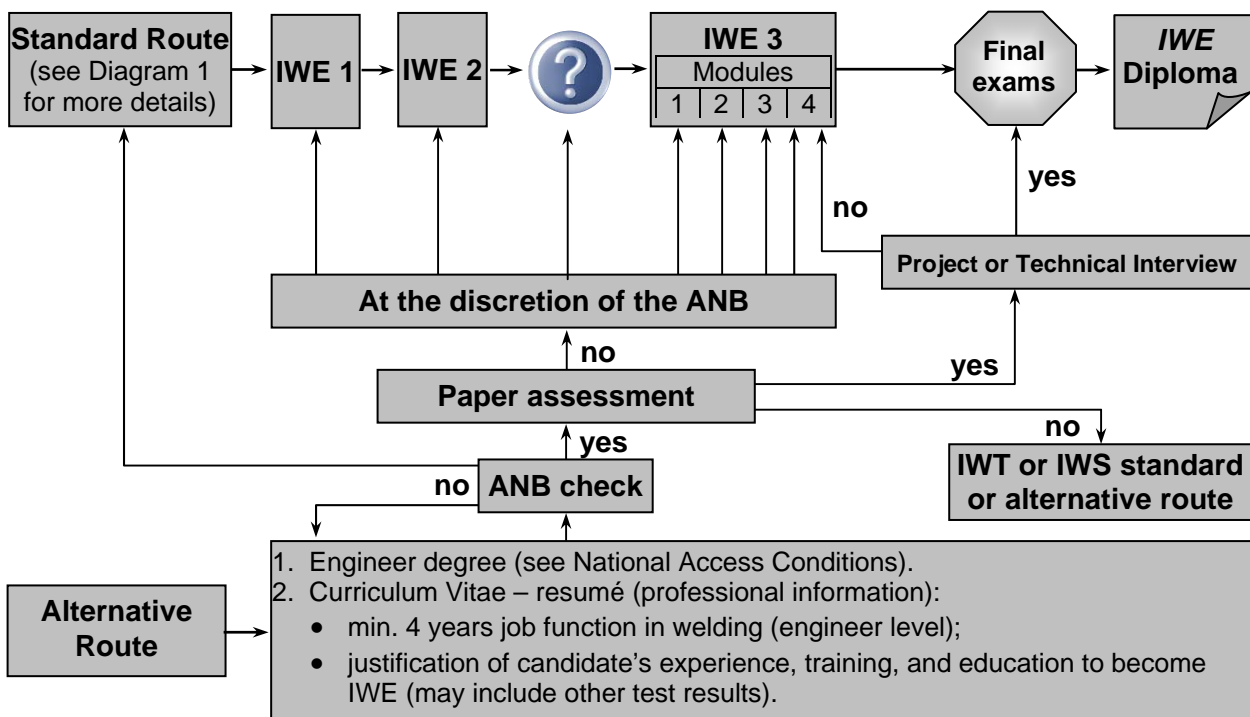


Diagram 5 - Alternative versus Standard Routes for IWE qualification
(see also appendix III)



4.2.2 International Welding Technologist IWT

- A copy of a diploma showing graduation as technologist complying with the Access Conditions.
- A curriculum vitae (CV) - resume containing professional information:
 - evidence of at least 4 years job function in welding at the level of a technologist (in a period of 6 years before application);
 - justification of candidate's experience, training, and education to become IWT (may include other test results).

Applicants who satisfy the Access Conditions AND already hold an IWS diploma should be considered under the Alternative Route.

Applicants who satisfy the Access Conditions AND hold an IWI-C diploma should be considered under the Alternative Route.

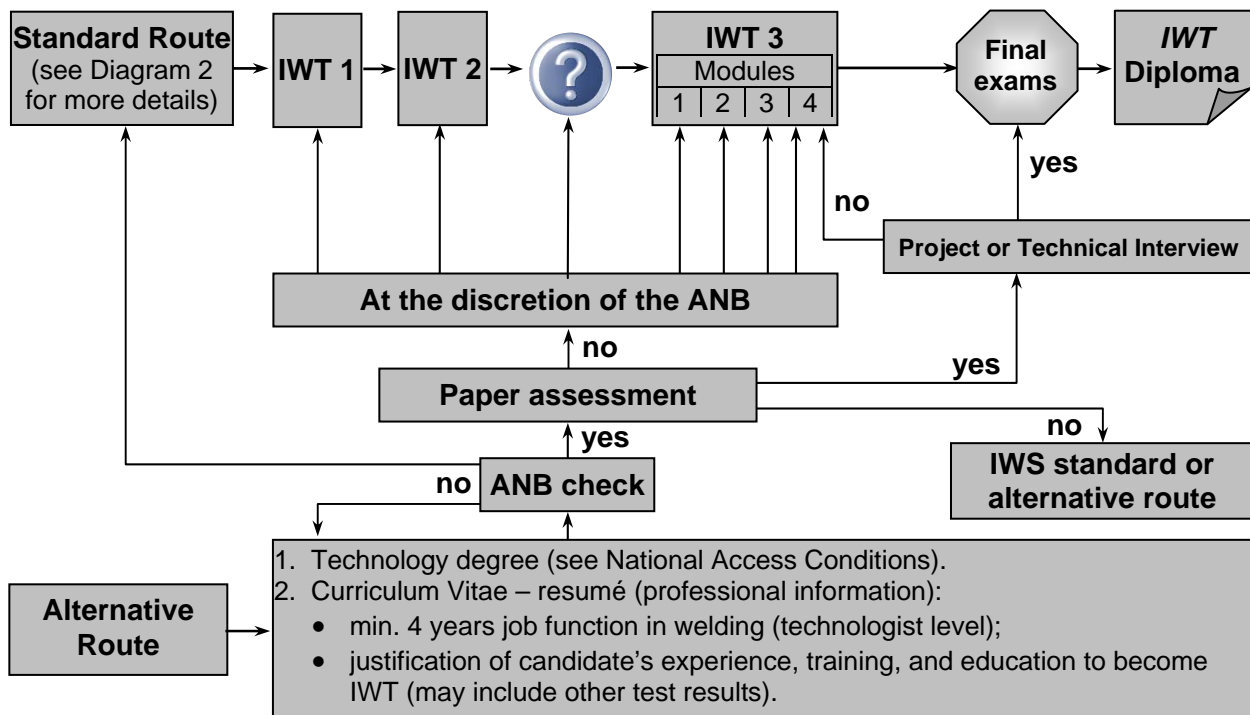


Diagram 6 - Alternative versus Standard Routes for IWT qualification
(see also appendix III)



4.2.3 International Welding Specialist IWS

- A copy of documentary proof showing compliance with the Access Conditions for IWS.
- A curriculum vitae (CV) - resume containing professional information:
 - evidence of at least 3 years job function in welding at a level equivalent to that of a specialist (in a period of 6 years before application);
 - justification of candidate's experience, training, and education to become IWS (may include other test results).

Applicants who satisfy the Access Conditions AND hold an IWI-S diploma should be considered under the Alternative Route.

Applicants who do not satisfy the Access Conditions but who have a minimum of six years of experience in welding coordination and demonstrate to the ANB that their combination of education, training and experience in welding technology has provided a level of knowledge equivalent to the current IIW requirements should be considered under the Alternative Route.

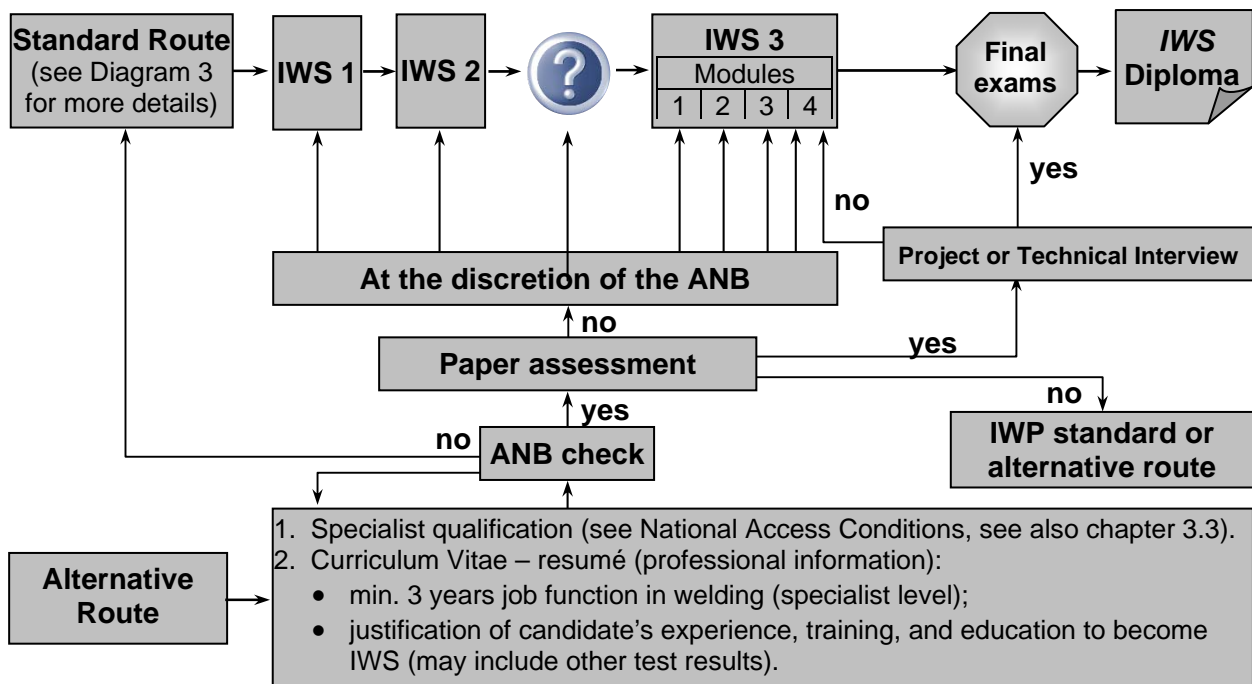


Diagram 7 - Alternative versus Standard Routes for IWS qualification
(see also appendix III)



4.2.4 International Welding Practitioner IWP

- A copy of a valid welder qualification certificate according with chapter 3.4 of the standard route.
- A curriculum vitae (CV) - resume containing professional information:
 - min. 3 years job function in welding as a certified plate or tube welder in a period of 5 years before application plus
 - min. 1 year job function in welding practitioner level in a period of 3 years before application;
 - justification of candidate’s experience, training, and education to become IWP (may include other test results).

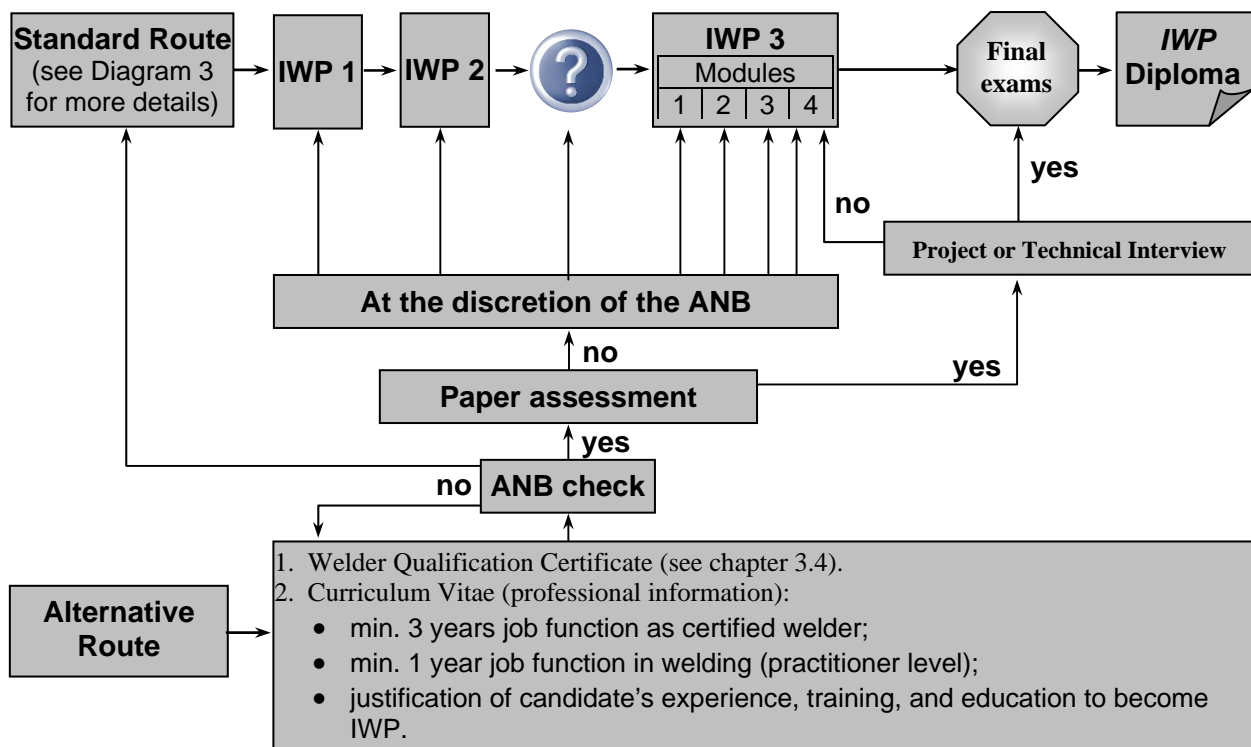


Diagram 8 - Alternative versus Standard Routes for IWP qualification
(see also appendix III)



Section I: Theoretical and Practical Education – Part 1, Part 2 and Part 3, Syllabus and Performance Objectives

I.1. Theoretical Education - Part 1 and Part 3

Module 1: Welding processes and equipment

Subject Title	Qualification Level*			
	(Training Hours Part 3+Part1/Part 1 – Training Hours)			
	IWE	IWT	IWS	IWP
1.1 General introduction to welding technology	3/3	3/3	1/1	1/1
1.2 Oxy-gas Welding and related processes	2/2	2/2	1/1	1/1
1.3 Electrotechnics, a review	1/1	1/1	2/2	2/2
1.4 The arc	3/3	3/3	1/0	1/0
1.5 Power sources for arc welding	4/4	4/4	3/1	2/1
1.6 Introduction to gas shielded arc welding	2/2	2/2	1/1	1/1
1.7 TIG Welding	5/4	5/4	3/2	2/2
1.8.1 MIG/MAG	6/4	6/4	5/2	5/2
1.8.2 Flux Cored Arc Welding	2/2	2/2	2/1	2/1
1.9 MMA Welding	6/4	6/4	4/2	4/2
1.10 Submerged-Arc Welding	5/4	5/4	3/0	3/0
1.11 Resistance Welding	6/0	6/0	3/0	0/0
1.12.1 Other Welding Processes – Laser; Electron Beam; Plasma	8/0	5/0	2/0	1/0
1.12.2 Other Welding Processes, other than 1.12.1	6/0	4/0	2/0	2/0
1.13 Cutting, Drilling and other edge preparation processes	4/2	4/2	2/0	2/0
1.14 Surfacing and Spraying	2/0	2/0	1/0	0/0
1.15 Fully mechanised processes and robotics	8/0	6/0	3/0	0/0
1.16 Brazing and soldering	4/0	4/0	2/0	0/0
1.17 Joining processes for plastics	2/0	2/0	1/0	0/0
1.18 Joining processes for ceramics and composites	1/0	1/0	0/0	0/0
1.19 Welding laboratory	10/0	8/0	6/0	0/0
Total	90/35	81/35	48/13	29/13

* P1 = Part 1, Figures under P1 are given for the Standard Route (see 4.1)



Module 2: Materials and their behaviour during welding

Subject Title	Qualification Level*			
	(Training Hours Part 3+Part1/Part 1 – Training Hours)			
	IWE	IWT	IWS	IWP
2.1 Structure and properties of metals	4/4	4/4	2/2	0/0
2.2 Phase Diagrams and Alloys	4/4	4/4	2/2	2/2
2.3 Iron – carbon alloys	5/5	5/5	3/3	1/1
2.4 Manufacture and classification of steels	4/2	4/2	2/1	2/1
2.5 Behaviour of structural steels in fusion welding	4/4	4/4	2/2	2/2
2.6 Cracking phenomena in welded joints	8/2	6/2	4/0	2/0
2.7 Fractures and different kinds of fractures	4/4	2/2	1/1	0/0
2.8 Heat treatment of base materials and welded joints	4/4	4/4	2/2	1/1
2.9 Structural (unalloyed) steels	4/2	4/2	2/2	2/2
2.10 High strength steels	10/4	8/4	4/2	1/1
2.11 Application of structural and high strength steels	2/0	2/0	2/0	1/0
2.12 Creep and creep resistant steels	4/0	3/0	2/0	0/0
2.13 Steels for cryogenic applications	4/0	3/0	2/0	0/0
2.14 Introduction to corrosion	4/0	3/0	2/0	1/0
2.15 Stainless and heat resistant steels	12/0	9/0	5/0	2/0
2.16 Introduction to wear and protective layers	5/0	3/0	2/0	0/0
2.17 Cast irons and steels	2/0	2/0	2/0	0/0
2.18 Copper and copper alloys	2/0	2/0	1/0	0/0
2.19 Nickel and nickel alloys	2/0	1/0	1/0	0/0
2.20 Aluminium and aluminium alloys	6/0	4/0	2/0	2/0
2.21 Titanium and other metals and alloys	3/0	2/0	1/0	0/0
2.22 Joining dissimilar materials	4/0	3/0	2/0	1/0
2.23 Destructive testing of materials and welded joints	14/4	14/4	8/2	3/2
Total	115/39	96/37	56/19	23/12

* P1 = Part 1, Figures under P1 are given for the Standard Route (see 4.1)

**Module 3: Construction and design**

Subject Title	Qualification Level* (Training Hours Part 3+Part1/Part 1 – Training Hours)			
	IWE	IWT	IWS	IWP
3.1 Basic theory of structural systems	4/4	4/4	2/0	0/0
3.2 Fundamentals of the strength of materials	6/6	6/6	4/4	0/0
3.3 Joint design for Welding and Brazing	4/4	4/3	3/0	2/0
3.4 Basics of weld design	6/0	6/0	4/0	0/0
3.5 Behaviour of welded structures under different types of loading	4/0	2/0	1/0	0/0
3.6 Design of welded structures with predominantly static loading	8/0	5/0	3/0	2/0
3.7 Behaviour of welded structures under cyclic loading	8/0	5/0	2/0	1/0
3.8 Design of cyclic loaded welded structures	8/0	4/0	2/0	0/0
3.9 Design of welded pressure equipment	6/0	4/0	2/0	1/0
3.10 Design of aluminium alloys structures	4/0	2/0	1/0	0/0
3.11 Introduction to fracture mechanics	4/0	2/0	0/0	0/0
Total	62/14	43/13	24/4	6/0

* P1 = Part 1, Figures under P1 are given for the Standard Route (see 4.1)

**Module 4: Fabrication, applications engineering**

Subject Title	Qualification Level*			
	<small>(Training Hours Part 3+Part1/Part 1 – Training Hours)</small>			
	IWE	IWT	IWS	IWP
4.1 Introduction to quality assurance in welded fabrication	6/0	6/0	2/0	1/0
4.2 <i>Quality control during manufacture</i>	16/0	12/0	10/0	6/0
4.3 Residual Stresses and Distortion	6/0	4/0	2/0	2/0
4.4 Plant facilities, welding jigs and fixtures	4/0	4/0	4/0	2/0
4.5 Health and Safety	4/0	4/0	4/0	4/0
4.6 Measurement, Control and Recording in Welding	4/0	4/0	4/0	2/0
4.7. Imperfections and Acceptance Criteria	4/0	3/0	2/0	1/0
4.8 Non Destructive Testing	18/0	8/0	8/0	8/0
4.9 Economics and Productivity	8/0	5/0	2/0	1/0
4.10 Repair Welding	2/0	2/0	1/0	1/0
4.11 Reinforcing-steel welded joints	2/0	1/0	1/0	0/0
4.12 Case Studies	40/0	28/0	14/0	0/0
Total	114/0	81/0	54/0	28/0

* P1 = Part 1, Figures under P1 are given for the Standard Route (see 4.1)



I.2 Theoretical Education - IWS 0

The module IWS 0 aims at teaching basic technical knowledge, which in general is lacking in participants entering via the route 3 when compared to participants entering via routes 1 and 2. It provides the chance for professional workers and International Welding Practitioners to become qualified as International Welding Specialists

The module IWS 0 deals with the following subjects:

		Teaching hours
0.1	Basic Metrology applicable to Welding	4
0.2	Technical Calculation	8
0.3	Technical Drawings	8
0.4	Basics of Electro-technology	2
0.5	Basics of Chemistry	2
0.6	Basics of Materials	2
0.7	Metal Products	2
0.8	Machining of Materials	2
0.9	Technical Mechanics	4
0.10	Joining Elements	2
0.11	Calculation of strength	4

40



I.3. Practical Education – Part 2

I.3.1 For the IWE; IWT, and IWS

This part does not aim at providing practical skills to the welding engineer/technologist/specialist but on gaining knowledge on the control of the different welding processes. The students shall become as familiar as possible with the problems and typical defects associated with incorrect use of the different welding methods. During their exercises the students are guided by skilled welding teachers.

Practical Training	hours:
Oxygas welding and cutting	6
MMA	8
TIG	8
MIG/MAG + Flux Cored Arc Welding	16
It is possible to use the advantages of Virtual Weld Training systems but maximum to 50% of the practical training hours!	
Demonstrations or video presentations on processes	22
Gouging	
Brazing	
Plasma welding	
Plasma cutting	
Submerged-arc welding	
Resistance welding	
Friction welding	
Electron beam welding	
Laser welding	
Other processes	
total :	<u>60</u>

It is strongly recommended that ATBs do demonstrations instead of videos wherever possible.

Candidates may be exempted by the ATB from the practical training, on a process by process basis, if they can demonstrate practical experience and/or training in the process concerned.

The laboratory exercises contained in the foregoing modules 1 to 4 of the theoretical part are additional and given usually at a later stage of the education.

I.3.2 For the IWP

The practical training has to be done on an individual basis.

The main processes are: MMA, MIG/MAG, FCAW, TIG and Gas Welding. 40 hours shall be reserved to broaden the student's skill in other relevant materials within his welder qualification/s. This training shall end with a practical examination in more than one process or more than one group of material (according ISO 9606 or national standards). For MIG welding only material group 22 and for Gas welding only material groups 1.1 and 1.2 are relevant.

If a student can demonstrate existing practical skill in and an understanding of the welding of different materials, it is accepted that he can sit for the practical examination in these processes and materials without prior practical training.



Typical test pieces and positions are given in Table 1. The test pieces shall be welded as single side welding without backing, except for aluminium, where backing is allowed. Each ANB will work to a similar table based on comparable national standards.

Valid national certificates are accepted as replacements for the practical examinations with test pieces in Table 1.

Table 1: Recommended test pieces and positions for practical examinations:

The dimensions given in the table are recommended/proposed, but not mandatory, other dimensions are accepted.

Welding process		Practical Test		
ISO/EN 9606/287	ISO/EN 9606/287	Material Group (ISO TR 15608)	Welding Position	Test Dimension(s) Diameter/Thickness
MMA	111	1	PF/BW	6,0 – 13,0
		3	PF/BW	6,0 – 13,0
		4, 5, 6	H-L045/BW	∅60,3 – ∅114.3/ 3.9 – 7.11
		7	PF/BW	6,0 – 13,0
		8	PB/FW	6,0 – 13,0
TIG	141	1	H-L045/BW	∅60,3 – ∅114.3 3.9 – 7.11
		3	PF/BW	2,0 – 6,0
		4, 5, 6	H-L045/BW	∅60,3 – ∅114.3 3.9 – 7.11
		7	PF/BW	2,0 – 6,0
		8	H-L045/BW	∅60,3 – ∅114.3 3.9 – 7.11
		22	PF/BW	2,0 – 6,0
MIG	131	22	PF/BW	6,0 – 13,0
MAG (and/or metal cored)	135 (136)	1	PF/BW	6,0 – 13,0
		8	PB/FW	6,0 – 13,0
FCAW (flux cored only)	136	1	PF/BW	6,0 – 13,0
		8	PF/BW	6,0 – 13,0
		3	PA/FW	6,0 – 13,0
GAS	311	1	H-L045/BW	∅60,3 – ∅114.3 3.9 – 7.11

Twenty hours shall be reserved to give the student basic understanding of the possibilities and limitations of the other processes mentioned in Table 1. The purpose of this training is only to demonstrate the possibilities and limitations of these processes, and no practical examination is required. If the student can demonstrate to the training establishment skill in and understanding of the other processes, he may be exempted from this training.

Acceptance criteria for the practical examination:

The quality of welding shall comply with ISO 9606, or comparable quality levels defined in National welders qualification standards used by IAB Group A countries. A welder qualification certificate may be issued.



APPENDIX I:

Requirements for equipment, facilities and specimens for the International Welding Engineer (IWE), Technologist (IWT), Specialist (IWS) and Practitioner (IWP) course leading to the award of IIW qualification

1. Equipment

The following equipment shall be in good working order and fit for its purpose:

1.1 Welding equipment

Equipment for the following processes shall be available for practical exercises.

Manual metal arc welding	- 111
MIG welding	- 131
MAG welding	- 135/136/138
TIG welding	- 14
Gas welding	- 311
Gas flame cutting	- 81

Further processes covered by the syllabus may be shown by means of demonstrations or video presentations.

1.2 Other equipment

Mechanical testing, metallurgical examination and NDT equipment shall be available for both demonstration and laboratory work purposes.

2. Specimens

A reference collection of well documented weld specimens, polished and etched, should reflect the processes covered by the Guideline and one specimen per process is required (at minimum for the most common welding processes – see syllabus item 1.2 to 1.12.1; recommended is to show all other processes by means of slides, photos, etc.). Preferably the specimens should cover a number of materials and thicknesses.



APPENDIX II:

Abbreviations for Processes:

The following abbreviations used in the document show the relation between the ISO designation, the process abbreviations used in Europe and those used in the USA.

ISO 4063	European (EA) and American (AA) abbreviations		Full name
111	EA	MMA	Manual Metal Arc Welding
	AA	SMAW	Shielded Metal Arc Welding
114	EA	FCAW	Self-shielded tubular cored arc
	AA	FCAW	Self-shielded tubular cored arc welding
12	EA	SAW	Submerged Arc Welding
	AA	SAW	Submerged Arc Welding
13	EA	GMAW	Gas Shielded Metal Arc Welding
	AA	GMAW	Gas Metal Arc Welding
131	EA	MIG	MIG welding with solid wire electrode
	AA	GMAW	Gas metal arc welding using inert gas and solid wire electrode
132	EA	MIG	MIG welding with flux cored electrode
	AA	FCAW	Flux cored arc welding
135	EA	MAG	MAG welding with solid wire electrode
	AA	GMAW	Gas metal arc welding using active gas with solid wire electrode
136	EA	MAG	MAG welding with flux cored electrode
	AA	FCAW	Gas metal arc welding using active gas and flux cored electrode
138	EA	MAG	MAG welding with metal cored electrode
	AA	FCAW	Gas metal arc welding using active gas and metal cored electrode
141	EA	TIG	TIG welding with solid filler material (wire/rod)
	AA	GTAW	Gas tungsten arc welding using inert gas and solid filler material (wire/rod)



ISO 4063	European (EA) and American (AA) abbreviations		Full name
142	EA	TIG	Autogenous TIG welding
	AA	GTAW	Autogenous gas tungstenarc welding using inert gas
21	EA		Resistance spot welding
	AA	RSW	Spot Welding
25	EA		Resistance Butt Welding
	AA	RSEW	Upset Welding
3	EA		Gas Welding
	AA	OFW	Oxy-fuel Gas Welding
311	EA		Oxy-acetylene Welding
	AA	OAW	Oxy-acetylene Welding
42	EA	FW	Friction Welding
	AA	FW	Friction Welding
43	EA	FSW	Friction Stir Welding
	AA	FSW	Friction Stir Welding
81	EA		Flame Cutting
	AA	OFC	Oxygen Cutting, oxyfuel cutting
86	EA		Flame Gouging
	AA		Thermal Gouging



APPENDIX III:

ANB Detailed Assessment

After the candidate has fulfilled the requirements of the ANB paper check he will be admitted to the ANB Detailed Assessment (Diagram 9).

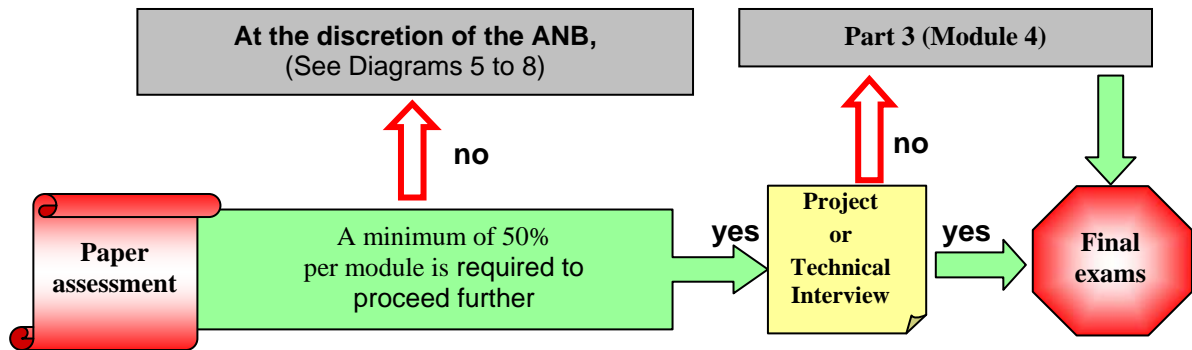


Diagram 9: ANB detailed Assessment

The full ANB detailed assessment shall contain:

- a) a detailed paper assessment (checklist with points)
- b) a project or a technical interview to test logical application of knowledge regarding the relevant guideline Module 4 syllabus

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.

**Appendix IV:****List of Referenced Standards**

Standard (-series)	Title
ASME IX	American Society of Mechanical Engineers; Boiler and Pressure Vessel Code, Section IX: Welding and Brazing Qualifications
ISO/TR 581	Weldability – Metallic Materials, Definitions
ISO/TR 17671-1 (EN 1011-1)	Welding - Recommendations for welding of metallic materials - Part 1: General guidance for arc welding
ISO/TR 17671-2 (EN 1011-2)	Welding - Recommendations for welding of metallic materials - Part 2: Arc welding of ferritic steels
EN 1321	Destructive tests on welds in metallic materials - Macroscopic and microscopic examination of welds
ISO 14732 (EN 1418)	Welding personnel - Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials
EN 1708	Welding - Basic weld joint details in steel (series)
ISO 2553	Welded, brazed and soldered joints - Symbolic representation on drawings
ISO 3834	Quality requirements for fusion welding of metallic materials (series)
ISO 4063	Welding and allied processes - Nomenclature of processes and reference numbers
ISO 5817	Welding - Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) - Quality levels for imperfections
ISO 9000	Quality management systems (series)
ISO 9606 EN 287-1	Approval testing of welders - Fusion welding (series) Qualification test of welders - Fusion welding - Part 1: Steels
ISO 9692	Welding and allied processes - Recommendation for joint preparation (series)
ISO 9712 (EN 473)	Non-destructive testing - Qualification and certification of personnel
ISO10042	Welding - Arc-welded joints in aluminium and its alloys - Quality levels for imperfections



Standard (-series)	Title
ISO/TR 17635 (EN 12062)	Non-destructive examination of welds - General rules for metallic materials
ISO 13916	Welding - Guidance on the measurement of preheating temperature, interpass temperature and preheat maintenance temperature
ISO 13920	Welding - General tolerances for welded constructions - Dimensions for lengths and angles - Shape and position
ISO 14731	Welding coordination - Tasks and responsibilities
CEN/TR 15135	Welding - Design and non-destructive testing of welds
ISO/TR 15235	Welding - Methods for assessing imperfections in metallic structures
ISO/TR 15481	Welding of reinforcing steel - Tack weldability - Test methods and performance requirements
ISO 15607	Specification and qualification of welding procedures for metallic materials - General rules
ISO/TR 15608	Welding - Guidelines for a metallic material grouping system
ISO 15609	Specification and qualification of welding procedures for metallic materials – Welding procedure specification (series)
ISO 15610	Specification and qualification of welding procedures for metallic materials - Qualification based on tested welding consumables
ISO 15611	Specification and qualification of welding procedures for metallic materials - Qualification based on previous welding experience
ISO 15612	Specification and qualification of welding procedures for metallic materials - Qualification by adoption of a standard welding procedure
ISO 15613	Specification and qualification of welding procedures for metallic materials - Qualification based on pre-production welding test
ISO 15614	Specification and qualification of welding procedures for metallic materials - Welding procedure test (series)
ISO/TR 16060	Destructive tests on welds in metallic materials — Etchants for macroscopic and microscopic examination
ISO 17660	Welding - Welding of Reinforcing Steel (series)
ISO 17662	Welding - Calibration, verification and validation of equipment used for welding, including ancillary activities



Standard (-series)	Title
ISO/TR 17663	Welding - Guidelines for quality requirements for heat treatment in connection with welding and allied processes