



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

**EUROPEAN MANUAL METAL ARC (MMA) DIVER WELDER  
(EW MMA-Diver)**

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

**For more information regarding the EWF Qualification System,  
the EWF-IAB/IIW Combined Secretariat or the National ANB  
should be contacted  
(see in the EWF and/or IIW sites the ANB contacts)**

**GUIDELINE OF THE EUROPEAN FEDERATION FOR  
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**Minimum requirements for the education, examination and qualification of  
European Manual Metal Arc (MMA)-Diver-Welder**

**Issued: April 2001**

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## Foreword

The use of this guideline is restricted to organizations approved by the Authorized National Body (ANB).

The section I of this guideline covers the minimum requirements for education and training.

The section II of this guideline covers the examination and qualification:

## Section I: Minimum requirements for education and training

### 1 Introduction

This guideline for the European education and training of diver-welders for hyperbaric wet MMA-welding according to EN ISO 4063 has been advised and formulated by members of the Committee for Education and Training of the EWF. It is designed to provide a harmonized scheme for a comprehensive education and training of diver-welders.

The International Standard EN ISO 15618-1 provides a scheme for diver-welder tests, to evaluate and to certify the capability of a diver-welder for a limited range of welding conditions. It serves for quality assurance for a specific job, and provides an education program based on experience, in which steps and sequence a high skill in welding can be acquired. Only highly qualified diver-welders are able to improve the credibility of the wet welding process, and to achieve the acceptance of the classifying authorities.

This guideline provides a combination of high skill, assessed by tests of increasing difficulty, including EN ISO 9606-1 and the necessary theoretical background, assessed by theoretical examinations. Diver-welders successfully completing this program achieve a high standard of qualification and skill, which enables them to perform the wet welding process of the required quality.

Figure 1 gives an overview on the modules available.

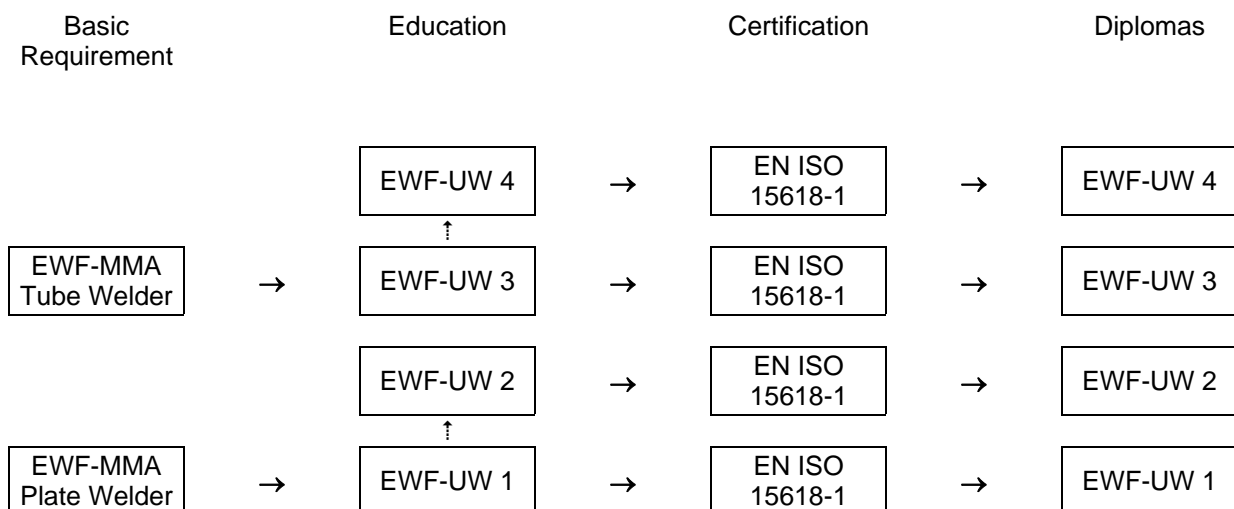


Figure 1: Use of the modules

## 2 Access to the course

Normal physical and mental capability is assumed. Basic skill according to the following requirements is essential. Course attenders and teachers shall have a good command of a common language, so that they can successfully participate in instruction, and take part in theoretical and verbal tests.

For a successful participation in the diver-welder training course, the trainee has to give his full concentration on the training course and its requirements, as wet welding is one of the most difficult welding technologies. High weld quality is necessary to achieve the acceptance of wet welding of structural components from the authorities. Such a weldment quality can only be achieved by full and non-disrupted concentration throughout the whole welding operation, and by excellent skill. The diver-welder has to identify himself with the task he has to perform. Therefore only well trained and experienced commercial divers should participate at such a diver-welder training course. It is an essential requirement that the trainee has to prove this diver qualification. This can be done by an approved certificate issued by a recognized authority.

The trainee has to prove his ability to weld satisfactorily under atmospheric conditions (e.g. by a diploma as an EWF-MMA welder, to have the necessary background on basic welding technology, materials structure, consumables, heat transfer safety requirements etc.). He shall have good experience and skill in practical welding under atmospheric conditions.

For participation in the theoretical and practical examination according to EN ISO 15618-1 a successful participation in this diver-welder training course is essential.

## 3 Curriculum of training

The diver-welder training course breaks down into practical and theoretical instruction. The training practice (welding and qualification) is based on relevant instructions and exercise schedules (see tables 3 to 6 as well as EN ISO 15618-1, figures 1 to 7 for the shape and dimension of test pieces).

The type of base material on which wet welding is usually applied will be unalloyed or low alloyed structural steel, corresponding to material group 1 according CR ISO/TR 15608. Suggested material dimensions are shown in tables 3 to 6. However, the range of thickness can be chosen to suit production requirements. The type of materials and electrodes used in the training should be similar to those to be used in the examination test pieces.

The periods of time given in the tables 3 to 6 represent the average time required to attain the expected level of skill. The time needed may vary individually, according to the capability of the trainee. For each individual training module, it is at the discretion of the teaching staff to establish the sequence and number of exercises.

The theoretical instruction given to the trainees aims to give a basic understanding of the wet welding process and the behavior of the materials in respect of the rapid cooling rate, hydrogen contamination, porosity and cracking problems, including standards and safety regulations. The themes and keywords are given under the modules descriptions. Reference to appropriate national/international standards, directives and regulations should be made throughout the course.

A "teaching hour" will contain at least 50 minutes of direct teaching time. After each module a practical and theoretical examination is performed. The test pieces to be welded are given under the description of each module, in correspondence to a WPS, the general rules for examination are given in section II of document EWF 001-416a.

As wet welding is one of the most difficult welding procedure, the instructor for practical welding (diver-welder-instructor) is required to be at the site with the diver-welder trainee, and give him active support and guidance for the process handling, electrode positioning, arc control, arc judgement, adjustment of electrical settings on the power source, droplet transfer and bead appearance etc., throughout the whole period of the course.

As the training course is very exhausting for the trainee, one training sequence of constant practice in water should not exceed more than three hours per sequence. After one training sequence in water the trainee should be given sufficient time for recovery.

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**This is not the full version of this document, this version has only the aim to supply general information**

From practical experience, one trainer shall not supervise more than five trainees working in the water depending on the facilities of the training schools.

#### 4 Theoretical education and practical training (Only the main Syllabus Themes)

The full EWF course for wet MMA-Welding consists of modules EWF-E-UW 1 to EWF-E-UW 4 for practical training, and of the instruction units EWF-UW 6.1 and EWF-E-UW 6.2 for the theoretical education.

##### 4.1 Theoretical education

###### 4.1.1 General

The content is given in the table 1.

**Table 1: Theoretical education — Hours**

Code	Part	hours
A	EWF-E-UW 6.1 Repetition Part	6 h
B	EWF-E-UW 6.2 Underwater Welding Part	8 h
		Σ 14 h

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.

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

###### 4.1.2 EWF-E-UW 6.1 Repetition Part (A)

	Teaching hours
E-UW 6.1.1 <u>Welding Processes and their general differences</u>	1
E-UW 6.1.2 <u>Introduction to Electricity</u>	2
E-UW 6.1.3 <u>Metallurgical Aspects</u>	2
E-UW 6.1.4 <u>Examination of Welded Joints</u>	1

###### 4.1.3 EWF-E-UW 6.2 Underwater Welding Part (B)

	Teaching hours
E-UW 6.2.1 <u>Materials for the Application of the Wet Welding Process</u>	2
E-UW 6.2.2 <u>Metallurgical Aspects in Wet Welding</u>	2
E-UW 6.2.3 <u>Power Sources and Polarity</u>	1
E-UW 6.2.4 <u>Health and Safety (in UW-application)</u>	3
<hr/>	
Total (Part A and B)	14

## 4.2 Practical training

The aims of the practical training of all modules are given in table 2. Welding positions included in table 2 shall be used according to EN ISO 6947.

**Table 2: Modules for the practical training**

<p><b>EFW-E-UW 4</b> Underwater Pipe: Lap: Welder Welding Position: PG, J-L045 Recommendation: Minimum wall thickness 10 mm Tube diameter: 150 mm to 250 mm</p>	<p>practical: theoretical: <u>test*</u>: <u>total</u>:</p>	<p>45 h 14 h ** <u>6 h</u> <u>65 h</u></p>
<p><b>EFW-E-UW 3</b> Underwater Pipe/Plate: Fillet Welder Welding Position: PG, PD Recommendation: Minimum wall thickness 10 mm Tube diameter: 150 mm to 250 mm</p>	<p>practical: theoretical: <u>test *</u>: <u>total</u>:</p>	<p>47 h 14 h ** <u>6 h</u> <u>67 h</u></p>
<p><b>EFW-E-UW 2</b> Underwater Plate: Lap Welder Welding positions: PG, PD Recommendation: Minimum plate thickness 10 mm Specimens may be selected according to figures 7a) or 7b) of EN ISO 15618-1</p>	<p>practical: theoretical: <u>test *</u>: <u>total</u>:</p>	<p>36 h 14 h ** <u>6 h</u> <u>56 h</u></p>
<p><b>EFW-E-UW 1</b> Underwater Plate: Fillet Welder Welding Position: PG, PD Recommendation: Minimum plate thickness 10 mm</p>	<p>practical: theoretical: <u>test *</u>: <u>total</u>:</p>	<p>37 h 14 h ** <u>6 h</u> <u>57 h</u></p>
<p>* The set time for the tests includes practical and theoretical tests. ** In case the additional courses of EFW-E-UW 2 to EFW-E-UW 4 will be attended within 6 months after the previous one, the theoretical training of the next following course can be omitted.</p>		

The average times for the test modules are quoted on a “stand-alone” basis. Where additional modules follow on from the initial module, the hours quoted can be reduced to represent the additional training and qualification requirements. This reduction in hours is only applicable where the initial qualification module took place within the preceding six months, and the welder has carried out welding on a regular basis (according to EN ISO 15618-1) during this period, in accordance with the initial qualification. Details for the practical exercises are given in the tables 3 to 6. Welding positions included in the tables 3 to 6 shall be used according to EN ISO 6947.

## **ANNEX A (normative)**

### **Requirements for Diver-Welder-Training-Schools**

#### **A.1 General**

The Diver-Welder Training is a professional upgrading course strongly orientated to practical application. The theoretical basis and know-how in the welding training course is specialized in a practical as well as in a theoretical part for the qualification of an underwater welder. Therefore special requirements are necessary to be fulfilled by the Diver-Welder-Training-Schools in respect to equipment, diving facility and specially qualified instructing personnel.

#### **A.2 Diving facilities and technical equipment**

Diving facilities and technical equipment should be of a national / international recognized standard, and follow the national / international safety rules and regulations.

#### **A.3 Qualification of instructing personnel**

The Diver-Welder Training Schools have to provide the following specially-qualified instructing personnel to guarantee a substantial training and education for the trainees:

- A.3.1** Experienced Welding Supervisor (e.g. Welding-Engineer,- Technician, preferably with commercial diving background) with excellent theoretical and practical experience and knowledge in wet welding.
- A.3.2** Experienced Hyperbaric Wet Welding Instructor certified as a welding specialist and commercial diver, trained and certified as a Diver-Welder according to EN ISO 15618-1 with excellent knowledge and skill, and long term practical experience in wet welding.

## **ANNEX B (informative)**

### **Abbreviations**

ANB	Authorized National Body
EWF	European Federation for Welding, Joining and Cutting
MMA	Manual Metal Arc
WPS	Welding Procedure Specification

## **ANNEX C (informative)**

### **Bibliography**

EN ISO 6947	Welds — Working positions — Definitions of angles of slope and rotation
EN ISO 9606-1	Approval testing of welders — Fusion welding — Part 1: Steels
EN ISO 15609-1	Specification and approval of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding
EN ISO 15618-1	Approval testing of welders for under-water welding — Part 1: Diver-welders for hyperbaric wet welding
CR ISO/TR 15608	Welding — Guidelines for a metallic material grouping system
Doc. EWF 001-416a	
Doc. EOTC/AG-15/97/001/416	