INTERNATIONAL EDUCATION, QUALIFICATION AND CERTIFICATION SYSTEMS IN WELDING

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IIW – International Institute of Welding

EWF – European Federation for Welding Joining and Cutting

ABSTRACT

The International System for Education and Qualification of Welding Personnel has been implemented based on the harmonised European System for education and qualification of welding personnel. This paper gives an overview of the International System focusing on the training guidelines and the quality assurance system developed. Systems for harmonisation of Certification of Welding Personnel and for supporting companies using welding to implement ISO 3834 have been developed by EWF and are presently being transferred to IIW in line with the EWF/IIW agreement established in 2000.

KEYWORDS

Welding technology; Guidelines for training; Personnel qualification; Personnel certification; Examination questions; Questions database.

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1 INTRODUCTION

The EWF-European Welding Federation work on the development of harmonised courses which started in 1980, resulted in the implementation of a series of Guidelines and in the definition of examination criteria for welding personnel.

In parallel, the IIW – International Institute of Welding, Commission XIV "Education and Training" has dedicated its activity to the interchange of know-how in training in welding.

In 1998, EWF and IIW signed the first agreement of co-operation towards the development of a single international system for education and qualification of welding personnel. By use of a single syllabus for each level of training course and a harmonized system for examinations management, the same qualification may be awarded in any country.

EWF has further developed the system towards certification of welding personnel and as well developed a system for certification of companies complying with the ISO 3834 requirements. These systems have been implemented in Europe for the last ten years. EWF and IIW agreed to transfer these systems to IIW and the approval and start of implementation of the IIW Certification Systems for Welding Personnel and Companies according to ISO 3834 at international level is expected for 2008.

2 THE INTERNATIONAL AUTHORISATION BOARD – IAB

In order to administer the training and qualification system and to develop it still further, the IIW has established the IAB – International Authorisation Board. This organisation aimed at the effective implementation of the system in all IIW countries, by publishing Guidelines for training syllabuses and examinations and implementing the Quality Assurance system controlling the system.

An Organisation, recognised by the IIW National member, is appointed as the Authorised National Body (ANB) for the supervision of the system in each country. Representatives from these ANBs form the operational management within the IAB, nominate and approve Lead Assessors and Peer Assessors whom ensure conformity of each ANB to agreed Rules.

The IIW has operated such a system for seven years, offering courses and qualifications for Welding Engineers, Inspectors, Welders and others. These qualifications form the basis of the widely accepted International Diplomas.

This international system now comprises the following documents:

- Education, Examination and Qualification Guidelines for:
    - Personnel with Responsibility for Welding Coordination (includes former International Welding Engineer – IWE, International Welding Technologist – IWT, International Welding Specialist – IWS, International Welding Practitioner – IWP)
    - International Welding Inspection Personnel – IWIP
    - International Welder – IW
    - Distance Learning (IWE, IWT, IWS, IWIP C/S)
    - International Welded Structures Designer - IWSD

- Rules and Procedures for the implementation of IIW Guidelines for the Education, Examination and Qualification of Welding Personnel

There are now 37 countries that have joined this system with an Authorised National Body, as follows: Australia, Austria, Belgium, Brazil, Bulgaria, Canada, China, Croatia, Czech Republic, Denmark, Finland, France, Germany, Hungary, India, Iran, Italy, Japan, Netherlands, Nigeria, Norway, Poland, Portugal, Romania, Russia, Serbia, Singapore, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Ukraine, United Kingdom and United States of America.

Nigeria, Singapore and United States of America are applicant ANBs.

3 THE INTERNATIONAL TRAINING AND QUALIFICATION SYSTEM FOR WELDING PERSONNEL

The harmonised courses, are now offered around the world through IIW/IAB. There are more than 600 Authorised Training Bodies approved and supervised by the ANBs for implementing the IIW Qualification courses, which combine both underpinning knowledge and application experience, thereby providing close links with industrial practice. After the main education, special courses for additional learning are offered in many special areas, thus providing a specific education still closer to the job function.

IWE	
WELDING PROCESSES AND EQUIPMENT	93h
MATERIALS	111h
CONSTRUCTION AND DESIGN	64h
FABRICATION APPLICATIONS	110h
PRACTICAL PART	60h
TOTAL	438h

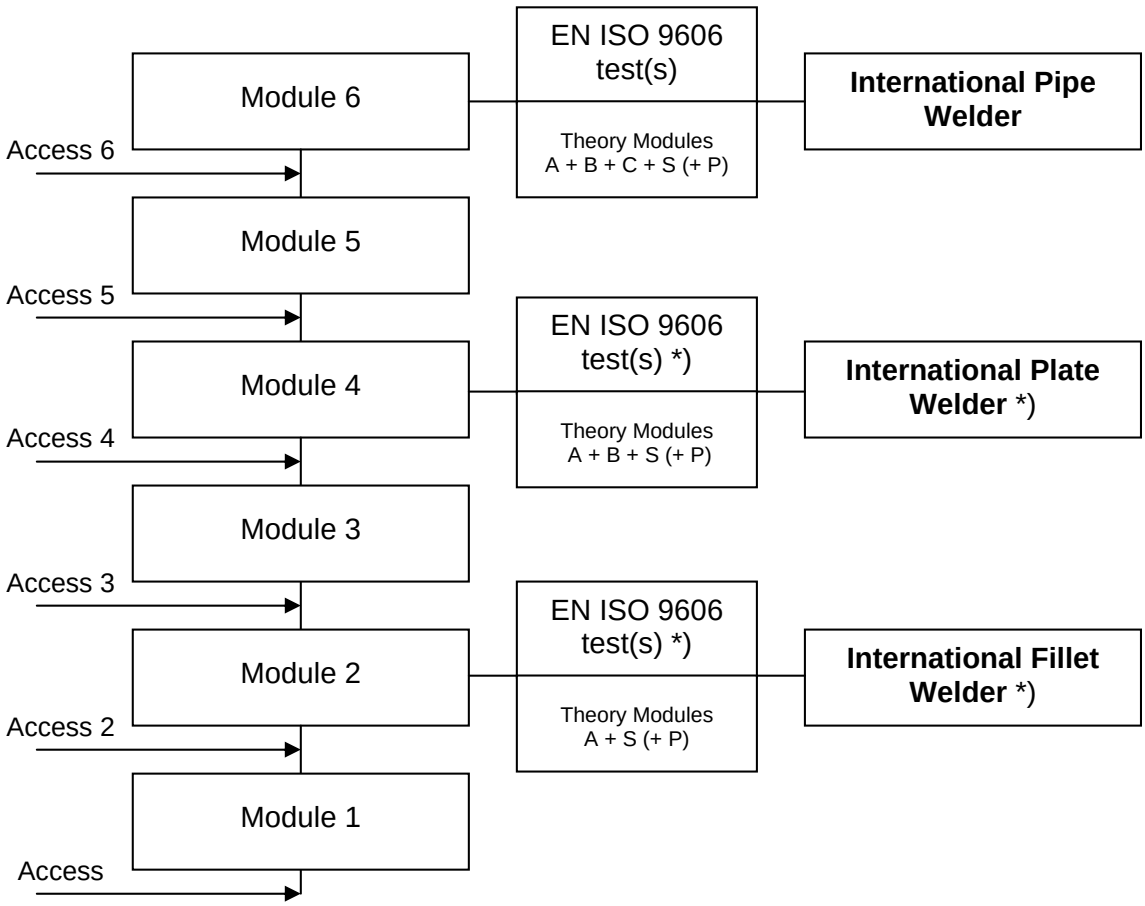
IWS	
WELDING PROCESSES AND EQUIPMENT	45h
MATERIALS	47h
CONSTRUCTION AND DESIGN	22h
FABRICATION APPLICATIONS	53h
PRACTICAL PART	60h
TOTAL	227h

IWT	
WELDING PROCESSES AND EQUIPMENT	76h
MATERIALS	82h
CONSTRUCTION AND DESIGN	40h
FABRICATION APPLICATIONS	80h
PRACTICAL PART	60h
TOTAL	338h

IWP	
WELDING PROCESSES AND EQUIPMENT	22h
MATERIALS	22h
CONSTRUCTION AND DESIGN	8h
FABRICATION APPLICATIONS	28h
PRACTICAL PART	60h
TOTAL	140h

IWIP	IWIC Comprehensive	IWIS Standard	IWIB Basic
WELDING PROCESSES AND EQUIPMENT	23h	13h	11h
MATERIALS	52h	41h	25h
CONSTRUCTION AND DESIGN	21h	17h	12h
FABRICATION APPLICATIONS	24h	23h	17h
WELDING INSPECTION MODULES	48h	40h	27h
PRACTICAL PART	49h	23h	15h
TOTAL	217h	157h	107h

Figure 2 – Example of themes and teaching times for five qualification levels



*) *At the option of the ATB and in agreement with the ANB, it may not be necessary to issue intermediate certificates and diplomas.*

Figure 3 - The over-all structure of training and examination of the international welder

The existing Guidelines define the course syllabus, defining for each subject objectives, scope and expected results, including the minimum teaching duration in hours assigned to them (Figures 2 and 3). Access to the harmonised courses is allowed only to those who possess an appropriate general education, equivalent but different for each country as these are based on national education systems.

At International level within IIW-IAB activities, the work under development comprises the development of new Guidelines: “Mechanized Welding Operators” and “Mechanical Destructive Testing at Specialist Level” and the Definitions of a Harmonised Examination System that includes Questions and Answers databanks and Operating Procedures.

For more information it is possible to download short versions of each IIW Qualification Guideliene, on the IIW web site (www.iiw-iis.org) and EWF web site (www.ewf.be)

4 THE INTERNATIONAL HARMONISED EXAMINATION FOR THE TRAINING AND QUALIFICATION SYSTEM FOR WELDING PERSONNEL

The IIW is aware of the importance of the mobility of labour within the world wide community, and a lot of work has been put on the harmonisation of a standard examination system, to ensure that welding personnel trained in the EWF-IIW/IAB system is examined in a uniform way, so that those gaining a Diploma in any EWF-IIW/IAB Member will have achieved the same minimum standard. This will be obtained by the development and implementation of a EWF-IIW/IAB Harmonised Examination.

To achieve the above mentioned goal, rules and procedures have been approved, and also an Internet Database Software tool has been developed.

The Harmonised Examination Questions Database will be shared by all EWF-IIW/IAB members.

The Database Software enables several features, such as: the approval of questions by Teams of International Experts, the translation of the questions to the several Members mother languages, automatic generation of harmonised exams, sort out statistics regarding the questions used on the exams and automatic exams scoring.

Examples of Database Software Screens are shown bellow, focusing questions, exams and users' tools (see Figures 4 to 6).

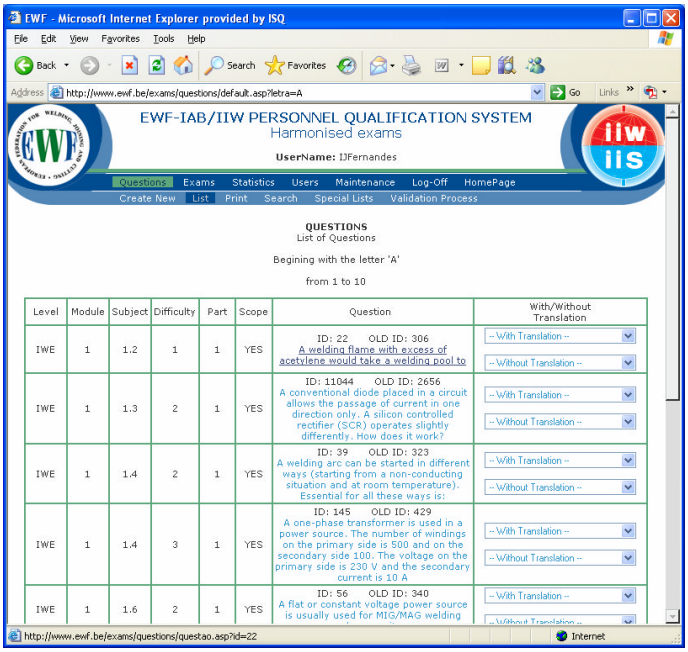


Figure 4 - Database Software screen regarding the list of questions with active status

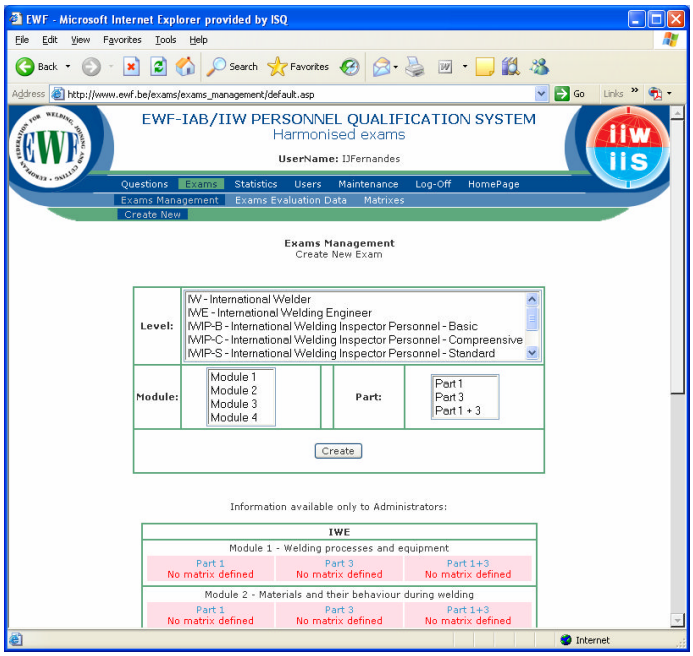


Figure 5 - Database Software screen regarding Exams Generation

Figure 6 - Database Software screen regarding Users

5 EWF CERTIFICATION SYSTEM FOR WELDING PERSONNEL

Safety and profit depend on technical control of welding operations. Key staff in all welding related activities needs to have an appropriate level of competence in welding technology and its application. In addition to employing competent and tested welders, manufacturers should ensure that engineers, designers and technicians who deal with welding matters have proven relevant competence. This is increasingly becoming a contract requirement: a trend which is expected to accelerate as new European Directives and International Standards for welding come into force. ISO 14731 “Welding Coordination – Tasks and Responsibilities” requires people with welding related responsibilities to be able to demonstrate that they are competent to carry out those responsibilities.

The EWF Certification Scheme provides a simple means by which job capability can be assessed and recognised. It defines the profile of education, knowledge, experience and responsibility required for a range of conventional welding tasks, and provides a professional assessment procedure.

Because Certification is concerned with current competence rather than historical attainment, periodic renewal is required. The scheme provides a convincing way of supporting companies seeking to achieve compliance with ISO 14731.

It must be remembered that the only body which can issue an authority to work to an individual is the employer: EWF and in a close future IIW are only in a position to assist and support this process in a way which is convincing to the employer’s customers particularly in relation to ISO 14731. Employers may also require some third party certification of their welding operations and one route to achieve this is the ISO 14731. Although it does not require the welding co-ordinators to hold any particular qualification or certification, possession by the Welding Co-ordinators of a relevant EWF and in future IIW certificate will assist in the process of company certification.

Four levels of certification are available, based on the past first four EWF Diplomas: European Welding Engineer, Technologist, Specialist and Practitioner nowadays replaced by the existing International Welding Engineer, Technologist, Specialist and Practitioner. The first three of these qualifications are deemed to satisfy the technical knowledge requirements of ISO 14731.

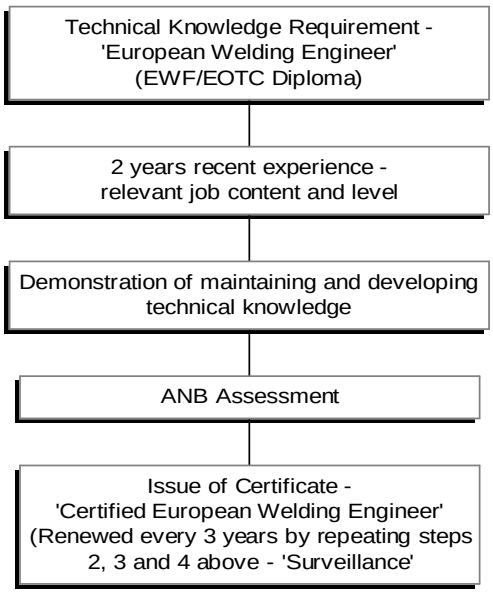


Figure 7 – Steps to Certification

Figure 7 shows the route to achieve Engineer level certification and the route for the other levels are similar. The certification titles are shown in Figure 8.

Certification Title	Welding Knowledge Qualification Level Required
Certified European Welding Engineer	European/International Welding Engineer
Certified European Welding Technologist	European/International Welding Technologist
Certified European Welding Specialist	European/International Welding Specialist
Certified European Welding Practitioner	European/International Welding Practitioner

Figure 8 – Certification and Qualification Titles

The EWF welding personnel certification system is in the process of being transferred to IIW. So far five European members have implemented the system and the opening of the system to the International community is expected to strongly increase its use worldwide.

6 MANAGEMENT OF TRAINING, QUALIFICATION AND CERTIFICATION SYSTEMS FOR WELDING PERSONNEL

In order to ensure that the mechanism by which the education and training Guidelines established by IIW/IAB are implemented throughout the world, IAB appoints an organisation in each country. These organisations are assessed and monitored against a set of rules compiled in the IAB Doc.IAB-001 - ”Rules for the implementation of IAB Guidelines for the education, examination and qualification of welding personnel”.

These organisations are known as **A**uthorised **N**ational **B**odies (ANBs) and are responsible for ensuring that the standards of education, examination and qualification are maintained in their country. In this, the objective is that qualified personnel at a certain level will achieve the same minimum level of knowledge, irrespective to the country in which they have been qualified.

The role of the ANB in its own country regarding personnel qualification includes:

i) The approval of training establishments, ATB- Authorised Training Body, for the conduct of courses in accordance with IIW guidelines.
ii) The conduct of the examinations.
iii) The qualification of personnel and the recording of relevant information.

An ANB accepts responsibility in its own country for the implementation of the IIW/IAB requirements, for the maintenance of the agreed standards, and for promoting IIW qualifications in accordance with the provisions of this Document.

The ATBs - Authorised Training Bodies are approved by the National ANBs to implement the IIW training courses aiming at awarding the IIW Qualification Diplomas. This recognition is based on audits conducted by the National ANB, through which it is assured that the ATB has the capabilities to fulfil the requirements defined under the IIW rules, procedures and guidelines.

The ANB has the responsibility to develop and score the exams. The ATBs are allowed to invigilate the written exams. If oral exams are needed the examination panel is composed by ANB and ATB representatives.

It is possible to approve ATBs in countries that are not IIW members and this can be done trough agreements between the applicant ATB and an active ANB from another country. This approval is ruled by a specific procedure.

7 MANUFACTURER CERTIFICATION SCHEME

7.1. INTRODUCTION

Manufacturing Companies are increasingly searching for certification to comply with the three main systems, Quality, Environment and Health & Safety, as a whole.

Due to the metalworking specific requirements, the European Federation for Welding, Joining and Cutting has decided to develop and implement an Integrated Manufacturer Certification Scheme, of which the Manufacturer Certification Scheme complying with the ISO 3834 requirements has been adopted by IIW in 2007 and will soon be implemented also in countries outside Europe.

Welding technology is involved in a major part of metal constructions many of which require tight technical specifications and quality control. The risks associated with a default in operation of a welded construction can be very severe as shown by examples from the past, which led to the loss of human lives and high material damages.

In 1994 the CEN - European Standards Committee published the first version of the standard EN 729 aimed at the definition of quality requirements for welding of metallic materials. Certification of companies using welding, based in EN 729, has been in use since then on a voluntary basis.

In 1994 ISO (International Standards Organisation) has also published the equivalent EN 729 with the identification ISO 3834. Lately ISO and CEN have been reviewing the EN 729/ISO 3834. This review process ended and the new EN ISO 3834 has been published. The implementation of this standard will become widely used in the near future as it is mentioned in several CEN product standards and Directives.

Whenever a manufacturer refers to compliance with a certain ISO 3834 quality level, it should be sufficient to demonstrate the manufacturer's capabilities to control welding activities for the type of product/work that is being produced by the company.

The preparation of a production unit to fulfil the requirements of these standards can be time consuming and complicated. In this context EWF has prepared a set of guidelines aimed at supporting companies in the implementation of the requirements indicated in these standards.

7.2. EWF INTEGRATED MANUFACTURER CERTIFICATION SCHEME

European Federation for Welding, Joining and Cutting (EWF), by virtue of its unique international expertise in the welding field has developed a specific Certification Scheme to guarantee companies compliance with EN 729/ISO 3834.

This work started in 1995 and in 1997 the EWF Certification Scheme was approved. At the same time EWF developed collaboration with the European Co-operation for Accreditation (EA). This had the aim to support EA on the elaboration of Guidelines on the use EN 45011 and EN 45012 for Certification to EN 729. This document was proposed by "EWF Drafting Group" and was approved and published by EA in May 2000 as the doc. EA-6/02.

EWF Companies Certification Scheme for quality requirements not only provides a way to companies to be Certified in compliance with ISO 3834 and but also leads to the introduction of the companies Data on the EWF database of Certified Companies. This database is only open to companies that were certified under the EWF Certification System. The database can be seen in **www.ewf.be** under "Certified Companies" and it is possible to make a search either by country or

by process (using the process standard identification code according to EN ISO 4063) or by base material (using the materials codification based on the CEN ISO TR 15608).

Due to the developments and needs from the manufacturers regarding the compliance with other Schemes, EWF Integrated Manufacturer Certification System has at the present also the possibility to Certify Companies according with the EWF Environment Management Scheme (EMS). The EMS was developed with the aim to Certify Manufacturers of Welding Products in compliance with EN ISO 14001. The introduction of a Safety Management Scheme (SMS) was also developed and approved in 2006.

The EWF Integrated Manufacturer Certification System is the unique System that can answer to a fully integrated manufacturers system on the metalworking field. At the same time the Technical Committee of EWF is developing specific supplements for application to specific products, such as, railways vehicles and components, pressure equipment, welded structures and so on, all of this supplements are namely to be applied for fulfilling the ISO 3834 requirements and specific EN product standards.

The EWF view of the future is a holistic model - EWF Integrated Manufacturer Certification Scheme encompassing quality, environment and health & safety as presented on Table 1.

Table 1 – EWF Integrated Manufacturer Certification Scheme – Holistic View

Certification Schemes	Main Rules/Requirements	Specific Rules/Requirements
Quality	Scheme for Compliance with ISO 3834	Guidance for compliance with specific EN Products Standards, i.e. Railways, Piping, Structures
Environment	Scheme for Compliance with EN ISO 14001	Not Applicable
Health & Safety	Scheme for Compliance with Health & Safety	Not Applicable

7.3. IMPLEMENTATION OF EWF MANUFACTURER CERTIFICATION SCHEME

For the System implementation, one organisation in each country is accredited by EWF, after assessment against the EWF Rules. These organisations are known as the “EWF ANBCCs – Authorised National Bodies for Company Certification” and are responsible for ensuring the EWF guidelines of assessment and certification are maintained. In this, the objective is the EWF Certified Companies will have demonstrated they have achieved a minimum level of capability for a specified scope of activity, irrespective of the country in which they have been certified.

The role of the ANBCC is to act on behalf of EWF in respect of company certification, including the conduct of company assessments (either directly or through Participating Assessment Bodies), the qualification of ANBCC Assessors and the certification of companies and the recording of relevant information.

A company audited and approved within this system is awarded a certificate that states the compliance with the EWF ISO 3834 Certification Scheme and/or also including the EWF Environment Management and/or Health & Safety Management System if applicable. The Certificate shows the scope with respect to type of products, product standards, parent material groups, welding and welding allied processes, deviations and authorised welding co-ordinators.

A database with the relevant information of all companies certified by EWF ANBCCs is kept continuously updated and is available for consultation on the EWF Web page as mentioned above.

EWF maintains this register of EWF Certified Companies and the information contained in the registers is made freely available to enquirer's worldwide. This provides an important sales benefit to the EWF Certified Companies.

The present EWF Manufacturer Certification Scheme according to ISO 3834, documental structure is the following:

Quality Scheme Requirements

Doc. EWF-636-07 – January 2007
– Management Schemes Interpretation and Implementation

Doc. EWF-637-07 – January 2007
- Supplement for the Implementation of EN ISO 3834 - Oriented to Welded Products

Doc. EWF-638-07 – January 2007
- Rules for ANBCCs Operating the EWF Manufacturer Certification System

Doc. EWF-639-07 – January 2007
- ANBCC's Assessment of Manufacturers of Welded Products Operating the EWF Manufacturer Certification System

Table 2 summarises the content of the abovementioned documents.

Table 2 – Summary of contents of EWF ISO 3934 Scheme documents

Interpretation for Manufacturers	Assessment of Manufacturers	Assessors	Questionnaires
Doc. EWF 636 explains the interpretation for each part of ISO 3834 on important items:	The Assessment procedure (Doc. EWF 639) has three phases:	The procedure for the evaluation and registration of assessors describes that the assessors must be either:	The questionnaires (Doc. EWF 639):
- Contract and design review - Subcontracting - Welding personnel - Inspection, testing and examination personnel - Equipment - Storage of parent materials - Calibration - Identification and traceability	Information phase and assessment preparation Assessment phase Certification phase The assessment team must be competent in relation to the specific product welding activities	Qualified and experienced in quality system auditing and experienced in welded fabrication or EWE or EWT with at least three years of work experience in the field of welded fabrication and familiarity with quality management systems After approval assessors are registered in the Register of Assessors, according to their quality and engineering profiles and according to the products they are experienced on.	Are used as check list of all important items of the standard and the EWF interpretation in an interrogative form, which will be used during the assessment.

AS referred to before the EWF ISO 3834 Certification Scheme was transferred to IIW in 2007. This system is being adapted by IIW/IAB so that its scope becomes International and not just European and it is expected that in the beginning of 2008 IIW will start the management of the implementation of the IIW Manufacturer Certification Scheme.

8 RESULTS OBTAINED

Until the end of 2006, a total of 36.197 IIW diplomas had been awarded (see Figure 9) and the accumulated number of EWF and IIW diplomas awarded reached, 140.000 (see Figure 10).

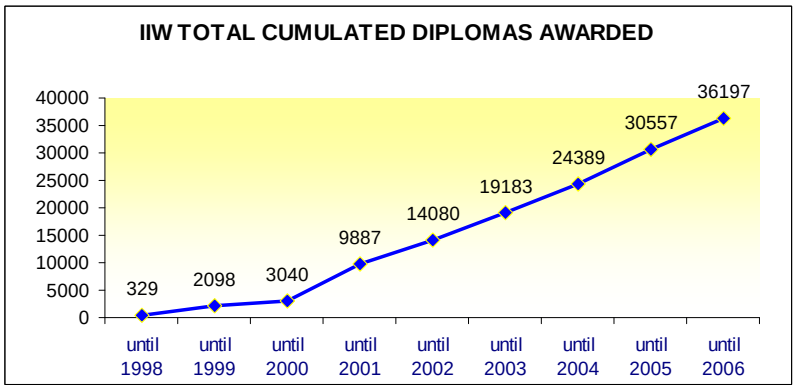


Figure 9 – IIW Total Cumulated Diplomas Awarded

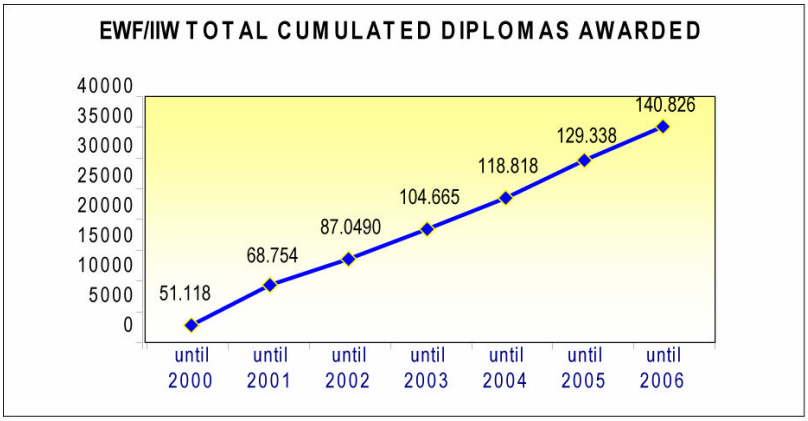


Figure 10 – EWF/IIW Total Cumulated Diplomas Awarded

Regarding EWF Personnel Certification System for Engineer, Technologist, Specialist and Practitioner till the end of 2006 aprox. 1.500 new certificates had been issued (see figure 11).

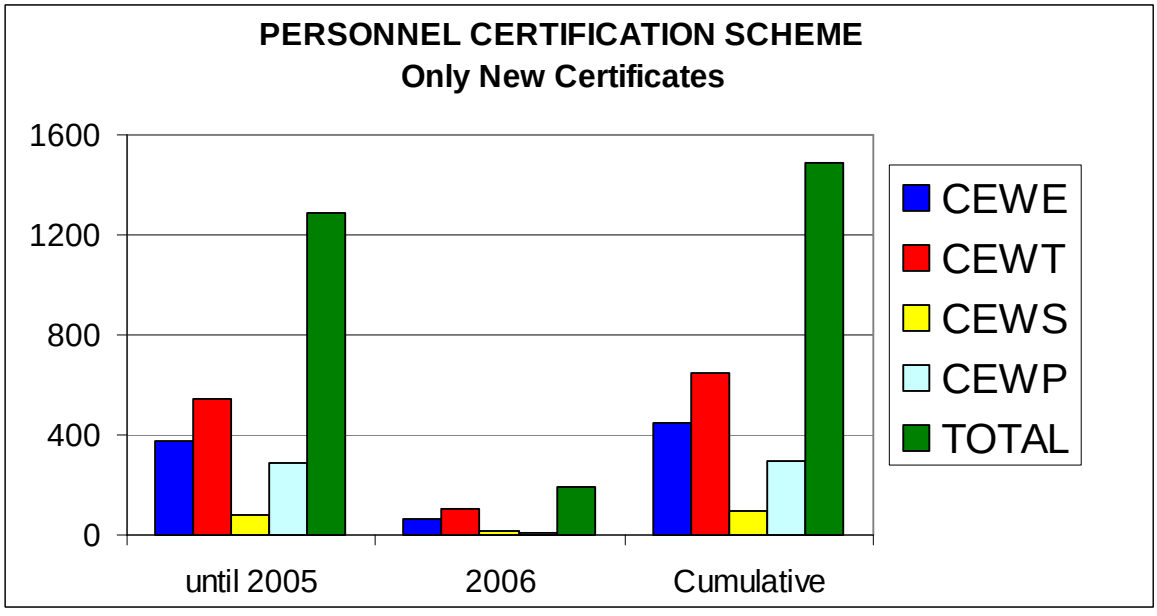


Figure 11 – EWF Personnel Certification Scheme Certificates Awarded

For the EWF Manufacturer Certification Scheme according to ISO 3834, till the end of 2006 approximately 500 companies have been awarded with the EWF certificate (see figure 12).

Figure 12 – EWF ANBCCs ISO 3834 Certification Activities

8 CONCLUSION

The International Education and Qualification System for Welding Personnel is recognised worldwide and objectively supported by industry and by international training and accreditation entities, opening the way towards one Global Education and Qualification System for Welding Personnel.

The relevance of this International System is increasing worldwide generating interest of new countries to enter the system. Every year new countries apply for membership of which Brazil, India, Nigeria and Singapore are examples.

The consolidation of the International System is in good progress with an average number of diplomas awarded of 6.000 per year and an expected growth of approximately 5% per year.

This consolidation being further ensured through the implementation of a harmonised examination system, which now represents 25% of the total examination paper for International welding engineers.

Regarding Certification of Welding Personnel and Companies according to ISO 3834 the European Implementation is in good progress with more than 500 Companies using the EWF Certification System, but certainly the transfer of these systems to IIW and its consequent adaptation to international needs and requirements will increase and broaden its use worldwide. A first survey done among the IIW/IAB members demonstrated that 60% of the members are willing to start to implement these futures IIW Certification Systems within the next 3 years. It is expected that IIW Certification Systems will be approved and start to be implemented in 2008.

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