

# TASK, FUNCTION & QUALIFICATION OF WELDING COORDINATORS ACCORDING TO EUROPEAN AND FUTURE INTERNATIONAL GUIDELINES AND STANDARDS

*Experience concerning personnel qualification according to the European Welding Federation (EWF) guidelines, in a non-EU country but with observer Status of the EWF also, in Romania.*

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## ABSTRACT

In order to secure the product quality and in addition to ISO 9000 ff, it is recommendable for technical welding firms to apply above all the EN 729 series for the optimisation of the product-specific quality management. The EN 729 defines three different levels of quality, linked, amongst other things, to various welding coordinating personnel. The EN 719 is based on their tasks and responsibility, defining the required level of knowledge of the welding coordinating personnel with regard to the training and testing guidelines of the EWF (European Welding Federation).

On the basis of detailed key words, the EWF-guidelines describe the minimum required contents of training, i.e., for the welding coordinators.

- European Welding Engineer (EWE)
- European Welding Technologist (EWT)
- European Welding Specialist (EWS)

Further guidelines describe the requirements placed in the training institutions, the admission preconditions for the respective training courses, as well as interim arrangements for the acting welding supervisory personnel. Eastern European countries, such as Romania, a non-member state of the EWF, qualify for the benefit of their economy welding personnel according to the European bilaterally recognised guidelines, in co-operation with a EWF-Member welding association.

Romania, a land with a large quantity of steel production and many uses for welding technology, requires internationally qualified personnel in order to be competitive on the technology, requires international markets. In the first EWE-training courses, in co-operation with the SLV Munich under the supervision of the German Welding Society (DVS), almost 100 Romanian engineers were trained by the ISIM, Timisoara, to become European Welding Engineers. The ISIM is currently in preparation for becoming recognised by the EWF in the foreseeable future, in order to be capable of

qualifying technical welding personnel according to the EWF-guidelines on their own responsibility.

The International Institute of Welding (IIW) with approximately 40 member states world wide, is currently dealing with the takeover of the EWF training concept. Provided that there is a positive further dealing with the takeover of the EWF training concept. Provided that there is a positive further development, it can be assumed that, in a few years, there will be technical welding personnel throughout the world that has been trained and qualified according to uniform guidelines and that is recognised in all member states.

Not only in Europe, but across the globe, it is not only the price that is of essential importance in the sector of manufacturing high-quality and, in particular, safety-relevant products, but also, above all, the quality of the product. The product quality is regarded as being the high level of safety in dealing with the product, as well as its functional nature and its durability.

In the last few years, the term "quality" has generally been mentioned in connection with the globally circulating ISO 9000 series of norms (norms for quality management and quality assurance, formally known as the EN 29000-series).

The ISO 9000 ff is not a norm. It is only in extremely rare cases that a product norm will refer or even demand the requirement of the inspection of a firm with regards to their QM-system according to ISO 9000 ff. The necessity of a validation of an introduced, documented and practised QM-system is commonly a customer demand and therefore also an important competitive criterion.

The sole application of ISO 9000 ff causes a welding company difficulties, due to the fact that there is no direct link to the special technology. Rather, the ISO 9000 ff refers to the fact that, for "special processes", for example the process of welding, additional requirements must be taken into consideration and adhered to (according to 4.9.2 in EN 29001:1987 and 4.8.2 in EN 29002:1987).

A "special process" exists if, by means of the subsequent quality and product examinations, it is not possible to confirm in a definite sense that the required quality norms have been adhered to i.e. for the welding. Even the most comprehensive of examinations will

not improve the quality of the finished product. For these reasons, a continual supervision and/or the adherence to the documented procedural instructions are required, in order to ensure that the stipulated requirements have been fulfilled. In order to ensure a faultless technical welding production and to recognise the sources of any possible difficulties, the company management needs a suitable QM-system, i.e. one that is relevant to welding technology. In accordance with this and on the orders of the EU Commission, the CEN issued as a more precise version of the ISO 9000-series, the EN 729-series for welding firms (quality requirements for welding - fusion welding of metallic materials).

Both of the series of norms, the ISO 9000 ff and the EN 729, can be taken by the welding firms as being a catalogue of requirements, a check list. Any unfulfilled requirements stipulated by the two norms represent loopholes in the company specific organisation. Missing regulations are recognised and must be drafted and supplemented. The EN-729 series regulates the "technical welding quality requirements" placed in welding firms and should guarantee, above all, the safety of processes. It defines a quality management system which, in combination with the ISO 9000-series, is particularly functional, Fig 1.

By means of the sensible combination, i.e. supplementing of the ISO 9000 with the EN 729, the welding company is provided with an efficient QM-system, which optimises the organisational processes and improves the competitiveness. It hardly appears to be an optimum solution to construct a QM-system exclusively around the EN 729, due to the fact that several essential elements are missing in the EN 729 for it to be a complete QM-system, such as management tasks amongst others.

The direct relation to the quality of a welded product is neither provided by the ISO 9000 nor by the EN 729 series. This can only be achieved by the incorporation of the relevant product norms, such as the currently national, i.e. they have not yet been harmonised on a European level (is being processed at the moment) norms for welded steel structures and construction of pressure vessels.

The EN 729 has been declared to be binding for all EU member states, i.e. for all nations which are required to fulfil contracts for member states as manufacturers of technical welding products. The norm is particularly relevant for the so-called 'regulated sector', i.e. for :

- welded steel and aluminium structures
- construction of track vehicles and railway permanent ways

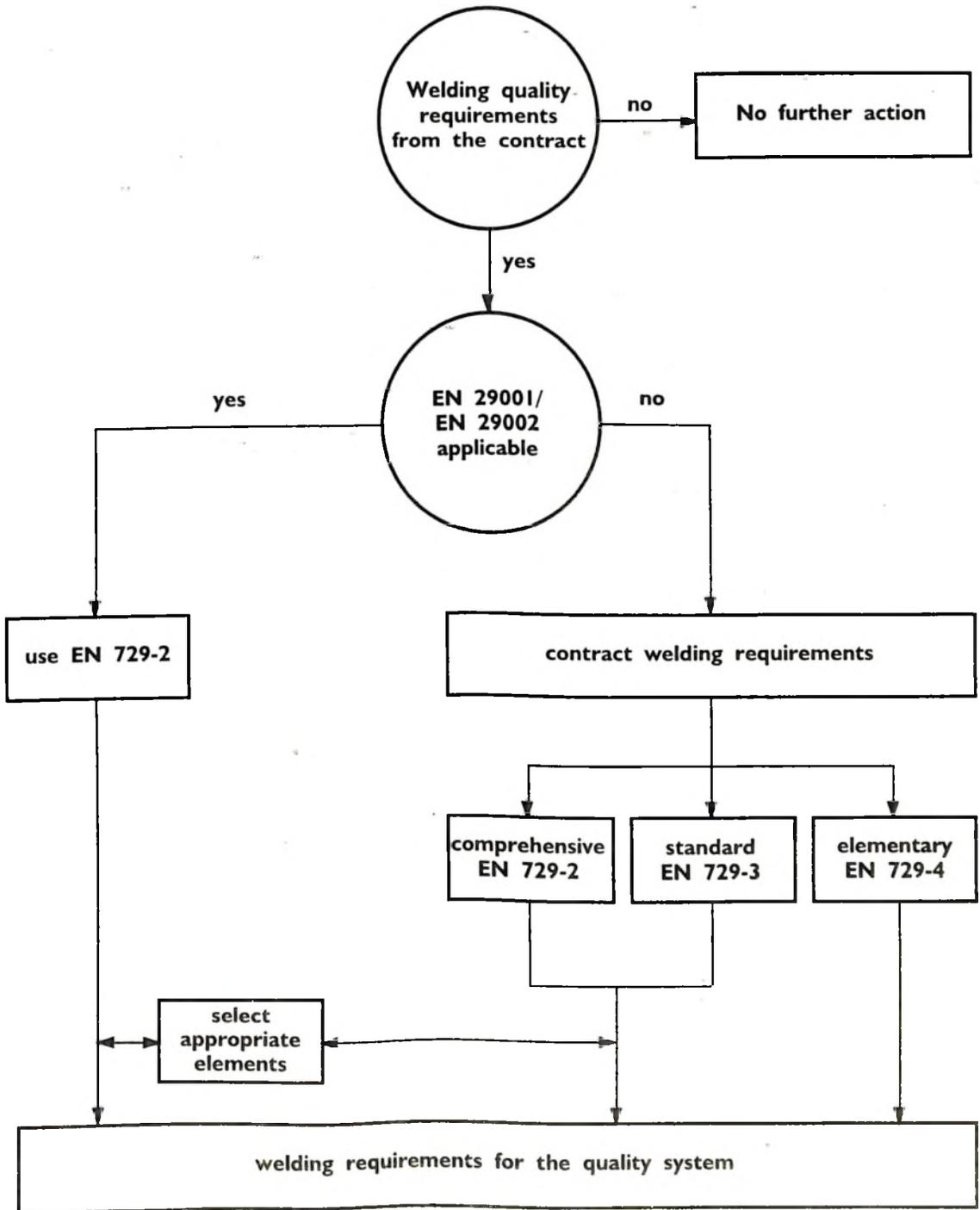


Fig. 1 : Flow diagram for selection of welding requirements

- ship construction, ship mechanical engineering and the construction of technical nautical installations
- military equipment construction
- aeronautics and space travel construction
- steam-boiler construction, pressure vessel construction, construction of acetylene and fluid gas installations, as well as high pressure gas pipes (plants requiring supervision)
- site-manufactured tanks and storage holders

- construction of pipes
- construction of nuclear reactors

The incorporation of a supervision is the precondition required for ensuring that the prescribed quality is adhered to, i.e. achieved. The EN 729 2-4 is structured in such a way that the 3 different sections can correspond with various requirements regarding complexity of the company, of the products as well as the applied production and welding procedures. Of the three sections of EN 729, the product manufacturer must select those parts

suitable for his or her manufacturing situation, i.e. if necessary, should be stipulated in accordance with the customer demands.

- **Section 2** : Comprehensive quality requirements
- **Section 3** : Standard quality
- **Section 4** : Elementary requirements

The first section of EN 729 contains guidelines for the selection and use of the three various quality levels. Fig. 2 depicts a summary of the elements of the various sections of the norms, making clear the

Elements	Comprehensive (part 2)	Quality Requirements Standard (part 3)	Elementary (part 4)
Contract review	●	○	○
Design review	●	●	○
Subcontractor	●	●	○
Welder and Operator	●	●	●
Welding coordinating personnel	●	●	□
Personnel for quality inspection and testing	●	●	○
Welding equipment	●	●	◆
Maintenance	●	□	◆
Production Plan	●	○	◆
Welding Procedure specification	●	●	□
Welding procedure approval	●	●	◆
Work instruction	●	●	□
Documentation	●	○	◆
Welding Consumables	●	○	○
Storage of basic metal	●	●	◆
Post and pre heat treatment	●	●	◆
Inspection and testing	●	●	○
Corrective action in production	●	●	○
Calibration of test equipment	●	◆	◆
Identification and traceability	●	○	◆
Quality reports	●	●	○

● totally fulfilled; ○ partly fulfilled; ◆ not fulfilled; □ is responsibility of the producer

Fig. 2 : Welding Quality requirements according to DIN 729 part 2-4

importance of the individual elements in connection with the relevant level of the quality requirements.

With regard to the welding personnel, it is required from all three levels that welders and device operators must be recognised in accordance with the EN 287 'Approval testing of welders', i.e. prEN 1418 'Approval of welding operators.'

Welding coordinators with relevant technical knowledge according to EN 719 are required for the stages

<b>Fig. 3 :</b>	
Welding related activities to be considered when appropriate	
1.1	Contract review
1.2	Design review
1.3	Materials
1.3.1	Parent metal
1.3.2	Consumables
1.4	Subcontracting
1.5	Production planning
1.6	Equipment
1.7	Welding operations
1.7.1	Preliminary activities
1.7.2	Welding
1.8	Testing
1.8.1	Visual examination
1.8.2	Destructive and non-destructive testing
1.9	Weld acceptance
1.10	Documentation

according to EN 729-2 and -3 ; level EN 729-4 prescribed no requirement for welding supervisory personnel, but the personal responsibility of the manufacturer is stated in the level EN 729-4.

In the EN 719 'Welding Coordinators - Tasks and Responsibilities,' the quality-related responsibility and tasks, including the co-ordination of the technical welding activities are determined for the welding supervision. The welding supervisory personnel carries the responsibility during the process of manufacturing for the welding technology and for all activities related to the welding process. The individual activities are contained in Fig. 3, they can be linked to a whole range of tasks and responsibilities, such as :

- exact details of preparation
- co-ordination
- supervision
- examination, subsequent examination or certification.

The welding supervisory function is the responsibility of the manufacturer, he or she must appoint at least one authorised welding coordinator. The EN 719 regards the welding coordination personnel as being 'personnel, whose suitability and knowledge, gained, i.e. through schooling, training and/or other relevant experience in manufacturing procedures, has been validated.'

In dependence on the 3 levels of the EN 729, the welding supervisory personnel is required to have comprehensive (see point 5.2.2), specific (see point 5.2.3) technical knowledge, as well as basic technical knowledge (point 5.2.4.). A welding supervisory representative with comprehensive knowledge can be used in the planning, the implementation, as well as in the supervision and examination, without limitations on the relevant task area. The specific technical knowledge of welding stipulated by the level 729-3 constitutes a restriction in the sector of materials and level 4 limits to simple construction components as well as to simple materials, which are not to be processed with a thermal treatment. The latter details are contained in the AD-leaflet 'Manufacturing and Examination of Pressure Vessels', HP3 'Welding Coordinators, Welders', November edition 1993. The AD-leaflets are drawn up by the associations co-operating in the 'Work-Group Pressure Vessels'. This refers still to the qualification of specialist welding engineers, welding technicians, welding specialist and apprentice welders according to the guidelines of the German Welding Society (DVS). In the latest edition of the AD-leaflet from April 1996, reference is made with regards to the qualification of welding coordinating personnel for the various quality levels to EN 719, section 5.2.2. to 5.2.4.

As a recommendation for the definition of the required technical knowledge, the appendix A of the EN 719 states: The European Welding Federation (EWF) has drawn up, on a voluntary basis, recommendations for the minimum requirements to be placed in the training, examination and certification of welding coordinating personnel. The recommendations are contained in the following documents :

- European Specialist Welding
- Engineer Doc. EWF 02-409-93
- European Welding Technologist Doc. 02-411-93
- European Welding Specialist Doc. 02-411-93.

Welding coordinating personnel that fulfills the requirements of these documents or possesses nationally recognised qualifications can be assumed to fulfill the relevant requirements according to 5.2.2, 5.2.3 and 5.2.4.

It has been the case in Europe that the training of the welding supervisory personnel has been carried out according to extremely varied criteria. However, in the meantime, the required uniformity of the training and the examination has been implemented.

The European standardising is taken care of in the European Committee for Norms (CEN), i.e., in the European Committee for Electrotechnical Standardising (CENELEC). In the sector of welding technology, the basic specialist, i.e. the reference norms for the application standards have been in the process of elaboration since May of 1987 in the Technical Committee CEN TC 121 'Welding'. The target of one of these studies clearly refers to the definition of the tasks and responsibilities (job function) of the supervisory person, whereas the contents and the training, as well as the examination and the certification

are determined by the EWF. The EWF certificates have life-long validity, whereas the EN examinations, in dependence on the requirements (i.e. placed in the skill of the welder), must be repeated in regular intervals.

Until 1990 there were extremely different methods employed for the recognition of welding coordinating personnel in the various European states. Even the respective training courses were extremely varied, both in the sense of the contents and with regards to the length of the training.

The EWF (European Welding Federation) was established in the year 1971. At the moment, 17 states of the EU and the EFTA belong to the organisation. The current structure of the EWF is depicted by Fig. 4. The member states are represented respectively by their national welding associations, whereby the EWF only accepts one

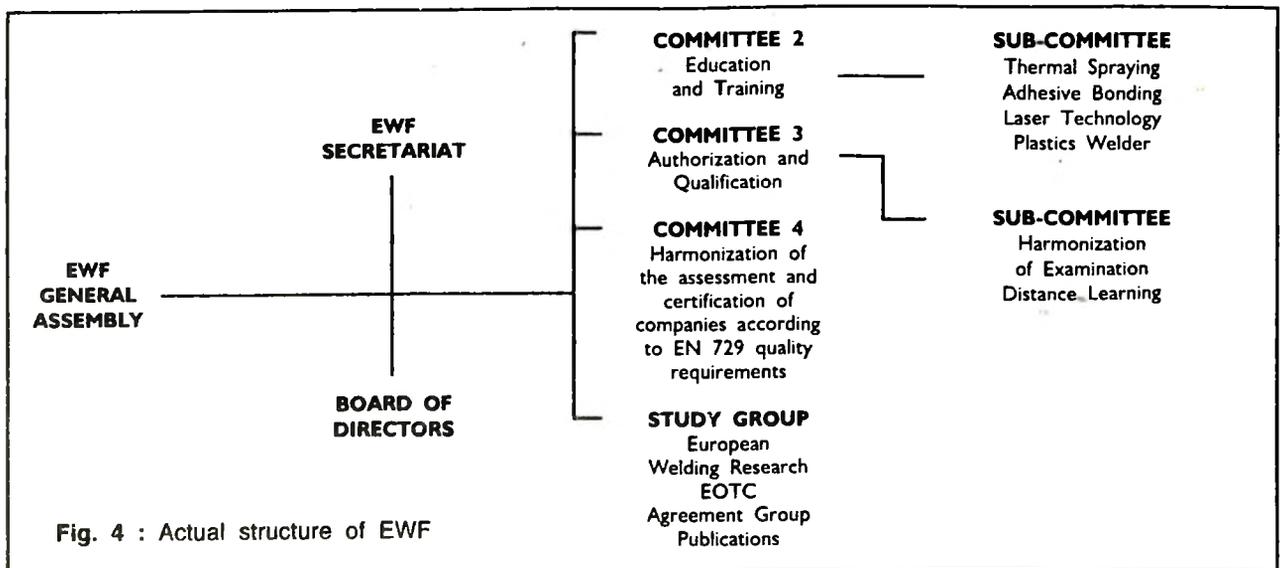


Fig. 4 : Actual structure of EWF

representative for each member state. One primary objective of the EWF is to achieve the harmonisation of the education and training of welding personnel. This was realised in the last few years through the creation of guidelines, determining the minimum requirements placed in the training and qualification of :

- Welding Engineers (EWE-European Welding Engineer)
- Welding Technologist (EWT-European Welding Technologist) and
- Welding Specialist (EWS-European Welding Specialist)

In the meantime, the training guidelines for the qualification of welding practitioners, welders, welding inspectors and thermal spraying specialists have been completed. Current efforts are concentrated on the sectors of synthetic material welding and adhesion, the laser technology, as well as robot operators. All EWF qualifications are subject to bilateral recognition in all EWF member states. The EWF member states started with the uniform training in accordance with the above mentioned guidelines in the year 1991. Additionally, regulations were made, according to which, within the framework of the transition regulation, a re-qualification of all persons active in the sector of welding can be carried out. The precondition for a re-qualification of this kind - explained using the

example of the welding engineer - is, on the one hand, that the initial preconditions for the participation in the respective EWF-training have been fulfilled. For a welding engineer for example, this means a completed education as an engineer. This involved comparing the sometimes extremely different engineer education courses in the EWF member states and (the feani report is generally used in this context), on the basis of a defined training, determining which of the respective national courses of education are to be regarded as being of equal quality.

A further precondition for the re-qualification is a certified national education as a welding engineer. The differences between the previous national and current EWF-education are defined by the respective ANB (Authorised National Body) of each of the member states. On the basis of these criteria, the decision is made whether it is necessary to attend a partial study course, to complete an examination, whether further training measures are recognised or whether a direct re-qualification can take place. The conditions for a re-qualification differ from country to country and are dependent on the respective initial situation. This course of action can be transferred principally to all EWF qualification measures.

According to the currently valid guidelines, the national welding

association (Authorised National Body - in Germany the DVS) responsible for the training activities according to the EWF - guidelines must validate on behalf of the EWF its competence and an effective system of quality assurance for training and examination activities by means of an inspection (audit).

The number of welding engineers trained each year in Germany is between 600 and 800. Since 1991, this post graduate training has been implemented in the 10 technical welding teaching and research institutions (SLV), in accordance with the guidelines of the EWF. Of course, not all of these EWEs are employed as welding coordinating personnel. Their greater knowledge in the specialist areas makes them efficient employees in the sectors of planning, development, work preparation and over the production, right through to the quality control, as well as in the internal sectors in firms and institutes dealing with questions related to welding technology.

As a post graduate course of studies, the welding engineer training is based on a completed course of studies in engineering. By necessity, the contents of the training are very close to practical experience, due to the fact that, after completion of the course, the graduate can immediately start work as a welding coordinator. With a relatively short period of practical

work experience, the training is structured with presentations of various welding procedures and exercises in procedures of Gas, Arc, TIG and Gas Shielded Metal Arc Welding and the comprehensive specialist theoretical section. The focal points of this section include treating the subject areas :

- technical welding procedures and equipment
- suitability of the materials
- design
- production and quality assurance

The training concept and the structure and scope of the examination presuppose the participation in a training course. The minimum training time is 446 hours for a welding engineer, 340 hours for the welding technologist and 222 hours for the welding specialist, Fig. 5. The contents of the training are defined in the form of detailed key words in the EWF guidelines. In the sense of time and contents, it constitutes the minimum requirements placed in the respective trainings, which within the framework of the national guidelines, may be exceeded, but must not fall short.

### THE ACTUAL SITUATION AND NEW DEVELOPMENTS IN ROMANIA

Welding is being applied at a very large scale. In Romania steel production is about 5 million tonnes/

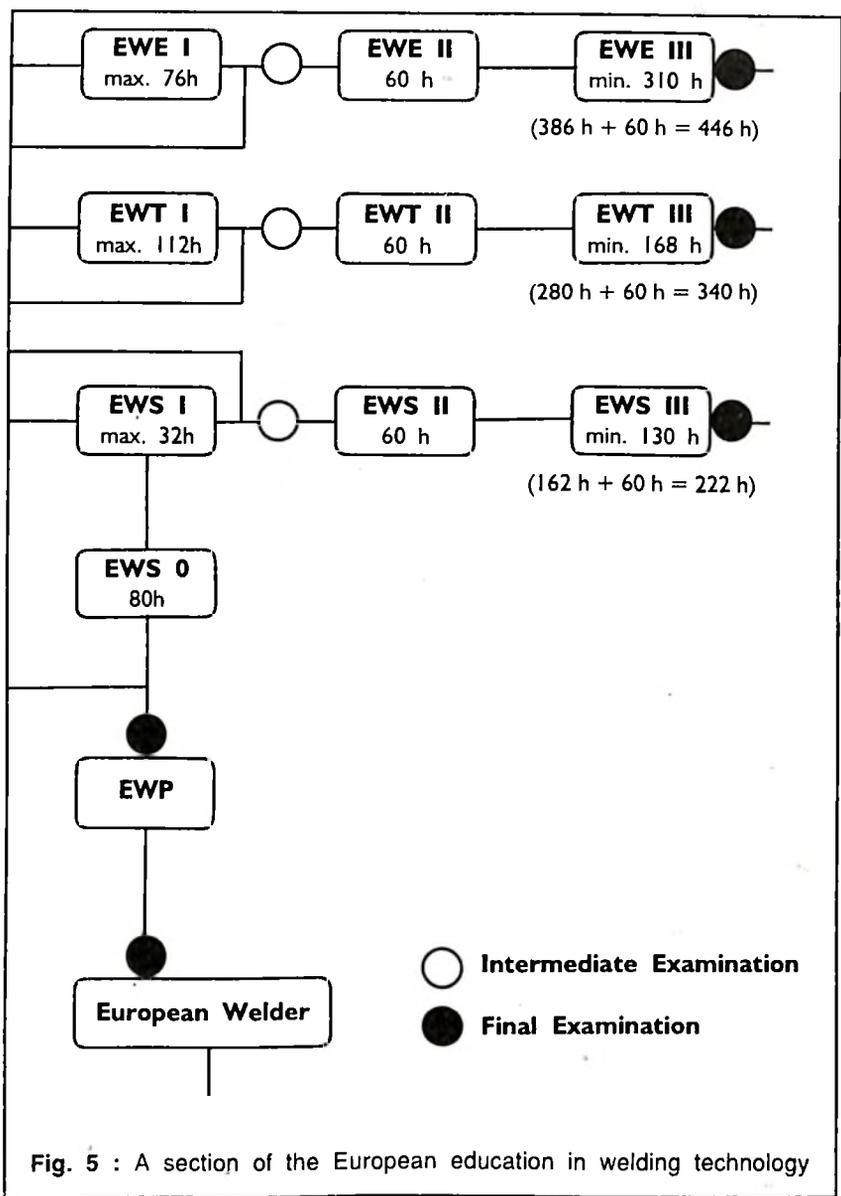


Fig. 5 : A section of the European education in welding technology

year, of which about 30% consists in welded structures. The main application fields of the welding processes are : metallic structures, equipment like chemical, petrochemical (including off-shore drilling platforms), energetic, transportation (causeway - cars, trucks, buses, railroad equipment - locomotives, wagons; shipping - ships), machine building.

The main welding procedures applied on a large scale are : gas shielded metal arc welding (75% of the application), TIG welding, submerged arc welding, resistance spot and seam welding. There are also being applied, but on a minor scale: plasma welding, friction welding, pressure butt welding, explosion welding, ultrasonic welding (for plastics), electron beam welding.

One also uses, in the same time, different welding allied processes like: brazing, metal spraying using flame, electric arc or plasma, flame and plasma thermal cutting.

The relative low level of welding mechanization is due especially to the low wage (much lower than in EU) of manual work in the welding costs' structure. That is why mechanization implementation does not ensure the same result regarding efficiency as in EU. However, in many enterprises, especially those having exporting relations, one uses on a large scale the MAG welding with CO<sub>2</sub> and, in the last time also, Ar/CO<sub>2</sub> mixtures. Most of the welded structure producers are great enterprises (with over 1000 employees) having qualified personnel, testing laboratory, training center for welders. The enterprises have also welding coordinators. The producing firms must possess a certificate testifying their capabilities to produce welded structures according to the Romanian standard STAS 11595/ISO 3583, the Institute of Welding and Material Testing (ISIM), Timisoara being authorised by the Ministry of Industry to accord these certificates.

A growing number of Romanian enterprises are having co-operation relations with firms from abroad. There are many firms having a quality assurance system according to ISO 9000, or with capability

certifications to produce welded structures according to DIN 18800 (over 35 enterprises), with certification according to HPO or according to American or other norms. There are in use, at the present time, 265 standards concerning welding and allied procedures, of which 18 are ISO standards and 53 SREN standards.

The European integration of the Romanian industry imposes the existence of a welding personnel trained and certified according to the European and/or international prescriptions. This explains the high interest of the Romanian firms for the qualification of their own personnel according especially to European standards. In Romania is functioning a Welding Society (ASR) having about 90 members - juridical persons and over 600 private members.

The necessity of training and certifying of European Welding Engineers to become welding coordinators according to the information given in EN 719 has become evident in different non EWF member countries, among which also is Romania which is an EWF observer. The EWF 416 document stipulates the possibility of developing training activities at European level in non-EWF member countries, under the intermediation of an existent ANB.

Based on these prescriptions and having in view the cooperation

relations existing among the welding societies from Germany and Romania, respectively among the welding institute Schweib technische Lehr-und Versuchsanstalt SLV Munich GmbH and ISIM Timisoara, in Romania has been started the organizing of European Welding Engineer courses at ISIM Timisoara by the German Welding Institute Munich (SLV Munchen) under surveillance of the German ANB (DVS-PersZert).

During October 1995 - July 1996 there were held such courses at which have participated 98 scholars from 71 firms. The courses schedule entirely accorded with the EWF 409 Document.

The access to these courses has been permitted for engineers, who graduated in long or short term university courses, this condition being the same as the ANB's country (Germany). In fig. 6 is schematically shown the university education system functioning in both countries and the access conditions for the EWF course.

The theoretical part of the course has been held by German teachers (from SLV Munich), respectively by Romanian teachers (from ISIM Timisoara and from the Technical Universities of Timisoara and Bucharest). The Romanian teachers and translators, so as the necessary facilities (equipment, apparatus, etc.) accomplished the conditions stipulated by EWF Doc. 416 and has

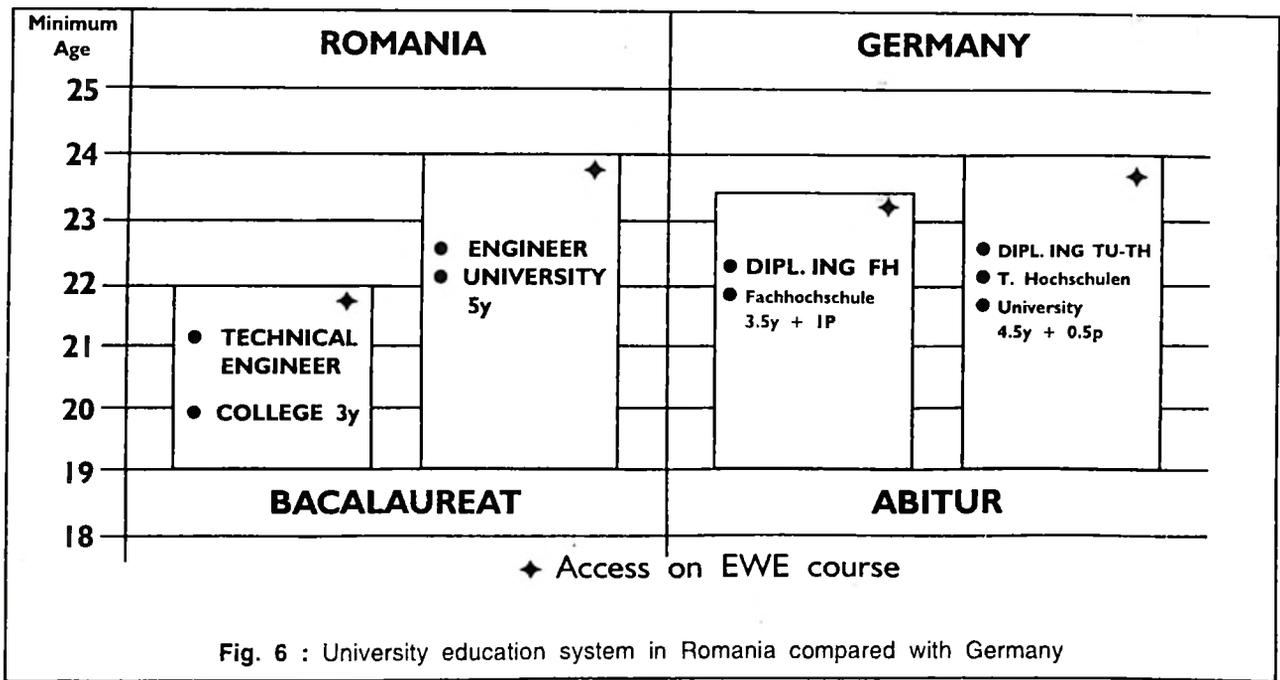


Fig. 6 : University education system in Romania compared with Germany

been verified by the ANB, resp. by its institution SLV Munich. In the case of the German teachers, translators having the requested qualification have been used. The practical activities have taken place in the ISIM laboratories.

The actual education and training of welding engineers in Romania is as follows : The higher (university) education has an open character and it is organised under the forms of : short term higher education and long term higher education. The short term higher (university) education lasts three years and it is organised in the university. The graduate gets a diploma of Technical Engineer in which the field of specialization is mentioned. The long term higher education lasts five years. The studies end with a licentiate degree that consists of a

project from the 3rd year of study, the most of the speciality disciplines being studied in the 4th and 5th years (7,8 and 9 terms). After the State Examination the graduates are awarded the diploma for mechanical engineering in welding speciality.

The ISIM organizes post-graduate courses having various themes and a 1-4 weeks duration. The technical universities having welding department give the opportunity to the specialists to obtain a doctor-engineer degree in the field of welding.

In order to overtake the personnel training and qualification system in Romania according to the EWF prescriptions, it is necessary to dispose a national certification organism (ANB) created and accredited by the EWF. For this

purpose, in Romania it was created in 1995 the ASR - Cert. Pers., as a Romanian welding personnel qualification/certification organism. ASR-Cert. Pers. is an organism of the Romanian Welding Society (ASR), being organized and functioning according to the following documents' regulations :

- **WEF 416** - Rules for the implementation of EWF guidelines for the education, examination and qualification of welding personnel within the EU and EFTA areas.
- **SREN 45013** - General criteria concerning the personnel certification organisms. The functioning of the certification appeals to Training Centres and Testing Commissions. For the present time a Training Centre in

the field of welding is functioning in Romania, at the ISIM Timisoara.

The ASR-Cert. Pers. is conducted by Steering Committee, including representatives from the industry (producers, clients), academic institutions, the ASR.

To be able to function, the ANB authorization by the EWF is obligatory. The duration for this task to be accomplished is estimated to be maximum 2 years. Until this authorization will be obtained, according in Romania of European qualification certificates of welding personnel might, according to EWF guidelines, be done only by an ANB from another country.

The organization of quality system of

ASR - Cert. Pers. has been started by the elaboration of a guide for its design and implementation. In the next stage the quality system documentation will be elaborated: the quality manual, the procedures, the professional standards, other documents, including quality recording documents.

In the same time it is necessary to have trained men for an evaluators/ auditors corps for the training centers, having in view their approval. During the quality system implementation stage and, afterwards, after the authorization/ accreditation, there are to be accomplished internal audits, having the purpose of correcting the existing nonconformity and to perfect the system. The quality system will be

designed, at the beginning, for all categories of welding personnel, and its implementation might be done step by step, depending on the demands.

The EWF system is being internationalized inside the International Institute of Welding (IIW). In Commission XIV one adopts the EWF guidelines regarding the personnel training, testing and qualification, and in the Commission VII the systems and the national authorised organisms (ANBs) functioning rules. So that for the future one recognizes the authorization of the ANBs of the EWF and of course of the ASR Cert. as an ANB by the IIW.



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## **THE INDIAN INSTITUTE OF WELDING Mumbai Branch**

### **Announcement for**

# **ANNUAL SEMINAR OF MUMBAI BRANCH**

**The Annual Seminar of the Mumbai Branch will be held at the  
Ramada Hotel, Palm Grove, Juhu Beach, Mumbai  
on 12th December, 1998**

**The Theme of the One-day Seminar is  
"WELDING PRODUCTIVITY THROUGH AUTOMATION"**