

International Certification Systems in Welding

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Abstract

Energy and Processing Industry are examples of sectors where the quality of the welded constructions presents highest challenges. These regard not only the range of different cases (materials, processes, positions) but also the stringent quality and safety requirements associated.

Another important aspect is the continued search for higher productivities, which lead to the use of innovative solutions and welding processes which must comply with the quality, health and safety demands.

The companies in this sector are increasingly searching for certification to comply with the three main systems – Quality, Environment, and Health and Safety, as a whole.

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.

Nowadays it is not only the quality of the product that is wanted by the costumers and society. Companies at the present are also considered as having a very important role on the sustained development. One of the ways companies can demonstrate their commitment to the society is through the implementation of proper systems to minimize pollution problems and to keep as high as possible the well-being of their workers and staff during the activities that must be performed for manufacturing their products.

The need to assure quality of welded constructions has been the basis for the development of a large number of standards in this area, firstly addressing the weld process and joint characteristic and more recently covering the overall activity related with welding technology in a company leading to the creation of quality systems. Environment and Safety regulations are also creating new challenges to the industry in

what regards its proper implementation with the lower possible costs.

EWF – European Welding Federation has created in the end of the 90' a scheme to support companies on the implementation of EN 729, which is now being adjusted to fulfill the requirements of EN ISO 3834. This system is in the process of being transferred to IIW and its implementation at international level will start in 2008, under the management of IAB – International Authorisation Board. But due to the Companies demand, the EWF has decided to develop and implement two more schemes, each one regarding two major areas, the environment and health & safety.

The new vision of EWF for the Companies Certification is an Integrated System that can be applied as a hole or on a partial basis.

This paper addresses the main aspects referred on the EWF Integrated Manufacturer Certification System.

IIW - Thesaurus keywords: Company; Certification; Personnel; Recommendations; Rules.

1. INTRODUCTION

Energy and processing industries are quite demanding in what regards quality and environment requisites. As an example it can be referred that construction codes for off-shore structures indicate the use of welding processes as submerged arc welding, TIG, manual metal arc welding, MIG/MAG and even flux cored arc welding are often not recommended due to the higher risk of generation of weld defects.

In these industrial sectors, though productivity is of course important, it is the reliability of the welded constructions that determine welding processes and procedures to be used. There is in fact an absolute need to prove the reliability of the welds often by integral inspection using non-destructive techniques.

Another example is the massive obligations of e.g. the petrochemical companies to comply with ISO 14 000. Stakeholders are aware of these environmental issues which are transferred to suppliers who thus also need to implement ISO 14 000.

The EWF (European Welding Federation) Integrated Manufacturers Certification System complies with ISO 3834, Environment (ISO 14001) and Health & Safety and aims at facilitating the implementation of these standards and recommendations.

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

In order to administer the certification systems the IIW-International Institute of Welding has established the IAB – **I**nternational **A**uthorisation **B**oard. This organisation aimed at the effective implementation of the system in all IIW countries, publish Guidelines and operating procedures to support companies.

In 2007 it has been agreed between EWF and IIW, to transfer from EWF to IIW the part regarding the compliance with ISO 3834. In the beginning of 2008 IAB has approved the IIW Companies Certification Scheme.

The Authorised National Body for Companies Certification (ANBCC) is the National entity that performs the supervision of the companies' certification system in each country. This organisation is appointed by the IIW and audited regularly according with a set of procedures defined by IAB – International Authorisation Board and accepted by most National Accreditation Bodies.

The Representatives from these ANBCCs form the operational management within the IAB, nominate and approve Lead Assessors and Peer Assessors who ensure conformity of each ANBCC to agreed Rules.

An ANBCC 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 certifications in accordance with the provisions of the document IAB-339- Rules for ANBCCs Operating the IIW Manufacturer Certification Scheme.

2. INTEGRATED MANUFACTURER CERTIFICATION SCHEME

2.1 Need for Health & Safety Certification Scheme

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.

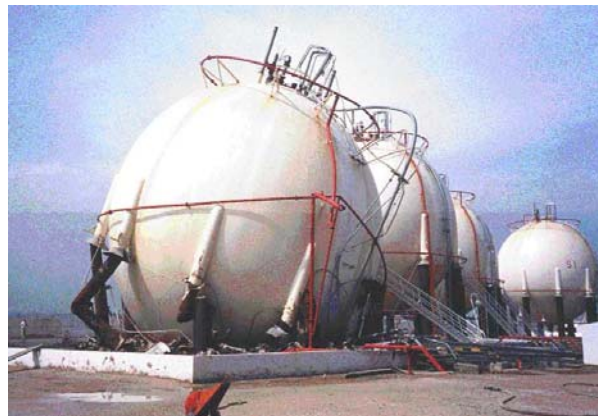


Figure 1: Collapse of a sphere due to failure on the leg

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 on 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 was published in 2005. The implementation of this standard is becoming widely used 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.

EWF during the implementation of the ISO 3834 (the former EN 729) felt the need to develop two more certification systems for companies, these are the Environment Management System (EMS) and the Health & Safety Management System (SMS), EWF sees these two management systems as a complement to the ISO 3834 certification system.

The Health & Safety System has been developed mainly due to the increased awareness of the impact welding can have in the quality of life of the welders in particular but also of all personnel involved in welding operations.

Welding is a physical demanding job. Safety hazards include the potential for fire or explosion and injuries from radiation, electrical shock, or materials handling. Health hazards (see table 1) are exposure to fumes released during welding as well as bad ergonomical situations on the welding shop floor.

Table 1 - Health hazards due to welding

Fume	Gases	Radiant energy	Other hazards
Aluminium Cadmium Chromium Copper Fluorides Iron Lead Manganese Magnesium Molybdenum Nickel Silica Titanium Zinc	Carbon dioxide Carbon monoxide Nitrogen oxide Nitrogen dioxide ozone	Ultraviolet Visible Infrared	Heat Noise Vibration Bad ergonomics

The influence of welding fumes on the human body differs for each material. Some have only a short term influence, while others have a long term destructive influence on parts of human organism, e.g. manganese can influence Parkinson-like diseases. Regarding welding fumes, EU as well as national maximum accepted concentrations (MAC values) had been legally described. These MAC values are decreasing in several countries to decrease the health risk for welders.

Postures which are maintained for too long expose the welder to cumulative stresses and strains. In manual welding the position of the welder (bending towards the welding zone) is stressful, often leading to back injuries. Although the welding torch doesn't seem to be very heavy, holding it in a stable position for some minutes gives one a different view at the meaning of the word "heavy". There are many types of tools used by the welder, these vary by shape, size, weight and power source. Some tools are simple but others are complicated to operate. A side effect of using certain power tools is vibration (slag removing) which can affect the entire body and cause neck and back pain, numbness, tingling, aching, stiffness, headache or blurred vision. Besides the effects from vibration, tools used can cause other types of

musculoskeletal problems. Proper use should include worker awareness of the ergonomic principles involved to safeguard against musculoskeletal injury. None or very limited guidelines are available at the moment.

It is remarkable that workplaces often are not designed to fit the needs of the workers but most of the time it is the other way around. Welding introduces many challenges to the field of ergonomics, which are at this moment only just being understood. There is a need to find solutions for problems such as RSI among welders (Repetitive Strain Injury) and Cumulative Trauma Injury (CTI), both resulting in low productivity, more sick leave and workers less satisfaction. If this is not achieved, costs for sick leave will represent financial drawbacks for the companies.

All the metalworking activities have Health & Safety risks, the EWF SMS has the aim to address only the welding and related activities, and it is a way for a metalworking company to evaluate their specific welding risks, and of course defining the proper plans to minimize welding associate risks in terms of H&S.

2.2 Structure of the 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 ISO 3834.

This work started in 1995 and in 1997 the EWF Certification Scheme was approved. At the same time EWF established collaboration agreement with the European Co-operation for Accreditation (EA). This had the aim to support EA on the elaboration of Guidelines on the use of 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.

Due to the developments and needs from the manufacturers regarding the compliance with other Systems, EWF Integrated Manufacturer Certification System has at the present also the possibility to Certify Companies according to 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 last pillar of the EWF Manufacturers Certification Scheme was the approval and implementation of the Health & Safety Management System (SMS). This system was approved in 2006.

The EWF view is a holistic model - EWF Integrated Manufacturer Certification Scheme encompassing quality, environment and health & safety as presented in Table 2.

Table 2 – 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

For the Scheme implementation, one organisation in each country is approved by IIW or EWF, after assessment against the IIW/EWF Rules (Only the European Countries must fulfil IIW and EWF rules, other countries only fulfil the IIW rules). These organisations are known as the “ANBCCs – **A**uthorised **N**ational **B**odies for **C**ompany **C**ertification” and are responsible for ensuring the IIW/EWF guidelines of assessment and certification are maintained. In this, the objective is the IIW/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 IIW or EWF in respect of company certification, including the conduct of company assessments, 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 IIW/EWF ISO 3834 Certification Scheme and/or also including the EWF Environment Management (EMS) and/or Health & Safety Management System (SMS) 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 IIW or EWF ANBCCs is kept continuously updated and is available for consultation on the IIW/EWF Web page as mentioned above.

IIW/EWF maintains this register of IIW/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 IIW/EWF Certified Companies.

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

- **EFW-636-07 – January 2007**
- Management Schemes Interpretation and Implementation (on this document are stated the requirements for the ISO 3834, EMS and SMS)
- **IAB-337-08 – January 2008**
- Interpretation and Implementation of ISO 3834 requirements
- **EFW-637-07 – January 2007**
- Supplement for the Implementation of EN ISO 3834 Oriented to Welded Products
- **IAB-338-08 – January 2008**
- Supplement for the implementation of ISO 3834 Oriented to Welded products
- **EFW-638-07 – January 2007**
- Rules for ANBCCs Operating the EWF Manufacturer Certification System (on this document are stated the requirements for the ISO 3834, EMS and SMS)
- **IAB-339-08 – January 2008**
- Rules for ANBCCS operating the IIW Manufacturer Certification Scheme (on this document it is stated the requirements only for the ISO 3834)
- **EFW-639-07 – January 2007**
- ANBCCs Assessment of Manufacturers of Welded Products Operating the EWF Manufacturer Certification System (on this document are stated the requirements for the ISO 3834, EMS and SMS)
- **IAB-340-08 – January 2008**
- ANBCCs Assessment of Manufacturers of Welded Products Operating the IIW Manufacturer Certification Scheme (on this document it is stated the requirements only for the ISO 3834)

Table 3 summarises the content of the abovementioned documents.

Table 3 – Summary contents of IIW/EFW ISO 3834 Scheme documents only

Interpretation for Manufacturers	Assessment of Manufacturers
<p>Doc. EWF 636/ IAB 337 explains the interpretation for each part of ISO 3834 on important items:</p> <ul style="list-style-type: none"> - Contract and design review - Subcontracting - Welding personnel - Inspection, testing and examination personnel - Equipment - Storage of parent materials - Calibration - Identification and traceability 	<p>The Assessment procedure (Doc. EWF 639/ IAB 340) has three phases:</p> <ul style="list-style-type: none"> - Information phase and assessment preparation - Assessment phase - Certification phase <p>The assessment team must be competent in relation to the specific product welding activities.</p>
Assessors	Questionnaires
<p>The procedure for the evaluation and registration of assessors describes that the assessors must be either:</p> <p>qualified and experienced in quality system auditing and experienced in welded fabrication or I/EWE or I/EWT with at least three years of work experience in the field of welded fabrication and familiarity with quality management systems.</p> <p>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.</p>	<p>The questionnaires (Doc. EWF 639 / IAB 340):</p> <p>are used as check list of all important items of the standard and the EWF/IIW interpretation in an interrogative form, which will be used during the assessment.</p>

2.3 Examples of Best Practise

2.3.1 The Hungarian ANBCC activity

Hungarian Association of Welding Technology and Material Testing (MHtE) is an example of a best practice case in the implementation of the Integrated Certification System in the companies in Hungary. It has more than one hundred members being active in welded metal structure fabrication. The General Assembly of MHtE and a Conference for responsible welding coordinators (engineers) organized yearly are good occasions for discussing the daily problems as well. The health and safety problems nowadays are really daily ones. It is enough to look at the exhibition area of welding fairs occupied by safety and environmental equipments offered and/or used in welded metal product fabrication.

Traditionally the health and safety in the industrial activity in Hungary is well regulated. There is a special law for safety and health and a departmental order (ministerial decree) for welder's health and safety. These legal, special and professional regulations mentioned are only a few from the series of other rules for health and safety valid in metal industry.

On the other hand a large number (cca. 10.000 or more) of the Hungarian companies are certified according to ISO 9001. The majority of companies producing welded structures have implemented and certified QMS. In many cases the welding coordinator is responsible for the QMS activities as well.

All this mean welding coordinators have special affinity for handling managing systems even if ISO 9001 or ISO 3834 or both (integrated MS) are implemented and for them the advantages of using such managing systems are well known.

MHtE will be in line with the general trends in Europe, therefore Hungary decided to implement EWF Health and Safety Management Scheme (EWF-SMS).

The EWF-SMS scheme is good for managing professional, legal problems related to welders' health and safety. The implementation of EWF-SMS leads to the fulfillment of all professional and legal requirements and points out initiatives for improvements.

One of the main advantage is the risk-analysis itself which is obligatory but the denomination of the corrective actions and evaluation of their effectiveness leads to significant improvement in the working environment. All these are inputs for in-workshop training and education courses on health and safety in welding and initiatives for continuous improvement. The specific management representative (even the welding coordinator) has the opportunity to contact the

management of the company and inform on health and safety problems of welders, flame cutters, etc.

The regular review of EWF-SMS with the aim of improvements will result on the decrease of industrial accidents, the work environment and the quality of life will be better – it means the comfort, feeling and safety of welders will be greater.

The practice of certification according to EWF-SMS made it clear that EWF-SMS is an important and positive option and tool for managing health and safety issues in the workplace.

Some of the professional results, improvements and the names of certified companies are published in HEGESZTÉSTECHNIKA (Welding-technology), a professional quarterly journal of MHE.

2.3.2 ECONWELD – Economically Welding in a Healthy Way

A European cooperation project is under development to target to reduce the injuries caused by welding. The project offers an integrated approach (source, surrounding and welder) on welding fumes:

- *Lower the droplet temperature.* One of the main causes for formation of fumes at MIG/MAG welding is the high temperature of the metal droplets coming from the wire. The droplet temperature is lowered by using pulsed-MIG welding with special pulse parameters, combined with additions to the shielding gas, reducing the surface tension of the transferred droplets.
- *Early condensation of welding fumes.* Another option is to ensure the fumes condense as quickly as possible after formation, not leaving the welding arc at all. This can be done by addition of condensation nuclei to the shielding gas. Thus, welding fumes won't interact with the welder.
- *New welding torch concepts.* MIG/MAG welding torches were developed and tested in the project: a welding torch with lateral aspirating openings leads to decreasing the amount of fumes drastically (Fig. 2)
- *Green filler wires.* A source of welding fumes is the material of the filler wire. Some manufacturers claim to supply the so called 'green wires' with a lower emission rate of welding fumes. These wires were tested and compared with traditional wires for MIG/MAG welding and lowered the amount of welding fumes maintaining the necessary (mechanical) properties of the weld.

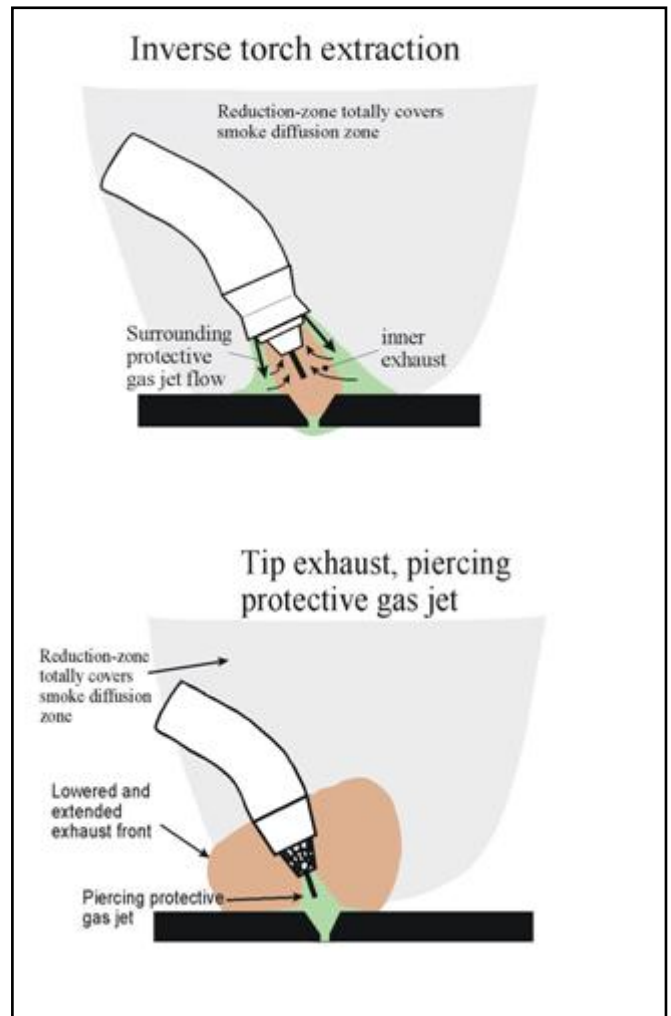


Figure 2: Comparative design of manual torch and the inverse torch

- *Exhaust development.* A lot of good welding fume extraction equipment is available, but only when working at a fixed place of work these systems will do their job. Problems are encountered when products are large; the welder has to move the exhaust hood from weld to weld with him. This is annoying and in practice thus often not done. This means that in practice good exhausting equipment is not very effective and the welder is still exposed to a lot of welding fumes. In this project a "smart" exhaust arm was developed which is able to move to the place of welding automatically. Position sensors as well as sensors for detecting beginning and end of the weld were developed.



Figure 3: Example of application of the ECONWELD lightweight aspiration torch

Governments and companies are aware of the hazards welders are exposed to. Much is known about the influence of welding fumes on the human body. Standards and guidelines have been set up for protecting the welder and his immediate surrounding from welding fumes and radiation. The welding helmet, part of the welders personal protective equipment (PPE), is always used. Most traditional helmets are designed for protection to radiation. Nowadays some helmets also protect the welder against fumes.

ECONWELD has developed new prototype smart helmet which warns the welder when fume concentrations exceed safe limits (**MAC value**).

here are no ergonomically guidelines on welding. In work shops, very little attention is paid to ergonomics. Guidelines were established in ECONWELD for ergonomically welding leading to a decrease in sick leave due to physically bad welding conditions, containing:

- Product design with welders' ergonomics in mind
- Aids for ergonomic welding in relation to different products (dimensions, structure) to be welded
- Awareness at the shop floor for good ergonomic practice.

No good virtual welding tools are available on the market to help designers to make welder-friendly designs (ergonomics). Most software available is used for calculating welding costs, heat input, preheating temperatures and welding parameters based on material selection, welding process and material dimensions etc and is rather simple and one-purpose only.

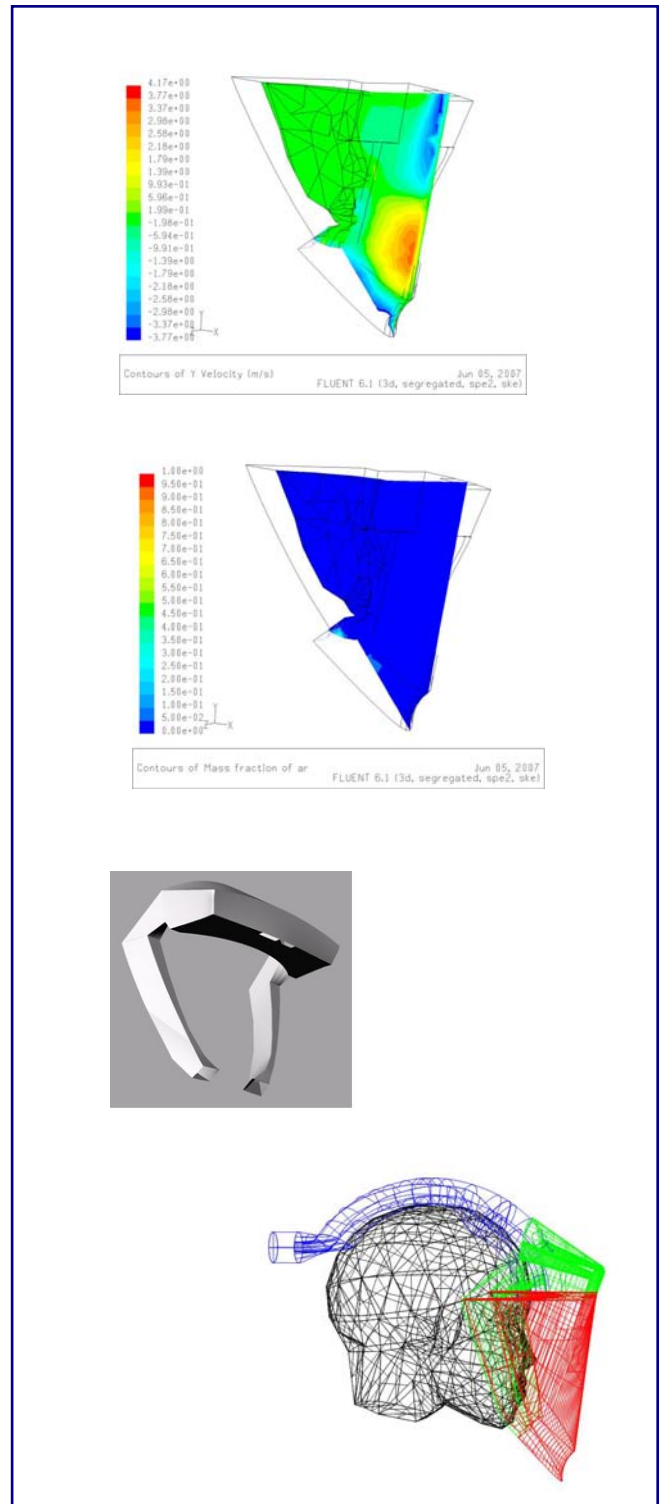


Figure 4: Modelling and design for development of helmet prototype

The software tool under development in ECONWELD enables product designers and engineers to calculate new solutions for the best ergonomic and minimised fume productions by easily changing the input parameters. Thus, designers can reduce stresses and strain on welders in an early stage.

In most European countries welders suffer from a bad profession image. In our computer dominated age professions like welding -regarded as heavy, physical demanding and dirty, unhealthy work- are not very popular. Next to this, people often don't recognise the craftsmanship needed in many welding jobs. This bad image lately started raising an already urgent problem; there is a lack of skilled welders.

The results of ECONWELD are expected to give welding a better image (less welding fumes → less dirty image; improved ergonomics → less physical demanding) and to contribute to the increase of the number of youngsters searching for a profession in welding technology.

Conclusion

The International System for Companies Certification is recognised worldwide, and objectively supported by industry and by international organisations related with welding technology, opening the way towards one Global Certification System in the field of Welding Technology.

The relevance of the International Certification System for Companies will generate worldwide a very high interest like it was when the EWF Certification Systems were implemented in Europe by EWF.

The International Certification System will not only be of benefit to the large end-users but also to the supplier companies. The benefit to the end-users is related to the purchasing process, and to the warranty that the supplier is capable in what regards the welding construction. To the supplier companies when they are certified according to the EWF/IIW Companies certification system, they demonstrate they not only comply with the ISO 3834, but they were assessed under a set of rules that are recognised by all the EW/IIW members.

In terms of energy and processing companies, the EWF/IIW Companies Certification System, can be applied by all types of companies where welding is an important production process, either in workshops or on site.

The EWF Environment Management System has been developed since 2004. This was the first scheme covering other areas than quality. Since its implementation, several companies in Europe have been certified according to this system as complement to the ISO 3834. This system is based

on the ISO 14001, but only covers the welding activities and ancillary activities like cutting, spraying and so on. The companies can use this scheme as a very comprehensive tool to evaluate the environment aspects and its impact in related welding activities.

The EWF Health & Safety System (SMS) has been developed since 2006, and the companies interest on this system is increasing (e.g. implementation of H&S System in Hungary, research and development project ECONWELD-Economically Welding in a Healthy Way), because companies have found that the EWF-SMS, can be used as a very comprehensive tool to evaluate and manage the welding associated risks. This helps companies in terms of developing proper plans to minimize welding hazards.

The EWF-SMS does not only provide to companies an improved safety environment but at the same time because the welding risks are minimized, production performance it is also increased.

Acknowledgement

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