State of the Art of International Standardisation in the Field of Welding and Allied Processes

(O Estado da Arte da Normalização Internacional no Campo da Soldagem e dos Processos Afins)

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Abstract

The development of new and the revision of existing ISO Standards in the field of welding and allied processes was formidable in the last five to seven years. In the middle of the year 2009 there were available more than 300 European and more than 270 International Standards in that field, most of the EN Standards are identical or very similar to ISO Standards. Industry has to take into account the new standards and the changes in the existing once especially in respect of filler materials, procedure qualification tests, personal qualification, non destructive tests and requirements to manufacturing joined products. There is a strong relation of these standards to product standards and to European Directives.

Key-words: *Welding standards, quality, ISO*.

Resumo: *O desenvolvimento de novas normas ISO e a revisão de normas ISO já existentes no campo da soldagem e de processos afins foi formidável nos últimos cinco a sete anos. Em meados de 2009 existiam disponíveis mais de 300 Normas Européias (EN) e mais de 270 Normas Internacionais nesta área, sendo a maioria das EN idênticas ou muito similares às Normas ISO. A indústria tem levando em consideração as novas normas e as alterações nas existentes, especialmente com respeito a materiais de adição, testes de qualificação de procedimento, qualificação de pessoal, ensaios não destrutivos e requerimentos para a fabricação de produtos com processos de união. Existe uma forte relação entre estas normas com normas de produtos e com as Diretrizes Européias*.

Palavras-Chave: *Normas de soldagem, qualidade, ISO*.

1. Introduction

Technical standards are developed on national, regional and international levels (Figure 1). The national level does not need any interpretation, although some national standardization organizations have a strong international impact like ASME, API and AWS of the U.S. in the corresponding branches.

Examples of regional levels are:

- African Regional Organization for Standardization (ARSO)
- Arab Industrial Development and Mining Organization (ARSO)
- European Committee for Standardization (CEN)
- Pan American Standards Commission (COPANT)
- Euro Asian Council for Standardization, Metrology and Certification (EASC)
- Pacific Area Standards Congress (PASC)
- ASEAN Consultative Committee for Standards and Quality (ACCSQ)

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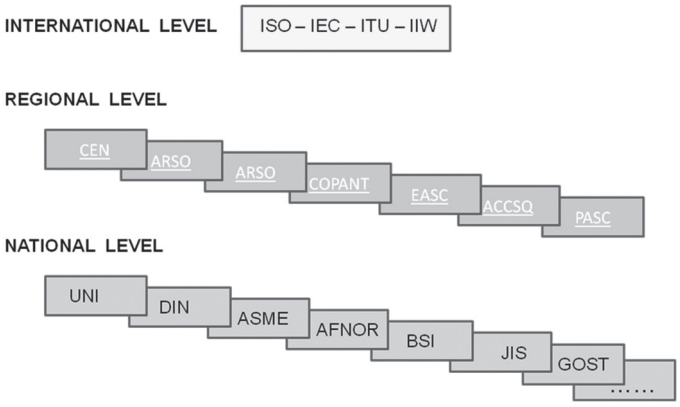

Figure 1. Levels for Standardisation Work.

European standards are developed by CEN, the European Committee for Standardisation, CENELEC, the European Committee for Electrotechnical Standardisation, both with their central offices in Brussels, and ETSI, the European Telecommunications Standards Institute with its central office in France.

This contribution mainly will deal with international standardisation activities by ISO, the International Organisation for Standardisation. ISO collaborates with its partners in international standardisation, the International Electrotechnical Commission (IEC) and the International Telecommunication

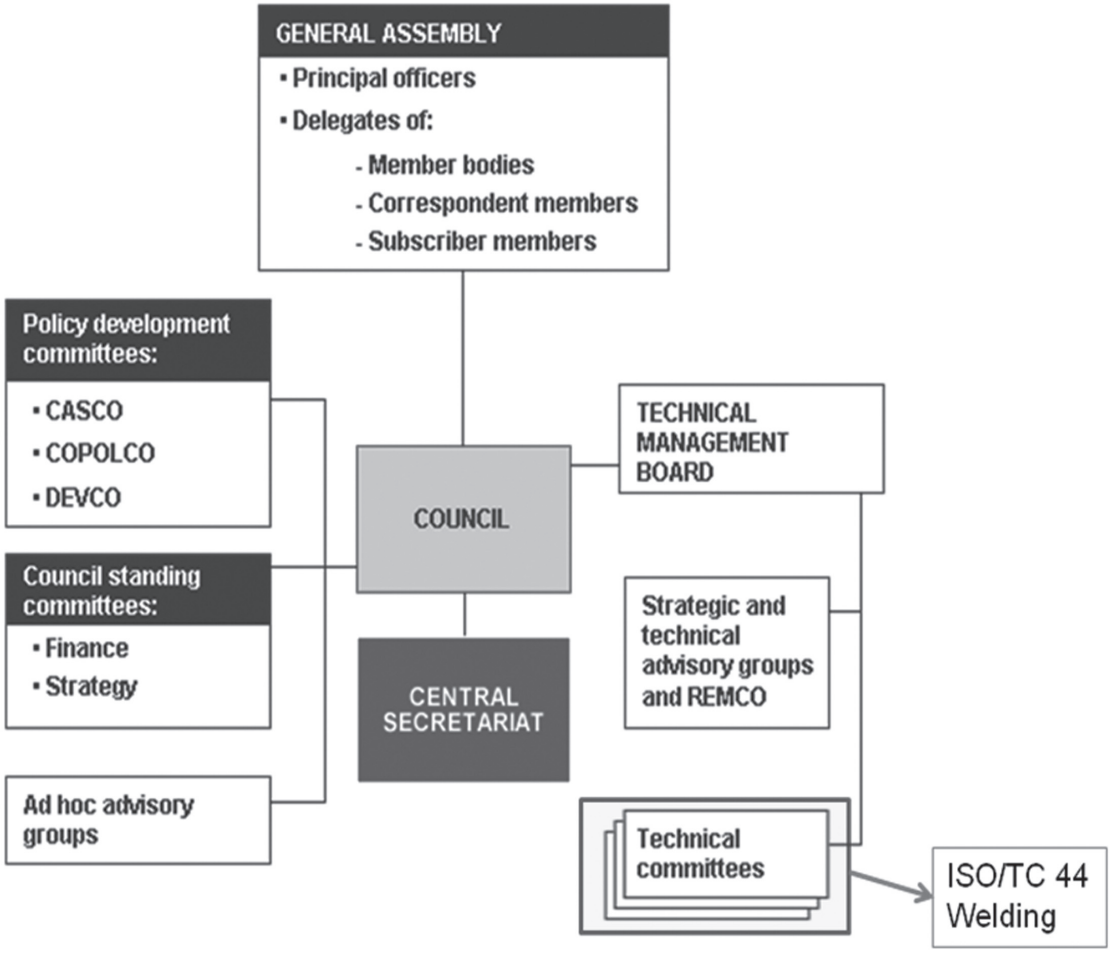

Figure **2**. ISO's Structure.

Union (ITU). The three organizations, all based in Geneva, Switzerland, have formed the **World Standards Cooperation** (WSC) to act as a strategic focus for collaboration and the promotion of international standardization.

2. The scope of ISO's work

ISO has more than 17500 International Standards and other types of normative documents in its current portfolio. ISO's work programme ranges from standards for traditional activities, such as agriculture and construction, through mechanical engineering, manufacturing and distribution, to transport, medical devices, information and communication technologies, and to standards for good management practice and for services.

3. ISO's structure

The structure of ISO is given in Figure 2.

4. International standardisation in the field of welding and allied processes

The international standardization work in the field of welding and allied processes mainly is done in ISO TC 44 "Welding and allied processes". The secretariat is with AFNOR, the French national standardisation organisation, and chairman is Mr. Lobinger, from France as well.

The scope of ISO/TC 44 reads: "Standardization of welding, by all processes, as well as allied processes; these standards include terminology, definitions and the symbolic representation of welds on drawings, apparatus and equipment for welding, raw materials (gas, parent and filler metals) welding processes and rules, methods of test and control, calculations and design of welded assemblies, welders' qualifications, as well as safety and health. Excluded: electrical safety matters related to welding which are the responsibility of IEC / TC 26"

ISO/TC 44 has published 274 ISO Standards and other ISO Documents like Corrigendum, Amendments, ISO/TR (Technical Reports) or ISO/TS (Technical Specifications). You can find the titles of these standards on the ISO Web Site by:

http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_tc_browse.htm?commid=48602&includesc=true&published=on.

Cooperation of ISO/TC44 exists for instance with the following Technical Committees:

- TC 5 Ferrous metal pipes and metallic fittings,
- TC 10/SC 1 Technical product documentation,

- TC 11 Boilers and pressure vessels,
- TC 26 Copper and copper alloys,
- TC 58 Gas cylinders,
- TC 79 Light metals and their alloys,
- TC 94 Personal safety -- Protective clothing and equipment,
- TC 107 Metallic and other inorganic coatings (including thermal spraying),
- TC 119 Powder metallurgy,
- TC 135 Non-destructive testing,
- TC 153/SC 1 Valves - Design, manufacture, marking and testing,
- TC 164 Mechanical testing of metals,
- TC 167/SC 1 Steel and aluminium - Structures, material and design,
- IEC TC 26 Electric welding and othe rs

The ISO Technical Committees are divided in SC's, Sub Committees, and WG's, Working Groups, if necessary.

The structure of ISO/TC44 is given in Table 1. It has participating members from 34 countries and observing members from 37 countries all over the world.

5. Actual activities in ISO/TC44

Standards of ISO/TC44 published in 2009 are listed in Table 2. At the present stage, ISO/TC44 and its subcommittees (SC) are working on 51 projects. These are revisions of existing standards and developments of new standards. The projects are listed in Table 3. Most of these projects are handled in a strong cooperation with CEN, the European Committee for Standardisation, following the Vienna Agreement to avoid as far as possible different standards on the same subjects on the European and the international level. Anyway there are some projects that are on European but not on international interest. These projects are listed in Table 4 and are handled only by CEN/TC 121 "Welding and allied processes" and its sub committees. The structure of CEN/TC121 is given in Table 5. All about CEN/TC 121 can be found under:
www.cen.eu/CENORM/Sectors/Technical Committees Workshops/ CENTechnical Committees/ CENTechnical Committees .asp? param =6103&title =CEN%2FTC+121

Table 1. Structure of ISO/TC44, Welding and allied processes.

WG 1	**Underwater welding (dormant)**
WG 3	**Brazing materials and processes**
WG 4	**Welding and brazing in aerospace**
SC 3	**Welding consumables**
SC 5	**Testing and inspection of welds**
SC 6	**Resistance welding and allied mechanical joining**
SC 7	**Representation and terms**
SC 8	**Equipment for gas welding, cutting and allied processes**
SC 9	**Health and safety**
SC 10	**Unification of requirements in the field of metal welding**
SC 11	**Qualification requirements for welding and allied processes personnel**
SC 12	**Soldering materials**

Table 2. New published Standards by ISO/TC44 in 2009.

Standard	Title
ISO 5173:2009	Destructive tests on welds in metallic materials -- Bend tests
ISO 17677-1:2009	Resistance welding -- Vocabulary -- Part 1: Spot, projection and seam welding
ISO 5821:2009	Resistance welding -- Spot welding electrode caps
ISO 4063:2009	Welding and allied processes -- Nomenclature of processes and reference numbers
ISO 5171:2009	Gas welding equipment -- Pressure gauges used in welding, cutting and allied processes
ISO 2503:2009	Gas welding equipment -- Pressure regulators and pressure regulators with flow-metering devices for gas cylinders used in welding, cutting and allied processes up to 300 bar (30 MPa)
ISO/TR 20172:2009	Welding -- Grouping systems for materials -- European materials
ISO 17663:2009	Welding -- Quality requirements for heat treatment in connection with welding and allied processes
ISO 15614-2:2005 /Cor 2:2009	Specification and qualification of welding procedures for metallic materials -- Welding procedure test -- Part 2: Arc welding of aluminium and its alloys
ISO 15609-4:2009	Specification and qualification of welding procedures for metallic materials -- Welding procedure specification -- Part 4: Laser beam welding

Table 3. Projects of ISO/TC44. Welding and allied processes.

ISO Nr.	Title	Status*	TC/SC
ISO/CD 544	Welding consumables -- Technical delivery conditions for filler materials and fluxes -- Type of product, dimensions, tolerances and markings	30.99	TC 44/SC 3
ISO/CD 2553-1	Welding and allied processes -- Symbolic representation on drawings -- Part 1: Welding	30.60	TC 44/SC 7
ISO/FDIS 2560	Welding consumables -- Covered electrodes for manual metal arc welding of non-alloy and fine grain steels – Classification	50.20	TC 44/SC 3
ISO/DIS 3580.2	Welding consumables -- Covered electrodes for manual metal arc welding of creep-resisting steels -- Classification	40.99	TC 44/SC 3
ISO 3581:2003/CD Amd 1	Welding consumables -- Covered electrodes for manual metal arc welding of stainless and heat-resisting steels – Classification	30.99	TC 44/SC 3
ISO 5172:2006/CD Amd 1	Gas welding equipment -- Blowpipes for gas welding, heating and cutting -- Specifications and tests	30.60	TC 44/SC 8
ISO/NP 5817	Welding -- Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) -- Quality levels for imperfections	10.99	TC 44/SC 10
ISO/DIS 6947.2	Welds -- Welding positions	40.20	TC 44/SC 7
ISO/FDIS 7289	Gas welding equipment -- Quick-action couplings with shut-off valves for welding, cutting and allied processes	50.00	TC 44/SC 8
ISO/DIS 7291.2	Gas welding equipment -- Pressure regulators for manifold systems used in welding, cutting and allied processes up to 30 MPa (300 bar)	40.60	TC 44/SC 8
ISO/NP 9455-10	Soft soldering fluxes -- Test methods -- Part 10: Flux efficacy tests, solder spread method	10.99	TC 44/SC 12
ISO/NP 9455-16	Soft soldering fluxes -- Test methods -- Part 16: Flux efficacy tests, wetting balance method	10.99	TC 44/SC 12
ISO/FDIS 9539	Gas welding equipment -- Materials for equipment used in gas welding, cutting and allied processes	50.00	TC 44/SC 8
ISO/DIS 10225	Gas welding equipment -- Marking for equipment used for gas welding, cutting and allied processes	40.60	TC 44/SC 8
ISO/CD 10863	Welding -- Use of time-of-flight diffraction technique (TOFD) for testing of welds	30.99	TC 44/SC 5
ISO/CD 10882-1	Health and safety in welding and allied processes -- Sampling of airborne particles and gases in the operator's breathing zone -- Part 1: Sampling of airborne particles	30.60	TC 44/SC 9
ISO/FDIS 11666	Non-destructive testing of welds -- Ultrasonic testing of welded joints -- Acceptance levels	50.00	TC 44/SC 5
ISO/DIS 11745	Brazing for aerospace applications -- Qualification test of brazers and brazing operators -- Brazing of metallic components	40.60	TC 44
ISO/CD 12153	Welding consumables -- Tubular cored electrodes for gas shielded and non-gas shielded metal arc welding of nickel and nickel alloys – Classification	30.99	TC 44/SC 3
ISO/NP 13585	Brazing -- Brazer qualification	10.99	TC 44

ISO/NP 13588	Welding -- Use of (semi-) automated phased array technology for examination of welds	10.99	TC 44/SC 5
ISO/DIS 14171	Welding consumables -- Solid wire electrodes, tubular cored electrodes and electrode/flux combinations for submerged arc welding of non alloy and fine grain steels – Classification	40.93	TC 44/SC 3
ISO/DIS 14174	Welding consumables -- Fluxes for submerged arc welding and electro slag welding – Classification	40.93	TC 44/SC 3
ISO/DIS 14341	Welding consumables -- Wire electrodes and deposits for gas shielded metal arc welding of non alloy and fine grain steels – Classification	40.99	TC 44/SC 3
ISO/FDIS 14343	Welding consumables -- Wire electrodes, strip electrodes, wires and rods for arc welding of stainless and heat resisting steels – Classification	50.20	TC 44/SC 3
ISO/DIS 14344.2	Welding consumables -- Procurement of filler materials and fluxes	40.99	TC 44/SC 3
ISO/NP 14732	Welding personnel -- Approval testing of welding operators for fusion welding and of resistance weld setters for fully mechanized and automatic welding of metallic materials	10.99	TC 44/SC 11
ISO/FDIS 15011-1	Health and safety in welding and allied processes -- Laboratory method for sampling fume and gases -- Part 1: Determination of fume emission rate during arc welding and collection of fume for analysis	50.20	TC 44/SC 9
ISO/FDIS 15011-2	Health and safety in welding and allied processes -- Laboratory method for sampling fume and gases -- Part 2: Determination of the emission rates of carbon monoxide (CO), carbon dioxide (CO2), nitrogen monoxide (NO) and nitrogen dioxide (NO2) during arc welding, cutting and gouging	50.20	TC 44/SC 9
ISO/FDIS 15011-3	Health and safety in welding and allied processes -- Laboratory method for sampling fume and gases -- Part 3: Determination of ozone emission rate during arc welding	50.20	TC 44/SC 9
ISO/CD 15011-5	321Health and safety in welding and allied processes -- Laboratory method for sampling fume and gases -- Part 5: Identification of thermal-degradation products generated when welding or cutting through products composed wholly or partly of organic materials	30.60	TC 44/SC 9
ISO/NP TS 15011-6	Health and safety in welding and allied processes -- Laboratory method for sampling fume and gases -- Part 6: Procedure for quantitative determination of fume from resistance spot welding	10.99	TC 44/SC 9
ISO/NP 15609-5	Specification and qualification of welding procedures for metallic materials -- Welding procedure specification -- Part 5: Resistance welding	10.99	TC 44/SC 6
ISO/NP 15614-13	Specification and qualification of welding procedures for metallic materials -- Welding procedure test -- Part 13: Resistance butt and flash welding	10.99	TC 44/SC 6
ISO/CD 15615	Gas welding equipment -- Acetylene manifold systems for welding, cutting and allied processes -- Safety requirements in high-pressure devices	30.60	TC 44/SC 8
ISO/DIS 17633	Welding consumables -- Tubular cored electrodes and rods for gas shielded and non-gas shielded metal arc welding of stainless and heat-resisting steels – Classification	40.20	TC 44/SC 3

ISO/FDIS 17635	Non-destructive testing of welds -- General rules for metallic materials	50.00	TC 44/SC 5
ISO/NP 17636-1	Non-destructive testing of welds -- Radiographic testing of welded joints -- Part 1: X- and gamma rays techniques with film	10.99	TC 44/SC 5
ISO/NP 17636-2	Non-destructive testing of welds -- Radiographic testing of welded joints -- Part 2: Computed testing	10.99	TC 44/SC 5
ISO/FDIS 17640	Non-destructive testing of welds -- Ultrasonic testing of welded joints	50.00	TC 44/SC 5
ISO/NP 17653	Destructive tests on welds in metallic materials -- Torsion test of resistance spot welds	10.99	TC 44/SC 6
ISO/NP 17654	Destructive tests on welds in metallic materials -- Resistance welding -- Pressure test on resistance seam welds	10.99	TC 44/SC 6
ISO/DIS 17672	Brazing -- Filler metals	40.99	TC 44
ISO/DIS 18274	Welding consumables -- Wire and strip electrodes, wires and rods for fusion welding of nickel and nickel alloys – Classification	40.20	TC 44/SC 3
ISO/CD 18275	Welding consumables -- Covered electrodes for manual metal arc welding of high-strength steels -- Classification	30.99	TC 44/SC 3
ISO/FDIS 18592	Resistance welding -- Destructive test of welds -- Method for the fatigue testing of multi-spot-welded specimens	50.00	TC 44/SC 6
ISO/PRF TR 20173	Welding -- Grouping systems for materials -- American materials	50.20	TC 44/SC 10
ISO/NP 22825	Non-destructive testing of welds -- Ultrasonic testing – Testing of welds in austenitic steels and nickel-based alloys	10.99	TC 44/SC 5
ISO/FDIS 23279	Non-destructive testing of welds -- Ultrasonic testing -- Characterization of indications in welds	50.00	TC 44/SC 5
ISO/DIS 24034	Welding consumables -- Solid wires and rods for fusion welding of titanium and titanium alloys -- Classification	40.20	TC 44/SC 3
ISO/CD TR 28821	Gas welding equipment -- Hose connections for equipment for welding, cutting and allied processes -- Listing of connections which are either standardised or in common use	30.99	TC 44/SC 8

* Stage Codes: **00.60** Close of review, **10.20** NP ballot initiated (Secr.), **10.60** Result of NP circulated (Secr.), **10.99** New project approved, **20.00** Project approved/registered, **20.20** WD study initiated, **20.60** Close of comment period, **20.99** WD worked out/ approved by WG, **30.20** CD study/ballot initiated, **30.60** Result of CD circulated (Secr.), **30.99** CD approved for registration as DIS, **40.20** DIS ballot initiated (ISO/CS), **40.60** Close of voting, **40.70** Results dispatched, **50.20** FDIS ballot initiated (ISO/CS), **50.60** Close of voting, Proof returned (Secr.), **50.70** Circulation of Formal Vote results, **50.99** Voting summary dispatched (CS), **60.60** Standard published (ISO/CS), **90.60** Close of review, **90.92** International Standard to be revised, **90.93** International standard confirmed.

Table 4. Standalone EN Projects.

CEN Standard	Title	Status CEN*
EN 287-1:2004	Qualification test of welders - Fusion welding - Part 1: Steels	
EN 910:1996	Destructive tests on welds in metallic materials - Bend tests	**
EN 1011-1	Welding – Recommendations for welding of metallic materials - Part 1: General guidance for arc welding	20.60
prEN 1289 rev	Non-destructive testing of welds - Penetrant testing of welds – Acceptance levels	10.99
prEN 1290 rev	Non-destructive testing of welds - Magnetic particle testing	10.99

prEN 1418 rev	Welding personnel - Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials	10.99
prEN 1598 rev	Health and safety in welding and allied processes - Transparent welding curtains, strips and screens for arc welding processes	10.99
prEN 1708-1	Welding - Basic welded joint details in steel - Part 1: Pressurized components	40.70
prEN 13133 rev	Brazing - Braze approval (prEN ISO 13585)	10.99
prEN 13134 rev	Brazing - Procedure approval	10.99
prEN 13507	Thermal spraying - Pre-treatment of surfaces of metallic parts and components for thermal spraying	40.70
EN 14610:2004	Welding and allied processes - Definitions of metal welding processes (to be replaced by "reworked" ISO 857-1)	Open
prEN 14751	Welding - Use of time-off light diffraction technique (TOFD) for examination of welds	10.99
prCEN/TR 15068	Gas welding equipment - Measurement of noise emitted by blowpipe for welding, cutting, heating, brazing and soldering - Measurement method	50.60
EN 15617	Non-destructive testing of welds - Time-off light diffraction technique (TOFD) - Acceptance levels	50.70
* Stage Codes: 10.99 New project approved, 20.60 Close of comment period, 40.70 Results dispatched, 50.60 Close of voting, Proof returned by secretariat, 50.70 Circulation of Formal Vote results ** To be replaced by ISO 5173:2009 as EN ISO 5173		

Table 5. Structure of CEN/TC121, Welding and allied processes.

CEN/TC121/SC1	Specification and qualification of welding procedures for metallic materials
CEN/TC121/SC1/WG8	Welding procedure approval testing for cladding
CEN/TC121/SC2	Qualification requirements for welding and allied processes personnel
CEN/TC121/SC3	Welding consumables
CEN/TC121/SC4	Quality management in the field of welding
CEN/TC121/SC4/WG1	Welding guidelines for ferritic steels
CEN/TC 121/SC5	Non destructive examination
CEN/TC121/SC5/WG1	Radiography of welds
CEN/TC121/SC5/WG2	Ultrasonic testing of welds
CEN/TC121/SC7	Equipment for gas welding, cutting and allied processes
CEN/TC121/SC8	Brazing
CEN/TC121/SC9	Health and safety in welding and allied processes
CEN/TC121/SC9/WG3	Welding curtains
CEN/TC121/SC9/WG4	Testing and marking of equipment for air filtration for welding and allied processes
CEN/TC121/SC9/WG5	Fume analysis data sheets
CEN/TC121/SC9/WG6	Procedure for quantitative determination of fume from resistance spot welding
CEN/TC121/WG13	Destructive testing

6. IIW and Standardisation in the field of welding

In parallel to ISO/TC44 there does exist another organisation accepted by ISO as international standardising body in the field of welding. That is IIW, the International Institute of Welding. The mission of IIW reads as follows: "To act as the worldwide network for knowledge exchange of joining technologies to improve the global quality of life."

The IIW Main Goals are:

- To identify, create, develop and transfer the best practices for sustainable development in a sustainable environment.
- To identify, develop and implement the IIW Education, Training, Qualification & Certification Programmes on a global basis.
- To promote the IIW and its Member Societies and services in various regions of the world for the common benefit of all.

And its Key Figures are:

- Conceived in 1947 and founded in 1948 by 13 countries, the IIW is today the largest worldwide network for welding and joining technologies.
- 53 Member Countries, representing experts in the various fields of welding and joining.
- Technical Commissions and Working Units.
- 34 Authorized National Bodies which have awarded more than 40,000 Diplomas since 1998 and 6,000 Diplomas in 2008.

Here it is not the place to explain IIW in detail, its history, its organisation etc. But it has to be mentioned that all the IIW Commissions and some other working units (**Table 6**) are noted to do standardisation work, but under the same rules as followed by ISO. The reason to accept another international standardisation body in the field of welding is the existing of IIW since 1948 and the availability of experts there that are not engaged in ISO.

Table 6. IIW Commissions and Select Committees that could do standardisation.

IIW Working Unit	**Title**
Commissions	
C-I	Thermal cutting and allied processes
C-II	Arc Welding and Filler Metals
C-III	Resistance welding, solid state welding and allied joining processes
C-IV	Power Beam Processes
C-V	Quality control and quality assurance of welded products
C-VI	Terminology
C-VIII	Health, safety and environment
C-IX	Behaviour of metals subjected to welding
C-X	Structural performances of welded joints - Fracture avoidance
C-XI	Pressure vessels, boilers and pipelines
C-XII	Arc welding processes and production systems
C-XIII	Fatigue Behaviour of welded components and structures
C-XIV	Education and training
C-XV	Design, Analysis and fabrication of welded structures
C-XVI	Polymer joining and adhesive technology
C-XVII	Brazing Soldering and Diffusion Bonding
Study Groups	
SG-212	The physics of welding
SG-RES	Welding research strategy and collaboration
Selected Committees	
SC-AIR	Permanent joints in new materials and coatings for aircraft engineering
SC-AUTO	Select Committee Automotive and Road transport
SC-QUAL	Quality Management in welding and allied processes
SG-SHIP	Shipbuilding
WG-STAND	Working Group Standardization

IIW standardisation projects can be found on the ISO web site by:
www.iso.org/ iso/ standards_development/ technical_committees/ other_bodies/ iso_technical_committee.htm? commid=55014, and clicking on "Work programme".

The Coordination of work in ISO/TC44, CEN/TC121 and IIW is done in the ISO/IIW Coordination Committee, once more to coordinate the work and to avoid duplication and competition.

Standards and Projects under CEN/TC121 and IIW lead are listed in Table 7 and 8.

Table 7. ISO/TC 44 Projects leaded by CEN/TC 121.

EN	ISO / IIW	Title	Status CEN*	Status ISO*
prEN ISO 15609-6		Specification and approval of welding procedures for metallic materials – Welding procedure specification - Part 6: Laser arc hybrid welding	10.99	
prEN ISO 15011-5	ISO/CD 15011-5	Health and safety in welding and allied processes - Laboratory method for sampling fume and gases - Part 5: Identification of thermal-degradation products generated when welding or cutting through products composed wholly or partly of organic materials	00.60	30.20
prEN ISO 15012-1 rev	ISO 15012-1 :2004	Health and safety in welding and allied processes - Requirements testing and marking of equipment for air filtration - Part 1: Testing of the separation efficiency for welding fume	00.60	90.92
prEN ISO 15012-3		Health and safety in welding and allied processes - Requirements, testing and marking of equipment for air filtration - Part 3: Determination of the capture efficiency of welding fume extraction devices	00.60	
prEN ISO 15614-1 rev	ISO 15614-1 :2004	Specification and qualification of welding procedures for metallic materials – Welding procedure test - Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614- 1:2004)	00.60	90.92
EN ISO 15614-1 / prAC	ISO 15614-1 :2004 / Cor 1:2005 ISO 15614-1 :2004 / Amd 1 :2008	Specification and qualification of welding procedures for metallic materials – Welding procedure test - Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1:2004)	10.99	90.92
prEN ISO 15653		Metallic materials – Method of test for the determination of quasi static fracture toughness of welds (ISO/DIS 15653:2006)	40.60	
prEN ISO 27508		Resistance welding – Method for the evaluation of the spot weldability of coated and uncoated weld bonded sheet materials	10.99	

* Stage Codes: 00.60 Close of review, 10.99 New project approved, 30.20 CD study/ballot initiated, 40.60 Close of voting, 90.92 International Standard to be revised

Table 8. IIW Standards and IIW Standardisation Projects.

ISO Standard Nr.	IIW Com-mission	Title	Status *
ISO 3580: 2004	II	Welding consumables -- Covered electrodes for manual metal arc welding of creep-resisting steels – Classification	90.92
ISO/DIS 3581	II	Welding consumables – Covered electrodes for manual metal arc welding of stainless and heat resisting steels – Classification	IIW
ISO/DIS 3690	II	Welding and allied processes -- Determination of hydrogen content in arc weld metal	40.20
ISO 6847: 2000	II	Welding consumables –Deposition of a weld metal pad for chemical analysis	90.93-2006

ISO 8249: 2000	II	Welding – Determination of Ferrite Number (FN) in austenitic and duplex ferritic-austenitic Cr-Ni stainless steel weld metals	90.93-2006
ISO/PRF TR 13393	II	Welding consumables – Hard facing classification – Microstructures	60.60
ISO 14343: 2002 + Amd.2006	II	Welding consumables -- Wire electrodes, strip electrodes, wires and rods for fusion welding of stainless and heat resisting steels -- Classification	90.92
ISO 14344: 2002	II	Welding and allied processes -- Flux and gas shielded electrical welding processes -- Procurement guidelines for consumables	90.92
ISO 14372: 2000	II	Welding consumables – Determination of moisture resistance of manual metal arc welding electrodes by measurement of diffusible hydrogen	30.99-2009
ISO 10447. 2006	III	Resistance welding -- Peel and chisel testing of resistance spot and projection welds	90.20
ISO 14270: 2000	III	Specimen dimensions and procedure for mechanized peel testing resistance spot, seam and embossed projection welds	90.93-2005
ISO/DIS 14271	III	Resistance welding -- Vickers hardness testing (low-force and micro hardness) of resistance spot, projection, and seam welds	40.20
ISO 14272: 2000	III	Specimen dimensions and procedure for cross tension testing resistance spot and embossed projection welds	90.93
ISO 14273: 2000	III	Specimen dimensions and procedure for shear testing resistance spot, seam and embossed projection welds	90.93-2005
ISO 14323: 2006	III	Specimen dimensions and procedure for impact shear and cross tension	60.60-2006
ISO 14324: 2003	III	Resistance spot welding – Destructive tests of welds – Method for the fatigue testing of spot welded joints	90.60-2008
ISO 14329: 2003	III	Resistance welding – Destructive tests of welds – failure types and geometric measurements for resistance spot, seam and projection welds	90.60-2008
ISO 14373: 2006	III	Procedure for spot welding on uncoated and coated low carbon and high strength steels	60.60-2006
ISO 16432: 2006	III	Procedure for projection welding of coated and uncoated low carbon steels	60.60-2006
ISO 16433: 2006	III	Procedure for resistance seam welding of coated and uncoated low carbon steels	60.60-2006
ISO/DIS 25239-1 to 5	III	Friction stir welding – Aluminium (Vocabulary, Design, Operators, WPQ, Quality and Inspection)	CEN/TC121 40.20
ISO/DIS 11699-1	V	Classification of X-ray film system for industrial radiography	Approved
ISO/DIS 11699-2	V	Industrial radiographic film – Control of film processing by means of reference values	Approved
ISO/AWI 22823	V	Classification of defects in metallic fusion welds	20.00
ISO 24497-1 to 3: 2007	V	Non-destruction testing – Method of metal magnetic (Vocabulary, Requirements, Inspection)	60.60-2007
---	V	Technical evaluation of black light equipment for manual application	Work in progress
---	V	General principles of radioscopic inspection of construction materials by X- and gamma rays. (a) Equipment. (b) Specific applications - welds, light alloy castings	Work in progress

ISO/NP TR 13392	IIIV	Health and safety in welding – Arc welding fume components related to welding processes and consumable type	10.99
---	IIIV	Health and safety aspects of welding – Health and safety checklist	10.99-2009
---	IIIV	Health and safety aspects of welding – Non-consumable thoriated tungsten electrodes	30.00-2009
ISO/TR 22824: 2003	IX	Welding consumables – Predicted and measured FN in specifications – A position statement of the experts of IIW Commission IX	60.60-2003
ISO/TR ---	IX	Comparison of preheat predictive methods	10.00-2009
ISO/TR ---	IX	Test procedure for creep crack initiation and growth testing of metallic materials	30.99-2009
ISO/PRF TR 14345	XIII	Recommendations on the fatigue testing of welded components.	30.99-2009
ISO 14347: 2008	XIII	Fatigue -- Design procedure for welded hollow-section joints -- Recommendations	60.60
ISO/WD 14731	XIV	A recommended practice for the approval of personnel employed in the supervision of welding	WD stage
* see footnote table 3			

7. European Market

In the European Union the harmonisation of the European Market is done mainly by European Directives.

EC directives define the “essential requirements”, e.g., protection of health and safety that goods must meet when they are placed on the market.

The European standards bodies have the task of drawing up the corresponding technical specifications meeting the essential requirements of the directives, compliance with which will provide a presumption of conformity with the essential requirements. Such specifications are referred to as “harmonised standards”.

Some of these harmonised standards have a strong relation to welding, see Table 9. In the case these product standards are the basis for contracts for manufacturers it is eminently important to consider the standards of CEN/TC 121 and/or ISO/TC 44.

Table 9. European Standards with relation to European Directives.

European Directive Nr.	**Title**	**Short Cut**
87/404/EEC	Simple Pressure Vessel Directive EN 286	SPVD
97/23/EC	Pressure Equipment Directive EN 13445	PED
99/36/EC	Transportable Pressure Equipment Directive div.	TPED
89/106/EEC	Construction Product Directive EN 1090	CPD
01/16/EC	Conventional Rail System Directive EN 15085	CRSD
96/48/EC	High Speed Rail Directive EN 15085	HSRD
98/37/EC 2006/42/EC	Machinery Directive div.	