

DVS

Competitive solutions for joining technology

DVS-up to date: “Welding Qualifications”



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www.the-joining-specialists.de

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Competitive solutions for joining technology

Welding Qualifications

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www.dvs-bildungsfuehrer.de
www.dvs-bildungseinrichtungen.de
www.dvs-ev.de/be-suche

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Credits for illustrations

DVS – German Welding Society

„Welding Qualifications“

The production of joined, including welded, products, requires special attention by the responsible parties. If joints were to give out, this might result in serious consequences, especially in case of seams. However, quality control of the joint can only be executed, if at all, in an incomplete manner or with enormous effort in case that destruction of the product is to be avoided during the process. For this reason, and in addition to non-destructive testing, additional methods are employed for quality control – especially in case of welded products. For products with safety aspects, this is even compulsory. Those methods may include the certification of joining-related production processes or staff as well as yield tests for all or random-selected products.

Owing to the increased use of welding technology for technical products, starting over 100 years ago, the producers and users of welded products recognized this problem. For the development and assurance of welding quality, the predecessor associations of the DVS were founded already as early as 1898, particularly on the prompting of the Chemical Industry and the then German Empirical Railway (Deutsche Reichsbahn).

Now as then, as will be in future, one of the main tasks of the DVS and its various sections is to support enterprises in the undertaking of creating unified rules for quality assurance of joining and especially also welded joints and the subsequent implementation of these rules.

In the field of policy definition, the DVS avails its technical expertise to political representatives in the areas of lawmaking and also supports federal and state governments in working out ordinances and creating standards committees at national European and international levels (DIN, CEN, ISO and IIW) and in working on these standards later on. The international unification of policies is the main focus here. Close contact of the association with its membership is an

absolute requirement to this end. They are the one who have the knowledge and experience. Involving firm staff in the respective panels is thus an essential aspect of our work.

Additionally, the DVS works on its own bulletins and guidelines where the expert knowledge of the DVS appears in bundled form and is made available to enterprises and experts as a supportive means. With its guidelines, the DVS implements, through the DVS system, requirements that were unified at international and European level but, in case of errors in the same, also national ones.

As part of the implementation process for the required measures, the DVS offers the following services throughout Germany and also for some other nations:

- Qualification of joining personnel through training, testing and certification in its own facility or some other facilities that are approved by it (DVS Pers-Zert®)
- Consulting of enterprises for creation of a quality management procedure after ISO 9001 and/or ISO 3834 and its certification (DVS ZERT® e.V.),
- Development of joining procedures and their qualification after relevant standards,
- Execution of destruction and non-destruction tests of the products (e.g. materials, components, welded joints etc.).

This bulletin provides an overview of what the DVS and its facilities, (Welding Training Bodies (SK), Schweißtechnische Lehranstalten (SL) und Schweißtechnischen Lehr- und Versuchsanstalten (SLV)) have to offer in the area of qualification for joining-and welding technology. ◀

Krefeld, March 2009

Prof. Dr.-Ing. Detlef von Hofe
Head CEN/TC 121 “Welding“

Overview

Company Qualifications

The term “qualification” covers the process of obtaining the relevant skills (qualifications) for fulfilling a given task or requirement. Qualification is an important method of quality management to assure stress-free business operation. One option for company qualification can be found in the standard DIN EN ISO 9001 “Quality Management Systems – Requirements”.

For “Welding-related qualification” the actual “welding” process is the focal feature for the quality requirements of the management system. In section 3.4.1, the DIN EN ISO 9000 standard says that the “process” is a “set of interrelated or interacting activities which transforms inputs into outputs.” More easily put, welding is a “special process”.

The DIN EN ISO 9001 standard constitutes a special guideline to cover all aspects of qualification of management systems in companies. For welding, since it is a special process, quality requirements are specified in the standards series DIN EN ISO 3834, Part 1 through Part 6, “Quality requirements for fusion welding of metallic materials”.

The end result, here, cannot be determined through testing of the finished component alone.

The standards series DIN EN ISO 3834 can be used independently of the DIN EN ISO 9001 for the qualification of welding operations. This standard, however, does not constitute a standard for quality management systems, as is the case for the DIN EN ISO 9001.

Types of Company Qualifications

The types of company qualifications are based on two different aspects:

1. Aspects that are subject to general legal requirements (in daily language, this is known as “legally not specified area” – this means that it is subject to general laws but not to specific laws related to the construction and building industries)

In laws like the Bürgerliche Gesetzbuch (BGB) or the Produkthaftungsgesetz (ProdHaftG), requirements for unified and lasting legal control within a given society are specified. These laws result in a general diligence and operational safety obligation for activities of all kinds. In 1903, this

diligence obligation was defined by the Reichsgericht in Leipzig as follows:

It constitutes an obligation to act – or omit activities – with the purpose of avoiding or decreasing – preventable – dangers for either direct users or third parties.

Further, burden of proof is on the manufacturer to clarify – in case of a faulty product – all relevant processes and to prove that he or she is blameless.

The manufacturer can meet his or her relevant obligations by applying the “Generally Approved Rules of Technology”. It is within the responsibility of the manufacturer to implement the respective measures for this.

2. Specific legal stipulations (known in day-to-day language as “legally specified area”)

Owing to legal stipulations, product standards or supplier agreements (specifications) application of the standards series DIN EN ISO 3834 can actually be specified. The relevant document must also show which parts of the DIN EN ISO 3834 are to be applied (Image 1).

The DVS and its bodies are available in a consulting function to the various firms, in the area of development of a quality management system while considered all the required specifications. DVS ZERT® e.V. offers a wide range of services regarding company qualification. This is done jointly with its partners, true to the motto “One stop for all”.

DVS ZERT® e.V.

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Qualification of the Welding Process

Securing product quality is one of the essential tasks of modern manufacture of technical products. To this end, we need to make sure that welding is executed in the most efficient manner possible and that all processes are suitably monitored. One means for this is a written process instruc-

tion, which is usually also one of the stipulations contained in the quality control standards.

The standards series “Requirements and qualification of welding procedures for metallic materials” DIN EN ISO 15607 to DIN EN ISO 15614 provides rules for process assurance with the goal of capturing all factors important to quality levels and hence to clearly describe the seam as a joining element, through identifying and qualifying information. Details can be found in table 1.

Proof of suitability of the welding procedure and its selected parameters must be furnished during production prior to the actual welding. There is the assumption that welding personnel is suitably trained and qualified.

Facilities offering Welding Qualifications

The SLVs – Schweißtechnische Lehr- und Versuchsanstalten provide a wide range of services in the area of welding technology. The various SLV facilities have available for consulting about and obtaining of welding qualifications a great number of staff and devices. ◀

Further information at: www.gsi-slv.de/dauerpunkte/standorte/

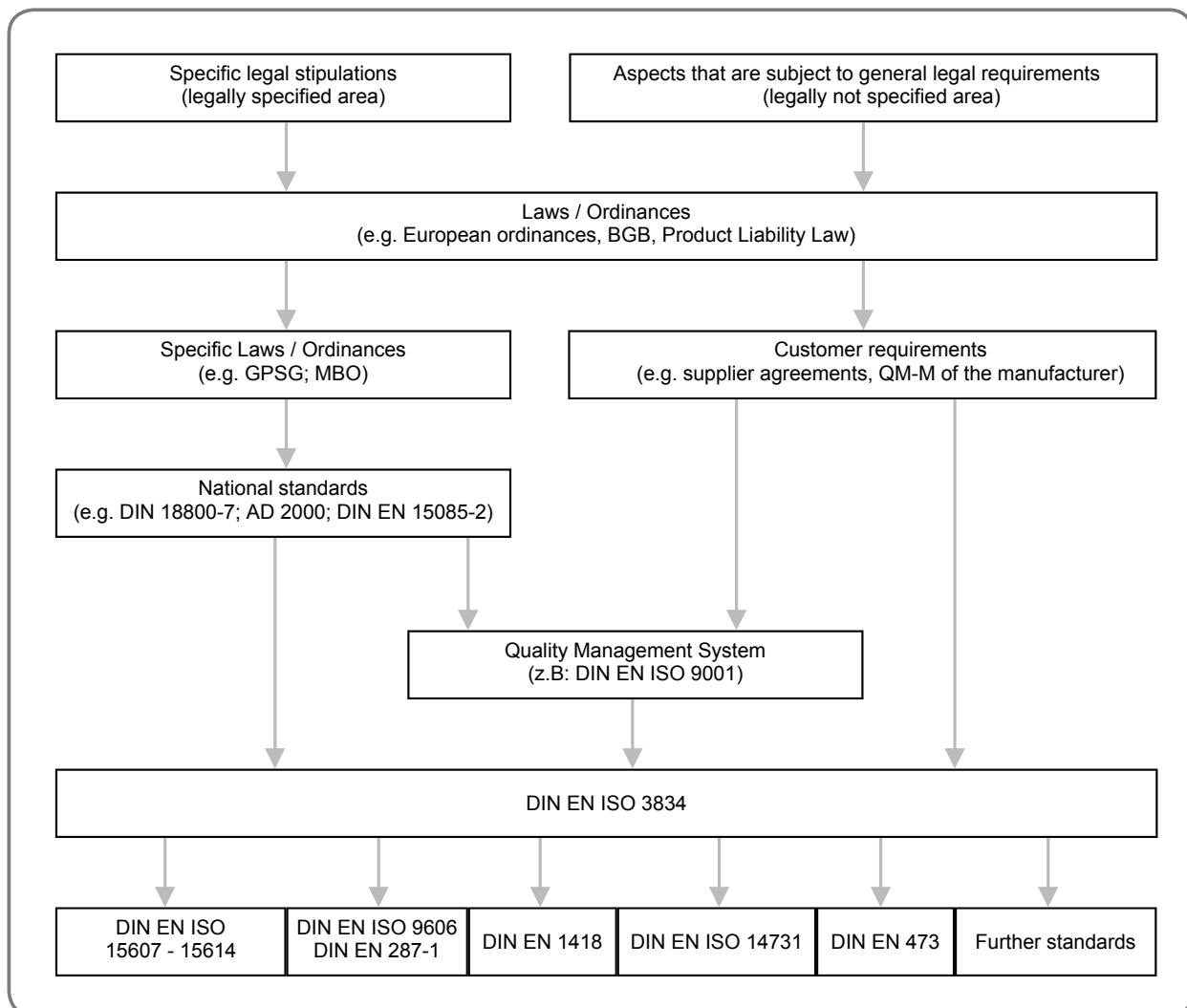


Image 1 Paths towards the application of welding standards

Overview

Process	Arc Welding	Gas Welding	Electron Beam Welding	Laser Beam Welding	Resistance Welding	Arc Stud Welding	Friction Welding
General Rules	15607*						
Guidelines for a grouping system	DIN CEN ISO/TR 15608			Not applicable		DIN CEN ISO/TR 15608	
WPS	15609-1*	15609-2*	15609-3*	15609-4*	15609-5*	14555*	15620*
Welding consumables	15610*		Not applicable				
Previous welding experience	15611*					15611*	15611*
Standard welding procedure	15612*				Not applicable		
Pre-production welding test	15613*					15613*	15613*
Welding Procedure Test	15614*	15614*	15614*		15614*	14555*	15620*
	Part 1: Steel / Nickel - Nickel alloys Part 2: Aluminium and its alloys Part 3: Non-alloyed and low-alloyed cast irons Part 4: Finishing welding of aluminium castings Part 5: Titanium, zirconium and their alloys Part 6: Copper and its alloys Part 7: Overlay welding Part 8: Welding of tubes to tube-plate joints Part 9: – Part 10: Hyperbaric dry welding	Part 1: Steel / Nickel – Nickel alloys Part 3: Non-alloyed and low-alloyed cast irons Part 6: Copper and its alloys Part 7: Overlay welding	Part 7: Overlay welding Part 11: Electron and laser beam welding		Part 12: Spot, seam and projection welding Part 13: Resistance butt and flash welding		
* These standards are DIN EN ISO standards							

Table 1 Detailed information on standards for requirements and qualification of welding procedures (According to appendix A of DIN EN ISO 15607)

Personnel Qualifications

The ability of welding staff to use knowledge and competence for economical production of quality welding products requires expert knowledge.

By expert knowledge or competence, we mean the ability to handle typical professional tasks and deal with situations in an independent and responsible manner, according to theoretical requirements. As a rule, the prerequisite for this is relevant training or further education.

In order to achieve trust into the welding production process and reliable execution of the same within the firm, staff welding-related activities must be clearly stipulated. These include, for instance, planning, execution, monitoring and control.

The DVS range of training services (see image 2) in the area of joining, cutting and coating builds on this and also on the fact that expert competency of staff, production economical level and product quality are inseparably connected. ◀

Further information at: www.dvs-bildungsfuehrer.de

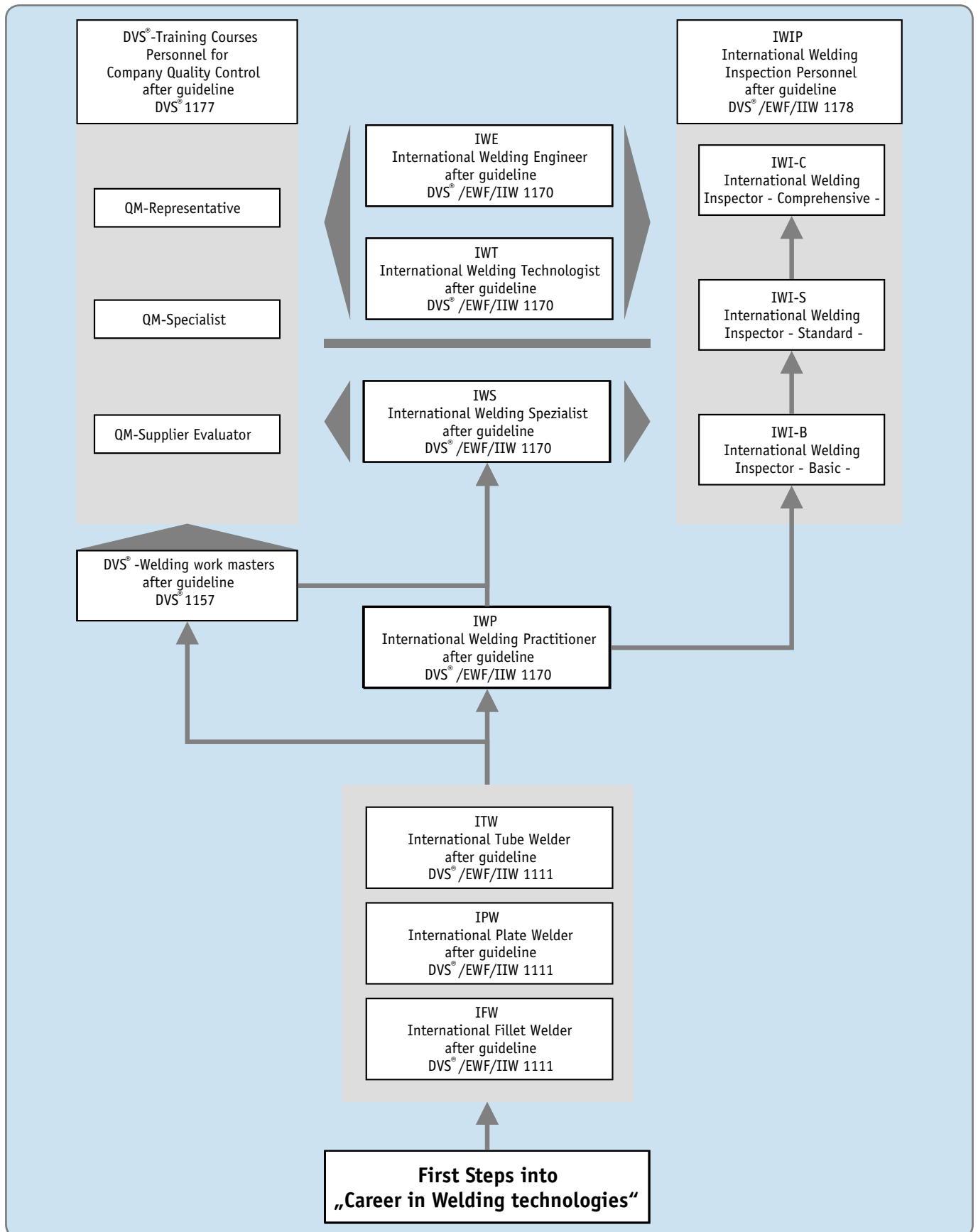


Image 2 "Training Paths in Welding"

Overview

Welder / Operator of Welding Facilities

A welder and/or operator of a welding facility ought to have suitable education and/or practical industrial experience in the relevant branch. That person needs to have the ability to follow verbal or written instructions in order to secure quality stipulations of welded products. Confirmation of this ability is through a manual skills test of the welder and through a test of the operator of welding facilities. Uniform rules for the test and/or exam are specified in the standards.

The validity of a welder's qualification according to DIN EN 287-1 begins from the date of welding of the test piece(s). The welder's qualification test certificate issued is valid for a period of two years. On condition that the welding coordinator or the responsible personnel of the employer can confirm that the welder has been working within the initial range of qualification. This shall be confirmed every six months.

The validity period of the operator examination correspond to a large extent to the rules of the DIN EN 287-1.

Training and Examination

All DVS® approved educational institutions, like so-called Schweißtechnische Kursstätten (SK's) or Schweißtechnische Lehranstalten (SL's) or Schweißtechnische Lehr- und Versuchsanstalten (SLV's) are equipped for training to the level of welder/operator. The DVS® educational institutions network encompassing more than 300 facilities for joining technology. There, you will find opportunities for training or further education of various levels and directions.

Welding Supervisory Personnel

Die DIN EN ISO 14731 "Welding coordination - Tasks and responsibilities" specifies quality-related responsibilities and tasks, including coordination of welding activities (Table 2).

Accordingly, the manufacturer must name at least one supervisor. However, within the manufacturer's organisation, it is also possible to name more than one supervisor.

Training and Examination

Welding supervision staff is trained through all levels, up to welding expert engineer, at the Schweißtechnische Lehr- und Versuchsanstalten (SLV's) of the DVS. At the Schweißtechnische Lehranstalten (SL's) of the DVS, training level is up to welding expert.

Inspection staff for non-destructive testing

DIN EN 473:2008-09 „Non-destructive testing - Qualification and certification of NDT personnel - General principles“ contains stipulations for the different staff levels and distinguishes between qualification and certification of the staff.

Whether qualified or certified inspection staff is required is outlined via contract and can be found either in the specifications or the operational policies.

Training and Examination

Inspection staff for non-destructive testing is trained at the Schweißtechnische Lehr- und Versuchsanstalten (SLV's). ◀

Technical knowledge level after DIN/ISO 14731	IIW Training DVS®/EWF/IIW Guideline 1170
Encompassing technical knowledge	International Welding Engineer IWE
Specific technical knowledge	International Welding Technologist IWT
Basic technical knowledge	International Welding Specialist IWS

Table 2 Arrangement of levels of training and corresponding technical knowledge after section 6.2 of DIN EN ISO 14731 about IIW training of welding supervisory personnel

Further information is available at: www.dvs-bildungsfuehrer.de

The Research Association on Welding and Allied Processes of DVS

The core activity of the Research Association on Welding and Allied Processes of DVS is the cooperative industrial research (IGF) in which companies, corporate bodies and research institutes from the various fields of joining technology actively take part. The Research Association is divided into 13 expert committees (FAs) with specific subject-related main focal points. The companies agree upon the need for cooperative research and define main focal points for pioneering research which the research institutes involved convert into concrete research projects without delay. The cooperative

industrial research achieves optimum closeness to the application and permits the direct utilisation and implementation of the results. The collaboration of industry means that know-how is transferred at an early stage and that the research work and the utilisation of the results are parallelised. IGF research projects may be promoted from funds of the Federal Ministry of Economic Affairs and Technology (BMWi) via the "Otto von Guericke" Federation of Industrial Research Associations (AiF). ◀



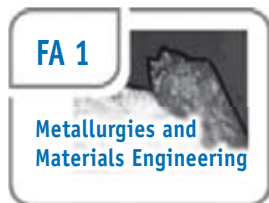
Managing Director

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 Phone: 0211 - 1591 - 173 | Fax: -200
 Email: jens.jerzembeck@dvs-hg.de

Further information at: www.dvs-ev.de/fv

Research Projects (Selection)

Completed Research Projects



Expert Committee 1 "Metallurgies and Materials Engineering"

Investigations into quality-assured arc welding of high-silicon, high-alloy materials

DVS-Nr.: 01.011 / IGF-Nr.: 10.625 B

Institutes involved:

Prof. Dr.-Eng. I. Martinek
Otto-von-Guericke University at Magdeburg, Institute of Joining-and Beam Technology

Process integrated heat treatment under sensor guidance for quality assurance during cast-steel contact welding

DVS-Nr.: 01.242 / IGF-Nr.: 29.100 D

Institutes involved:

Prof. Dr.-Eng. V. Wesling
Clausthal University of Applied Sciences Institute for Welding and Machinery



Expert Committee 3 "Arc Welding"

Mini radar sensor as low-cost sensor for quality assurance during gas-shielded welding

DVS-Nr.: 03.027 / IGF-Nr.: 10.928 B

Institutes involved:

Prof. Dr.-Eng. habil. K.-J. Matthes
Chemnitz University of Applied Sciences, Institute of Production Engineering and Welding Technology

An arc sensor as quality assurance element for constant root weld seams and even welding through

DVS-Nr.: 03.030 / IGF-Nr.: 11.007 N

Institutes involved:

Prof. Dr.-Eng. D. Rehfeldt
Fachgebiet „Fügen durch Stoffverbinden“,
Universität Hannover bis 31.12.2002 (Ruhestand)

Investigations into the qualification of plasma powder joint welding of aluminium for industrial applications

DVS-Nr.: 03.052 / IGF-Nr.: 12.751 B

Institutes involved:

Prof. Dr.-Eng. V. Wesling
Clausthal University of Applied Sciences, Institute for Welding and Machinery

Dr.-Ing F. Barthelmä

Society for Production Engineering and Development
Schmalkalden e.V.

Qualification and utilization of hybrid-synergy effects for high-performance welding of light metals

DVS-Nr.: 03.056 / IGF-Nr.: 13.783 N

Institutes involved:

Prof. Dr.-Eng. U. Reisgen
RWTH Aachen, Institute of Welding- and Joining Technology



Expert Committee 5 "Special Welding Processes"

Quality assurance of MSG welding processes through computer-supported welding data monitoring and logging

DVS-Nr.: 05.149 / IGF-Nr.: 23.000 Q

Institutes involved:

Prof. Dr.-Eng. U. Reisgen
RWTH Aachen, Institute of Welding- and Joining Technology

Technical Committee (Aft) of DVS

The technical-scientific cooperative work of DVS is predominantly determined by the activities of its Technical Committee (Aft) with its working bodies oriented to specific subjects. Specialists from the economic and scientific fields, from authorities and from other areas collaborate in them. The Technical Committee promotes the active exchange of experience amongst experts, describes the state of the art by elaborating and contributing to the preparation of a set

of technical rules (DVS technical bulletins, technical codes, guidelines and standards) and is actively involved in the technical development of welding and the allied processes such as brazing/soldering, thermal spraying, adhesive bonding, mechanical joining and plastics joining. Joint committees with the Standards Committee for Welding Technology of DIN also exist for this purpose. ◀

Further information at: www.dvs-aft.de

Community Panel DVS AG Q 2 / DIN NA 092-00-04 AA “Quality Control for Welding”

Chairman:

Dipl.-Eng. Jochen Mußmann
Fachverband Dampfkessel- Behälter- und
Rohrleitungsbau e.V.

Vice Chairman:

Eng. Herbert Flory
ALSTOM Power Energy Recovery GmbH

Secretary:

Dipl.-Eng. Michael Metzger
Tel.: 0211 / 1591-177 Fax: -200
Email: michael.metzger@dvs-hg.de

Website: www.dvs-aft.de/Aft/Q/Q2

Quality cannot be obtained via verification - it must be made!

To this end, the DVS / DIN community panel “Quality Control for Welding” supervises the creation, by experts from industry and trade, as well as from research and development institutions, of DVS-bulletins and guidelines, national and international standards and other policies.

This encompasses the areas of welding instruction, procedure testing, approval tests for welding installations, quality requirements and evaluation groups as well as the execution of welding joints including recommendations for welding of metallic materials.

The working group Q 2 considers itself a mirror panel of the working units of the International Institute of Welding (IIW):

- SC QUAL “Quality control for welding and allied processes”
- XIII “Fatigue behaviour of welded components”
- XV “Design, analysis and fabrication of welded structures”. ◀

Technology

Essential work results (selection)

DVS-Bulletins and Guidelines

DVS 0703 Limits for imperfections of fusion-welded joints according to DIN EN ISO 5817
Published: Juli 2008

DVS 0706 Evaluation criteria for butt welds and fillet welds after EN 30042/ISO 10042 – Aluminium materials
Published: December 1994

DVS 0709 Surface texture requirements of steel joints for non-destructive inspection procedures
Published: March 1995

DVS 0711 Areas of responsibility and authority; welding supervisors after DIN EN 719
Published: March 1994

DVS 0714 Welding operation requirements for calibration of welding installations
Published: Februar 1996

DVS 0716 Welding operation requirements after European standards and directives – Product requirements
Published: March 1997

DVS 0718-1 Evaluation of fracture planes for fusion welding joints of metallic materials – steel butt welds and fillet welds
Published: August 2000

Standards

DIN EN 1011 Teil 1-8
Welding - Recommendation for welding of metallic materials

DIN EN ISO 3834 Teil 1-6
Quality requirements for fusion welding of metallic materials

DIN EN ISO 5817
(2006-10) Welding - Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) - Quality levels for imperfections

DIN EN ISO 15607 – 15614
Specification and qualification of welding procedures for metallic materials

Specialist Books (In German only)

Specialist Book Series Welding Technology Volume 98
Quality Control – Manual: Quality control for small and medium-sized welding operations
Published: 2008

Specialist Book Series Welding Technology
Product liability and guarantee in welding
In preparation

DIN/DVS Paperbacks
Quality requirements for fusion welding of metallic materials – Comment to the standards series DIN EN ISO 3834
Published: 2007

The specified publications can be purchased via DVS Media GmbH:

DVS Media GmbH · Aachener Straße 172 · D-40223 Düsseldorf · Tel.: 0211 / 1591-162 · media@dvs-hg.de · www.dvs-media.info

Education Committee (AfB)

Personnel qualification in DVS

The Education Committee (AfB) of DVS elaborates and structures the range of training and further education offered by DVS in the fields of joining, cutting and coating. It follows tendencies and trends as well as concrete developments in the education sector and evaluates their effects on society in general and on the areas of joining, cutting and coating in particular. AfB is oriented to the latest state of the art

and to the needs of the German economy. Due to the close network of DVS, the structures of the society are used optimally, the latest findings are exchanged across bodies and there is feedback about the current needs. DVS thus offers the expert world of joining technology, members and interested people a comprehensive range of competitive solutions for joining technology.

Further information at: www.dvs-afb.de

Community Panel DVS AG Q 5 / DIN NA 092-00-02 AA “Qualification of personnel for welding and allied processes”

Chairman:

Dipl.-Ing. Jörg Mährlein
Schweißtechnische Lehr- und Versuchsanstalt SLV Duisburg

Vice Chairman:

Dipl.-Ing. Andreas Otte
HWK Ostwestfalen-Lippe zu Bielefeld

Secretary:

Dipl.-Ing. Michael Metzger
Tel.: 0211 / 1591-177 Fax: -200
Email: michael.metzger@dvs-hg.de

Website: www.dvs-aft.de/AfT/Q/Q5

The DVS / DIN community panel “Quality Control for Welding” supervises the creation, by experts from industry and trade, as well as from research and development institutions, of DVS-bulletins and guidelines, national and international standards and other policies for the qualification of welders, operators, fitters and personnel with responsibility for welding coordination.

The working group Q 5 considers itself a mirror panel of the working units of the International Institute of Welding (IIW):

- SC QUAL “Quality control of welding and allied processes”
- XIV “Education and training”
- IAB Group A “Training, examination”

Education

DVS-PersZert®

DVS-PersZert® is a partner in personnel qualification of experts and management persons in the area of joining, cutting and coating. Like any other product or service, personnel qualification is also subject to specific quality criteria. This applies to the content to be conveyed as well as to the manner of conveying. Further important factors are both spatial and equipment related conditions of the education institutions as well as the qualification of the teachers and/or trainers. Only when quality standards are high, the client can be sure to obtain adequate performance for his money.

On behalf of the DVS, the DVS-PersZert® independently looks after all matters related to the qualification of personnel after national, European and international standards and directives. DVS-PersZert® is accredited by the Trägergemeinschaft Akkreditierung GmbH (TGA), Frankfurt, for the non

legalised and by the Zentralstelle der Länder für Sicherheitstechnik (ZLS), Munich, for the legalised areas after DIN EN ISO/IEC 17024 as a certification authority for personnel in the areas of joining, cutting and coating. Further, the DVS educational institutions are officially acknowledged according to the AZWV – approval and certification ordinance – further education – and as thus meet the requirements for being „Träger von Weiterbildungsmaßnahmen“ after § 84 of the German Sozialgesetzbuch (SGB) III.

Further, DVS-PersZert® is approved by the International Institute of Welding (IIW), Paris, as well as the European Federation for Welding, Joining and Cutting (EWF) as an Authorised National Body (ANB) for training and examination according to their guidelines. ◀

Essential work results (selection)

DVS®-Training Guidelines

DVS®/EWF/IIW 1111 International Welder (IW) Minimum requirements for the education, training, examination and qualification of welding personnel
Published: July 2004

DVS® 1146 DVS®-Course Reinforced steel welding – welding of reinforced steel after DIN EN ISO 17660 Part 1 for the processes 111, 114, 135 and 136
Published: September 2007

DVS® 1157 DVS®-Course DVS® Welding Work Master
Published: March 2006

DVS®/EWF/IIW 1170: Personnel with Responsibility for Welding Coordination
Published: October 2008

- International Welding Engineer (SFI/EWE/IWE)
- International Welding Technologist (ST/EWT/IWT)
- International Welding Specialist (SFM/EWS/IWS)
- International Welding Practitioner (SP/EWP/IWP) ◀

Standards (Selection)

DIN EN 287-1

(2006-06) Qualification test of welders - Fusion welding - Part 1: Steels

DIN EN ISO 9606 Teil 2-5

Qualification test of welders - Fusion welding

DIN EN 1418

(1989-01) Welding personnel - Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials

DIN EN ISO 14731

(2006-12) Welding coordination - Tasks and responsibilities

DVS information brochures

As a new service, DVS is offering its members and all the interested people bundled technical information about various subject areas in joining technology with the portfolio of services from DVS. The information brochures prepared in two languages (German/English) include not only detailed explanations about the respective main focal points including a description of the development potential but also valuable explanations about the activities and available work results of DVS in the fields of research, technology and education.

The brochures which have been published until now are available to you for downloading.

www.dvs-ev.de/dvs-aktuell-ftb

Printed copies can be requested by e-mail (aft@dvs-hg.de).

