

RESEARCH | TECHNOLOGY | EDUCATION

IN FOCUS

Resistance Welding in DVS

The technical-scientific cooperative work in DVS

DVS is a technical-scientific association that is fully committed to joining technology, with nearly 120 years of experience under its belt. In other words: at DVS, everything revolves around joining, cutting and coating of metallic and non-metallic materials and material composites. The objective of all DVS activities is to comprehensively promote joining technology. This is done in many different ways.

DVS initiates and accompanies research activities, grasps the current state of the art, develops it continuously and makes sure that the DVS training and continuing education offerings, too, reflect the respectively latest state of knowledge from technology and research. This narrow network made up of research, technology and education is the core element of the technical-scientific cooperative work in DVS.

True to the principle „one becomes three“ technical discussions, research questions, or work results are communicated across the various departments, which is why they also mutually positively influence one another. With this interdisciplinary approach, DVS guarantees that its varied work results will always be based on the latest findings and are mutually compatible with each other.

An impressive example of this successful working philosophy is being documented by DVS set of rules, consisting of DVS Technical Bulletins and DVS Technical Codes. For the training and continuing education, DVS set of rules sets high training

standards and comparable qualifications. In the technical areas, joining, cutting and coating methods, however, also aspects of testing and quality assurance, industrial safety and environmental protection as well as the added upstream and downstream process stages are being currently described. The foundations for the highest standards and uniform procedures are specified by DVS set of rules.

With the series of booklets titled “In Focus”, we would like to demonstrate to you with the help of specific examples which practically oriented results the technical-scientific teamwork produces in DVS and would like to invite you to get involved in the varied activities in DVS. Every booklet is dedicated to a central topic of interest and shows how the close connection between research, technology and education in DVS not only benefits the respective industry but the entire industrial location of Germany. DVS offers competitive solutions for joining technology – the work results are published among other things by DVS Media GmbH in trade journals, reference books and other publications and are therefore made accessible to the professional circles.

Dipl.-Ing. Jens Jerzembeck
Head of Research and Technology

Photo: Fotolia



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Resistance welding

Resistance welding, known to man for over 150 years, is a tried and tested joining technique of great value. It is the dominating joining technique for thin metal sheet and wire applications and nowadays is firmly established in industrial production along with its process varieties of spot welding, projection welding and resistance roller seam welding as well as resistance butt welding and flash welding, for instance in the sheet metal processing industry (focus on: vehicle construction), electronics industry (small parts- and micro welding) and for the construction of reinforced steel mesh, industrial grids, rails and chains.

In competition with other joining techniques, the following tendencies are recognizable in the area of resistance welding:

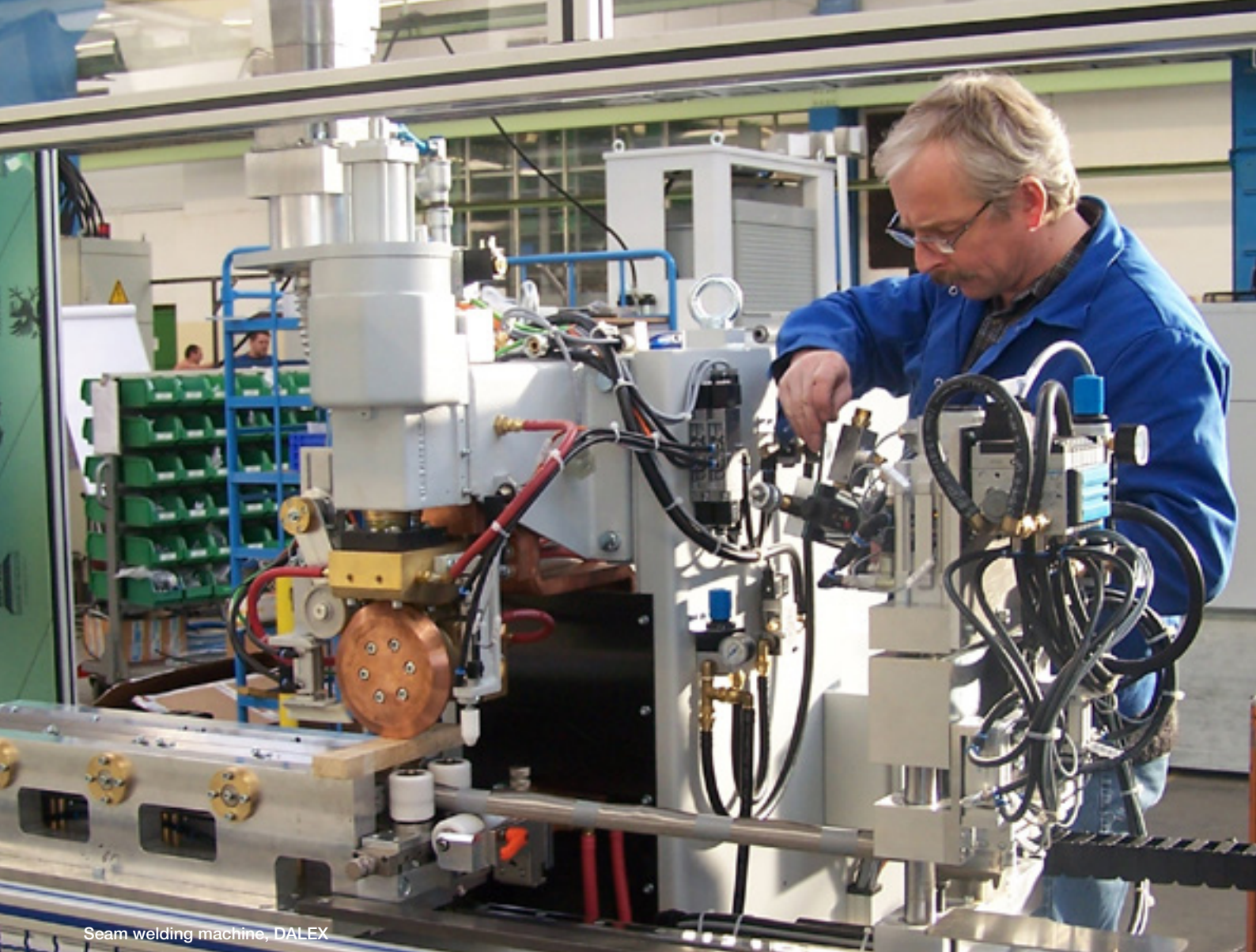
- In the thin sheet metal area, especially for automotive body construction, resistance spot welding will continue to defend its strong position - on account of its high level of both process reliability and productivity - despite stiff competition from beam procedures, automated joining technology or adhesive bonding.
- Process reliability will continue to increase also during joining of aluminium alloys and novel steel materials, due to optimisation of welding processes and through improved instrument engineering.
- Increased use of medium-frequency inverter technique (Advantages, for example, include short welding times due to high output densities or the particular suitability for aluminium welding, and welding of austenitic and/or surface refined steels)
- Use of high-performance robotic welding pliers for aluminium resistance spot welding

Dipl.-Ing. Ralf Bothfeld,
Harms und Wende GmbH & Co. KG
Chairman of Working Group
"Resistance Welding" (AG V 3) at DVS

- Improved and increased use of control devices for quality control and decrease of inspection effort.
- Increased application of the hybrid joining process of weld bonding for joining characteristics improvement under dynamic stress situations.
- Further advances in welding process simulation techniques (Integration in process chains).
- Further advances in DC technology for resistance butt welding and flash welding machinery (Trend toward the use of direct current since, with the same primary power, a higher secondary current can be achieved and thus the welding time can be reduced)

The following pages will provide comprehensive information about the contents of the technical-scientific cooperative work and the work results in the area of „resistance welding“.

Dr.-Ing. Karl Pöll,
Matuschek Meßtechnik GmbH, Alsdorf
Chairman of Expert Committee "Resistance Welding"
(FA 4) in the Research Association of DVS



Seam welding machine, DALEX

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The DVS regulatory framework on „Resistance Welding“ provides extensive application-oriented information on processes, quality assurance, testing, construction, training, materials, etc., and also defines special requirements that are placed on professionals in the field of resistance welding.

Through the interdisciplinary collaboration between the Research Association of DVS, the Technical Committee and the Committee on Education, an established and recognized global DVS regulatory framework has been created that represents a closed system in itself.

DVS members have free access under: www.dvs-regelwerk.de

Research at DVS

The Research Association on Welding and Allied Processes e. V. of DVS

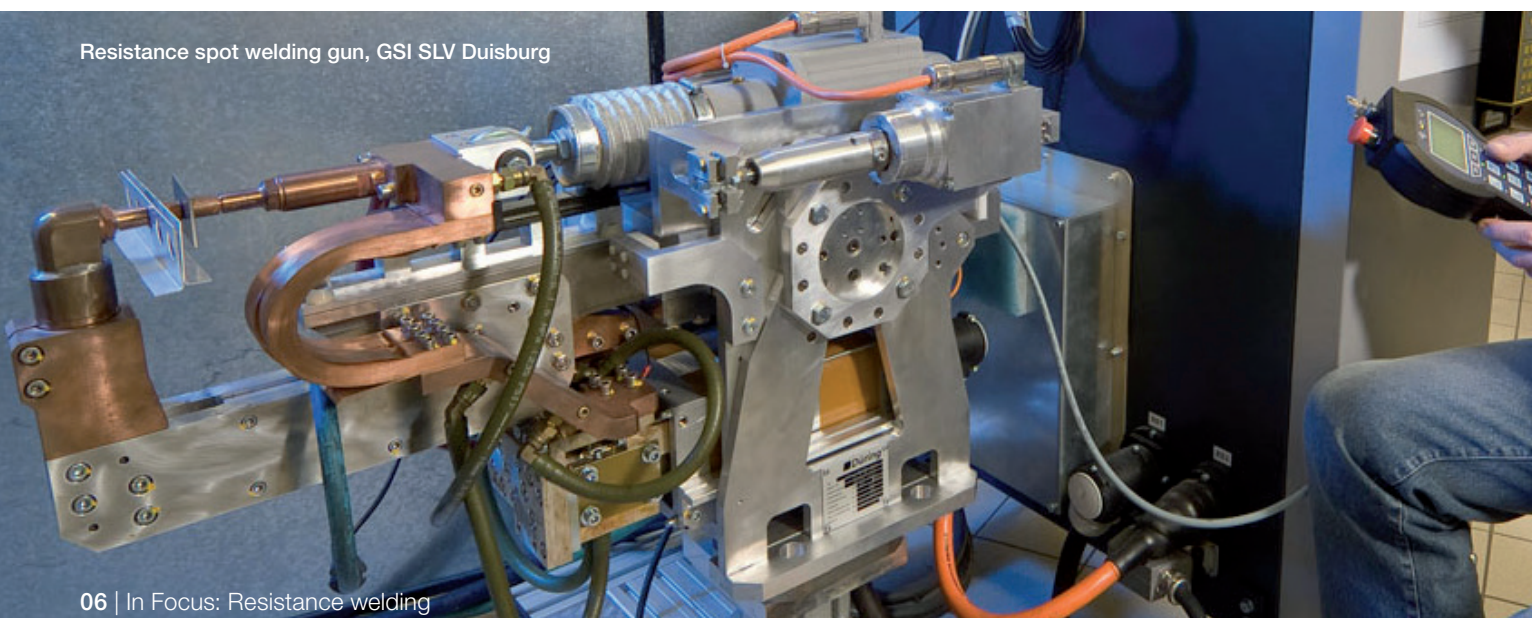
At the core of the Research Association on Welding and Allied Processes e. V. of DVS, there are the expert committees (FA). They are respectively assigned to a given department and as a result have a clearly defined thematic orientation. The functions of the expert committees are defined clearly: They are the interfaces assimilating the knowledge from enterprise, industry, trade and workmanship from the research centres, from the research association itself and from DVS. Each of them contribute their own individual specialist knowledge to the work of the expert

committees, something that means that practically oriented re- search projects and results can be guaranteed from the outset. This is because it is the task of the expert committees to derive research requirements within their respective specialist department and to communicate the results of the respective research. Therefore, the expert committees of the research association of DVS are also involved in all phases of a given research project. They initiate and plan the projects, guide and control their implementation and finally evaluate the results.



Expert Committees of the Research Association of DVS

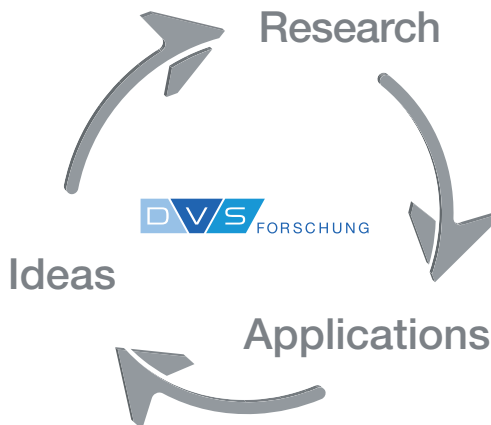
Resistance spot welding gun, GSI SLV Duisburg



Cooperative industrial research

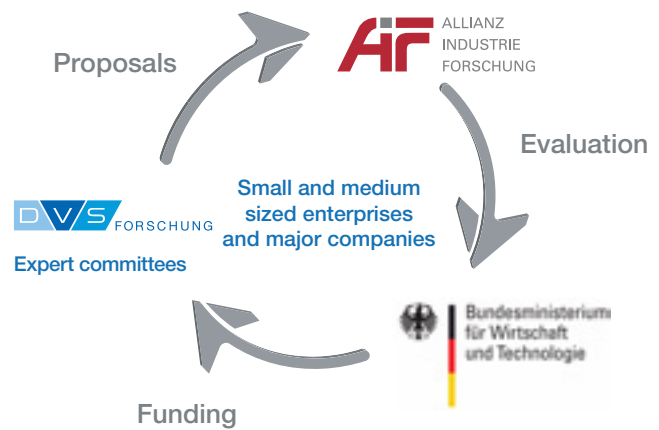
The core activity of the Research Association is the Cooperative Industrial Research (IGF), which orients itself above all on the interests of small to medium-sized enterprises from the joining technology industry which frequently lack the means for own research activities. Via the IGF, these it is possible to intercept these disadvantages that exist for structural reasons and to convert them into real competitive advantages because IGF combines the aspects of minimised economic risk with major research potential.

Core competence of the IGF is the close integration of theory and practice: Requirements that are formulated directly from operational practice form the basis for the research activities. In view of joining-related research, these requirements are announced within the individual expert committees of the research association. In the second step, the research priorities will be derived from this and these will be subsequently investigated by different research institutes in the form of research projects. Owing to the permanent communication with the expert committees and the active cooperation of enterprises going along with it during all the various phases, the aspect of a practically oriented research project always remains guaranteed. In addition, the cooperation of enterprises with the IGF gives rise to a swift knowledge transfer and hence also a parallelism of research and results exploitation. This is because the enterprises can investigate the initial results from the research directly for their practical usefulness and report their findings from this back to the research centres.



Research from practice for practical use:
The principle of the cooperative industrial research

The funding of the research projects takes place via the AiF – Federation of Industrial Research Associations „Otto von Guericke“ e. V. from funds provided by the Federal Ministry of Economic Affairs and Technology (BMWi).



Partners and implementation of the Cooperative Industrial Research

In this context, too, the expert committees of the research association assume important functions for they are the ones to decide which research projects are important for the joining industry and, hence, should be recommended for implementation. These research requirements are finally evaluated by a professional appraiser process of the AiF and, in the event of a positive decision, are recommended to the BMWi for implementation.

Given the complex processes within joining-based cooperative research, the interface functions of the expert committees within the research association manifest in a variety of ways. The way in which these expert committees perform their tasks, however, can be summarized under one umbrella heading: „Research from practice for practical use“.

i For more information and updates on the work of the Research Association on Welding and Allied Processes e. V. of DVS, please see: www.dvs-forschung.de

Expert Committee 4 “Resistance Welding”

Fundamental principles and research fields

The Expert Committee is composed of experts from industry and academia. Renowned companies of manufacturers and users implement current research needs together with the lead research centres in Germany.

Process optimisations are one of the focal areas of the work of this technical committee, especially the competition with other joining techniques like, for instance, laser beam welding.

However, hybrid joining technique manufacturing approaches are also considered, e.g. weld bonding.

The following fields of research are currently within the scope:

- As part of the quality assurance, contents are worked on concerning quality control/non-destructive testing and welding process control/ online testing
- Research into occupational safety continues to remain of essence (EMC/EMCE and further occupational safety aspects)
- Parameter definition also remains an ongoing task. These also serve for application in simulation processes and for product optimisation
- Small parts welding in electrical engineering and precision engineering
- Approaching joining technology as part of the overall production chain, especially in connection with an upstream forming process or a downstream coating process, is a major focus
- High and maximum strength steels (with coatings) in combination with soft steel materials
- Incorporation of further current topics



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You will find an overview of other current or completed research projects under www.dvs-forschung.de/forschungsergebnisse

Titan Grd. 1 welded with medium frequency (1.000 Hz)
 $F = 2,5 \text{ kN}$, $I = 7,0 \text{ kA}$, $t = 1.800 \text{ ms (!)}$, Dieter Mittelberg

How applied research works – an example

Research Topic:

“Improving process reliability of weld bonding of aluminium materials and determination of joining parameters for construction and simulation”

Research Centre:

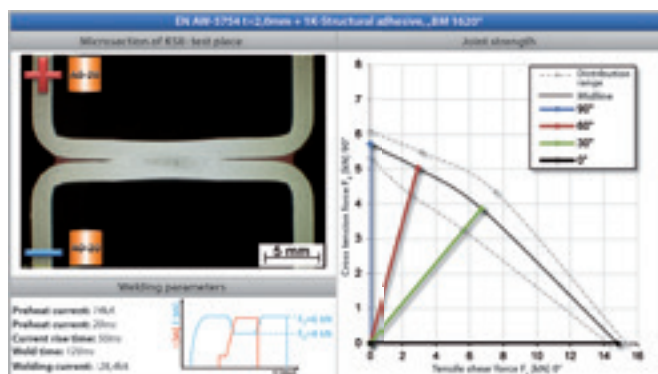
SLV Duisburg Niederlassung der GSI mbH, Duisburg

Runtime: 01.10.2010 - 30.06.2012

IGF-No.: 16.335 N / **DVS-No.:** 4.050

Starting situation:

The hybrid joining process of weld bonding is successfully used with steel materials in car body shell manufacturing. Short cycle times and lower joining forces in comparison to mechanical joining processes are aspects that favour resistance spot welding even for aluminium. The advanced inverter technology, special process control systems and the possibility to take advantage of electricity and power programs open up new possibilities for the spot welding of aluminium. The question of whether these new system technologies can be used advantageously for joining of aluminium materials has been the object of the research project.



Objectives:

The essential objectives of the research project were as follows

- to compile the foundations for a reliable weld bonding of aluminium materials by means of novel systems and control engineering for industrial applications
- to determine the procedural limitations for the weld bonding of aluminium materials as well as the influence of the adhesives and the process procedure on the quality of the joint
- to determine specific values for the construction and calculation of the weld bonding joints
- to compile notes for the reliable production of weld bonded structures made of aluminium materials

The specific features of the test materials and the adhesives has been demonstrated and the joining quality was evaluated. By way of example, the figure shows the connection strengths under all four load angles and the corresponding polished micrograph section.

Findings:

Overall, the potential of the hybrid technology was clearly demonstrated by the study. Based on the examined boundary conditions, reliable weld bonding of aluminium with high strength bonding is possible. These studies serve the user as an evaluation aid during production. Comparisons between test materials and adhesives were identified and the joining quality was evaluated.

Connection strengths under all four load angles and polished micrograph section

References from the industry

Dipl.-Ing. Ralf Bothfeld,
Managing Director Harms & Wende GmbH & Co. KG:

For us as control and process specialists for resistance welding, the project will enrich our own research and has helped to further develop the approaches to regulation and process control in resistance welding of aluminium.

Harald Schmidt, Product Manager Welding Technology
AEG SVS Schweißtechnik GmbH:

The Weld Bonding project is beneficial for us as a KMU since this process is becoming increasingly popular with our customers and more and smaller enterprises precisely have no experience or instructions issued to them in this still very specific process. With this project, at least the basics of weld bonding of aluminium are being presented.

Technology at DVS

Technical Committee

In view of currently more than 250 different joining processes, whose numbers continue to increase, the technical-scientific cooperative work of DVS can and must be done systematically. Guarantor for this is the Technical Committee (AFT) with its more than 200 subject-oriented working bodies. The AFT unites more than 2,000 specialists from the economic and scientific fields,

from authorities and from other areas, that are work together to capture the state of the art and continuously advance it.

The fact that DVS, with this bundled up specialist knowledge, is also recognized in international circles as a sovereign and competent partner in all questions relating to joining technology is obvious. Through its involvement in the International Institute of Welding (IIW) and the EWF - European Federation for Welding Joining and Cutting, DVS decisively supports the international joining technology network in its activities.

International partners of DVS:

DIN	German Institute for Standardization
CEN	European Standards Committee
ISO	International Standards Organisation
IIW	International Institute of Welding
DIBt	German Institute for Structural Engineering
VdTÜV	Federation of the Technical Inspection Associations
DVGW	German Association of the Gas and Water Industry
AGFW	Association for District Heating
AWS	American Welding Association
NIL	Dutch Welding Association
EWF	European Federation for Welding, Joining and Cutting

The work results in the AFT are published as DVS Technical Bulletins and DVS Technical Codes. Besides, a close collaboration with other rule-making national and international institutions like the German Institute for Standardization, the CEN or others (see table) further ensures that the contents of DVS Technical Bulletins and DVS Technical Codes are sensibly coordinated with the rules and regulations of the other institutions.

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DVS members benefit from free access to the German-version set of rules of DVS at

www.dvs-regelwerk.de.

All DVS Technical Bulletins and DVS Technical Codes of the association are retrievable there in electronic form.

Flash butt welding machine (GSI-SLV Duisburg)



Structure of the Technical Committee

Main Division W

Basic materials, filler materials and auxiliary materials

AG W 1 Technical gases	AG W 2 ** Welding of cast materials	AG W 3 ** Joining of metal, ceramic and glass	AG W 4 Joining of plastics	AG W 5 * Welding consumables	AG W 6 * Welding of aluminium and other light metals
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Main Division V

Processes and equipment

AG V 1 * Gas welding	AG V 2 * Arc welding	AG V 3 * Resistance welding	AG V 4 Underwater engineering	AG V 5 * (Thermal) cutting	
AG V 6.1 * Brazing	AG V 7 * Thermal spraying and thermal sprayed layers	AG V 8 Adhesive bonding	AG V 9.1 Electron beam welding	AG V 10 ** Mechanical joining	AG V 11 * Friction welding
AG V 6.2 * Soldering			AG V 9.2 Laser beam welding and allied processes		

Main Division Q

Quality management, design, calculation, health and safety

AG Q 1 Design and calculation	AG Q 2* Quality management for welding	AG Q 4* Testing of welds	AG Q 5* Demands on welding personnel	AG Q 6 Health and safety and environmental protection
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Main Division I

Information

AG I 1 Information and communication technology	AG I 2* Application oriented welding simulation	AG I 3 History of welding technology	AG I 4 * Illustration, terms and definitions
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Main Division A

Applications

AG A 1 Welding in turbo machine building	AG A 2 Joining in electronics and precision engineering	AG A 5 Welding in construction settings	AG A 6 Welding in shipbuild and marine engineering
AG A 7 Welding in railway vehicle manufacturing		AG A 8 Joining in vehicle manufacturing	AG A 9 * Welding in aviation and aerospace engineering

Specialist Societies

Specialist Society for "Brazing/Soldering"	Specialist Society SEMFIRA/EMF ***
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AG: Working Group, * Joint Working Group with NAS (Standardisation Committee Welding and Allied Processes)

** Joint Working Group with other Societies, ***SEMFIRA = Safety in ElectroMagnetic Fields, EMF = ElectroMagnetic Fields.

Working Group AG V 3 “Resistance Welding”

In this working group, there are currently a total of approx. 200 experienced experts working out - on a volunteer and joint basis - DVS Technical Bulletins and DVS Technical Codes as well as international standards relating to resistance welding. The DVS Working Group forms a Community Panel for the development of standards together with the standards committee “Welding and allied processes” of the DIN e. V..

DVS promotes international standardization. DVS member enterprises with an interest in standardization can participate in the standardization work on the subject of Resistance Welding free of charge via a DVS mandate.

The Working Group AG V 3 “Resistance Welding” of the DVS Technology Committee consists of 8 sub-groups that are engaged in addressing the manifold questions surrounding the area of resistance welding.

- AG V 3.1 “Flash welding, resistance butt welding and pressure welding with magnetically compelled arc butt (MIAB)”

- AG V 3.2 “Resistance spot, projection and roller seam welding”
- AG V 3.3 “Resistance welding in Electrical Engineering and Precision Engineering”
- AG V 3.4 “Resistance welding of coated metals”
- AG V 3.6 “Measuring and process control”
- AG V 3.8 “Manufacturing means for resistance welding”
- AG V 3.9 “Testing of resistance welding joints”
- AG V 3.10 “Training in resistance welding”

The worked out DVS Technical Bulletins and DVS Technical Codes are included in the DIN-DVS paperback books 312/1 through 312/3 “Standards, DVS Technical Bulletins and DVS Technical Codes on the subject of resistance welding”.

Events

V 3 / FA 4 Community Panel

The Expert Committee 4 “Resistance Welding” hosts an annual expert panel in collaboration with the DVS working group V3 “Resistance Welding”.

The focus of the event is the discussion and evaluation of completed research projects as well as reporting on ongoing projects.

Furthermore, there is reporting on the extensive activities of the technical-scientific cooperative work on the individual subject areas of resistance welding, especially concerning the DVS set of rules.

DVS- special conference titled “Resistance Welding”

The DVS Working Group V 3 “Resistance Welding” presides over a tri-annual DVS special conference titled “Resistance Welding”. Duisburg has established itself as a venue. The broad range of topics during the conference addresses interested parties involved with resistance welding through the areas of research, development, planning, production or quality assurance.

The objective of this conference is to present the latest research findings in the field of resistance welding to a broad professional audience, in lectures and discussions. These research findings were achieved with the assistance of DVS and financed by public funds.

Furthermore, the simultaneous “Trade Exhibition Resistance Welding” offers opportunities for information exchange. Manufacturers of machinery, devices and installations can present their latest developments here.

The next conference will be held in 2016.

Participants of the conference “Resistance Welding 2013”



The practical relevance of the DVS set of rules – an example

DVS Technical Bulletin 2935-2 “Resistance spot welding of sheet metal of low alloyed steels - Cold rolled multiphase steels (AHSS)”

Multiphase steels (also: AHSS-Advanced High Strength Steels) are considered as being the consistent advancement of cold-rolled sheet metals of low alloyed higher strength steels. These are used above all in the automotive industry, with the perpetual objective of a further weight reduction with concurrent increase of the passive safety.

The DVS Technical Bulletin 2935-2 “Resistance spot welding of sheet metals of low alloyed steels - cold-rolled multiphase steels (AHSS)” informs the user about the spot weldability (process ISO 4063: 21) of these steels and the features of the spot welded joints. Moreover, there are guidelines and process information for performing the welding work.

Concerning the contents, this DVS fact sheet refers exclusively to spot welding of cold-rolled strip and metal sheet up to three millimetre of thickness.

In the fact sheet, the new higher strength dual-phase, complex-phase and TRIP steels are described concerning their mechanical and technological characteristics and their microstructures. The welding area locations and the electrode status volumes of the materials were determined in comparison to conventional deep-drawing steels.

The fact sheet describes resistance spot welding of sheet metals in the area of application of up to max. 3 mm of single sheet thickness in the press-hardened state.

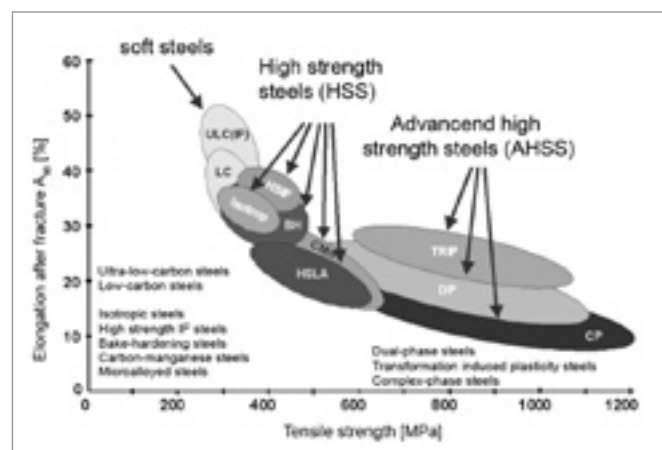
Prospects DVS work on set of rules

DVS Technical Bulletin 2935-3 „Resistance spot welding of sheet metals of low alloyed steels (press-hardened steels)”.

By means of press hardening (hot forming, (Pressure Controlled hardening) it is possible to produce moulded sheet metal parts of highest strength and high geometric complexity.

In the field of hot forging, the material 22MnB5 has primarily been used up to now, further material developments e.g. 38MnB5 are about to be launched on the market. Generally, the welding area of Advanced High Strength Steels is being shifted compared to conventional deep drawn steels towards lower amperages.

Another focus of the fact sheet illustrates the fracture behaviour of the spot welds. The hardness values in the spot weld resulting from the alloy composition, lead - in combination with the geometry-related indentation - to brittle-ductile transitions and shear fractures. However, the higher basic material strengths of the Advanced High Strength Steels cannot be implemented without limitation, on account of their greater notch sensitivity, into higher head tensile strengths of the joints, so that hybrid joining processes have to be recommended, such as weld bonding.



Overview of higher strength steel grades

This fact sheet is particularly of great importance for the automotive industry.

Expected release date: 2014

Education at DVS

Education Committee

The Education Committee (AfB) initiates measures to adapt the education and certification offering of the DVS to present developments and to prepare for future requirements. At the same time, the AfB acts as a guidance committee for the Personnel Certification Body DVS-PersZert and its activities. In this respect, the AfB assumes the role of a Strategy Committee. In this, it is being supported by the working group Training and Examination (AG SP).

The working group Training and Examination assumes – in the “Education and Certification” area – the task of creating uniform training and testing material as part of the qualification of joining experts and managers. Thereby, national, but also current European and international requirements of the EWF – European Federation for Welding, Joining and Cutting or the International Institute for Welding (IIW) are implemented in the training and testing standards.

Because the AG SP equally considers the interests of industry and trade in its work, the needs of industry are directly reflected in the compiled Directives. The area of responsibility of the AG SP encompasses the development of the specific syllabuses and curriculums for joining-related education and training, in addition, however, also all other areas that are associated with the field of Training and Examination. The fact that these training and testing standards are ultimately truly complied with all over the country, and are actually also being implemented, is something that is ensured by the Personnel Certification Body of the DVS, DVS-PersZert.

The Expert Committee 4.8 „Resistance Welding“ is responsible for training and further education content related to resistance welding. It deals with the developing of DVS guidelines for qualification and testing in the field of resistance welding.

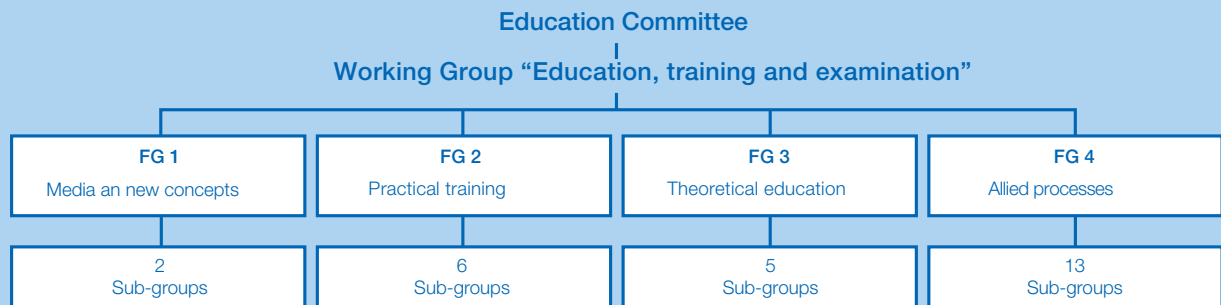
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The latest training and further education offers can be found at: www.bildungskatalog.de

Photo: Fotolia



Structure of the Education Committee



FG: Expert Group

Training and career paths in the field of resistance welding

The DVS guidelines for training and certification have created a closed system that enjoys great renown on both a national and international level.

Guideline DVS-EWF 2940 “European Resistance Welder-Fitter (EWP-RW)– Training, Examination and Certification”

This directive for the theoretical and practical training as European Resistance Welder- Fitter was prepared by members of the Technical Committee of the EWF.

It is designed so that it provides the essential basic knowledge in resistance welding, which must be mastered by the welding staff performing tasks in accordance with DIN EN ISO 14554-1 (section 6.3) .

It is suitable for the mediation of the basic knowledge such as for plant fitters, examiners, supervisory personnel, foremen, design engineers, as well as members of the Technical Sales force.

In addition, the EWP-RW is suited for assisting the Welding Supervisors according to EN ISO 14554-1 (section 6.4) in the manufacturing facility.

It is possible that additional knowledge and/or experience will be required from the welding personnel in order to carry out certain activities , which extends beyond the teaching content conveyed during the training for EWP-RW. To take these requirements into account, additional training programmes are developed as needed.

This Directive takes into account the minimum requirements for training and advanced training in resistance welding from an European aspect through the fact that it specifies goals, contents and their associated recommended teaching units for each individual subject.

It is subject to regular review by the technical committee of the EWF, in order to be in line with the current “state of the art”.

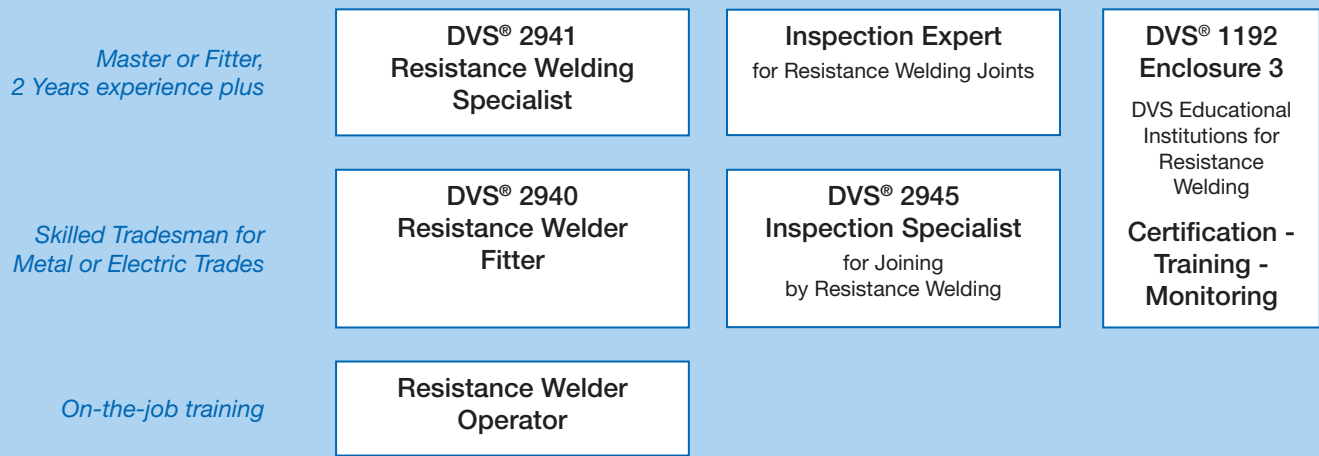
Guideline DVS-EWF 2941 “European Resistance Welding Specialist (EWSR)- Training, Examination and Certification”

This directive for the theoretical and practical training as European Resistance Welding Specialists for resistance welding was prepared, evaluated and worded by members of the Technical Committee of the EWF.

This Directive, in the form of goal setting, keywords, and recommended time periods, covers the minimum requirements for education and training in resistance welding as were agreed within the EWF. It is subject to regular review by the technical committee of the EWF in order to deal with any changes that affect the “state of the art”.

Participants who have successfully taken part in this course are expected to be able to apply the welding technologies that are required under this guideline.

Training and career paths in the field of Resistance Welding



With this DVS® course, individuals are trained to become qualified specialists for the testing of joints in metal sheet constructions. The “Inspection Expert for joints through resistance welding”, hereinafter referred to as “Inspection Expert”, is the expert responsible in manufacturing for the testing by means of “workshop testing method” and for the testing by means of ultrasound. He or she has the required knowledge and skills for the execution of the inspection of thin sheet joints.

The final exam is intended to demonstrate the knowledge and skills acquired in the course.

**Guideline DVS 2945
“Inspection Expert for Thin Sheet Joints”**

This Directive applies to the testing of connections at sheet metal structures that were produced with the joining processes covered in this Directive (resistance spot welding, projection welding, and roller seam welding, stud welding, inert gas welding, laser-beam welding, mechanical joining and bonding). It defines the course contents as well as the exam for testing the knowledge and skills of the Inspection Expert.

The training and testing pursuant to this Directive shall also apply as proof of the employment of qualified staff, as required in several regulations and standards. This Directive is a part of a structured overall training concept in the area of resistance welding.

The guideline outlines a basic training in resistance welding as is required for welding for staff in the field of welding supervisor according to EN ISO 14554-1 (section 6.4), with regard to monitoring, testing, briefing, technical sales, etc. In addition to this basic training, it might be necessary that the welding personnel must obtain the qualification for the respective areas of responsibility through advanced training and / or experience. According to the requirements, additional training programmes will be developed.

Trade media and teaching materials for Resistance welding

DVS Media GmbH

When it comes to publications and press relating to all aspects of the subject of joining, cutting and coating, DVS Media GmbH is the right place to go. The programme of the publishing house includes German and foreign language trade journals, specialist books, teaching media, technical bulletins and directives, videos and software. The products of DVS Media GmbH reflect all fields of activity of the DVS Association and all findings that have been worked out there.

Numerous professional media of DVS Media GmbH devote themselves to the work results that have originated in the areas of research, technology and education in connection with the resistance welding: This includes Specialist books and trade journals, as well as training materials and DVS directives, available individually or collected as a paperback.



How to get DVS Technical Bulletins and DVS Technical Codes

DVS members have free access to all DVS fact sheets and DVS guidelines at www.dvs-regelwerk.de.
Non-DVS members can order the DVS set of rules under www.dvs-media.info

Your contact persons for publications on Resistance welding



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Photo: istockphoto

Publications on Resistance welding



DIN-DVS Pocket Book 312/1 Welding Technology 9: Resistance welding: Training, basics, processes and materials

One topic - Three reference books: Building on the basis of DIN-DVS Pocket Book 312, this collection of the standards and DVS Technical Bulletins on resistance welding has been structured anew and divided up into three different volumes. Welding specialist personnel and quality inspection engineers, however, also instructors, will find a comprehensive overview here of relevant documents for their respective specialist departments. The first volume, the DIN-DVS Pocket Book 312/1, provides nine DIN standards and 44 DVS Technical Bulletins on the following subjects: General Information; terminology and welding processes, welding process test, materials and personnel training.

2010, 602 pages, A5, paperback in German
ISBN: 978-3-87155-285-4



DIN-DVS Pocket Book 312/2 Welding Technology 11: Resistance welding Quality assurance and testing

Now, the former DIN-DVS Pocket Book 393 presents itself as volume 2 of the new DIN-DVS Pocket Book trio on resistance welding. Here, above all quality inspection engineers will find what they are looking for; the 23 DIN standards and 19 DVS Technical Bulletins on quality assurance and testing of resistance welded joints, however, are also applicable to the everyday work of welding specialists and welding engineers. A practitioner will find the relevant documents for his department, readily-accessible under one umbrella.

2010, 564 pages, A5, paperback in German
ISBN: 978-3-87155-286-1



DIN-DVS Pocket Book 312/3 Welding Technology 15: Resistance welding Equipment

All the standard documents about equipment and devices for resistance welding were summarised in the DIN-DVS Pocket Book 321/3. In what is a total of 33 DIN standards and 10 DVS Technical Codes, not only fitters and operators will discover the technical know-how for everyday use; the fields of training and continuing education will also benefit from this document set.

2010, 452 pages, A5, paperback in German
ISBN: 978-3-87155-287-8

Your contact persons in the area of “Resistance Welding”

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