

RESEARCH | TECHNOLOGY | EDUCATION

IN FOCUS

Arc 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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Arc welding – Fit for the future

One understands by welding “the insoluble joining of components under application of heat and/or pressure with or without filler metals”. Of all methods, fusion welding is the best known one and here, the materials to be joined are heated up to their melting point and then intermix so that they are firmly joined together after hardening.

The electric arc has already been supplying the necessary energy for fusion welding since the end of the 19th century. Manual arc welding is one of the oldest electric welding processes for metal materials. It quickly became clear that, inter alia, the oxygen from the ambient air allows for oxidation processes that damage the material and/or the weld seam. In order to prevent this, the processes that we know of today, such as welding with shielded electrode or flux cored arc welding, submerged arc welding, or welding under gas shielding atmosphere were gradually developed. All processes have the objective to optimise the quality of the weld seam and to continuously expand the bandwidth of the weldable materials and alloys.

Among the known fusion welding processes, manual metal arc welding with covered stick electrode is the oldest, but however, up to today still an applied arc welding process. However, welding with covered stick electrode continues to be utilized in those areas where it can exploit its advantages: It is versatile in its use in challenging welding positions, especially in outdoor settings. The devices technology is simple, cheap and very compact nowadays. Last but not least on account of the high

level of attainable weld seam quality, the excellent ductile values and its low cracking risk, it will maintain its position in welding technology also in the future.

In modern industrial nations, welding production without MIG/MAG shielded gas welding processing would be unthinkable nowadays. Submerged arc welding is now firmly established as a high performance process, for instance in the shipbuilding industry or in generous tube production. Nowadays, welding with non-consumable tungsten electrodes under inert gas, TIG in brief, is nowadays being predominantly used in chemical plants construction as well as in the aerospace industry and also in fields with special requirements.

Processes for specific droplet separation, for laser beam -electric arc combinations, low-energy or high-energy GMAW variations as well as processes with an automatic oscillation originate from constant research. At the same time, the proportion of automated welding production is steadily increasing. This large number of process variants and automation options, today more than ever, requires a specific targeted training and continuing further education in welding technology of the specialist staff, however, also in the field of test engineering. Only a good knowledge transfer all the way up to the welder or operator makes it possible to exploit the potential of new welding and materials technologies.

Hoping that you will enjoy your reading,

Prof. Dr. Reinhard Winkler,
GSI SLV, Duisburg,
Chairman of the Working Group “Arc Welding”
(AG V 2) at the DVS

Dipl.-Ing. Rockhard Zsehra,
DVS – German Welding Society, Düsseldorf
Expert Advisor



Liquid pump housing welded with TIG cold wire arc, (Carl Cloos Schweißtechnik GmbH)

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The DVS set of rules on “Arc Welding” offers extensive application-related information about procedure, quality assurance, testing, design, training and materials etc. and, in addition, also defines the special requirements placed on skilled workers in the field of arc welding.

Through interdisciplinary collaboration between the Research Association of DVS, the Technical Committee and the Education Committee, a globally established and recognized DVS policy set has been created, which constitutes a self-contained system.

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

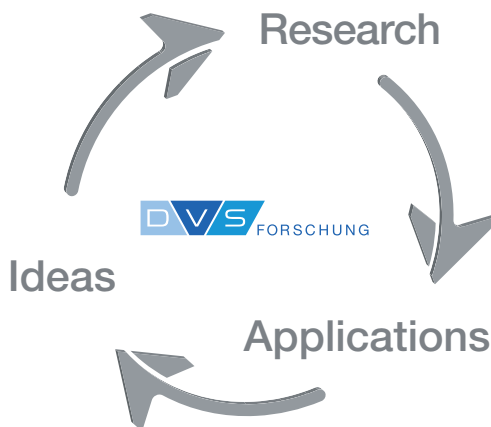
Tandem process, an advancement of the double wire welding technology, (Carl Cloos Schweißtechnik GmbH)



Cooperative industrial research

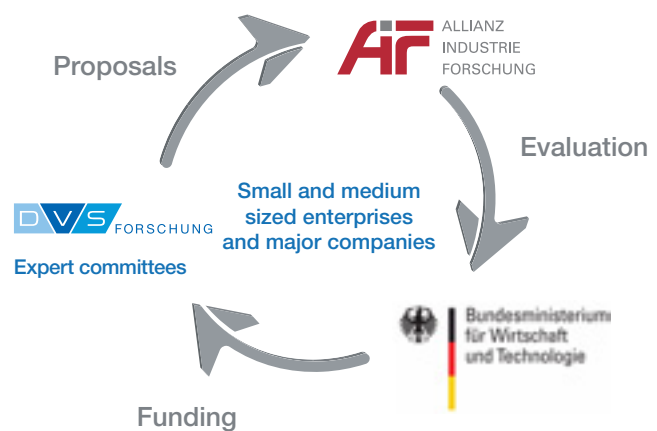
The core activity of the Research Association is the Cooperative Industrial Research (IGF), which orients itself above all on the interests of small to medium-sized enterprises from the joining technology industry which frequently lack the means for own research activities. Via the IGF, these it is possible 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 3 “Arc Welding”

The general goal behind the research works of the Expert Committee 3 “Arc Welding” is the further advancement of efficiency and profitability of arc welding processes for joining in industrial settings. Under consideration, especially, are the requirements of small and medium-size enterprise. These research undertakings are to take into account such aspects as boundary and environment conditions like pre-treatment and follow-up treatment, tolerance levels, warpage, emissions, impurities and typical practice quality criteria.

The joining processes must become clearly understandable. Economic considerations and estimations are also part of the research scope. In the course of the research undertakings, solutions are to be worked out and documented. Via parameter information concerning welding tasks, a comparison of the results of other research projects and practical applications should be made possible. Arc welding processes must become predictable, capable of being simulated, low-emission, easy to monitor, quality defined, economical and characterised by production reliability.



Current research areas and key topics are as follows:

Arc joining processes for high-performance materials and material combinations, modelling, simulation, visualisation and calculation of arc joining processes, the adaptation of process variants and hybrid processes to joining tasks, developments in instrument engineering and systems engineering as well as sensor technology and quality assurance in the field of arc welding.

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

How applied research works – an example

Research Topic:

“Plasma hybrid welding with integrated laser and sensor technology (PiLS)”

Research Centres:

Technische Universität Hamburg-Harburg
Institut für Laser- und Anlagensystemtechnik

Leibniz-Institut für Plasmaforschung und Technologie e. V.

Runtime: 01.03.2010 - 31.08.2012

IGF-No.: 16.414 B / **DVS-No.:** 03.098

Starting situation:

While approaches for hybrid welding were mostly laser-dominated in the past - with the consequence of high investment costs for a high-capacity laser - a defocused laser beam of low performance was used in this undertaking, merely in a supporting function of the plasma process.

Objective:

The objective was to develop the hybrid process and a novel machining head that specifically provides the necessary geometric setting options for the process and to try out a way of diagnostics by means of which the process can be monitored in view of a possible sensor control.

Findings:

In the experiments completed, plasma arc and laser beam worked on the workpiece in a joint molten bath with a consistent base point, wherein the arc was arranged pungent and the laser beam sluggish to the welding direction. The dimensions of the plasma torch and the required electric arc length, here, allows a minimum angle of 38° between the arc longitudinal axis and the laser beam.

The research results show - for I seams on the butt joint of an unalloyed structural steel in the hybrid process with only 300 watts of laser support - a significant improvement in weld seam quality and/or an increase in welding speed by 60% without loss in quality in comparison to pure plasma welding (Figure 1). Besides, the hybrid process increases the gap bridging capability, reacts less sensitively to impurities or edge misalignment of the joining parts, tolerates a wider range of the welding parameter settings and makes it possible to produce arched-shaped seam paths without adjusting the feed rate (Figure 2).

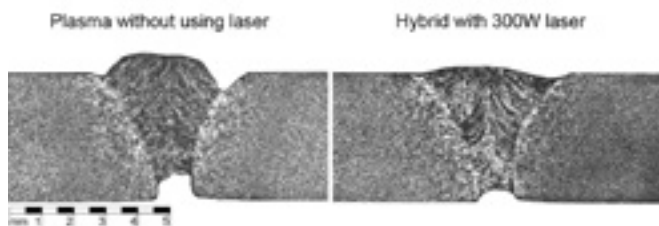


Fig.1: Weld seam cross-section of a plasma and/or hybrid-welded butt joint connection of 4 mm of metal sheet thickness with high feed rate (50 cm/min) without weld preparation and without the use of filler material

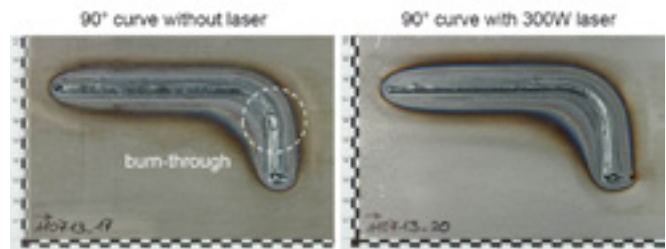


Fig.2: Upper bead of a plasma-welded and/or hybrid-welded 90° seam arc with a constant 100 cm / min feed rate at 2 mm sheet thickness

These positive effects can be traced back to a stabilisation of the arc base points at the workpiece and hence of the whole process as well as to a constriction of the weld pool geometry through the laser beam. Photographs with high-speed cameras demonstrate that the activation of the laser causes a return of the reversal of direction of flow in the weld pool and favours the formation of a tapping hole (Figure 3). The thus increased intensity and the higher speed reduce the thermally induced distortion of the components, save on downstream scopes of directional activities and contribute to a considerable productivity increase.

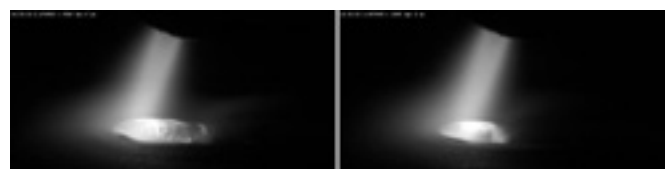


Fig.3: weld pool images left without, right with laser support; weld pool reversal and tapping hole formation recognizable through modifications on the molten pool edge

References from industry

Dr. Hinrich Timmann, Managing Director of J. Carl Weber GmbH Metallwaren Apparatebau:

The result of this process development is a site-tolerant high-performance welding process that, due to the low investment requirements, is especially interesting for small and medium sized enterprises and is suited for all applications in the range of mating sheet metal processing.

Prof. Dr.-Ing Harald Kohn, ITC International Technology Consulting, Bremen:

For small and medium sized enterprises, welding is a very important joining process of great economic significance and

hence often a decisive factor for the economic efficiency of the companies. The process developed within the scope of the project PiLS is on grounds of the inexpensive investment and high effectiveness an interesting addition to the welding equipment that is currently available on the market. The error tolerance and thus lower positioning effort compared with the laser welding minimises, among other things, the preparation time; the clearly higher process speed at low linear energy compared with the electric arc methods means low warpage i.e. avoidance and/or decrease of remachining. The results achieved show that greater welding depths are possible through further studies. This field should be studied through a follow-up project, since the advantages of the process increase disproportionately with bigger joining depths.

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
EFW	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.



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.

Plasma-powder-arc-process,
(Carl Cloos Schweißtechnik GmbH)

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 2 “Arc Welding”

In the area of arc welding, more than 400 experts are working together in process-related working groups on DVS Technical Bulletins and Technical Codes. The following are represented: Manufacturers of welding power supplies and welding filler metals, users from different industries and employees of research centres. Experts from the areas training and advanced training and certification also assist the development of regulatory frameworks. Currently, the working groups from the areas manual metal-arc welding, inert gas welding, stud welding and flux cored wire welding on a trans-process Technical Bulletin system on the subject “Welding of heat-resistant steels”.

Another task of the working groups consists of organising lecture events like Workshop “Arc Physics”, “Arc Brazing” or the ROBOT Conference. These events offer interested professionals the possibility to inform themselves about the state of the art, current research and development projects as well as about the handling of new regulatory frameworks.

In addition, the working group gets involved in the standardization work in the working committee DKE 361 “arc welding equipment” at the Deutsche Kommission Elektrotechnik Elektronik Informationstechnik.

Working groups and working committees in the field of arc welding

AG V 2.1 “Metal arc welding”

The working group compiles DVS Technical Bulletins in the field of manual electric arc welding. The DVS Technical Bulletins become are being continuously adapted to growing requirements through new materials and coordinated with standardized requirements.

AG V 2.2 “Stud welding”

Professionals from companies of the device and accessories manufacturers, user circles as well as institutes are collaborating in this working group in task definitions from the fields of arc welding - stud welding processes, methods and devices. Current subjects are the revision of the standards DIN EN ISO 13918 and DIN EN ISO 14555 and the creation of DVS Technical Bulletins about stud welding of the individual material groups, about systems engineering, about the calculation of bolt welded joints and about automation.

AG V 2.3 “Inert gas welding with non-consumable electrode”

Device and accessories manufacturers, user circles as well as institutes are tackling technical tasks that are attributable to tungsten shielding gas fusion welding processes, tungsten inert gas welding and tungsten plasma arc welding. Among the current projects is the creation of DVS Technical Bulletins about dealing with welding materials, about systems engineering and about processes with which specific performance can be achieved. Regulatory framework for the assessment and treatment of heat tinting in devices of the chemical and food industry, for dealing with tungsten electrodes, and on transforming is being compiled.

AG V 2.4 “Inert gas welding with consumable electrode”

Subjects from the fields of metal-inert gas welding (MIG) and metal-active gas welding (MAG) are in the focus of the activities. The observation of the research in the area of electric arc physics and the respective investigation methods of the arc as well as the development of the process and systems engineering are implemented into hints for practical application, i.e. they are intended for the user. Here, the consideration of pulse technology currently dominates. At the moment, user-oriented Technical Bulletins are being created with regard to regulated GMAW variations. Furthermore, work is underway on a measuring method for hydrogen contents in welding filler metals. The creation of DVS Technical Bulletins about the welding-based handling of individual materials also belongs to the field of application of the working group.

AG V 2.5 “Submerged arc- electro slag welding”

Submerged arc welding with wire electrode, strip electrode, several wire electrodes, metal powder additive, flux cored wire electrodes as well as the electroslag welding here are being tackled here by manufacturers of the fillers and the welding power sources, as well as by users and professionals from the fields of research and education. Besides dealing with applications for new materials, new process variations and new wire / powder combinations, they are currently increasingly working on user support for the welding of creep resistant steels.

AG V 2.6 “Mechanization, automation and roboting during arc welding”

Topics concerning welding-related automation, the use of robots and sensors, but also the training of operators, are among the subject that are being handled in this committee. Also, quality assurance in automated welding production and automa-

ted testing of weld seams or weld seam preparations is part of the agenda of this working group. Currently, the Guideline DVS 1184 “Operating staff for fully automatic welding equipment – Metal-inert gas welding” is in the making, as well as user notes on the costs and benefits of a robot application. These should provide the user with a first overview about what they need to keep in mind during the transition from manual on automated welding production. In addition, the working group organises the regularly held ROBOT Conference.

AG V 2.7 “Welding with flux cored wire”

The user gets assistance in the use of flux cored wires when welding through Technical Bulletins and training materials from of the working group. Among the current projects are application-oriented Technical Bulletins on the subjects of welding

of creep resistant steels and welded coatings. A directive and training materials on deposition welding as well as technical bulletins on self-shielding Flux cored wire electrodes are being conceived at present.

AG V 2.8 “Arc physics”

The welding group V 2.8 “Arc Physics” holds an annual workshop on arc physics. The lecture event covers current research topics in the field of arc welding. Also, device manufacturers and users present new developments and implementations of the research findings. Another task of the working group is the coordination of the cooperation among different research institutes and companies for collaborative research projects.

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

Technical Bulletin DVS 0926-3 “Process parameters and instrumentation for pulse arc welding”

Constantly increasing requirements for base metals and filler metals as well as for the joining technology go hand in hand with electricity source development for MIG/MAG welding (GMAW welding). The developments throughout the instrumentation field is mainly due to the enormous advances in electronics and the insights of the arc physics area. Today, therefore, modern power sources are available that, on account of their digital signal processing, allow an exact regulation with a very encompassing user controls menu as well as an improved ignition and welding properties.

At the same time, the complex parameter settings, for instance during the application of the pulse electric arc, were adapted to the needs of the welders by means of very simplified operating concepts. Technical Bulletin DVS 0926-3 answers several questions that users might have, among the rest, questions on the feed rate, and distinguishes between delta U and delta I controller, as well as explaining the controlled droplet transitions (Fig. 1).

Setting variables for GMAW pulse welding as well as control variables and their effects are being clearly explained. Modified pulse electric arcs like the short pulsed arc are being explained. Advantages compared with normal pulse electric arcs, like low heat input, which is particularly beneficial for thin metal sheet processing, are clarified.

Even combined modulation types (consisting of a low- and high-current phase) are compared with each other in a user-oriented manner. Advantages and predestined applications will be shown.

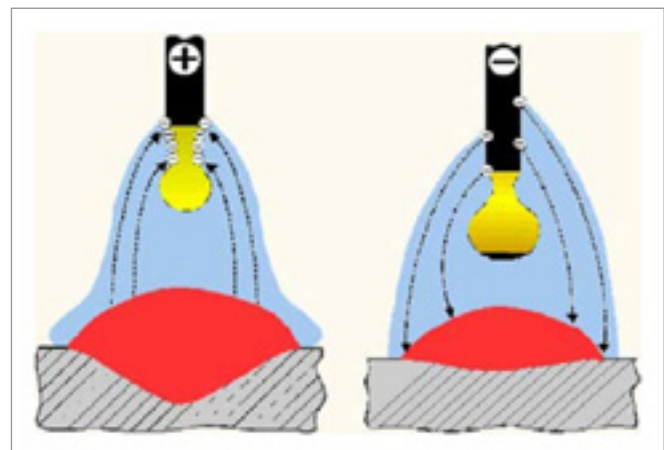


Fig 1: Influence of wire reverse polarity on electric arc behaviour and material transitions

With the development of the current generation of fully electronic digital welding machines and welding systems engineering with the matching advanced modern control techniques, a new era has dawned for fully electronic welding power sources in the field of arc welding. Since the introduction of the fully electronic digital welding machines on the market, many users have been shown with which kind of flexibility new welding tasks could be tackled that came with high requirements for sheet metal welding and were able to be completed within the shortest time possible. With respective settings, these welding machines are also able to be used for arc brazing (Fig. 2).

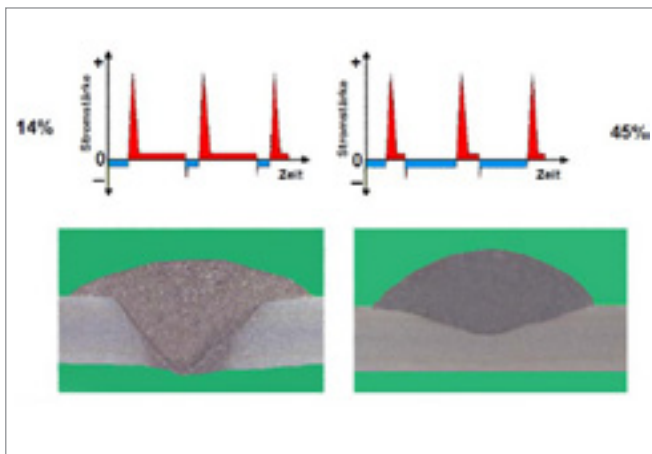


Fig. 2: Influence of the negative base current phase on weld seam profile for an aluminium alloy

With today's digital welding power sources and/or systems, GMAW welding processes can be adapted through different electric arc and modulation kinds to fit the respective components and the respective manufacturing process (Fig. 3). The welding properties, assuming correct dimensioning of the live part, depend on the quality of the welding process control. The features of the latter can be controlled with today's digital technology and the microcontrollers and can be integrated into a mass production process. For the purposes of a flexible and easy adaptation of the welding equipment features to the often quickly changing welding tasks, several programmes and the respective control panels that are available on the market today assist the welder in operating the welding machine so that he can concentrate, therefore, on the essentials, which is the wel-

The DVS Technical Bulletins series 0926 consists of:

- Technical Bulletin DVS 0926-1 "Requirements for energy sources for gas shielded metal arc welding"
- Technical Bulletin DVS 0926-2 "Requirements for wire feed systems, hosepacks and welding torches for gas shielded metal arc welding"
- Technical Bulletin DVS 0926-3 "Process parameters and instrumentation for pulse arc welding"

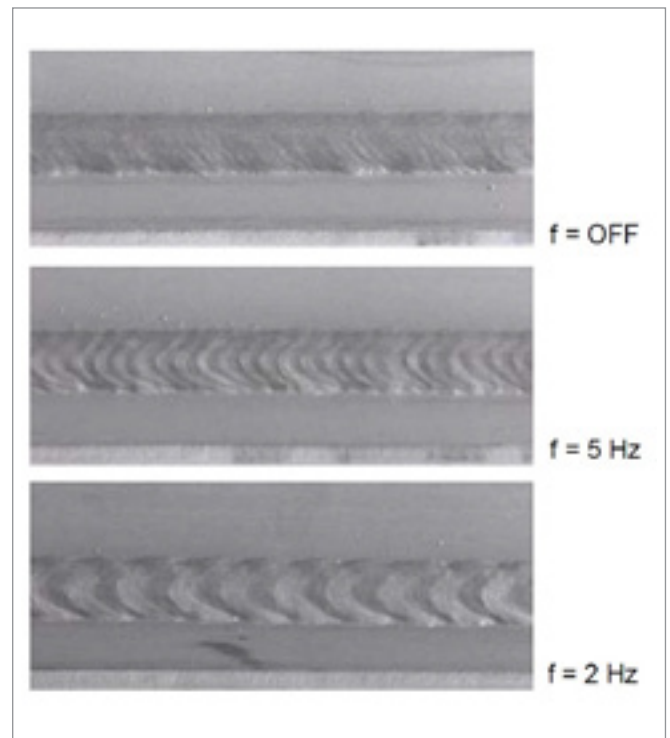


Fig. 3: Weld seam surfaces of aluminium welds with GMAW pulse/pulse

ding task itself. With today's digital GMAW welding systems, reproducible GMAW welding results can be attained for the purposes of the intended quality assurance in manufacturing. In spite of the high internal complexity of the process control with the modulation kinds described on top, it is possible to keep operation for the user at a clear and simple level.

Part 3 was published in 2012 and provides an overview of all the typical features of GMAW welding and their process variants in terms of their applicability to the welding-based processing of metallic materials. It is in particular intended for the areas of manufacturing as well as for training and continuing education.

ABICOR- Innovation Award

The ABICOR- Innovation Award was launched in 1995 by Alexander Binzel Schweißtechnik GmbH & Co. KG on account of its 50th anniversary, and since 1998 it is offered every two years. For the lasting support of research and development in the area of arc welding and cutting – mainly of young professionals from science and industry – ABICOR BINZEL has decided to give out this award as a welding highlight on a bi-annual basis. The DVS – German Welding Society is the awarding authority.

Honoured activities are primarily those with fundamental significance, which can be expected to lead to the furthering of automation and mechanisation in the field of arc welding and cutting. An independent jury, made up of well-known scientists and specialists from industry, will judge the submitted works according to scientific and technological progress, quality assurance, economic efficiency considerations as well as environmental protection and occupational safety aspects. Of course, the implementation prospects and the expected benefits are also included in the evaluation.

The award is worth 10,000 Euro in total. It includes a first place with a cash prize of 5,000 Euro, a second place with a cash prize of 3,000 Euro and a third place with a cash prize of 2,000 Euro.



Please request the conditions of participation at:

DVS – Deutscher Verband für Schweißen
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P +49. (0)2 11. 15 91-123
rockhard.zsehra@dvs-hg.de

Information is available at:
www.the-joining-specialists.de

EWM Award Physics of Welding

With this award, EWM HIGHTEC WELDING GmbH funds up-and-coming scientists from academic and research institutes as well as welding technology training and research institutions for the implementation of their welding engineering visions. The company, which has been dedicated for many years to welding process research supports the prize-winner financially in developing a clearly deepened comprehension of this field.

Core of the EWM Award that is bestowed every two years since 2009 are new ideas and scientific approaches with electric arc welding, laser beam welding, electron beam welding or hybrid welding processes. The focus here is on innovative approaches that contribute towards a further increase of the energy efficiency of joining processes, such as the EWM drives with its sustainability initiative „BlueEvolution“. Already today, the enterprise has succeeded in developing welding processes that conserve energy and hence save costs to a considerable degree as well as reducing the pollutant emissions in the welding fumes.

Young talents up to the age of 30 may apply by submitting a written application as well as concept of their planned research project and development work. The submission of the docu-

mentation is made via the online application form at www.ewm-group.com/award or to Mr. Rockhard Zsehra, Expert Advisor at DVS e. V. The prize winner, who will be determined by an independent jury, can look forward to funding of his or her scientific work amounting to 30,000 €.

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Education at DVS

Education Committee

The Education Committee (AfB) initiates measures to adapt the education and certification offering of 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 DVS Guidelines. 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 DVS, DVS-PersZert®.

The working groups FG 2 “Practicle Education” and FG 3 “Theoretical Education” are responsible and take the lead for training and continuing education in the field of arc welding. They elaborate DVS Guidelines for qualification and examination of staff in the area of arc welding. Furthermore DVS Guidelines are developed by the Working Group V 2 “Arc Welding” which is part of the Technical Committee.

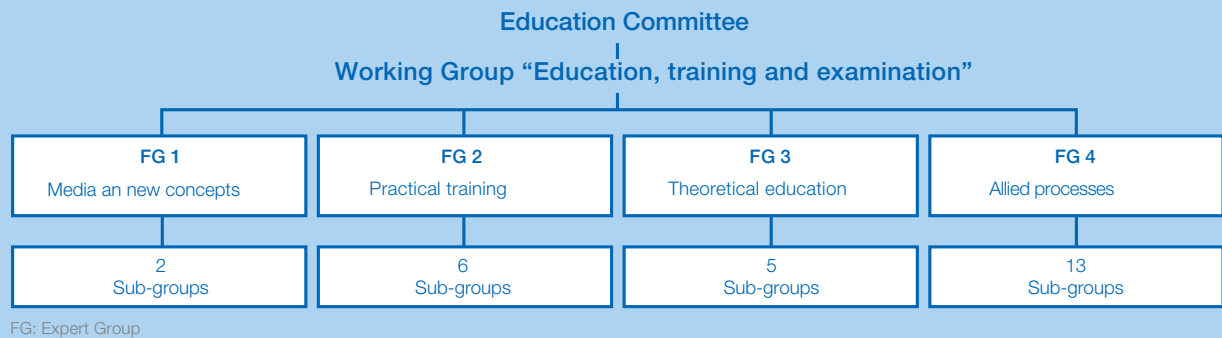


The latest training and further education offers can be found at: www.bildungskatalog.de

Photo: Fotolla



Structure of the Education Committee



Training and career paths in the field of Arc Welding

Guideline DVS-IIW/EFW 1170 (IAB 252r1-11) “Welding Supervisor – Minimum requirements for training, examination and qualification”

Welding supervisory personnel is assigned in accordance with the recommendations of the International Institute of Welding (IIW) according to the nature and / or complexity of the production:

- Welding Supervisor with extensive knowledge:
DVS-IIW/EFW International Welding Engineer
(SFI / IWE / EWE)
- Welding Supervisor with special technical expertise:
DVS-IIW/EFW International Welding Technician
(ST / IWT / EWT)
- Welding Supervisor with basic technical knowledge:
DVS-IIW/EFW International Welding Expert
(SFM / IWS / EWS)

Guideline DVS 1181 “DVS-training course welding engineer”

The welding engineer is an expert for the design and calculation of weldments. Above all, functional reliability and the production costs are very decisively determined by the proper, stress resistant, welding implementation. The concept and structural design of welded assemblies and products require a wide specialist knowledge and operational experience from the engineer. The training course conveys knowledge about the welding pro-

cesses and equipment used in manufacturing and also about the base metals and filler metals that are being used as well as their behaviour during welding, about the construction and calculation of the welded assembly groups as well as about the quality assurance and test engineering. From the regulations of DIN EN ISO 3834-1, the requirements are derived for advanced training as a welding engineer.

Guideline DVS-IIW/EFW 1111-1 International Welder (IS) – Minimum requirements for training, examination and qualification – Part I: General information, prerequisites, subject overview

Guideline DVS-IIW/EFW 1111-2 International Welder (IS) – Minimum requirements for training, examination and qualification – Part II: Rules and instructions for test objects

This Guideline for International Education and Training of welders has been developed, evaluated and formulated by group A of the International Authorisation Board (IAB) of the International Institute of Welding (IIW). The purpose of this directive is the standardization of training, examination and qualification of welders worldwide. It provides the framework for the verification of both the professional as well as the practical knowledge, in accordance with the requirements of ISO 9606/DIN EN 287-1 and the test objects, provided that Part II of this guideline will be applied. Where ISO 9606 is named in this guideline, DIN EN 287-1 shall also be applied accordingly.

The international standards of the series ISO 9606 provide a system for qualification testing of welders to test and assess their manual dexterity for limited scopes of application. They are used for quality assurance for a specific activity, however, they do not include any program for training and education. Nevertheless, the industry needs welders with comprehensive skills in order to maintain flexibility in production. This directive provides a combination of theoretical and practical training, supplemented through theoretical exams and by tests of gradually increasing degrees of difficulty, including welder qualification tests according to ISO 9606. This directive takes into account both aspects, and contains specifications on the practical and theoretical training of fillet weld, sheet metal and pipe welders.

The theoretical training as well as the training program are made up of the three theoretical modules A, B and C, providing the theoretical basic knowledge of welding, and six practical modules (3 pairs), according to the three skill levels. Specific requirements for each welding process are included in the modules S. Specific requirements for each material (group) are included in the modules P.

It is at the discretion of the ANB whether the training course will be complemented by other special subjects. These subjects should serve as an expansion of the basic knowledge listed in this directive. The directive is being reviewed regularly by Group A of the IAB, in order to take account of changes to the state of the art.

Guideline DVS®-IIW/EFW 1178 “International Welding Quality Inspection Staff”

This Directive for the internationally harmonised training of Welding Quality Inspection Staff members who are to be used as quality auditors within the scope of their professional activity was compiled by Working group IAB A3b of the International Institute of Welding (IIW). It is designed in such a manner that, from a training aspect, it covers all essential subjects of welding and the quality assurance that must be mastered by those individuals who are meant to responsibly assume duties related to quality assurance according to various levels. In order to meet the requirements for specific applications or tasks, it may happen that additional training and/or experience is necessary, going beyond the scope of the knowledge conveyed.

The task of the quality auditor already starts before the beginning of the welding works, lasts for the duration of the welding activity, includes tasks after the completion of the welding process as well and does not end until the results have been summarised correctly in a test report. As a part of the quality assurance system, the examination steps are defined in an inspection plan and test plan that clearly describes everything that is necessary. The quality auditor is often responsible for the creation of documents that ensure the traceability of the components and the associated production steps.

New Guideline DVS 1184 und 1184-1 “Operator for fully mechanised and automatic welding equipment, metal inert gas welding”

The application of this Directive is for fully mechanical and automatic fusion welding (metal inert gas welding, submerged arc welding, tungsten inert gas welding and plasma arc welding). These include, for example, welding on the following equipment:

- welding portals
- linear chassis
- automatic welding machines
- welding robots

Besides the conveying of specialised theoretical knowledge, there is also a special focus on practically oriented training. The directive should preferably be applied for the qualification of individuals who are setting and/or adjusting the relevant welding parameters at fully mechanical and automatic welding units and therefore significantly influence the weld seam result.

In addition to basic welding engineering knowledge and programming techniques, the application of seam sensors and robotic welding of manufacturing components, the knowledge transfer is module-based.

For the programming and welding of the test parts as well as after passing the theoretical and practical examination, the participants will get an examination certificate according to DIN EN 1418 and/or following the introduction of DIN EN ISO 14732, they will then also get the examination certificate according to this new standard.

Trade media and teaching materials for arc 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 technical codes, videos and software. The products of DVS Media GmbH reflect all fields of activity of the DVS Society 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 arc welding: This includes Specialist books and trade journals, as well as training materials and set of rules, 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 Technical Codes and DVS Technical Bulletins 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 arc welding



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Photo: istockphoto

Publications on arc welding



The Arc Welder Guidelines for training and practice

In the field of technology, further research and development keeps happening. New welding machines deliver more steady electric arcs and a weld pool that is easier to control. Many other examples could also be named here. The current edition of this publication the latest developments and the current standardization. It provides many practical tips and notes and is particularly well suited as a refresher course of skilled workers and foremen as well as for support for work preparation and quality control.

11th Edition 2013
128 Pages, 255 Images & Figures / 24 Tables
ISBN: 978-3-87155-561-9
Item number: 205610



Arc joining processes - state of the art and future potential

This reports volume contains a summary of the current state of arc welding technology in the year of publication. Besides specific process characteristics, current applications fields as well as specific features are presented in detail. In line with in current and future research activities initiated by the DVS in the field of arc welding, this publication provides an overview of the short-term and medium-term need for this widespread and universally applicable, trend setting joining process.

J. Wilden, D. Bartout, F. Hofmann
2009 Edition
100 Pages, 46 Images & Figures, 10 Tables
ISBN: 978-3-87155-255-7
Item number: 300249



Technical Bulletin DVS 0941-3 Flux cored wire for metal arc welding of stainless steels and heat resistant steels

This DVS Technical Bulletin applies for metal active gas welding of ferritic, martensitic, austenitic and austenitic-ferritic stainless steels with homogeneous or similar flux cored wire, with or without shielded gas. There are application hints and notes for a qualitatively flawless and economical welding process-based machining of the materials.

DVS 0941-3, February 2012, 10 Pages

You can find further DVS Technical Bulletin on the subject under www.dvs-regelwerk.de

Your contact persons in the area of “Arc Welding”

Your contact person for Research | Technology | Education



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AG V 2 “Arc Welding”

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DVS maintains a tight network made up of **research, technology** and **education** as a core element of the technical-scientific cooperative work.

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Your participation in our committees is worthwhile!

- Because you will learn about important changes in the rules and regulations work first.
- Because you will actively participate in shaping technology fields.
- Because you can experience first-hand technical knowledge transfer.
- Because you can identify trends early on.
- Because you can benefit from important national and international contacts.

Become a part of our network of over **3,000 companies** and **16,000 professionals** who are associated with the joining technology.

Please contact us!

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