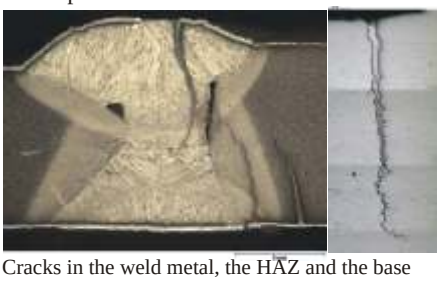
GSI news

SLV Berlin-Brandenburg · SLV DUISBURG · SLV FELLBACH · SLV HANNOVER · SLV MÜNCHEN · SLV Saarland · SK BIELEFELD · SLV HALLE · SLV Schweißtechnische Lehr- u. Versuchsanstalt NAV GmbH

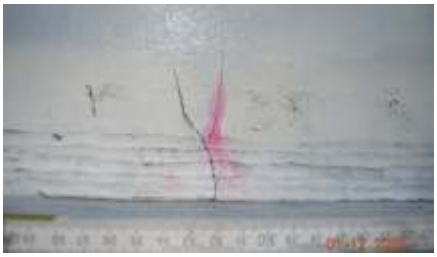
Formation of cracks in galvanized steel structures

Current examinations on galvanized steel structures have shown the problems that zinc melting with elevated contents of tin (Sn>0.3%), lead (Pb>0.9 %) and bismuth (Bi>0.1 %) lead to an increase in fracture defects due to so-called "liquid metal induced stress corrosion cracking (liquid metal embrittlement) on steel constructions. This is a particular appearance in areas of increased residual stresses due to welding and deforming of high-strength steels as from S 355 (included). At the moment the causes for the occurrence of such fractures are being investigated in research projects and concepts for avoiding such fractures are being developed.



Cracks in the weld metal, the HAZ and the base metal of a butt weld filled with zinc

The fractures can practically not be recognized with the bare eye since they arise in the galvanizing bath and therefore are filled with zinc melt. The problem has particularly arisen with building components as from mid 2000 since from there on galvanizing shops have modified their alloys as described above.
Due to the fact that there are risks with existing buildings, the Superior Building Authorities of the Federal States in accordance with the Institute for Construction, DIBT in Berlin, have issued decrees according to which first larger, galvanized steel constructions made from high-strength steels having certain constructive characteristics, manufactured after July 2000, have to be tested on their lack of fracture by the owners. To this end, designers and static engineers have been invited to identify the locations subjected to stresses in areas relevant to stability, in order to then, first by random tests, to inspect the buildings in the critical areas by means of non-destructive testing. Hence, magnetic particle testing (MT) it to be applied, where the evaluation of possible indications has to be carried out by a level 2 tester having undergone additional instruction concerning the special problem.
Since at the beginning of this year the SLVs



Concealed galvanizing crack (MT tested) adjacent to a wide open crack (PT tested) in the frame of a girder with welded bracket as well as indications of longitudinal cracks in the weld metal

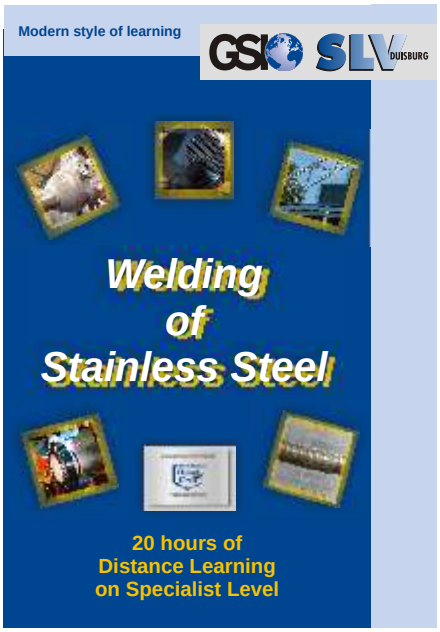
carried out MT tests over months on a massively fractured large building and therefore have obtained experience in particular with the evaluation of indications, they have been named to be the favourable contact for the tests to be carried out.
If you seek further information, do not hesitate to contact the departments "Quality Assurance" of the SLVs. At the beginning of this year, there will be various central meetings in various regions, which will inform about the procedure with existing constructions and measures for avoiding cracks on new projects. Please pay attention to the announcements such as in the GSI News.
You can find the first comprehensive information in the Internet such as by the Superior Building Authority in Rhine Pallatinate in the Ministry for Finance under: www.fm.rlp.de. The easiest way to obtain information is to search with e.g. Google or Lycos the word "Verzinkungsrisse" (Fracture caused by galvanization).

Concealed cracks after MT-testing in the area of a stiff pedestal of a post

Authors:
Dr.-Ing. H. Nies, Dr.-Ing. G. Kuscher

Contact person:
Departments "Quality Assurance" of the branches of the GSI mbH
(addresses see page 6)

"Cost Aspects in Welding Production" - Self-Study-Programme for Welding Coordinators



"Welding Of Stainless Steel" - A multi-media self-study CD especially aimed at welding coordinators, welders, masters and craftsmen who want to know more about this type of material.

Further information you will find under:
www.slv-duisburg.de

New Standards also for Resistance Welding

On a regular basis, new standards and instruction sheets are published and revised, respectively for the field of resistance welding, too.
For a long time generally valid definitions in the area of current measurement were missing. Now, this gap has been filled by the DIN ISO 17657 Resistance Welding - Welding current measurement for resistance welding, consisting of several parts, a work comprising almost 100 pages.
In parts 1 to 5 of this standard measurement of the welding current is being treated starting from a guide for measurement and continuing with the description and definition of the equipment technology up to calibration. Photograph1 shows the principal build-up of the welding current measurement principle with the welding machine (2), the measurement belt (1) and the welding current measurement device consisting of several parts (7), which is being treated here.
Both, measurement on alternating current (AC) an on direct current (DC) are being treated. The compliance with welding times pursuant to the standard with both types of current is shown in Figure 2.
Most of the current measurement devices used today have a number of functions and

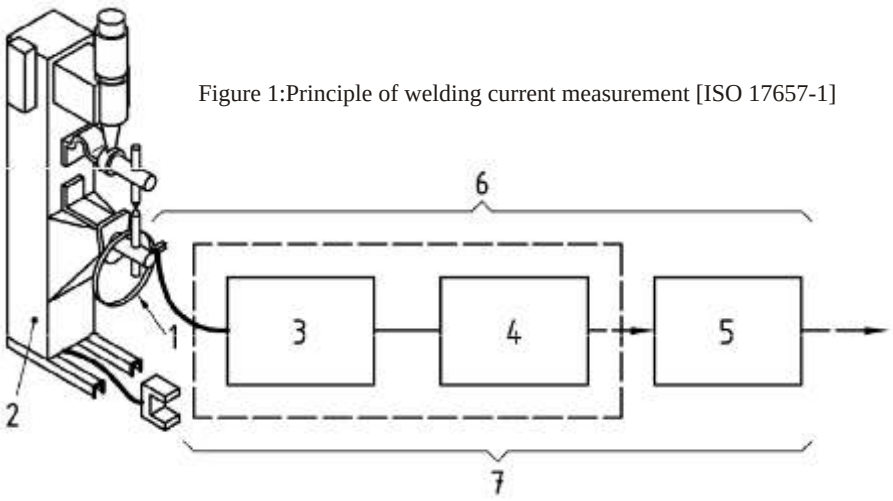


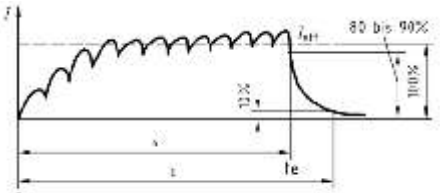
Figure 1:Principle of welding current measurement [ISO 17657-1]

adjusting possibilities which are not sufficiently understandable for the user. Due to this, misadjusting is frequent in practice. Moreover, the comparison of the measured values of differently adjusted devices is possible in very close limits only. Therefore it is appreciated that now a standard has been set up which can be referred to, if measurement tasks have to be defined.

For years already have welding current measurement devices of various manufacturers been applied in training courses in the SLV Duisburg and, at least in the advanced courses, the traps connected with misadjusting have been demonstrated.
One important aspect is described in parts 4 and 5 of the standard: the verification and calibration, respectively of the devices to be carried out on a regular basis. Due to the fact that this type of work usually cannot be carried out by the user himself, here our tip: this service is offered by the SLV Duisburg!

Contact person:
Mr. Schreiber
Phone: +49 203 3781-224
E-Mail: schreiber@slv-duisburg.de

AC: b=Welding time



DC: a=Welding time, b=Time of current flow

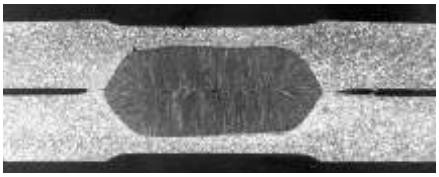
Figure 2:Definition of the welding times [ISO 17657-1]

Current information on manufacturer qualification and standardization
- New standards and guidelines as from March 2005 -

DIN EN 287-1 (06/06)	Examination of welders - Fusion welding - Steels
DIN EN 10080 (08/05)	Steel for the reinforcement of concrete - weldable ribbed reinforcing steel - General
DIN EN 10088-1 (09/05)	Stainless Steels - Part 1 - List of stainless steels
DIN EN 10088-2 (09/05)	Stainless Steels - Part 2 - Technical delivery conditions for sheet/plate and strip for general purposes
DIN EN 10088-3 (09/05)	Stainless Steels Technical delivery conditions for semi-finished products, hot-rolled bars, rods and sections for general purposes
DIN EN 10164 (03/05)	Steel products with improved deformation properties perpendicular of the product; technical delivery conditions
DIN EN 10210-1 (07/06)	Hot finished structural hollow sections of non - alloy and fine grain structural steels; Part 1: Technical delivery requirements
DIN EN 10210-2 (07/06)	Hot finished structural hollow sections of non - alloy and fine grain structural steels; part 2: tolerances, dimension and sectional properties
DIN EN 10219-1 (07/06)	Cold formed structural hollow sections of non-alloy and fine grain structural steels; Part 1: Technical delivery requirements
DIN EN 10219-2 (07/06)	Cold formed structural hollow sections of non-alloy and fine grain structural steels; Part 2: Tolerances, dimensions and sectional properties
DIN EN 13479 (03/05)	Consumables - General Standard on Consumables and Powder for Fusion Welding of Metallic Materials

Spot soldering - S-bonding in the SLV Halle

Resistance spot welding is a simple, reliable and economical joining process. Its disadvantage, however is, that visible surfaces have to be re-worked requiring larger expenditure than that required for joining. The cause of this are the deep electrode indentations generated by shrinking of the molten metal volume (figure on the right).



Comparision of spot soldering (left) and spot welding (right)

By the assembly of a solder depot at the spots to be joined later, the welding spots can be replaced by solder spots, fusion of the base metal can be avoided and therefore the indentations of the electrodes specific to the spot welding and spot welding - bonding processes can be prevented (figure on the left).
By mechanising the generation of a solder depot - a prototype of such a device already exists - the solder depot can be reproduced. For the second process step, the actual joining, the common, existing spot welding machines may be used.
With the prototype line of products developed, the size of the depot can similar to spot welding be adapted to the plate thickness and load exerted, respectively (depot dimensions 5x5, 7x7, 9x9 or rectangular depots of similar space).
The static tensile shear force with specimens from non-alloyed steels having a thickness of 1 mm (solder depot dimension 5 x 5) are within the same dimensional range as with spot welding joints having a nugget diameter of 5 mm). Random investigations on endurance strength have shown that spot soldering obtains approx. 150 % value compared to spot welding.
With spot S - welding, the adhesive is applied using the known technologies between the generation of the depot and soldering.
Through modification of the parameters a stable soldering process is obtained in spite of the "disturbing element glue". Compared to a bare spot soldering, the tensile shear force is reduced by approx. 10 % with non-cured glue. Upon curing of the glue the shear tensile force is almost doubled.
Spot soldering has been successfully applied for several years to plate thicknesses of 1 mm; there are standard values of up to 3 mm. For spot S - bonding a standard technology for a thickness combination 1+1mm and 1+2mm is available as well as investigations on fatigue strength for a plate thickness of 1 mm being a good basis for e.g. the automotive industry.

Advantages:
- Saving post-working processes
- Utilization of existing spot welding devices
- Visual surfaces without impairment also possible as a seal joint
- Strength values comparable to a spot welded joint (spot soldering) and a spot welded bonded joint (S - bonding)

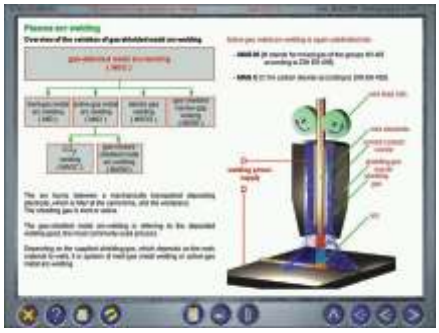
Contact person:
Dr. Sitte
Phone no.: +49 345 / 52 46-430
E-Mail: sitte@slv-halle.de

International Welding Engineer/Technologist IWE/IWT Course 2008

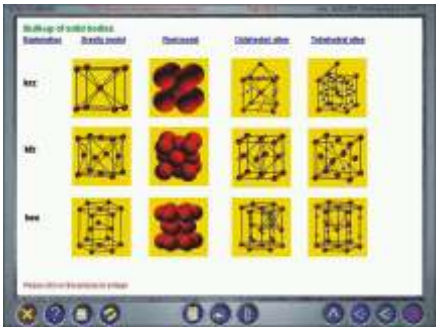
Since 1999 the SLV Duisburg is offering the International Welding Engineer/Technologist IWE/IWT course also in English Language with participants from all over the world and since 2001 the SLV Duisburg has successfully established the distance learning course IWE/IWT part 1. The course part 1 has proved to be an effective alternative to conventional classroom training and this experience flowed directly into the development of the IWE part 3 course which will be launched in January 2008.

Blended learning is the concept for the new IWE Part 3 course and an excellent combination of different modes of home-learning include online tutoring and conventional classroom learning. The Presence time is so reduced to 160 hours and the participants stay only 4,5 weeks in the SLV Duisburg.
This means 4 weeks less of travelling with costs for transportation and accommodation, 4 weeks less absence from work, no need to sacrifice holidays. The first presence time phase will take place in April 2008.
It offers considerable flexibility and time saving because students can choose where and when to study using the teaching learning materials.
The technical knowledge of the modules is contained for your individual studies and in

Case you already have certain knowledge concerning the single modules those may be learned in shorter time or even be skipped.
Students have regular interaction with the Tutor. This enables them to discuss and clarify



anything they could not understand from the teaching learning materials.
The presence phases with face to face learning, workshops, laboratory tutorial and case studies deepen the knowledge and promote the personal supporting the contact to the lecturer and to the other students.



After a successfully completion of the course and passing the final examination the participants will receive an IIW Diploma and the title International Welding Engineer or International Welding Technologist.

Whatever your interests, distance learning can help you gain the knowledge and skills that will help you to build your future.

Further information you will find under: **www.slv-duisburg.de**

Contact person:
Mr. Moll
Phone no.: +49 203 / 3781-252
E-Mail:moll@slv-duisburg.de

Arc stud welding with strike ignition on dissimilar joints

With dissimilar stud welding mostly alloyed studs from CrNi steels are welded using arc welding with their face side to non-alloyed plates such as a steel support structure. Two different fields of application are of importance: 1) Stud made of stainless steel - plate made of non-stainless steel not exerted to thermal loads. Commonly used are threaded bolts made of X5CrNi18-10 (1.4301). Currently, there are limitations to bolts up to 12 mm pursuant to the DIBt approval certificate no. Z-30.3-6 of the DIBt. 2) Refractory: Application with thermal loads at low mechanical stresses. The resistance to thermal loads of the bolt material is ensured by heat resistant materials such as X15Cr NiSi25-21 up to approx. 1200 ° C.
In the research report 5137/2005 of the SLV München influences of important welding and marginal conditions on the quality of the weld are shown. Welding tests on bolts made from the material 1.4301 up to 19 mm diameter as well as refractory joints with bolts made of heat resistant materials such as X15CrNiSi20-12, X15CrNiSi15-21 and NiCr23Fe up to diameter are carried out. The welding works are carried out on non-alloyed plates S235 or S355 up to 16 mm plate thickness using ceramic rings or alternatively shielding gas.
With ceramic ring stud welding welding is carried out with good build up, low tendency to spatter and low susceptibility to arc blowing. One advantage is a larger ceramic ring leading to a wider fusion zone of the plate and a fillet weld shaped build up (figure).

View and penetration shape of an optimized W-S stud welding

At joints with bolts 1.4301 cracks are only proven in very thick molten pools with centred fusion of the bolt. At refractory joints the formation of cracks during stud welding is dependent on the material. Materials with high nickel contents having thin molten pools can also show hot cracking. Despite cracks, the specifications of the transverse bending test are fulfilled due to the good toughness properties of the alloyed materials. Metallographic tests show an inhomogeneous martensitic- austenitic structure with strongly varying hardness values between 340 and 589 HV5 with the bolt materials 1.4301 as well as hardness values below 300 HV1 with the refractory joints. As for the rest, the joints show an only a few macroscopic defects.
With bolts from 1.4301, the location of fracture in the bolt is securely obtained after the application of a heat treatment with the purpose of lowering soaking only. Without heat treatment, the fracture frequently occurs in the welding and heat affected zone of the bolt with stresses at failure of up to 650 N/mm2. The fracture behaviour was caused by a partial soaking of martensitic structural zones in the weld zone. With refractory joints no soaking in the weld zone is proven.
The examinations have shown a positive result of ceramic ring welding for all diametres using dry (and larger, respectively) ceramic rings. The execution of the welding under shielding gas pursuant to the building authorities can be neglected in the case of ceramic ring stud welding.
The examinations are sponsored by the budgetary means from the German Ministery for Economy and Technology (Bundesministeriums für Wirtschaft und Technologie) via the working group of industrial associations of research (AiF-Nr. 13.597 N) and supported by the association of research of the DVS. The SLV München expresses her thanks for the promotion of the research work, in particular for the support from the following companies: AS Schöler + Bolte Bolzenschweiss-Systeme GmbH (Witten), Bolzenschweißtechnik bsk & BTV GmbH (Köln), Heinz Soyer Bolzenschweißtechnik GmbH (Wörthsee-Etterschlag), Köster & Co GmbH (Ennepetal), Nelson Bolzenschweiß-Technik GmbH & Co. KG (Gevelsberg) as well as the members of the project accompanying committee.

Contact person:
Mr. Jenicek
Phone no.: +49 89/12 68 02-57
E-Mail: jenicek@slv-muenchen.de

The new series DIN EN ISO 3834

In March 2006 the series DIN EN ISO 3834 "Quality requirements for fusion welding of metallic materials" whose parts 1-5 replace the series of DIN EN 729, parts 1-4.
In parts 2-4 the different levels of the requirements on quality are described, but now it is directed to DIN EN ISO 9001: 2000.
Part 5, which did not exist in the series of the DIN EN 729 refers to standards and guidelines that have to be complied with depending on the different fusion welding processes, in order to prove the respective quality level (comprehensive, standard, elementary).
The application of the new standard series in the different fields of application (steel, vessel, pipeline and rail vehicle construction etc.) is dependent on the type of classification of these standards (dated or non-dated).
The series of the DIN EN ISO 3834 is like the DIN EN 729 not a quality management system, but it comprises several characteristics that contribute to a QMS. Information, which elements of the ISO 9001: 2000 are necessary supplementary to setting up a QMS are listed in chapter 6 of the DIN EN ISO 3834-1.

The GSI offers seminars on this topic.

Further information you will find under: **www.gsi-mbh.de**

Commissioning of a New Plant for Friction Stir Welding in Berlin

Friction Stir Welding is a process developed in England by the TWI at the beginning of the 90s which has mainly proven itself for the joining of aluminium. In both, process development and application to structures in rail vehicle construction as well as in aerospace, the SLV Berlin-Brandenburg was one of the pioneers of this technology. Besides of the technological know-how extensive knowledge on machine design as well as on the selection of materials of stirring devices, the active component is available. They are of special interest today when this technology is to be made available for small and medium-sized companies, too.
In order to further develop the scope of performance on the current state of machine technology, the investment in a new machine technology has been supported by the GSI. Improved performance parameters as well as handling functions are supplemented by new functionalities such as an integrated powered control system. Therefore, it becomes possible to extend the applications also to materials other than the particularly suitable aluminium materials and to fulfil the requirements on quality assurance.

Mr. Boywitt informs the working group of the SLV leaders about the FSW plant

Supplementary to development work the plant is also available for service welding.
On the occasion of the meeting of the branch leader of the GSI and SLV, respectively on June 1st, 2006 the new FSW plant was commissioned, thus further completing the scope of performance of the GSI.
Further information on the topic "FSW welding" see: www.slv-bb.de, headline "Forschung und Entwicklung" (research and development)

Contact person:
Prof. Paulinus
Phone no.: +49 30 / 4 50 01-1 00
E-Mail: dietmar.paulinus@slv-bb.de

Current information on manufacturer qualification and standardization

- New standards and guidelines as from March 2005 - ***Continued from side 2***

DINENISO 3834-1 (03/06)	Quality requirements for fusion welding of metallic materials Part 1 - Criteria for the selection of the appropriate level of quality requirements
DINENISO 3834-2 (03/06)	Quality requirements for fusion welding of metallic materials Part 2 - Comprehensive quality requirements
DINENISO 3834-3 (03/06)	Quality requirements for fusion welding of metallic materials Part 3 - Standard quality requirements
DINENISO 3834-4 (03/06)	Quality requirements for fusion welding of metallic materials Part 4 - Elementary quality requirements
DINENISO 3834-5 (03/06)	Quality requirements for fusion welding of metallic materials - Part 5 - Documents with which it is necessary to conform to claim conformity to the quality requirements of ISO 3834-2, ISO 3834-3 or ISO 3834-4.
DINENISO 2560 (03/06)	Welding consumables - Covered electrodes for manual metal arc welding of non-alloy and fine grain steels - Classification
DINENISO 9606-2 (03/05)	Qualification test of welders - Fusion welding - Part 2 - Aluminium and aluminium alloys
DINENISO 10042 (02/06)	Welding - Arc welded joints in aluminium and its alloys - Quality levels for imperfections
DINENISO 15614-2 (07/05)	Specifications and Qualifications of welding procedures for metallic materials - Welding procedure testing - Part 1 - Arc welding of aluminium and its alloys
CENISO/TR 15608 DIN-Report (01/06)	Welding - Guidelines for a metallic materials grouping system
DVS1621 (07/06)	Technical rules - Handling of work specimens in rail vehicle construction
DVS1622 Technical sheet 1 (07/06)	Adaptation of DIN 6700 to current standards - Qualification and selection of filler metals; adaptation of the material groups
DVS1622 Technical sheet 2 (08/06)	Adaptation of DIN 6700 to current standards Fusion welded joints to aluminium and its alloys

Contact person:
Mr. Loos
Phone no.: +49 2 03/37 81-4 98
E-Mail: loos@slv-duisburg.de

Branch of the GSI in Egypt

Since August 15, 2006 the GSI has been operating their third foreign office, - in Kairo - the date when the GEWC (German Egyptian Welding Center) started their activities. After the SVV in Prague and theGSI SLV Polska in Gliwice / Poland the first office of the GSI outside of Europe was founded. The company is based on the joint venture between the GSI and the company AL SALEM (Kairo). The company GEWC is directed by Mr. Dipl.-Ing. Said Hafez of German nationality who has been employed with the SLV Fellbach, Branch of the GSI mbH, since 1986.

Mr. Dipl.-Ing. Said Hafez, Leader of the branch in Egypt

First, he worked as an engineer in the research Department for three years and since 1989 he has been directing the practical and theoretical education department and has been deputy leader of the SLV Fellbach.

Contact person:
Mr. Ahrens
Phone no.: +49 2 03/37 81-1 31
E-Mail: ahrens@slv-duisburg.de

CE -Sign in Structural Steel Engineering

A lot of people know that in the pressurized vessel manufacturing industry the CE sign, the declaration of conformity about harmonized European Standards, among others the Guideline on Pressurized Vessels 97/23/ EG, has been introduced.
In the currently applicable Building Products Act (Bauproduktengesetz (BauPG)), the application of the European Guideline of Construction Products 89/106/EWG, the first products for steel construction will soon be regulated in compliance with the CE sign and will be introducted into the Building Rules List (Bauregelliste (BRL)), being legally binding then.
The GSI-SLVs have already been accredited for these areas.
The essential ones are:

- EN10025-1:
  Hot rolled products of structural steels
  Part 1: General technical delivery Conditions.

- EN 13479:
  Welding consumables - General product standard for filler metals and fluxes for fusion welding of metallic materials

- EN 14399:
  High-strength structural bolting assemblies for preloading
  Part 1: General Requirements

- EN 40-5 and 6:
  Lighting columns

To this end, the manufacturers can apply for the supervision and certification and will be served as soon as possible at the most economic costs. Further harmonized standards are constantly published for steel construction and the GSI will constantly be accredited (being approved). Therefore, the GSI can award the German manufacturers the certification (CE sign) as fast as possible, in order to qualify them for the German market.
Contact person:
All branches of the GSI
(addresses see page 4)

Testing instead of repairing!

Under this provoking headline some of the results of a research project of the SLV Duisburg and the TH Aachen will be presented in the following. To this end, the problems of lack of fusion are explained which are rated high in steel and mechanical engineering.
With a weld construction with lack of fusion and exerted to dynamical loads there is the risk of the stress concentration causing the formation of a crack at the point of lack of fusion (Fig. 1).

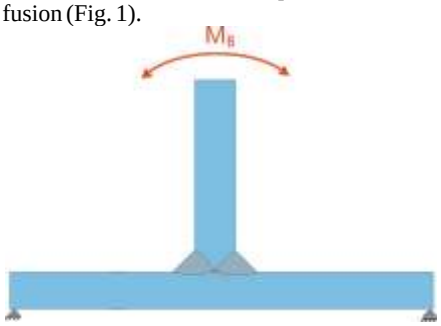


Fig 1: Lack of penetration of a t-joint as a crack initiator

Therefore, with dynamically loaded weld construction complete fusion is demanded. Every lack of fusion, even if it is very small, therefore leads to cost intensive repairs. It is not the question, whether these repairs are really necessary concerning safety of the component. Moreover, the question will be raised, whether the quality of a weld seam is always better after being repaired. Often it is difficult to produce the required pre-treatment of a weld seam complying with the standard. Moreover, the repeated heat input has influence on the material properties.
With welded specimens under dynamic load in many cases a failure mechanism initiated at the surface was observed. The stresses on the surface of the part often proved to be more critical than a stress concentration on lack of penetration which is located near the stress neutral zone (Figure 2).

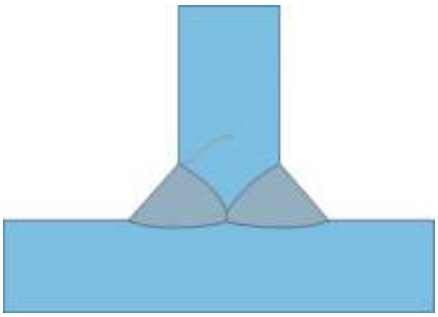


Fig. 2: Failure due to lack of penetration starting from the surface of the component

Decisive for the acceptance of lack of penetration is its extent, which, however cannot be determined using the common methods of non-destructive testing. The application of acoustic lenses as well as the evaluation of edge wave echoes (figure 3) in the above mentioned research project has lead to measurement results which serve as the basis for a proof on the safety of the building part through fracture mechanics and on a safe operation.

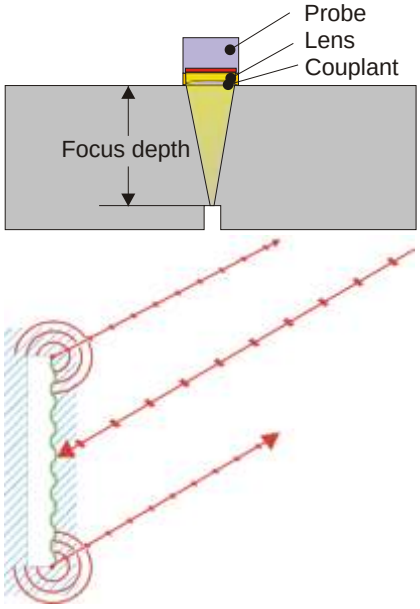


Fig. 3: Application of acoustic lenses (above) and evaluation of edge waves

Therefore, unnecessary repairs can be avoided. Residual gaps proven to be safe can be planned during the construction. Counter gouging requiring a lot of work with plain connections can be avoided.

Contact person:
Mr. Schmeinck
Phone no.: +49 203 3781-155
E-Mail: schmeinck@slv-duisburg.de

SLV-GSI Polska

The SLV-GSI Polska with with its headquarters in Zabrze, Poland, commenced operations on 1 December 2005 under direction of Mr. Dipl.-Ing. Piotr Gladysz.
The SLV-GSI Polska, a 100% subsidiary of the GSI mbH, has its field of activity on the field of consulting and service of Polish companies in the area of welding. In close cooperation with the approved parts of the GSI, in particular the SLV Halle, the branches of the GSI in Berlin, Hanover and Duisburg company inspections on the field of building supervision are consulted and supported by experts. Services such as the execution of procedure specifications, working specifications as well as the certification of welders´ exams but also supervision of manufacture, acceptance of welding structures or the organisation and execution of professional seminars and exchange of experience of welding supervisors are among the field of operation of the SLV-GSI Polska.
After one year of operation it can be stated that the common customers of the GSI mbh and the SLV-GSI Polska have well accepted their scope of offer. The SLV-GSI Polska has developed to be an expert partner and cooperator for the Polish companies.

Contact person:
Mr. P. Gladysz
Phone no.: +48 32/3 73 42 21
E-Mail:slv-gsi.polska@post.pl

Branches of GSI

Schweißtechnische Lehr- und Versuchsanstalt
SLV Berlin-Brandenburg, Niederlassung der GSI mbH
SLV-Leader: Dr.-Ing. Dietmar Paulinus
Phone: (0 30) 4 50 01-0, Fax: (0 30) 4 50 01-1 11
Internet: www.slv-bb.de

Schweißtechnische Lehr- und Versuchsanstalt
SLV Duisburg, Niederlassung der GSI mbH
SLV-Leader: Dr.-Ing. Steffen Keitel
Phone: (02 03) 37 81-0, Fax: (02 03) 37 81-2 28
Internet: www.slv-duisburg.de

Schweißtechnische Lehr- und Versuchsanstalt
SLV Fellbach, Niederlassung der GSI mbH
SLV-Leader: Dipl.-Ing. Helmut Roth
Phone: (07 11) 5 75 44-0, Fax: (07 11) 5 75 44-33
Internet: www.slv-fellbach.de

Schweißtechnische Lehr- und Versuchsanstalt
SLV Hannover, Niederlassung der GSI mbH
SLV-Leader: Dr.-Ing. Rainer Mittelstädt
Phone: (05 11) 2 19 62-0, Fax: (05 11) 2 19 62-22
Internet: www.slv-hannover.de

Schweißtechnische Lehr- und Versuchsanstalt
SLV München, Niederlassung der GSI mbH
SLV-Leader: Dipl.-Ing. Franz Zech
Phone: (0 89) 12 68 02-0, Fax: (0 89) 18 16 43
Internet: www.slv-muenchen.de

Schweißtechnische Lehr- und Versuchsanstalt
SLV im Saarland, Niederlassung der GSI mbH
SLV-Leader: Dr.-Ing. Helmut Nies
Phone: (06 81) 5 88 23-0, Fax: (06 81) 5 88 23-22
Internet: www.slv-saar.de

Schweißtechnische Kursstätte SK Bielefeld,
Niederlassung der GSI mbH
Leader: Dipl.-Ing. F.-W. Gehring
Phone: (05 21) 6 50-44/-45, Fax: (05 21) 6 50-40

Cooperating institutes

Schweißtechnische Lehr- und Versuchsanstalt
Halle GmbH
SLV-Leader: Dr.-Ing. Martin Ströfer
Phone: (03 45) 52 46-0, Fax: (03 45) 52 46-4 12
Internet: www.slv-halle.de

Schweißtechnische Lehr- und Versuchsanstalt
Mecklenburg-Vorpommern GmbH
SLV-Leader: Dipl.-Phys. Jan Hoffmann
Phone: (0381) 8 11-50 10, Fax: (0381) 8 11-50 99
Internet: www.slv-rostock.de

TC-Kleben GmbH (Adhesive Bonding)
Director: Dipl.-Ing. Julian Band
Phone: (02451) 971200, Fax: (02451) 971210
Internet: www. Tc-kleben.de

Other institutes of GSI

MPA Kalibrierdienst GmbH (Calibration)
Director: Dipl.-Ing. Volker Rutschke
Phone: (030) 457985-80, Fax: (030) 457985-88
Internet: www. mpa-kalibrierdienst.de

SVV Praha (CZ)
Director: Dipl.-Ing. Pavel Flegl
Phone: +420 244 471 865, Fax: +420 244 470 854
Internet: www.svv.cz

SLV-GSI Polska Sp. z o.o. (PL)
Director: Pjotr Gladysz
Phone: +48 32 37 34 221, Fax: +48 32 37 34 222

GEWC (EG), German Egyptian Welding Center
Director: Dipl.-Ing. Said Hafez
Phone: +20 1236 36030
E-Mail: hafez@gewc.net

Flag

GSI News are published annual by GSI - Gesellschaft für Schweißtechnik International mbH.

Print run: 1.000

GSI - Gesellschaft für Schweißtechnik International mbH
Aachener Straße 172
40223 Düsseldorf
Phone: +49 (0211) 15 96 227
Fax: +49 (02 03) 3 60 90 02
Internet: www.gsi-mbh.de