

IIW - DOC - III - 903 - 87

Structural stress concentration at spot-welded joints : improved model, comparison of results, stress singularity

The FEM using brick/plate element model is used in this paper to evaluate the structural stress concentration factors and the result is compared with the other models used by the author. The load cases on the basis of which the convergence and accuracy investigations were carried out are compression - tension, transverse shear and tensile shear. With different load models the results are compared. Stress singularity at the weld-spot edge is also explained.

IIW - DOC - III - 917 - 88

Specimen dimensions and procedure for mechanized peel testing Resistance spot, seam and embossed projection welds.

Details of testing procedure, location of specimens for testing and reporting details are given for mechanised peel testing of single spot projection welds in overlapping sheets in any materials of thickness 0.5 - 3.0mm. Figures are given for multi - spot test plate; also used for testing a seam weld, single spot test piece, single specimen bending procedure and peel test specimen.

IIW- DOC - III - 938 - 89

A simple method to predict the fatigue behaviour of multi spot welded tensile sheared assemblies

1. Part I - IIW - DOC - III - 807 - 85

Resistance spot welding of high strength low alloy steel sheet A survey

This old document contains extracts regarding fatigue loading and fatigue resistance efficiency of each spot weld in multi - spot tensile shear assemblies.

2. Part II - IIW - DOC - III - W67 - 74 - 88

Fatigue behavior of multi spot welded tensile sheared assemblies

This document deals on repeated loading's enhanced notch effect. The influence of the notch effect is being discussed. Behaviour of components including welded arrays under fatigue loading is explained. Fatigue resistance of a multi spot welded assembly is also explained.

IIW - DOC - III - 939 - 89

Mechanical properties of resistance spot welding machines and their mathematical determination

In this paper the mathematical modelling of the dynamic mechanical machine characteristics are discussed. Influencing variables are listed and mathematical determination of these variables are explained. Only theoretical work is reported.

IIW - DOC - III - 940 - 89

Mechanical characteristics of spot welding machine Review of Published literature

In this paper, the working group have compiled the information available on mechanical characteristics of spot weld machines, as it has serious bearing on the electrode life as well as spot weld quality. The results generated by Krause et. al on "Factors influencing electrode head dynamics" and the results on "Effect of heat friction/machine rigidity by Satoh et. al are summarised. Further, the results on effect of frame rigidity of D.C. machines are being discussed. Based on this compilation the following areas are identified for modification of ISO 669 and evolving Design guidelines for spot welding machines.

1. Define important parameters which characterise machine performance.
2. To optimise and standardise measuring techniques.
3. Determine the relative importance of the measured parameters in
 - a. controlling machine performance.
 - b. Weld growth
 - c. Electrode life/wear.
4. Define acceptable limits for the more important machine parameters.
5. Determine typical characteristics of a range of machine types.

IIW - DOC - III - 948 - 89

Specimen dimensions and procedure for shear testing Resistance spot and embossed projection welds

This Document is a proposed standard of ISO. The aim of shear testing is to determine the maximum shear force that the pieces can sustain. The scope of this standard covers, sheet thickness 0.5 to 10 mm. Dimensions of shear test piece is given for each thickness for single spot and multispot test pieces. Shear test arrangements may be either with or without shim plate. Details of types of fracture in tensile, shear test is given in figure and typical load elongation diagrams for the shear test are also given. In multispot welding the first and last spot welds must be

disregarded. For projection welding all welds must be tested. The minimum number of test pieces shall be twelve for both spot and projection welding.

The test report shall specify the welding process, equipment, material, dimensions of the test piece, individual values, mean value and standard deviation of the cross tension force weld diameter, and also the type of fracture.

IIW - DOC - III - 949 - 89

Specimen dimensions and procedure for impact shear and cross tension Resistance spot and projection welds

This Document is to be published as international standard via the new IIW/ISO route. The scope and field of application of this paper deals with specimen dimensions and testing procedure for impact shear and cross - tension testing of spot and projection welds in overlapping sheets of thickness 1 to 4 mm where the welds have a maximum diameter of $5t$ (t = sheet thickness). The objective of impact shear and cross-tension testing is to determine the maximum failure force and failure energy that the test pieces can sustain during testing.

Modified pendulum machine and drop weight machines are used for both impact shear test and impact cross tension test. Dimensions of impact shear test specimen and impact cross - tension specimen are given put to 4 mm thickness. Testing arrangements are shown in figures. The test report specifies the material, equipment, mean value and standard deviation of the maximum failure force and failure energy alongwith the type of fracture information.

IIW - DOC - III - 90

Development of spot weldable damping steel sheet

This Document discusses on the development and spot weld ability of a newly spot weldable damping steel sheets which can be easily spot welded without the bypass circuit. In this study, it was found that the spot weld ability of the spot weldable damping steel sheets depends upon the amount and the size of the metal powder in the resin layer. This newly developed composite - resin damping sheet can be spot welded without the bypass circuit as well as ordinary steel sheet. In addition, it has the same spot weldability, that is weld lobe and electrode life, as ordinary steel sheet.

It was clear that the damping steel sheet, which some properties such as damping property, formability and spot weld ability, can be made from the core resin involving the metal particles which is the same size as the resin thickness.

IIW - DOC - III - 90

Report on Resistance welding and related welding processes studies in Japan 1989

This report contains abstracts of many articles in the field of Resistance and friction welding areas. Abstracts are available on

spot, seam and flash butt welding. A series of articles on spot welding electrode life assessment is given. Weld ability of vibration-damping composite steel sheet is discussed in few articles. Electrode tip wear is analysed using zinc coated steel sheets. Testing of spot welded samples by Ultrasonic evaluation is discussed. Fatigue life of spot welded structures is studied and presented in few papers.

Friction welding of aluminium alloy reinforced, Titanium - Aluminium and Magnesium alloy is discussed in few papers. This compiled report gives an overall review of Resistance and Friction welding applications in Japan during 1989.

IIW - DOC - III - 951 - 90

Stress intensity factors for spot welds between plates of unequal thickness

The stress intensity factors for weld spots between plates of unequal thickness are derived for spot welded specimens. The structural stress state at the weld spot edge is determined by the finite element method. The decomposition of the total structural stress state into symmetrical and antisymmetrical components of membrane, bending, transverse shear and longitudinal shear stresses have been done. The internal stress are transferred to a strip model with slits representing the cross sectional contour of the weld spot edge. The resulting equivalent stress intensity factors is determined applying the J - integral on a path identicals to the outside contour of the model. The boundary element method for plane and antiplane stress fields is used to determine KI, KII and KIII. The dependence of the stress intensity factors on the thickness ratio of the two strips is stated by simple formula which are desired on the basis of J and J^* integral solutions

III - DOC - III 965 - 91

Development of spin electrode system for superior electrode tip life in spot welding of coated steel sheets.

A spin electrode system was developed to improve electrode tip life in spot welding of coated steel sheets. This method features a periodically rotating electrode, which is inclined in relation to the force axis. This electrode rotation introduces a type of self - dressing action to the electrode tip and, therefore, delays tip wear. Electrode tip life tests conducted by using a prototype equipment clearly indicated superiority of this system over the conventional spot welding method and an approximately 20 times electrode life was achieved for a galvanised steel.

IIW - DOC - III - 966 - 91

Testing method for electrode life evaluation in spot - welding steel sheets

This is the final draft of the testing method for electrode life evaluation in spot welding steel sheets proposed by Japan

Welding Engineering Society Standard. Under this method, special care has been taken for standardisation of electrode shape and for recording the mechanical properties and water cooling effect of the spot welding machine used for electrode life evaluation. Unlike other evaluation methods, in this case the end of electrode life is judged by 30% decrease of tensile shear strength from its initial value in the start of continuous spot welding instead of nugget diameter as the criteria.

IIW - DOC - III - 967 - 91

On three-dimensional elastic-plastic stress analysis of spot welded joint under tensile shear load.

The necessity and the purpose of elastic-plastic stress analysis is explained first. Then a three-dimensional elastic-plastic FEM stress analysis is made of single spot-welded joints simulating a joint in which the weld has the same weld strength as that of base metal and a joint in which the weld has higher weld strength compared with that of base metal, both under tensile shear load. As the result, stress distribution and elastic and plastic strain distribution of these joint load state and unload state are observed.

These results are discussed comparing with results of a three-dimensional elastic FEM analysis and operational results, and it is concluded that the results obtained from the elastic-plastic analysis are much closer to the operation result than those obtained from the elastic analysis. Moreover, strain concentration due to inhomogeneity of yield point distribution is found as inner surface of base metal under higher load condition in the elastic-plastic analyses, and the relation between their strain concentration and joint crack generated in base metal in the low cycle fatigue is discussed.

IIW - DOC - III - 968 - 91

Report on Resistance welding and related welding processes studies in Japan 1990

This report contains abstracts of many articles in the field of Resistance and Friction welding areas. Abstracts are available on spot, upset and flash butt welding. A series of articles on spot welding electrode life assessment is given. Electrode tip wear is analysed using zinc coated steel sheets (galvanised). Testing of spot welded samples by Ultrasonic evaluation is discussed. Fatigue life of spot welded structures is studied and presented in few papers.

Friction welding of stainless steel, sintered compact steels, Al-Fe alloys, cutting steels is discussed in few papers. This compiled report gives an overall review of Resistance and Friction welding applications in Japan during 1990.

IIW - DOC - III - 971 - 91

Advances in process data acquisition and processing in resistance welding using pressure.

The measuring technology available hitherto for resistance welding did not provide a satisfactory means for performing the tasks under production environment. With the advent of cheaper microprocessor technology and incoming innovations in sensors development, computer based data acquisition system for resistance welding machines have become easier. The individual stages of this development are being discussed with reference to the resistance welding equipment and their capabilities. In the latest development, a trend is apparent towards real time monitoring system for resistance welding operation.

III - DOC - 972 - 91

Influence of transverse vibrations on the fatigue strength of spot welded tensile-shear specimens

Influence of transverse vibrations on the fatigue strength of spot welded tensile shear specimen is determined. The investigations are carried out on two test machines with two different systems viz., servohydraulic or mechanical for generating vibrations. Clamping of specimens can influence the results of fatigue strength tests. ■

**PHOTOCOPIES OF THE ORIGINAL DOCUMENTS
ARE AVAILABLE ON REQUEST AT NOMINAL COST.
PLEASE WRITE TO ASSISTANT SECRETARY
USING READER'S CARD**

— Assistant Editor