

## Abstracts of IIW Documents

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*Editor*

### IIW Commission III : Resistance Welding

Reported by - Dr. K.G.K. Murti  
*Chairman, Indian Commission III*

#### IIW Doc : III-921-88

**Specimen dimensions and procedure for impact shear and cross tension testing resistance spot and projection welds.**

*Mr. H.J. Krause.*

##### **Abstract**

This specifies specimen dimensions and testing procedures 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 5 t (t = sheet thickness). The aim of this testing is to determine the maximum failure force and failure energy that the test pieces can sustain.

#### IIW Doc : III-936-89

**Calibration of welding current and time meters for AC resistance welding.**

*Dzuranyi Edward, Kuban Jazef, Matus Viktor, Stefanek Anton.*

##### **Abstract**

A new calibration method, using an IBM Personal computer, for current meters used in resistance welding has been discussed. Evaluation program in Basic is again given. This method enables calibration of welding current without complicated stabilisation of welding current.

#### IIW Doc : III-926-89

**On Fatigue strength of spot welded joint in coated steels.**

*Satoh, Katyama and Ueda*

##### **Abstract**

In this investigation, the metallurgical characteristics of spot welded joint in coated steels are studied as it may have influence on fatigue strength of spot welded joint.

Experimental results obtained from fatigue testing in coated steels are described. This result is compared with spot welded joints of mild steel and it is indicated that under high-cycle load condition the coated steels spot weld strength is as good as mild steel.

#### IIW Doc : III-927-89

**Effects of mechanical properties of spot welding machine on electrode life - 2nd report.**

*Satoh, Katyama, Abe, Fukuda & Gohova*

##### **Abstract**

This report discusses about the simulation test for electrode life and collision phenomenon of upper electrode. Cr-Zn-Cu, Al<sub>2</sub>O<sub>3</sub> - Cu and Cr-Cu alloy electrodes are compared for its spread on the nose. Experimental analysis of the collision phenomenon of upper electrode are also being discussed.

#### IIW Doc. No. III-928-89

**Development of the method to evaluate the fatigue life of spot welded structures by fracture mechanics.**

*Yuuki and Ohira*

##### **Abstract**

Fracture mechanics seems to be the most possible approach to the evaluation of the fatigue life of spot welded structures in an automobile body. But there exists the difficulty to analyse the stress intensity factors for a spot in the structure. In this study, the efficient system "BEM-SPOT" to analyse the K values for a spot in the structure, coupling a finite element analysis with a boundary element analysis. This system can predict the fatigue life of a spot welded structure based on fracture mechanics.

**IIW Doc : No. III-930-89 and XIII-1312-89**

**Local fatigue strength characteristic values for spot weld joints.**

*D. Radaj*

**Abstract**

Local fatigue strength characteristic values for spot welded joints are compiled in the form of endurable local strains, structural stresses and stress intensity factors on the basis of an evaluation of published material. Such stress or strain amplitude endured dependent on number of cycles are hitherto known only for unalloyed and higher tensile steels. Strength hypotheses for locally multiaxial stress and strain parameters are discussed.

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## **IIW Commission IV : Special Welding Processes**

Reported by - A.V. Thakur

*Chairman, Indian Commission IV*

**IIW Doc : IV-435-87**

**Computer-Aided Design for the Electron Optical System of the Electron Beam Welding Guns**

*Liu Baoyan, Shenyang Institute of Computing Technology, Shenyang, China - February, 1987.*

**Abstract**

The document recommends a set of equations on the strong beam and suggests an analytic method of rectangular finite method for a magnetic lens and a different method for an electric field. It points out how to regulate the emitting system at critical between the temperature - limited and the space - charge - limited emission. It also shows the equations of the electron trajectory in the drift region and of the electron motion in the guns region. Then it gives a computing method of the space charge and introduces a corrected method of calculating the effect of thermal velocity on the beam with a specific example of the CAD on a particular computer.

**IIW Doc : IV-451-88**

**Fundamental Study on 1 KW Class YAG Laser Welding Using Optical Fiber**

*N. Nakajima et al, Mitsubishi Heavy Industries Ltd, Japan,*

**Abstract**

The experimental apparatus including optical systems of YAG Laser is explained. Laser Oscillator consists of four YAG rods (8 mm dia and 150 mm length each) with

maximum power of 1.3 KW. The optical fiber of 0.8 mm in core diameter and 60 m in length has been employed. Laser welding has been carried out on Nickel based alloy heat exchanger seal welding.

The influence of shielding gas on weld penetration has been studied with Helium, Nitrogen, Argon and air. It has been shown that Nitrogen gas shield produced deep penetration without porosity. To achieve weld penetration of 2.0 mm, the focal point was to be kept + 0.5 mm with respect to work surface. The relationship between the welding speed and penetration depth has been established. With optical system rotated, the effect of welding position hardly matters on penetration depth and it was stable. By macro and micro analysis, the weld was proved to be free from crack and porosity in all position on welding.

**IIW Doc : IV-450-88**

**Uniforming of Laser Beam Distribution and Its Application to Surface Treatment**

*S Shono et al, Mitsubishi Heavy Industries Ltd, Japan, July, 1988*

**Abstract**

The beam uniformity conditions using a Kaleidoscope has been studied and the optimum Laser hardening parameters with uniform rectangular beam has been arrived. The beam intensity analysis has been carried out with consideration to beam interference through ray tracking and beam superimposition from the reflected image point. The relation between dimensions of the kaleidoscope and beam intensity uniformity has been brought out.

On the basis of the analysis results, the authors have made two types of kaleidoscope heads using the incident lens of  $f = 127$  mm. With them, it has been confirmed that the uniform rectangular beam can be obtained. The Laser hardening conditions with uniform rectangular beam has been studied on a material of 0.32% C, 0.66% Mn, 0.20% Si, 0.14% Cr and it has been determined that the beam absorption rate is about 75% and hardening temperature is 970°C. In addition, on the basis of the temperature analysis results, the setting charts of the hardening conditions have been obtained that give the beam diameter and beam traveling speed for the width and depth to be hardened.

## **and Control of Welds.**

Reported by - Baldev Raj

*Chairman, Indian Commission V.*

**IIW Doc : V -856-87**

### **An Introduction to Acoustic Emission Technology (AET) for In-process Inspection of Welds**

*G.L. Goswami, Radiometallurgy Division, BARC Bombay*

#### **Abstract**

This document discusses the technique and system along with the acoustic emission parameters important for weld quality analysis. This also deals with the application of this technique in different welding processes like TIG, resistance, electro-slag and submerged arc.

A detailed description about the acoustic emission system, sensors, instrumentation, data recording etc, have been given in the document. It reviews the present day status of the Acoustic Emission Technology as an on-line weld quality monitoring technique.

Different welding processes produce their characteristic weld defects and accordingly acoustic waves are generated. In TIG welding, weld cracking has been successfully monitored using AET. It is evident that there is a sudden increase in the acoustic activity when weld cracking takes place. Even detection of lack of penetration seems to be possible by this technique. Defects like porosity or pin holes which produce relatively weak acoustic signals may be difficult to detect.

Detection of defects by AET during various other welding processes like submerged arc welding, electroslag welding, resistance welding, electron beam welding and laser beam welding have been discussed in this document.

This technique requires a lot of initial experimentation with a particular weld application for deriving out the optimum acoustic parameters. But having once established the proper parameters, this technique is more useful in repetitive production welding jobs. With the introduction of sophisticated instrumentation in AET, it is possible to carry out the test even in noisy shop floor environments. Large number of reports on the subject of AE in recent years is a clear indication that it is getting importance in welding industry.

## **Assessment on Weld Quality of Low Alloy Steel Boiler Drums - A Critical Study**

*B.B. Mishra, Thermax Pvt. Ltd., Pune, India.*

#### **Abstract**

This document highlights the importance of complimentary NDT techniques which have improved the quality of welded components and reduced the rate of rejection in the fabrication of low alloy steel boiler drums.

In each stage of fabrication of low alloy steel vessels, there is a lurking fear of developing defects particularly cracks in the material or weld. Hence it becomes imperative for quality control personnel to devise a fool proof method of assessing quality so that no intolerable defect escapes the testing procedure.

The recommended practice for butt welds as per the governing codes is radiography or ultrasonic testing preceded by either magnetic particle testing or dye penetrant inspection.

The document describes the NDT methods adopted by one of the boiler drums manufacturer which have resulted in better quality of welds and less rejection. The initial dye penetrant inspection and subsequent radiography done as per code requirement cleared seams of boiler drums as free from defects. But the complementary NDT tests (MPT and UT) adopted by the manufacturer revealed a few cracks in the weld seam hither to cleared by radiography. The welds were gouged to see the defects visually to conform the findings of ultrasonic testing. The manufacturer observed that when only dye penetrant inspection had more than 25% repairs and it cost the company 10% of the total fabrication cost to repair the seams and a delay of 20% in the total cycle time.

After introduction of magnetic particle inspection followed by ultrasonic testing, the defects in the seams came down to 3% and the delay also was considerably reduced which has resulted the company a good amount of cost saving.

**IIW Doc : V - 873-87**

### **The application of fitness for purpose criteria in design, fabrication and inspection of welded products.**

#### **Abstract**

This document deals with nondestructive testing in relation to the fitness for purpose assessment of welded structures. It concentrated on the detection and assessment of metallurgical defects, particularly cracks and other planar defects, both surface breaking and hidden.

rational assessment of structural integrity by fracture mechanics. The consequence of this for NDT is a challenge to prepare rational defect acceptance criteria which are compatible both with the requirements for defect detection and evaluation imposed by fracture mechanics and with the limited capabilities of the NDT techniques.

The document deals with the reasons for pursuing a fitness for purpose approach for NDT such as :

- 1) to extend the range of materials, welding procedures and operating conditions.
- 2) on an exceptional basis during manufacture, to allow concessionary acceptance of defects which are rejectable according to quality control criteria.
- 3) during the service life, to allow the critical reassessment of the plant in order to demonstrate the continued absence of significant defects and hence to allow continued operations, deferment of repairs, and possibly plant life expansion.

Regarding the choice of NDT techniques, the document recommends that each weldment should be considered from the point of view of geometry access, surface condition, material, likely defect types and fracture mechanics requirements for defect detection. In most cases, this will point to one technique or, more usually, a combination of NDT techniques which are most suited for the detection and quantitative evaluation of the defects of concern.

recommends that certain prior conditions must be met before NDT can be usefully applied :

a) the design, access and surface preparation should take into account the requirements of various NDT methods for the detectability and evaluation of defects of structural concern. In particular, it must be recognised that root profile and weld cap condition significantly affects the capabilities of all NDT methods for the important inner and outer regions of the weld.

b) there is a need to design and plan the fabrication and to set sufficiently high quality levels with future inservice inspections in mind.

**IIW Doc : V - 852-87**

**Classification of X-Ray films - new results and proposals**

*Heidt, H., Schmitzer, D., Stadel, J.*

**Abstract**

The classification of X-ray films has been the matter of serious discussions for quite some time. The basic idea of classifying the films is to contribute to good and constant image quality. The authors opine that granularity would be the best parameter for the classification of films. After a brief description about the methodology of measurement of granularity, a good description of the influence of developer is given. The authors then proceed to classify the existing films from various companies into different classes based on gradient and granularity. This classification appears to be quite simple and unambiguous.

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