India Welds

Making Technology Adoption Easy!

If you cant explain it simply you don't understand it well enough!
- Albert Einstein

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From the Editor's Desk!

Dear Welding Enthusiast!

The recent events on welding have made it evident that welding as a profession, welding as an art, welding as a business are undergoing a major change.

Change is imminent. Change is inevitable. Change is positive. Yet it takes a lifetime to accept the changes. What takes so much to take us out of our status quo and accept the development and innovations? ***Why do we resist change?***

One of the answer perhaps lie in the fact that we don't understand the change. For understanding a transition, we must have a thorough knowledge of the basic tenets on which the foundation of change is laid.

So at IndiaWelds, we bring in the best brains from the welding profession to explain and impart the basic knowledge on welding. A revisit to the basics makes us better prepared to understand the latest in welding technology.

Through this newsletter that has entered its fourth edition in the first year, we have tried to explain the basics of welding. We hope you have enjoyed the mix of articles in Hindi language as well.

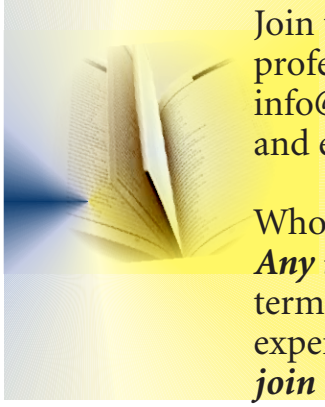
We are also conducting workshops, with the industry and students. We invite you to be a part of this effort.

Besides, IndiaWelds is now in the process of creating the biggest repository of welding professionals. We are adding up welding professionals from all ranks and places in India everyday. We thank all for entrusting the faith in us.

If you also want to be a part of this dynamism, please write to us at info@indiawelds.com and join to make technology adoption easy!

Happy Reading!

Ashay
Editor
India Welds



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Who can join:
Any individual who is qualified in terms of education qualification or experience ***in the field of welding can join us.***

WHAT'S INSIDE

The Future of Welding has come from Space!

Cold Welding is an interesting subject that has intrigued many minds. But how was it discovered and how it defies the word that sits at the core of the welding process…'heat'? In this article we look at the basic of the concept of cold welding

The concept of 'cold welding' was learnt from the anomaly of the Galileo High Gain Antenna deployment. On April, 11,1991, the Galileo spacecraft from NASA was executed. The high gain antenna was supposed to open after the spacecraft was tested launching in the space. The hatch would not open. However the astronauts landed back safely.

The antenna which opens like an umbrella, never reached fully deployed position and left undeployed (Fig.1), to protect the spacecraft from the heat of the sun.

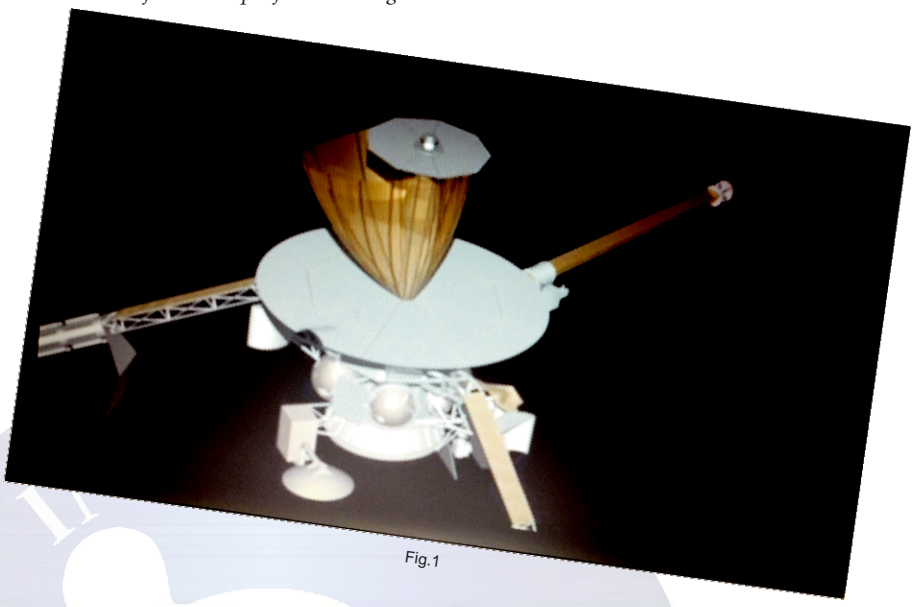

Fig.1

Blessing in disguise!

This severe failure, later on, was analyzed by European laboratories and they concluded by citing the reason was due to adhesion or sticking of similar materials, now termed as 'cold welding'.

From such experience of failure story 'cold welding' also known as 'contact welding' was born and recognized as a phenomenon in the 1940s.

Exploring Cold Welding

After this, it was discovered that the clean flat surface having similar atomic structure if put in contact under vacuum, with little pressure would strongly adhere. Also, a good joint could be possible to make in this method.

Further, this must ensure that there is no presence of oxide film, any other contaminants, dirts, grease like substances etc. This is the principle of Solid-State welding. Thus, 'cold welding' (CW) is a solid-state welding.

Workability of Cold Welding

Cold welding had been a problem in the space craft, as two similar metal would join in space (vacuum). In space craft, use of plastics or ceramics, other different types of metal and with the use of coatings could avoid such undesirable occurrences.

However, it would be incredibly workable on earth at ease. The pressure needed in 'cold welding' can be given by a pair of rolls, and without any external heat the joint can be made. This is also known as "roll bonding' which occurs because of plastic deformation.

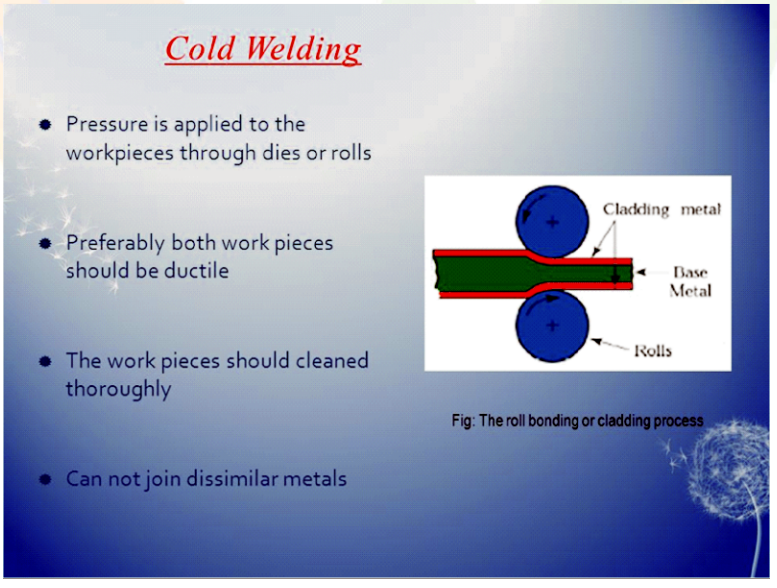

Fig 2

Very good cladding is being done through this process as schematically shown in fig. 2. Dissimilar metals can now also be joined, but the best result with high bond strength is only possible with two similar metals.

Two wires with similar materials are now being joined easily by 'cold welding' just by holding them in contact under vacuum with little pressure.

The Future

The fact that cold welding is a workable reality has brought many opportunities of study and explorations. It is probably just time that we will have a much convenient welding process getting popularized. Or will it just end up in labs and in discreet instances? It is for us all to see.

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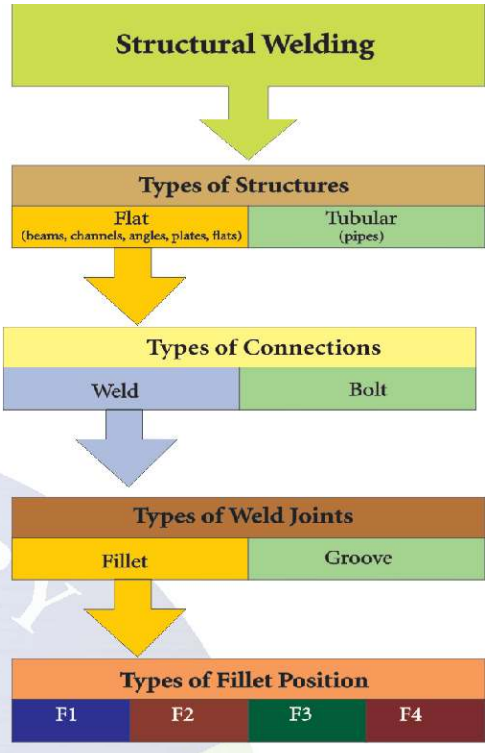
Specialized area: Welding and Tribology.

All About Structural Welding - Part -3

In the previous two articles of the series we have seen what structural welding entails as a subject. We looked at the joint in fillet welds and understood what makes a weld joint. An understanding of Structural Welding can for certain not be complete without discussing in detail the discontinuities in welds. Since we are looking at the fillet joints, we take some of the very common issues in discontinuity in such joints in this section..



In this section, we will take up discontinuities like undercut, porosity, incomplete fusion, incomplete joint penetration and cracking. These are by far the most common fillet joint issues that we come across in structural welding.

All that is not Defect!

We often use the term defect for all that makes a bad weld. Technically, however there is a difference between what makes discontinuity and what we can call a defect.

Here we look at first what is discontinuity and then explain what are the unacceptable weld profiles.

Discontinuity vs Defect

Discontinuity is defined as an interruption of the typical structure of a material, such as a lack of homogeneity in its mechanical, metallurgical, or physical characteristics.

A discontinuity could be the result of a defect, but isn't necessarily a defect.

A **defect**, on the other hand, is a discontinuity that by nature or accumulated effect (for example, total crack length)

renders a part or product unable to meet minimum applicable acceptance standards or specifications. A defect results in rejection of the part or product.

Unacceptable Weld Profiles

Unacceptable weld profiles can cause a reduction in base material thickness, reduction in weld size, or stress concentrations on the weld or plate surface.

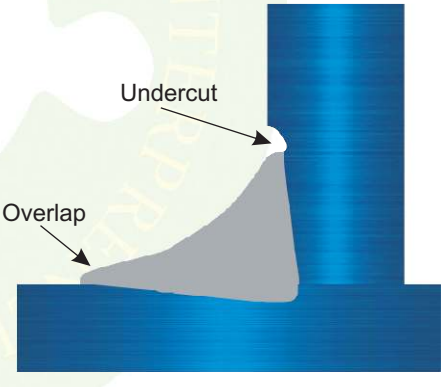
These types of weld discontinuities often seriously detract from the overall performance of a welded component in service .

Discontinuities in Fillet Welds

Undercut

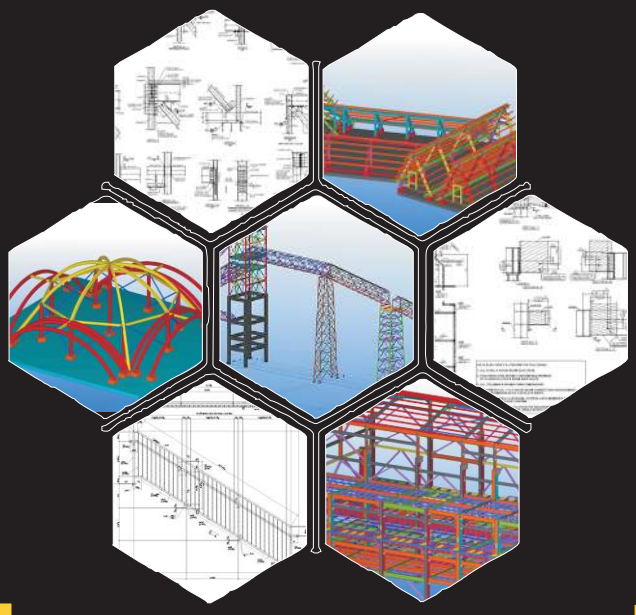
Undercut is defined as a groove melted into the base metal adjacent the weld toe, or weld root, and left unfilled by weld metal.

It is usually caused by high amperage, electrode angle, long arc length and rust. Metal cleaning before welding is therefore essential.



Porosity

Porosity is defined as a cavity-type discontinuity formed by gas entrapment during



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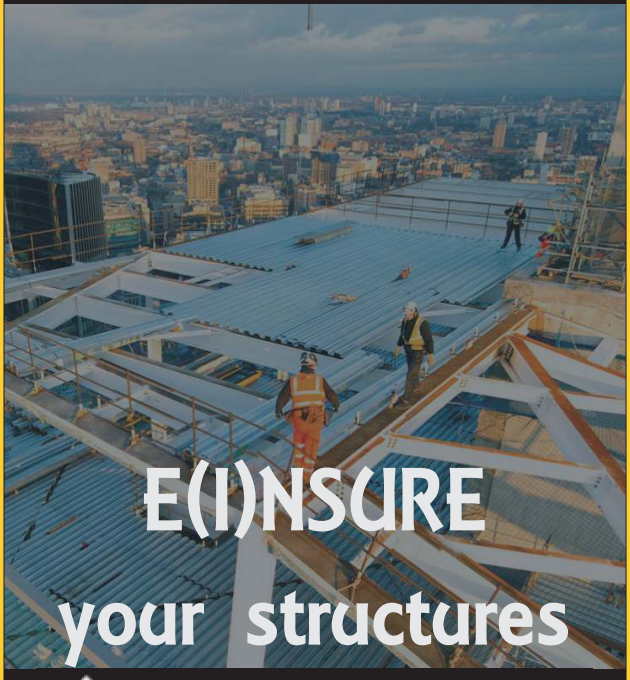

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These trapped gases in the molten weld may form bubbles or pockets as the weld solidifies.

Incomplete Fusion

Incomplete fusion is a weld discontinuity in which fusion doesn't occur between the weld metal and fusion faces or adjoining weld beads.

This absence of fusion can occur at any location within the weld joint and be present in fillet welds or groove welds.

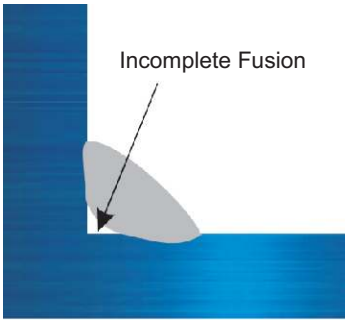
Incomplete Joint Penetration

Incomplete joint penetration is a discontinuity in a groove weld in which the weld metal doesn't extend through the joint thickness. It's the failure of the filler metal or base metal to fill the root of the weld completely.

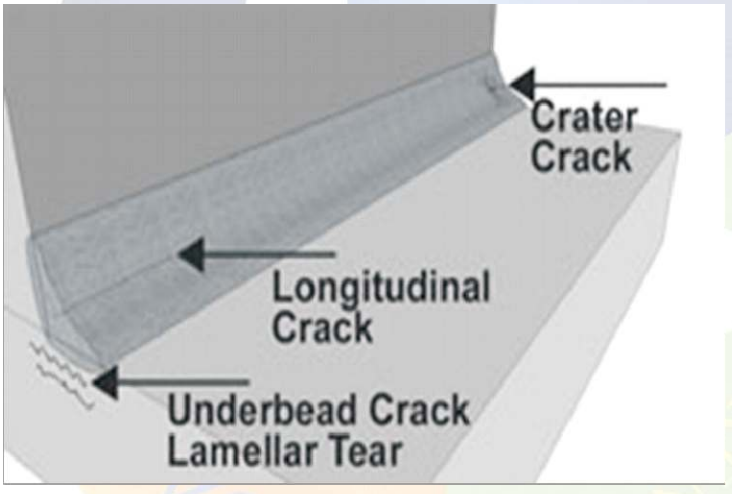
Cracking

Cracks in a weldment are probably the most dreaded of all the weld discontinuities. Because so many materials and applications are used in welding, cracking is a complex subject.

The base material's crack sensitivity may be associated with its chemistry and its susceptibility to the formation of elements that reduce its ductility.



Excessive stresses in the weld joint, particularly if the material is in a crack-sensitive condition, can cause cracking to occur.



The most common cause for cracking has been attributed to lack of pre heating in thick sections particularly in cold weather.

Cracking is a serious flaw and Is best detected by UT or MPI (sub surface) or DP (if open to surface).

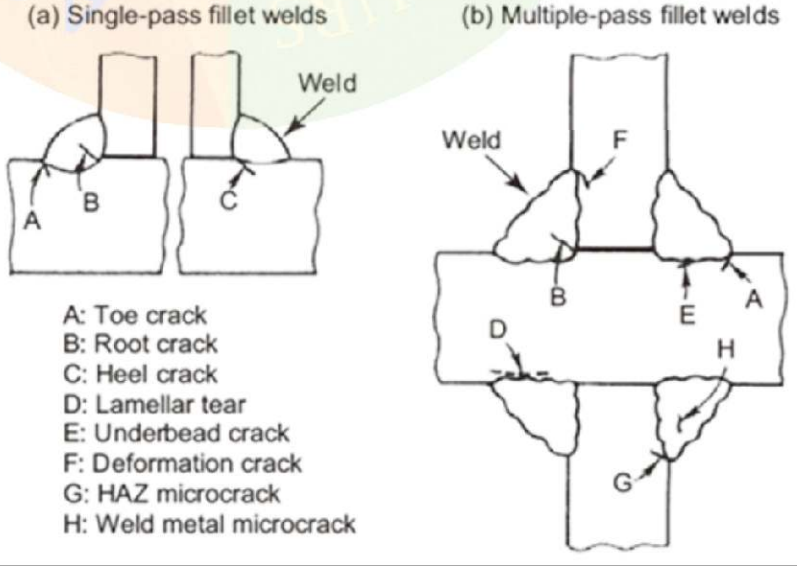
All these topics are being covered in various sections of this newsletter.

Next we will take up means/ methods to eliminate occurrence of the discontinuities in fillet welds and how to best tackle them.

It will be interesting to learn how some basic knowledge can save crores of rupees that go into repairing each year! Check out our next article in the series.

By: Team IndiaWelds

(Image Courtesy: Internet)



Visual Inspection of Weld Joints

It is every welder's dream to create a flawless weld joint. But the prerogative to declare the quality of weld is the fancy of every welding inspector. So, here we look at the basic preliminary visual inspection that's the first line of defence against any bad weld getting past the quality check.

Visual testing is the first and foremost activity in the process of determining the quality of weldment.

Visual examination of weld joint is an important activity, carried out to check the integrity and soundness of the weldment. It is an economically viable activity, as the process doesn't demand deploying costly equipments. However, it requires the task of a well experienced welding inspector
.
We begin with the understanding of the requirements for visual inspection.

Responsibilities of a welding inspector

- **Code compliance**
- **Workmanship control**
- **Documentation Control**

The Prerequisites

- Illumination should be at least 350 Lux (minimum) though it is recommended to carry out visual inspection at an illumination of more than 500 Lux.
- The inspectors eye should be within the radii of 600 mm of the surface of item being inspected and the viewing angle must not be less than 300.

Fig.1 (a) : Welding Gauge
Image Courtesy:www.weldingandndt.com

Tools Required

A visual examination calls for using certain tools. Here is a consolidated list:

- Welding gauges (Fig. 1(a) and 1(b))
- Weld gap gauges
- Linear misalignment gauges (Hi-Low)
- Magnifying glass (X2 to X5)
- Mirrored boroscope or fibre optic viewing system (when access is restricted)

Next we will take up each stage of welding and look at what it takes to decide the quality of welding by an inspection personnel.

Inspection Stages

Before Welding:

The inspector shall be familiarised with the applicable codes and standards/drawings/welding procedures (WPS and PQR). Welder qualification shall be carried out before production welding. The inspector shall confirm the material and review the MTC.

Welding consumables shall also be inspected before welding. Joint preparation and alignment shall also to be checked prior to welding.

After confirmation of all the parameters (as mentioned above), the welding inspector can permit the welder to start the production welding.

If preheat is applicable, then the preheat temperature shall be confirmed before starting the weld.

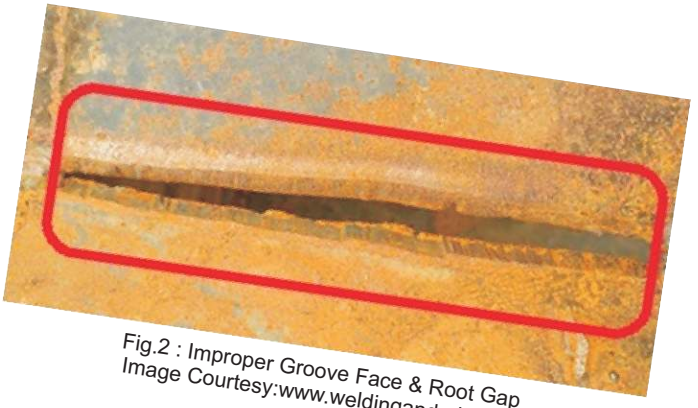


Fig.2 : Improper Groove Face & Root Gap
Image Courtesy:www.weldingandndt.com

Fig.2 shows improper groove face and root gap, a welding inspector must see the groove preparation and root gap before welding

Visual inspection can be done at three stages

- **Before welding,**
- **During welding and**
- **After welding.**

During Welding:

The inspector shall check the welding process and welding parameters with respect to the welding procedure specification (WPS) at any time during welding. Root run and root run dressing, interpass temperature shall be witnessed by the inspector. The welding consumables shall also be checked during welding.

Fig.1 (b) : Welding Gauge
Image Courtesy:www.weldingandndt.com

After welding

After complete welding, identification number is punched near joint. Complete visual inspection is done and

Fig.3: Visual Inspector at Work
Image Courtesy:www.weldingandndt.com

repaired as per approved procedure.

Defects (or discontinuity) revealed by Visual Inspection

- Crack
- Underfill.
- Undercut
- Surface porosity
- Overlap
- Lack of side wall fusion
- Arc strike
- Spatters
- Excessive Penetration
- Unacceptable weld profiles

Fi.3 shows welding inspector checking the weld reinforcement size by a Bridge Cam welding Gauge

A dimensional survey shall be done to ensure the dimension of the part after welding. After satisfactory completion of welding, proper documentation is prepared.

Post Weld Treatment

If a Post weld treatment is specified in WPS, Then the operation should be monitored and documented.

Following parameters are to be considered when Post weld heat treatment is required:

- Area to be heated
- Heating and cooling rates
- Holding temperature and duration
- Temperature distribution

In addition to visual inspection, a number of other NDT (Non Destructive Test) methods are available to check the quality of weldment.

Some of the most common NDT methods are;

- Radiographic testing (RT)
- Ultrasonic testing (UT)
- Magnetic particle testing (MT)
- Liquid penetrant testing (PT)
- Electromagnetic testing (ET)
- Acoustic emission testing (AET)

Image Courtesy:www.weldingandndt.com

Each NDT methods has its own significance and importance for example Liquid penetrant testing is very efficient and economical for checking surface defects, whereas, with the help of Ultrasonic test and Radiography test, entire depth of the weld can be inspected.

Selection of NDT methods depend on the requirements. Person engaged or assigned to carry out these tests must possess the necessary qualification.

A written test procedure, format for reporting and the applicable code must also be decided before conducting the examination.

These topics will be further taken up in detail in the forthcoming issues.

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B.E (Mech), ASNT NDT Level II (VT,UT,RT,MT,PT).
More than 10 years experience.
Website: www.weldingandndt.com
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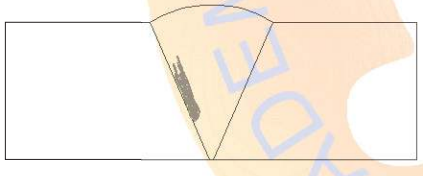
वेल्डिंग में खामियाँ -भाग 2

आर्क वेल्डिंग में कई कारणों से वेल्ड में कई प्रकार की खामियाँ रह जाती हैं। यह खामियाँ वेल्ड की मज़बूती को कम करती है, इसलिए हमें यह देखना चाहिए कि वेल्ड में ऐसी खामियाँ न हों। इस भाग में हम वेल्डिंग में होने वाली अनेक प्रकार की खामियों और उनके होने के कारणों की जानकारी हासिल करेंगे।

हमने पहले भाग में देखा था कैसे गलने में कमी और पेनिट्रेशन में कमी हमारे वेल्डिंग के लिए हानिकारक होती हैं। वहीं ओवरलैप भी हमारे वेल्डिंग को खराब करती है। ईस भाग में हम और कुछ खामियों के बारे में जानकारि लेंगें।



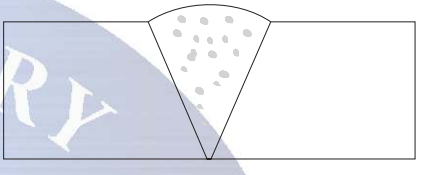
5. स्लैग इंक्ल्यूज़न (Slag Inclusions)

कभी कभी स्लैग के कण या अन्य किसी अधातुके कण (जैसे रेत मिट्टी इत्यादि) वेल्ड के भीतर रह जाते हैं।

इन अधातुकीय कणों को स्लैग इंक्ल्यूज़न कहते हैं। चित्र में यह खामी दिखाई गई है।

अकसर स्लैग इंक्ल्यूज़न, दो पैसेज के बीच में ठीक से स्लैग पूरी तरह न साफ करने के कारण होतेहैं। वेल्डर की असावधानी या लापरवाही से अकसर यह खामी पैदा होती है।

इसके इलावा लंबे आर्क के इस्तेमाल से, बहुत अधिक या बहुत कम करेंट रखने से, या क्रै कवाली कोटिंग के इलेक्ट्रोड का इस्तेमाल करने से भी स्लैग इंक्ल्यूज़न हो सकते हैं।



6. पोरॉसिटी (Porosity)

जब भी नाइट्रोजन, कार्बन मोनो ऑक्साइड या कभी कभी हाइड्रोजन, वेल्ड मेटल में कैद (trap) हो जाते हैं, तो वेल्ड मेटल में छोटे छोटे पोले छिद्र बन जाते हैं।

इसे पोरॉसिटी कहते हैं। चित्र में यह खामी दिखाई गई है। कभी कभी यह गैस छिद्र काफी बड़ा हो जाता है तब इसे ब्लो होल (Blow Hole) कहते हैं।

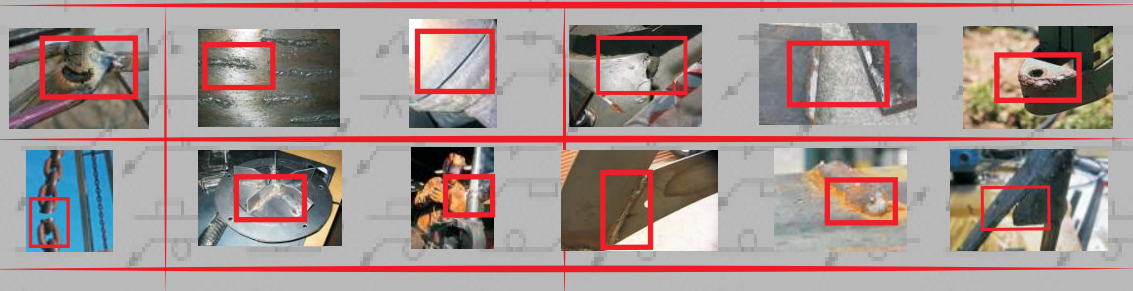
यह छिद्र गोल अथवा लम्बाकार बेलन की तरह भी हो सकते हैं।

अकसर पोरॉसिटी का मुख्य कारण वर्क पीस का गंदा, जंग लगा हुआ होना, या पानी अथवा तेल पड़ा हुआ होना या ग्रीज़ लगा होना है।

नम हुए या पानी में भीग गये इलेक्ट्रोड से वेल्ड करने से, या बहुत लम्बे आर्क तथा अधिक करेंट के इस्तेमाल से भी पोरॉसिटी आ सकती है।

STOP PIRACY

Do NOT encourage duplicates.
STOP compromising on welding safety, Today!



Probably success of an innovation can be measured by looking at the its many duplicates in the market!

But should you compromise quality over cost?

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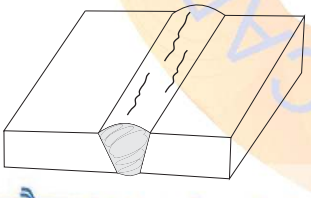
7. स्पैटर (Spatter)

आर्क वेल्डिंग के दौरान आर्क से छोटी छोटी मेटल की बूंदे चट चट की आवाज़ करती हुई उड़ती है और वेल्ड के आसपास बेस मेटल पर जमा हो जाती हैं। इससे वर्क पीस खराब दिखता है। स्पैटर के मुख्य कारण हैं – वेल्डिंग करेंट का बहुत अधिक होना, लम्बे आर्क का इस्तेमाल, नम या भीगा इलेक्ट्रोड, आर्क ब्लो या इलेक्ट्रोड की गलत कोटिंग इत्यादि।

8. क्रैक्स (Cracks)

कभी कभी वेल्ड मेटल या वेल्ड में दरारें (Cracks) पैदा हो जाती है। यह खामी बड़ी गंभीर खामी है और इसके साथ कोई भी केड पास नहीं होता। क्रैक्स के कई प्रकार हैं और प्रत्येक के कारण भी अलग अलग हैं।

हम कु छ मुख्य प्रकार के क्रैक्स की जानकारी हासिल करेंगे।

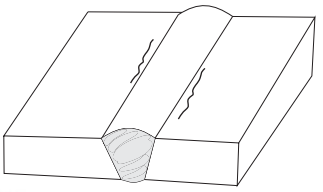


i. हॉट क्रैक्स (Hot Cracks)

ऐसे क्रै क्स जब केड मेटल गरम होता है तभी बनते हैं। जब वेल्ड मेटल जमने लगता है तब बनते

अकसर हॉट क्रै किंग केड मेटल में सल्फ फॉस्फोरस की अधिकता से पैदा होते हैं। ले इसके बिना भी हॉट क्रेक हो सकते हैं।

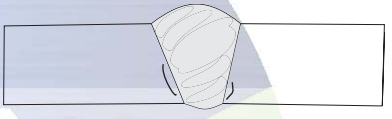
अकसर रूट पास में हॉट क्रै क्स हो सक इनका रिपेयर बहुत ज़रुरी है। चित्र में हॉट दिखाए गए हैं।



ii. कोल्ड क्रै क्स (Cold Cracks)

अकसर यह क्रै क्स केड से लगे हुए बेस मेटल के हीट अफेक्टेड ज़ोन में होते हैं।

अधिकतर अधिक टेंसाइल स्ट्रेंथ वाले लो अलॉय स्टील्स में और अधिक कार्बन वाले बेस मेटल में यह क्रै क्स हो सकते हैं। चित्र में कोल्ड क्रै क दिखाई गई हैं।

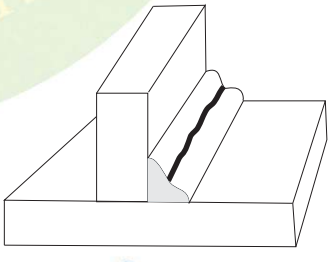


iii. अंडरबीड क्रैक्स (Underbead Cracks)

चित्र में अंडरबीड क्रै क दिखाए गए हैं। यह वेल्ड बीड के ठीक नीचे बेस मेटल में पैदा होते हैं।

लो हाइड्रोजन (L H) इलेक्ट्रोड क इस्तेमाल न करने से अंडरबीड क्रैक्स होते हैं।

यदि L H इलेक्ट्रोड नम हो गया हो, तो भी अंडरबीड क्रैकिंग हो सकती है।



iv. सेंटरलाइन क्रै क्स (Centre Line Cracks)

अकसर फिलेट वेल्ड्स में या मोटे बट वेल्ड में मोटे प्लेट की वेल्डिंग में ऐसे क्रै क्स बन सकते हैं। चित्र में ऐसे क्रैक्स दिखाए गए हैं।

By: Partho P. Banerjee
A Welding Enthusiast with 15 years experience

Keep Welds Warm this winter: Preheat

Preheating is a process which is often weighed against the cost that it incurs, or for that matter the extra work that in entails in the process of fabrication. It is time that we look beyond these and understand how important preheating is for a perfect welding, especially in cold season.

Preheat is the temperature of the base metal in the volume surrounding the point of welding immediately before welding is started. In a multipass weld, it is also the temperature immediately before the second and subsequent passes are started. (Interpass Temperature)

The process – when and how

Preheating may be done by the use of gas burners, electric coils, or by heating in a furnace.

For good results, it is essential for the heating to be uniform around the joint area. Intense, non uniform heating is of little use in retarding cooling and may be detrimental in causing higher residual stresses, distortion or undesirable metallurgical changes in the base metal.

When preheating is specified, the entire weld joint should be heated evenly through the material thickness to the desired minimum temperature.

Setting up the Temperature

To obtain a uniform temperature through the material thickness, it is desirable to apply the heating sources to one side of the material surface and to measure the material temperature on the opposite side.

Whenever the heating and temperature measurement must be done from the same surface, one must assure that more

than just the surface of the material has been heated. When an interpass temperature is specified, the weld area must be inspected prior to depositing the next weld bead.

Welding may not continue if the measured temperature exceeds the maximum interpass conditions specified in the welding procedure. The weldment must be permitted to cool down to the specified upper limit of the interpass temperature before continuing with the weld.

Preventing stresses and cracks

In Low Alloy Steel, if welded and allowed to cool quickly, it can develop hard or brittle phases in the heat affected zone, which is susceptible to cracking. Preheating of components prior to welding helps to prevent hardening of the weld/ haz by formation of brittle phases.

A softer, more ductile structure is more resistant to cracking. The slower cooling rate also gives more time for any hydrogen introduced into the weld to diffuse away from the welded joint, preventing pressure build-up.

If welds are made in highly restrained joints, or in materials with very low ductility, the welding cycle of heating followed by rapid cooling can result in cracking in the weld or the surrounding area. This is due to the weld metal or adjacent parent metal not being able to withstand the effects of shrinkage stresses created by contraction.

Preheating balances the thermal cycle, reducing shrinkage stresses in the weld and in the adjacent parent material.

Keeping moisture at bay

Any components left overnight in the outside are likely to be damp or even wet. The moisture will act as a source of hydrogen and the result could be hydrogen cracking.

While not normally, the main objective of preheating, its use for removal of surface moisture prior to welding is not only advisable, but very often essential.

So, it is time that we look at preheating from a different perspective and induct it into our welding procedure for a quality finish.

By: Jaspal Singh
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