EFFECT OF WELDING SPEED AND GROOVE ANGLE ON STRENGTH OF BUTT WELD JOINT USING TIG WELDING

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Abstract— Welding is the metal joining process in which two or more metal having same material or different can be joined by heating to a plastic state .It is mostly used for joining metals in process industry, in fabrication, maintenance, repair of parts and structures. The metal plates and pipes used in process industry and they have welding strength as their important parameter.

In this thesis, the welding speed and geometry to find out tensile and impact strength in case of butt weld joint will be done. For V-groove geometry different models of plate with various included angles from

350, 450, 500will be made from structural steel (A633 Grade E).Currently different welding speeds are used in precision welding applications such as nuclear reactor pressure vessels, boilers etc. where welding accuracy as well as quality with strength is an important parameter. So in this project experimentation will be done on different welding speed such as 0.4 cm/sec, 0.8 cm/sec and 1.20cm/sec to prepare a V-groove butt weld joint. Generally the V-groove geometry with included angle up to 600 is in use.

Keywords: Welding Speed, Weld Joint, Tig Welding

CHAPTER-1
INTRODUCTION

Welding is, at its center, merely the way of bonding 2 objects of metallic. Whereas there are opportunity approaches in which to affix metallic (riveting, brazing and bonding, as an example), attachment has turn out to be the strategy of selection for its electricity, potency and flexibility.

There are loads of completely special attachment methods, and a number of ar being unreal all of the time. Some methods use warmth to generally melt 2 objects of metal along, commonly including a "filler steel" into the joint to behave as a binding agent. Opportunity methods deem pressure to bind metal along, and still others use a mixture of each heat and stress. No longer like bonding and brazing, anywhere the metal gadgets being joined stay unaltered, the approach of attachment continually adjustments the work items.

This may appear to be a trivial reason, however it is certainly vital to know-how why attachment produces such robust bonds. In the approaches of soldering and brazing, portions of steel arejoined with the aid of introducing a third material (with a decrease melting factor) into the mixture. Melting this 0.33 material among the surfaces of the unique portions binds the portions together. The bond, but, is handiest as robust as the becoming a member of material. Welding, then again, cuts out the intermediary and joins the original portions immediately to each other. The result is a strong, cohesive bond that's regularly as strong as the fabric itself.

As for substances, a few ar plenty of easier to weld than others. Steel may be an fantastic choice because of its power, affordability and weldability. As a rule, the more potent the metallic, the harder it's to weld. Consequently,

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many metallic alloys had been developed with attachment in thoughts. Of path, actually any metallic will be welded, in addition to forged iron, bronze, steel element and even metallic, although the latter wishes a extremely covered atmosphere as a result of the metal is consequently reactive.

Whatever you are welding, bear in mind: protection first. If you have ever seen welding in man or woman, you could testify to the blinding brightness the system creates. Looking directly at a weld web page without protection can produce what is referred to as arc eye, a painful irritation of the cornea that feels like getting sand on your eye. No surprise that an awesome welder's mask is a prerequisite for any welding outfit.

Welding mask are available many patterns. The handiest ones have a darkened panel that the welder seems thru even as welding. More superior masks automobile-darken as the welding website receives brighter. In addition to mind-blowing brightness, welding can generate temperatures of up 10,000 ranges F (five,538 ranges Celsius) and showers of sparks, making heavy-obligation gloves and a long-sleeve shirt essential.

Lastly, proper ventilation is vital, relying on the welding approach. Welders may be exposed to dangerous substances along with lead, mercury and carbon monoxide. Vent hoods can prevent fumes from collecting within the workspace.

THE PROCESS OF WELDING

Most welding carried out nowadays falls into one in all two classes: arc welding- and torch welding. Arc welding use-s an electrical arc to soften the paintings materials in addition to filler cloth (occasionally referred to as the welding rod) for welding joints. Arc welding includes attaching a grounding cord to the welding material or other steel surface. Another twine referred to as an electrode lead is located at the material to be welded. Once that lead is pulled away from the material, an electric powered arc is generated. It's a little like the sparks you see while pulling jumper cables off a car battery. The arc then melts the work portions together with the filler fabric that allows to sign up for the pieces.

CLASSIFIATION OF WELDING PROCESSES

Welding technique can be labeled into distinct classes depending upon the following criteria :

(a) It may be classified as fussion welding or strain welding depending upon at the application of heat. If software of warmth isn't always required, it's far referred to as stress welding.

(b) In case of fusion welding it may categorized low temperature welding and high temperature welding. When heat is generated to expand low temperature it's far called low temperature welding like soldering and brazing. Other fusion welding methods are high temperature welding strategies.

(c) Fusion welding can also be categorised on the idea of method of warmth era like gasoline welding, electric powered arc welding, resistance welding, thermit welding, and many others.

(d) On the basis of the kind of joint produced it is able to be categorised as butt welding, seam welding, spot welding, lap joint welding, and so on.

Each of the above sort of welding can be similarly labeled relying on other micro stage traits.

Gas Welding

It is a fusion welding wherein sturdy gas flame is used to generate warmth and lift temperature of metal pieces localized on the place wherein joint is to be made. In this welding metallic pieces to be joined are heated. The metallic for this reason melted starts off evolved flowing along the rims in which joint is to be made. A filler metallic may also be added to the flowing molten steel to top off thehollow space at the edges. The hollow space filed with molten metal is allowed to solidify to get the strong joint.

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Different combos of gases may be used to obtain a heating flame.

The famous fuel mixtures are oxy-hydrogen combination, oxygen-acetylene, and so forth. Distinct blending proportion of two gases in a mixture can generate exceptional sorts of flames with distinct characteristics.

Oxy-Acetylene Welding

Oxy-acetylene welding can used for welding of wide variety of metals and alloys. Acetylene mixed with oxygen while burnt below a managed surroundings produces large quantity of warmth giving higher temperature upward thrust. This burning additionally produces carbon dioxide which facilitates in stopping oxidation of metals being welded. Highest temperature that may be produced by this welding is 3200oC. The chemical reaction worried in burning of acetylene is

$$2C_2H_2 + 5O_2 = 4CO_2 + 2H_2O + Heat$$

on the basis of supply strain of gases oxy-acetylene welding is labeled as high stress welding on this device both gases oxygen and acetylene furnished to welding quarter are excessive strain from their respective excessive stress cylinders. The different one is low stress welding in which oxygen is furnished from excessive pressure cylinder but acetylene is generated by means of the action of water on calcium carbide and provided at low stress. In this example high strain supply of oxygen pulls acetylene at the welding zone.

An evaluation can be drawn among low strain and excessive stress welding. High strain welding equipment is handy, substances pure acetylene at constant strain, with better control and coffee fees in comparison to low stress welding.

LITERATURE REVEIW

1.Effect of welding geometry parameter on hardness for aisi304 tig.

Welding is an area wherein technological tendencies out match the tendencies in its technology base that's generally driven with the aid of the outstanding industrial demand for welded structure. Reliability, Reproducibility and Viability necessities are forcing Technologists to take a look at weld defects consisting of distortion, warm cracking, in a systematic and logical technique than on experimental basis.

2. A overview paper on impact of welding pace and groove angle on Strength of butt weld joint the usage of tig welding.

Welding is most critical operation in any enterprise. It is crucial to optimize the diverse parameters of welding process in order that we can achieve the reliability, productivity and great of the goods. So industries are forcing the engineers to take a look at the welding manner parameters including electrodes, inert fuel, present day, voltage and so forth. The objective of any industry is manufacturing of excessive quality merchandise at low fee and increase the manufacturing fee. TIG welding system is versatile and normally used operation for joining of materials with the software of warmth and /or strain or fillet material to increase the production with much less time and price.

METHODOLOGY

Objective of the work

In this thesis, materials V-groove geometry distinct models of plate with diverse included angles from 350, 450, 500will be crafted from structural metal (A633 Grade E).Currently special welding speeds are including zero.Four cm/sec, zero.Eight cm/sec and 1.20cm/sec to put together a V-groove butt weld joint.

CHAPTER-2

EXPERIMENTAL PROCEDURE

In this thesis, experiments are made to understand the effect of TIG welding parameters welding speed and groove angle on output parameters such as hardness of welding, tensile strength of welding.For the experiment, welding parameters selected are shown in table.

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The welding current and electrodes considered are

PROCESS PARAMETERS	LE VEL1	LEVEL2	LEVEL3
WELDING SPEED (cm/s)	0.4	0.8	1.20
GROOVE ANGLE(^{0})	35	45	50

GROOVE ANGLE(^{0})	WELDING SPEED (cm/s)
35	0.4
35	0.8
35	1.2
45	0.4
45	0.8
45	1.2
50	0.4
50	0.8
50	1.2

CHAPTER-4

INTRODUCTION TO TAGUCHI TECHNIQUE

• Taguchi defines Quality Level of a product because the Total Loss incurred by means of society due to failure of a product to perform as desired when it deviates from the added goal overall performance degrees.

• This consists of fees associated with negative overall performance, operating prices (which adjustments as a product ages) and any added charges due to dangerous facet consequences of the product in use.

Taguchi Methods

• Help businesses to perform the Quality Fix!

• Quality troubles are because of Noises inside the product or manner machine

• Noise is any unwanted impact that will increase variability

• Conduct tremendous Problem Analyses

• Employ Inter-disciplinary Teams

• Perform Designed Experimental Analyses

• Evaluate Experiments using ANOVA and Signal-to noise strategies

Defining the Taguchi Approach

• Noise Factors Cause Functional Variation

• They Fall Into Three “Classes”

– 1. Outer Noise – Environmental Conditions

– 2. Inner Noise – Lifetime Deterioration

– three. Between Product Noise – Piece To Piece Variation

• The Point Then Is To Produce Processes Or Products The Are ROBUST AGAINST NOISES

• Don’t spend the money to put off all noise, build designs (product and manner) that may perform as desired – low variability – within the presence of noise!

• WE SAY:
ROBUSTNESS = HIGH QUALITY

• TO RELIABLY MEET OUR DESIGN GOALS MEANS: DESIGNING QUALITY IN!

TAGUCHI PARAMETER DESIGN FOR TURNING PROCESS

In order to pick out the system parameters affecting the selected device exceptional characteristics of turning, the subsequent process parameters are selected for the present work: reducing pace (A), feed fee (B) and intensity of reduce (C). The selection of parameters of interest and their tiers is based totally on literature evaluate and a few initial experiments conducted.

Selection of Orthogonal Array

The procedure parameters and their values are given in table. It was also decided to look at the 2 – factor interaction outcomes of technique parameters on the selected traits at the same time

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as turning. These interactions had been taken into consideration among slicing speed and feed charge (AXB), feed price and depth of reduce (BXC), cutting velocity and depth of cut (AXC).

PROCESS PARAMETERS	LE VEL1	LEVEL2	LEVEL3
WELDING SPEED (cm/s)	0.4	0.8	1.20
GROOVE ANGLE(^{0})	35	45	50

Results: Using randomization technique, specimen was turned and cutting forces were measured with the three – dimensional dynamometer. The experimental data for the cutting forces have been reported in Tables. Feed and radial forces being 'lower the better' type of machining quality characteristics, the S/N ratio for this type of response was and is given belo

Where y1,y2,…..,yn are the responses of the machining characteristics for each parameter at different levels

Results

Taguchi technique stresses the significance of reading the response variant the usage of the sign–to–noise (S/N) ratio, resulting in minimization of great characteristic variation due to uncontrollable parameter. The slicing pressure is taken into consideration because the quality feature with the idea of "the larger-the-better". The S/N ratio for the larger-the-higher is:

$S/N = -10 *\log(\Sigma(Y2)/n))$

Where n is the range of measurements in a tribulation/row, in this case, n=1 and y is the measured value in a run/row. The S/N ratio values are calculated by means of taking into account above Eqn. With the help of software program Minitab 17.

5.CONCLUSION

The experiment designed by Taguchi method fulfills the desired objective. Fuzzy interference system has been used to find out the ultimate tensile strength .The all possible values of have been calculated by using MINITAB 17.0 software. Analysis of variance (ANOVA) helps to find out the significance level of the each parameter. The optimum value was predicted using MINITAB-17 software.

The welding parameters are Welding speed, and groove angle for TIG welding of work piece steel. In this work, the optimal parameters of welding speed are 0.4cm/s, 0.8 cm/s & 1.2 cm/s, groove angle 35,45 and 50 degrees. Experimental work is conducted by considering the above parameters. Ultimate tensile strength validated experimentally.

The experimental results confirmed the validity of the used Taguchi method for enhancing the welding performance and optimizing the welding parameters in TIG welding at welding speed 1.2 cm/s , and groove angle 35.

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