

Effect of Welding and testing of boiler material components

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Abstract: industrial benefits of tip tig welding is for Power plants,oil platforms,ship yards, LNG, refining, medical equipment ,food and beverage equipments .In the current scenario ,arc welding is employed for welding of boiler components and weld is tested for quality in components ,defective products account for 10%and sometimes from 15 to 20% of the number of produced components .This leads to heavy loss to the industry .Hence in this project ,a methodology to reduce defects in boiler components has been proposed.In the proposed methodology ,defects of boiler components such as cracks ,distortions, gas inclusions and lack of fusion and incomplete penetration are identified initially through non-Destructive testing techniques .In order to reduce the defects ,instead of arc welding,Tungsten inert gas welding ,Metal inert gas and TIP TIG welding is employed

Keywords: *Welding ,Testing, TIG, MIG, TIP TIG*

1-Introduction

A steam generator or boiler is a closed vessel made of high quality steel inwhich steam is generated from water ,by the application of heat .Function of boiler is to convert chemical energy of the fuel to heat energy and to transfer this heat energy to water for evaporation as well as to steam for super heating.Welding is an operation bywhich two or more parts are united ,by means of pressure or both ,in such a way there is continuity of nature of the material between these parts.Traditional Arc welding defects are identified through this project.defects are formed because of electrode , welding parameters and environment etc. TIG-welding (Tungsten Inert Gas) or GTAW and electrode made of Tungsten to high heat generation on the tungsten electrode filler metal is added separately and weld without filler material. MIG (Metal inert Gas) filler metal is added continuously . GMAW is a semi automatic process and MIG to weld material thicknesses above 4mm.TIP TIG is a unique manual and automated TIG wire feed combined with a hot wire power source .NDT techniques are give the evidents for defects. Different welding methodologies and techniques are followed by various authors,out of which Metal Inert Gas,Tungsten Inert Gas welding method considered to be an effective one

The following materials are used :HR6W,HR35,Alloy 617,Alloy 263,Alloy 740,Alloy 141,HIGH BH9Cr steel,Low C-9Cr steel,SAVE12AD.

2.LITERATURE SURVEY:

R.Ramachandran et.al(2015), . Above researcher conducted the experiments on analysis and experimental investigations of weld characteristics for a TIG welding with SS316L.

Manoj saini et.al(Jul2014), Above researcher conducted the experiments on Mechanical properties of bimetallic weld joints. .

B.S.Thakkar et.al(March 2012) , Above researcher conducted the experiments on design of pressure vessel using ASME code SECTION VIII,DIVISION 1.

Ahmed Khalid Hussain et.al. (2010), Above researcher conducted the experiments on importance of TIG welding process.

Research Gap: Above researcher is not done with tip tic welding method are applied and NDT Techniques and is not done with overcome the drawbacks of traditional arc welding and not researched over Tungsten Inert Gas welding,MIG welding and NDT Techniques

3.EXPERIMENTAL DETAILS

3.1TIP TIG Welding settings



Fig .1.TIP TIG /USA WELDING MACHINE

The TIP TIG process produces both manual and automated welding in the welding industry

3.2 Material

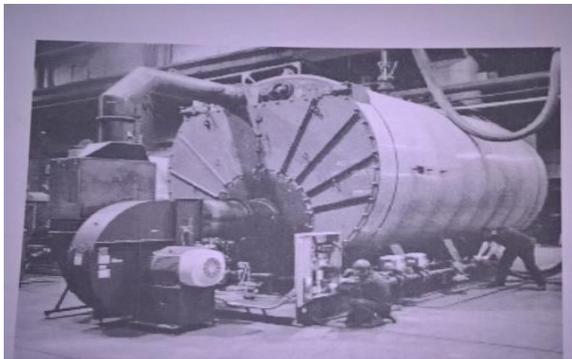


Fig.2.Boiler structure

A steam generator or boiler is a closed vessel made of high quality steel in which steam is generated from water ,by the application of heat

Table-1:Materials

Material name		composition
Alloy 617	Ni based	Ni-22Cr-12Co-9Mo-Ti-Al
Alloy 740	Ni-based	Ni-25Cr-20Co-2Nb-2Ti-Al
Alloy 141	Ni-based	Ni-20Cr-10Mo-2Ti-Al
HIGH BH9cr steel	Advanced Ferritic steel	9Cr-3W-3Co-Nb-V-B
Low C-9Cr steel	Advanced Ferritic steel	0.035C-9Cr-2.4W-1.8Co-Nb-V
SAVE 12 AD	Advanced Ferritic steel	9Cr-3W-2.6Co-Nb-V-B



Fig.3.Conventional mig

The MIG process uses a direct current power source with the electrode positive

(DCEP)by using positive electrode and avoiding lack of fusion and oxide inclusions .The metal is transferred from the filler wire to the weld bead by magnetic forces and capability to the process and makes it possible to weld that the spray transfer is obtained.

Table-2:Setting for TIG and MIG welding

Typical Welding parameters of Mild & Low Alloy TIG ,MIG					
Process	Diameter of wire		Volta ge(v)	Ampe rage(A)	Shielding Gas
	inches	Millim eters			
TIG(GTAW)	0.035	0.9	10-12	50-70	100%Argon
	0.045	1.14	10-12	70-100	
MIG (GMAW)Spray Transfer	0.035	0.9	28-32	165-200	98%Argon +2%Oxygen
	0.045	1.14	30-34	180-220	Or
	1/16	1.6	30-34	230-260	75%Argon +25%CO ₂
MIG (GMAW)Short circuiting Transfer	0.035	0.9	22-25	100-140	100%CO ₂
	0.045	1.14	23-26	120-150	75%Argon +25%CO ₂

4. METHODOLOGY

The methodology to be followed for the identification of welding defects using Non Destructive Testing and the reduction of welding defects of pressure vessel using Tungsten Inert Gas welding and Metal Inert Gas methods are summarized as follows.

Table-3: Methodology

welding of boiler using arc welding
nondestructive testing of boiler
tensile test ,break test and weld verification of boiler
identification of welding defects
welding of boiler using tig&mig&tip tig welding to reduce defects
welding of boiler using tig &mig welding & non-destructive testing boiler
conclusion

5. RESULT AND DISCUSSION

- Work piece material is tested by radiographic testing and ultrasonic testing
- Radiographic testing showing the better results for TIG welding, MIG welding and TIP TIG welding comparing with ARC welding process.
- x-ray passing through a component and impinging on a film.
- Density in the range 2.0-3.0
- Quality and sensitivity by the use of an IQI



Fig.4. Double wall double image radiograph (Defect free) of a pipe butt weld. Note the IQI, identification numbers and position markers.

- Quality of weld is more for TIG welding, MIG welding, Tip TIG welding comparing with ARC welding process through by ultrasonic testing
- In thickness checking the reflections from all surfaces are measured through by ultrasonic testing.
- Ultrasonic 's requires a relatively good surface finish

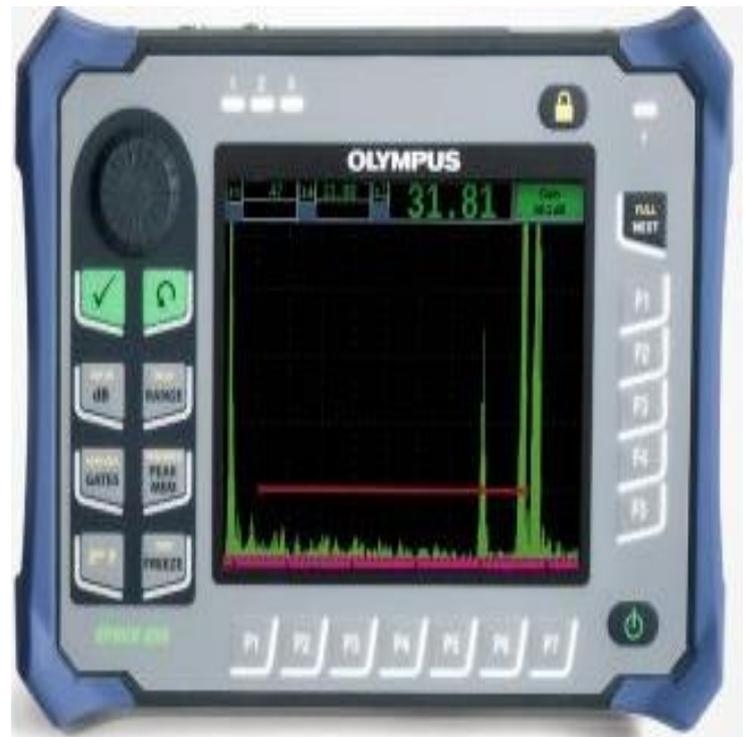


Fig .5. EPOCH 650 ULTRASONIC Flaw Detector Ultrasonic testing

Frequencies ranging from 0.1-15 MHz, and occasionally upto 50MHz.

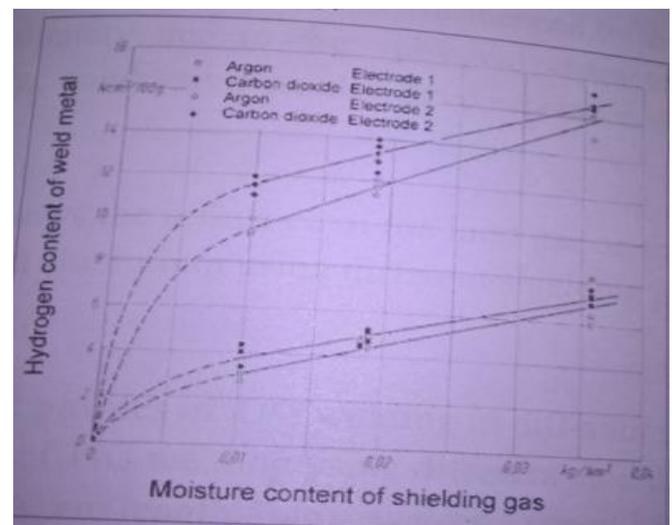


Fig.6. Graphs of Argon and Helium

The graph is taken for moisture content of shielding gas in X-axis and Hydrogen content in Y-axis. Due to the higher ionization energy of helium compared to argon, a greater welding voltage leads to a higher thermal input into the workpiece

6. CONCLUSIONS

- Traditional Arc welding is having some pit falls .
- To overcome the drawbacks, Tungsten Inert Gas welding and also using tip tic welding method are applied.
- NDT testing to use identify the welding defect
- TIP TIG welding give better result compare with other two welding technique.

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