

Technical Newsletter from
ADOR WELDING LIMITED
Formerly **Advani - Oerlikon Ltd.**

ORBITAL WELDING SYSTEMS FOR HIGH QUALITY AND ENHANCED PRODUCTIVITY IN WELDING OF PIPES AND TUBES.

INTRODUCTION:

The power sector in India meets the energy requirement of the world's 5th largest energy consumer, accounting for 4.0% of global energy consumption by more than 17% of global population. About 65.34% of the electricity consumed in India is generated by thermal power plants, 21.53% by hydroelectric power plants, 2.70% by nuclear power plants and rest being hydro, solar, wind and biomass power plants.

Rapid economic growth has created a growing need for dependable and reliable supply of electricity. Government of India has planned to enhance gross domestic product (GDP) to 10% in 11th Five year plan. In order to achieve this, energy requirement, which is one of the major contributing factor in upgrading the GDP, will increase. Country's existing production & consumption of electricity is 181.5 GW and expected demand by 2020 is 950 GW.

Since thermal power plants produces majority of the electricity in India, the need for parts like deaerator, heat exchangers, super critical heaters, economizers, condenser, feed water heater are ever increasing. Welding is one of the major activities for tubes and pipes required for these components as well as for nuclear and other power plants. The future power plants will be super critical and ultra super critical for higher efficiency. The need for quality piping and tubing that can withstand higher pressures

Product Update

CHAMP TIG 300 P



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and temperatures is ever increasing.

Tubes and pipes are also used in the oil and gas industry as well as in semiconductor, pulp & paper, food processing, pharmaceutical and aerospace and other industries.

The intent of this article is to give glimpse of various welding techniques used in tubing and piping applications. This article highlights the concept and advantages of orbital welding and various weld heads used in different applications.

TRADITIONAL WELDING OF PIPES AND TUBES

One of the oldest methods of doing welding in piping and tubing is manual metal arc welding and manual TIG welding; in the latter the operator welds the job by holding the torch in one hand and filler material in another. Though manual welding is one of the preferred ways of doing welding it has limitations like

- Weld quality throughout all joints is not consistently same.
- No control on joint to joint penetration and HAZ uniformity.
- Inconsistent torch travel speed and filler wire feed speed.
- Difficulties in all position welding --- high skill of welder required.
- No uniformity in weld bead formation in case of grooved pipe welding
- No oscillation & side wall fusion control over multiple joints.
- Low arc on time & frequent stoppages & starts.

ORBITAL TIG WELDING CONCEPT

To overcome these limitations the concept of orbital welding system was introduced and is now becoming increasingly popular in India as well.

Orbital welding is a specialized area of welding whereby the arc travels circumferentially around the static work piece, in a continuous process without interruption.

In this mechanism the arc generated from the tungsten electrode rotates along the circumference of tube or pipe. The tungsten electrode is fixed on the rotor which is rotated by servo motor mechanism. This servo motor has a feedback encoder which detects the exact location of the electrode and controls the travel motion. These orbital welding power sources are either microprocessor or computer based programmable pulse TIG DC welding machines.

ADVANTAGES OF USING ORBITAL WELDING

- Programmable power source.
The power sources are programmable. They can store many programs for weld schedules with multiple levels. The print out of weld programs can be taken any

WIRES FOR TIG & MIG



TIGFIL 70SG

Suitable for welding Carbon steels, ASTM A-106 Gr B, etc.,

TIGFIL 70S2

Suitable for welding carbon and micro alloyed steel

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COMBO MS 600



- Optimum use of existing MIG welding machines
- Economical - Minimum investment since there is no need to buy complete SAW outfit

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number of times for ease of traceability. The display boards of power source are user friendly with simple Graphical User interface (GUI).

- Better penetration and less HAZ.
Being pulsed TIG welding machines the heat input is controlled over a period of defined pulse width with the help of primary and background current settings. This fulfils the basic objectives of better penetration yet lower HAZ.
- Better quality & repeatability.
The quality of first weld and last weld after several years will be identical with the proper weld schedule.
- Reduced skill levels risk.
All the skills of certified welders are taken care by these welding machines. It is designed to take care of all safety aspects.
- Improvement in productivity.
Due to repeatability consistency, and higher travel speeds, the productivity of automated orbital applications is significantly higher than manual welding productivity.
- Consistent torch travel speed and wire feed over the weld cycle.
(a) Servo motors with encoder feedback mechanism for travel and wire for uniform weld bead formation.
(b) Automatic arc voltage control (AVC) for avoiding arc extinguish and stub out problems.
- All position welding possible (including 5G and 6G).

MAIN COMPONENTS OF ORBITAL WELDING MACHINES

In this article we will detail the 2 main components: the power source and the weld head

POWER SOURCE

The power sources are microprocessor/ computer controlled programmable Pulse TIG DC machines. AC Orbital TIG/MIG welding machines can also be used. They work on the principle of RF arc start where high KV generated in the condenser bank in dumped on the job for arc strike. The arc start can be touch start in some cases with AVC control.



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MICROPROCESSOR BASED POWER SOURCES

Microprocessor based power sources can store 100 programs and computer based power source can store as many programs as possible with 150 to 400 Amps. 100% duty cycle modern orbital welding equipments from AMI has advanced features like AVC and oscillation control, travel and wire feed control, gas flow feedback control and current controlled cards .



In case of micro processor based machines, with the help of filled weld schedule development sheet, data is entered in to the machine & saved. Entering these parameters with the product reference guide is very easy and hardly takes 5 -10 minutes for filling it in both the sheet as well as on the machine.

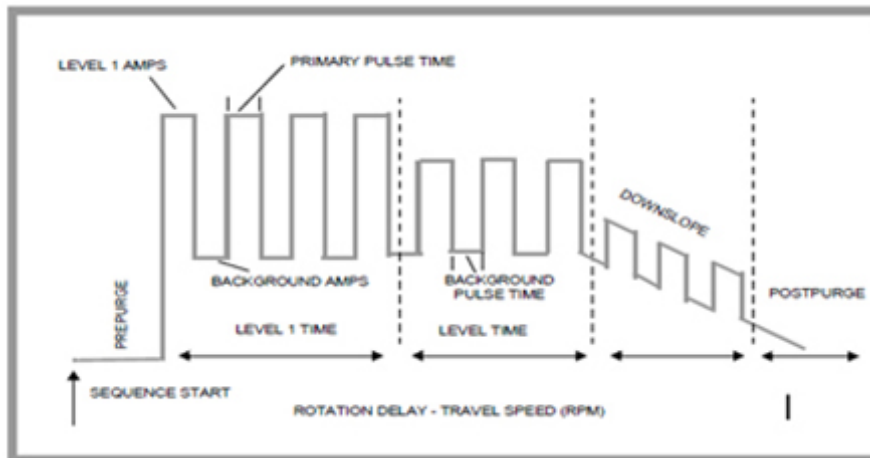
COMPUTER CONTROLLED POWER SOURCE

In the computer controlled power source, entering key parameters like outer diameter , wall thickness & material type, all other parameters like Gas pre purge – post purge time, upslope-down slope, primary-background currents for various levels, pulse width & travel speed etc are automatically arrived with the help of the software programmed in the computer in-built memory.

Actual sequence of operations in welding takes place as shown in the graphical representation below.

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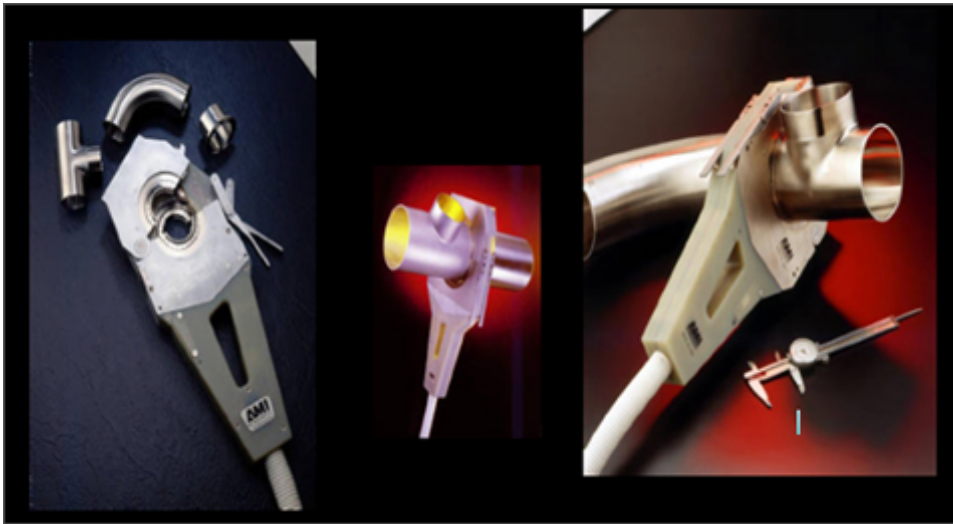
These types of power sources can be programmed to take care of multi levels & multiple passes. The program adjusts the primary & back ground currents level wise for maintaining the heat input and controlling the heat affected zone.

WELD HEADS USED FOR ORBITAL WELDING APPLICATIONS.

Orbital welding is preferred for tube to tube welding, tube to tube sheet welding as well as pipe to pipe welding. In this article we will discuss these 3 applications illustrating the welding heads of M/S. Arc Machines Inc, U.S.A. whose orbital welding systems are available in India from Ador Welding Ltd.

TUBE TO TUBE WELDING HEADS

Model M8 & M9 from AMI are the most preferred weld heads used for tube to tube fusion welding. These weld heads are lighter in weight and are water cooled which increases the life of rotors and other mechanism inside and also useful for non stop production with 100% duty cycle. Calibrating these weld heads with the power sources for perfect synchronization is very simple. If coupled with Microprocessor based power sources, calibration program is to be entered & if used with computerized power sources, they have auto calibration facility.



These weld heads are used in semiconductor, pulp & paper, food processing, pharmaceutical, aerospace industry.

TUBE TO TUBE SHEET WELD HEADS

For tube to tube sheet, where the tube is flushed, welding with AMI M96 model is the most preferred because of its simplicity, lighter weight & tube holding arrangement with the pneumatic mandrel. It also has water cooling line for cooling the head while used for mass production.

AMI model M6A is the popular weld head for tube to tube sheet where the tube is projected / slightly recessed or flushed. These weld heads are equipped with water cooling arrangement wire feeder, AVC, chill follower, locating fixture mechanism .

The X-Y slides of this weld head help to align the torch as well as the wire guide holder at any angle to take care of welding across the centre line .The chill follower mechanism is the distinct advantage of this weld head which fits in to tube to be welded and tracks the path of the tube, which takes care of the oval joint and forms uniformity. Continuous multiple passes can be programmed based on requirements. Water cooled chill follower helps to avoid burn through by absorbing excess amount of heat.

Locating fixture is another advantage of this weld head. It increases the productivity rate in comparison to the mandrel type of weld heads. It is self supporting pneumatically operated and holds the weld head well.

PIPE TO PIPE WELD HEADS

Models M79 and M81 from AMI are the open frame weld heads used for pipe to pipe welding. M79 weld head is capable of welding pipes ranging from 0.75" to 6.625". It has all the functions for welding J/V edge prepared joints with oscillation. Multiple passes are possible with manual as well as with auto cycles. Model 81 weld head is designed to weld pipes with low radial clearance as low as 50mm. Both these weld heads are water cooled with 100% duty cycle.

Models M15 & M52 are used for bigger pipe to pipe welding (pipe diameters ranging from 3" to any size) where the weld heads are mounted on guide rings which are fitted on the pipe with the help of simple feet arrangement.

These weld heads are 400 A DC 100% duty cycle water cooled type. They have additional features like torch oscillation, cross seam, AVC stroke mechanism etc. Optional devices like camera vision systems can also be coupled with these weld heads along with infra red sensors & LEDs. These are helpful for viewing the leading & trailing welding quality. The NGT-B M15 is the heavy duty precision weld head designed specially for thicker narrow gap welding.

These weld heads are used in power generation & oil & gas industries.

CONCLUSION

In short, there are various techniques for welding in the tubing & piping industry, but orbital welding is becoming more popular for enhancing the quality, productivity & consistency of weld joints. Customized welding solutions with orbital welding systems are also available and the technology and usage of these equipments and solutions is becoming simpler and common.

For more information on AMI power sources and welding heads Please write to us cmo@adorians.com or visit www.adorwelding.com. Our representative will be delighted to help you establish and maintain superior welding quality with these orbital welding systems.



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