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# Robotic Welding System - The Myth or The Reality

By  
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The only one lesson that the fabrication industry have to learn from the past decade, it is that the stakes of efficiently doing business have permanently been raised in coming years .

The early 2000 were characterized by an enhanced emphasis on quality, reducing costs to compete in a global market, optimizing floor space for maximum output, training and maintaining the skilled workforce. And to achieve these goals, the major fabricators had adopted robotic welding technology especially in Automobile and Earth Moving Equipment manufacturing Industries.

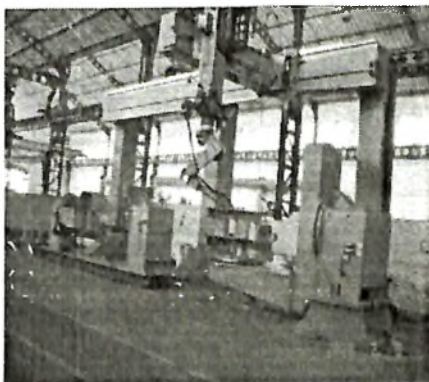
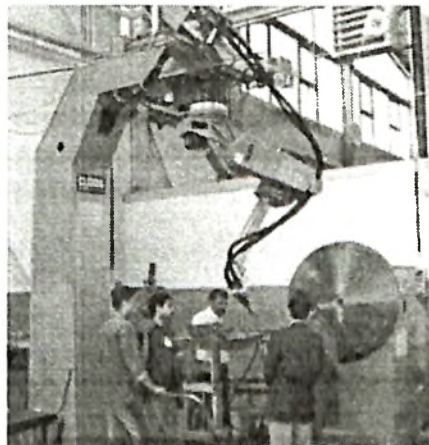
But today by 2007, when the pressure of Global village economy is raising high and high on the manufacturers, Automation has become a matter of survival, not only for large fabricators producing high volume of components, but even for the small fabricator, for whom the ability to raise productivity while reducing costs will determine the actual viability of the business in fabrication Industry.

During 2000's, the number of new arc welding robot installations in India grew at an average rate of 12 percent per annum. This growth continues to accelerate, as per the latest available report ; the numbers for the first half of 2007 indicate that arc welding robot

installations were up 50 percent over the same time period in 2007.

But still most of the first-time buyers of robotic systems are still hesitant to make the purchase decision with confidence. They are concerned about making a mistake-may be a big and expensive mistake.

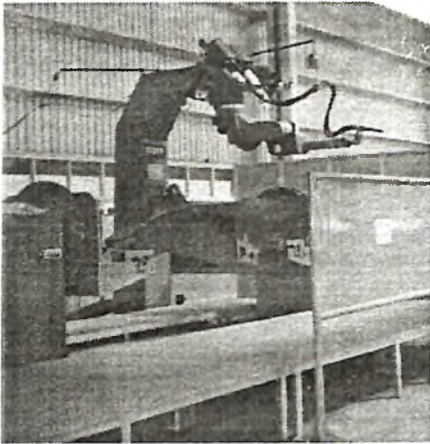
To overcome this fear, we are addressing the myths and reality surrounding robotics in general, and specifically, robotic welding systems.



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## THE MYTHS

1. It requires to employ "scientist" to program a robot.
2. Installation of a robotic welding cell can only justified by high volume production.
3. All welding quality related problems will get automatically resolve by installing a Robotic welding system.
4. A robot operator must be a highly trained, skilled and highly paid staff and difficult to retain as permanent employee.
5. Robotic welding Systems are very expensive and it is really difficult to justify the investment, since the labour is so cheap in India.
6. Holding fixtures are too difficult subject to address but is a critical component for the successful Implementation of a Robotic Welding Installation.
7. A robot can weld any part that can be welded manually.
8. Robots cannot weld very large parts or assemblies.
9. It is preferred to buy a cheap robot welding system, where the major parts are manufactured locally & system integration is done by third party.



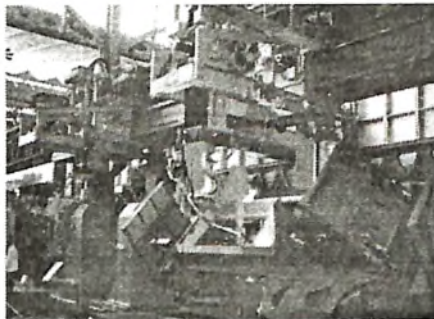
10. Cloos India Welding Technology Pvt Ltd Can the Robotic system be suitable for the kind of electricity Power supply available in India and the ambient condition and the dusty work environment of a fabrication unit in our country.

#### THE REALITIES

1. Programming of a robot is simple. The simple interactive & symbolic display on the touch type Screen of the Teach Pendant enable even workers who do have the language barrier, to learn the programming of a robot within few days.



2. A welding robot need not have to be dedicated to do a single task i.e making one Component every time. It is possible to store many programme for the number of welding parts in the memory of the Robot Controller unit. Then it is possible to change from one part to another part very quickly if the holding fixtures are properly designed and manufactured for adopting multiple jobs. Hence several different parts can be welded in the same Robotic welding system even in a day.



3. The welding robot can not solve the welding quality problems by itself. If the components are not designed & assembled properly or the welding joints are not prepared or presented properly to the robot, there will also be problems with quality even with Robotic welding.



4. It is only experience, training and practice that make a person skilled welder, whereas a robot welder only has to load the part, press the Start button in Pre-selector to activate

the system, and then unload the part. The training of a robot operator can literally take much less time.

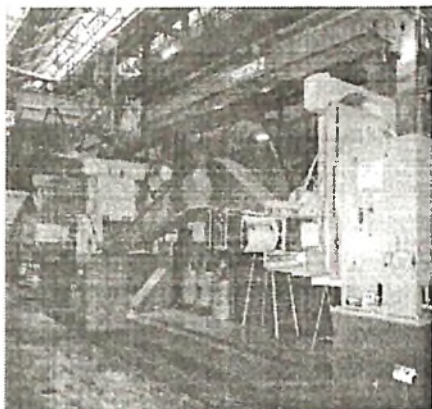


5. Following the market trends of the hardware, the price of a Robotic welding system has dropped dramatically during the past few years but at the same time the software capabilities, programming ease, motion speed and accuracy have been enhanced. The result of this is, at much lower price, a robotic welding system now offers far superior performance.

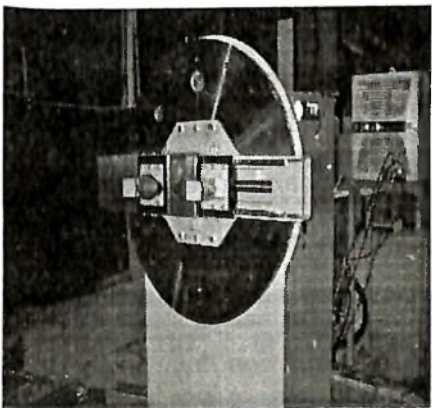


6. It is true that the accessibility of the Robot for welding depend upon the design and the accuracy of the holding fixture which finally holds the job on the positioner. This also decides the positioning accuracy and ease for programming for the Robot. With proper guidance and design support from the Robot supplier, who must be having enough experience in executing similar jobs earlier, the holding fixtures can be fabricated locally and such holding fixtures work

perfectly in conjunction with the robot.

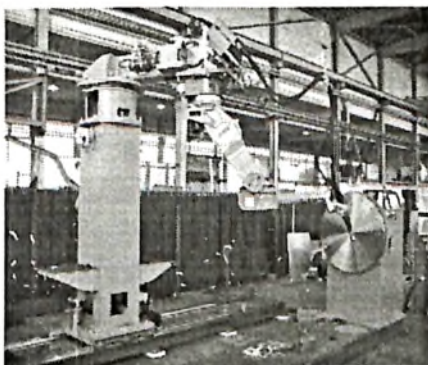


It is true that the Robotic system can not weld all the parts that can be welded manually. The requirements of holding fixture, the accessibility problems of the Robot and specific positioning requirements for gravity welding may make impossible or impractical for robotic welding. The expert part design assistance will help to provide success in robotic welding applications. In most cases, application expertise is critical. Selection of Properly designed and manufactured Holding fixture with universal adoptability will enhance the usage of Welding Robot, since the same fixture can



accommodate many jobs one after the other and the time for changing the holding fixture with respect to the job can be productively used.

7. Robot are usually mounted on a Floor mounted Linear tracks, C frame or an over head gantry Head with additional Horizontal and Vertical slides, which increases the working envelope of the Robot and thereby the Robot is able to weld parts that may be 22Mtr long and 6Mtr wide.



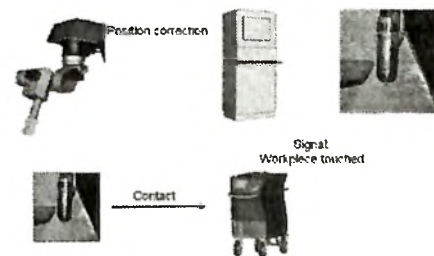
8. The success of a Robotic system depends upon Software support and ability to resolve the problems related to supplied hardware. Most of the Robot Systems Integrators normally purchase the Robot, Welding machine and the work piece positioner from three or more separate suppliers and integrate them into a Robotic system. The problem lies with such arrangement is the technical

integration or marriage between to these parts and the serviceability of the parts procured from various sources. Hence a single window Robotic system supplier is always preferred compared to the system integrators through-out the world.

The following softwares are essentially required for carrying out quality fabrication by a Robot :-

### GAS NOZZLE SENSOR

The weld start position can vary. Material tolerances or workpiece distortions which occur during welding by heat supply are two of many reasons. A robot equipped with a touch sensor is able to find out the weld start position before processing start. A metallic tooling part or a tracer pin which is located at the tooling is used as measuring device. Thus the sensor can be used in the whole robot working area without restricting its flexibility and accessibility. The search routines are carried out near the weld start on the surface and at the edges of the workpiece. The robot executes up to 3 search routines depending on direction and size of the tolerance in order to analyse the difference between the workpiece to be welded and the positions stored in the robot controller. The robot approaches the workpiece from 3 directions (X, Y, Z coordinates) to achieve exact measuring results.





- With the advent of solid state electronics, the provision are now available to support the system over a period of seven to ten minutes with back up USV, so that in case of abrupt power failure, the system remains energied without loosing any data.
- The use of Roof cooling Air conditioner maintains Controlled and uniform temperature in side the controller cabinet irrespective of external temperature.
- An Automatic Switching Dehumidifier unit takes care of the excess humidity present in the envornment.
- In order to facilitate, the high data storage capacity inside the controller unit, one hard disc having 2 GB capacity is also provided.
- To ensure smooth working of the system, a separate Water cooling unit is provided, so that adequete water pressure is maintained for cooling irrespective of the length of the linear track .
- In order to ensure smooth flow of the welding wires during welding and to ease the handling the bulk Mig Wire spools, an additional drive unit with control is priovided on top of the bulk spool to make the system with positive Pushpull arrangement.
- Additional TFT Screen on the controller unit will enable the operator to see the weld data on the bigger screen and as well to run the Robot system even in case the Teach Pendent is under breakdown due to mishandling or any other reasons.
- Use of Tandem welding Technology for higher weld metal deposition efficiency in order to meet the higher production requirement.

## FOR MAKING THE PROCUREMENT DECISION

Once the myths about robotic welding systems have been cleared, the benefits vrs. actual costs should then be evaluated. It will be always wise that the buyer should not stress too strongly on certain fabrication process including welding for most effectiveness of the proposed robotic system. Involving the supplier of the Robotic system in the initial stages of the designing & preparing the WPS will greatly enhance the fabricator's application of robotic technology to specific product line and production needs. Reputable suppliers of Robotic solution normally render such assistances to the customers since it is imperative that the successful implementation of a welding Robotic system depends not only on the supplied hardware, but also on understanding & meeting the production needs of the fabricator.

The decision-making process should begin with a detailed review of the following items:-

- the number of work pieces to be welded per day & their sizes including the weight
- the accessibility of all the weld seams by the Robot preferably in gravity position for welding
- repeatability of the work piece and total production requirement
- requirement of Holding fixtures
- The Means to compensate the distortion after welding
- The welding process to be used in conjunction with the Robot to meet the production requirement by the robotic solution.

During the decision process, the supplier of Robotic system and the fabricator should work together to determine the

appropriate system configuration with accessories including the optimal layout for the robotic System, requirements of Man power and their Training and requirements of service and maintenance (internal and external supported by the supplier of Robotic solution).

During finalizing the robotic system layout, one must consider the space for the Robotic system including the Linear track with overhang Robot , the welding power source, robot controller and wire feed package and wire spools , but also the material movement such how the work piece will reach to the area, and after welding, how the finished parts will leave the area. Work flow simplicity characterizes a good System layout.

## THE PITFALLS - TO BE CAUTIONED

It is clear by now that the supplier of Robotic system whose idea for any order for a robotic welding system as a one-time-opportunity sale can not provide the total support as required by the customer and hence will certainly effect the successful implementation of the Robotic welding by the customer. A supplier who understands the fabrication business, and have enough experience in executing similar jobs with Robotic welding can only provide vital input during the lengthy decision and design phase, as well as essential ongoing support after the system is on-line.



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Most of the robotic welding systems are much simpler and easier to use than the average fabrication unit owner may or might think. But it is also true that while using Welding Robot, the customer will experience new problems that did not exist (or at least were not significant) when a welder holds the torch and welds.

The human being is the most sophisticated Computer ever available in the world and a skilled welder will be always able to compensate for sloppy or ill-designed fixtures, varying trim lines and errors due to poor dimensions of Work piece. An experienced welder is also capable of overcoming problems with the welding equipment, wire delivery or the supply of shielding gas. But unfortunately the welding robot does not have any eyes to see these errors and can take the corrective actions to reduce the effect of the errors.

Hence any Robotic welding system will demand closer quality control in the manufacturing process of the work piece. In addition to this, the clamping fixtures should be precise. These requirements simply point out the importance of considering a supplier having experience in executing similar jobs early in the purchase decision process.

When a work piece is mounted on the holding fixture and the weld bead tolerances become visible first time, the programmer or the operator can make a choice between adjusting welding parameters and technique or rejecting the parts.

Now a days, robotic welding systems can incorporate vision capabilities by using Laser Camera that provide for adjusting electrode position and welding parameters to permit quality automated welding even on work piece with variations but within certain limits.

However, the option for Laser Camera and accessories are very expensive and hence by employing Arc Seam Sensor and Gas Nozzle Sensor, the minor compensation in the work piece can be taken care on line.

### **COST JUSTIFICATION**

In order to make the decision-making process is proper, it will be possible to justify the cost of a Robotic welding system by relying upon somewhat conventional measures. This has been proved in the past that Robotic systems have offered increasingly better performance at sharply lower prices, where labour cost and other benefits are continued to rise.

The training required to develop the skill of the welders, the scarcity of trained & experienced welders in many parts of the country and the potential effects of worker turnover should also be considered as a part of the Manual welding costs. The economic consequences of these factors may be small, but they are of highest significance.

The problem of finding out enough highly skilled & experience welders to meet some special large orders has affected many companies in the fabrication industry at once or another. Today, in fact, a very fewer people are joining as welders and among them a few welders get properly trained and at the same time many experienced welders are approaching retirement.

The effort to justify the ROI (Return on Investment) for the Robotic welding system should take into account the relative expenses of training an individual for many years for developing in a fully qualified welder. The scarcity of highly skilled labour indicates that we must also take into account factors like the cost of poor quality, including

rework, scrap and, most important, customer dissatisfaction etc.

The expenses made to maintain the safety factor norms for welders can also give robotic welding systems another edge in the cost-justification process. The development in process technology such as Tandem welding, the Consumable wire and Gas Mixture, etc in combination with automatic controls linked with software and solid state Technologies with enhanced Laser vision systems permit Robotic welding at a maximum speed of even 22 Mt per minute, enables to achieve overall cost reductions.

### **CONCLUSION**

Quality, productivity and safety these are the three pillars of competitiveness. Robotic welding technology now delivers all three at a lower cost, with more flexibility and with greater ease of implementation. The fabrication industry must not forget that the stakes are now higher than ever before. Indian Earth Moving Equipment manufacturers and their vendors have already made the investments for welding Robotic systems to meet the future demands. But it is time for responsible large and small fabricators, to discard the myth about robotic welding and investigate the realities for themselves.