

Analysis and Implementation of Parameters of CNC Plasma Arc Cutting Machine in a Manufacturing Firm

Sanjeev Kumar

Department of Mechanical Engineering
IEC College of Engineering & Technology
Greater Noida, India
sanjeevmahoba.jss@gmail.com

Ijlal Ahmad Rizvi

Assistant Professor, Department of Mechanical Engineering
IEC College of Engineering & Technology
Greater Noida, India
ijlalrizvi.me@ieccollege.com

Abstract – The progress established on the project so far consists of assigning our project in the work schedule of the company, completion of a pilot survey with the senior manager and operators in the company, establishing the time frame of work in the industry with the consent of the company. During this whole time period the background science about the working of plasma, CNC machinery and its maintenance is also being studied with aid from our mentor and the senior members in the industry. The plan consists of conducting a study involving establishing working standards on a machinery of the company and deducing productivity after maintenance activity.

Keywords– CNC, Plasma arc cutting machine, Cutting machine parameters, Plasma machining.

I. INTRODUCTION

Plasma cutting machine cuts metals of different thicknesses with the help of plasma torch. An inert gas is used at high speed out of a nozzle. Some of the electric arc coming out of nozzle is converted into plasma. Velocity of plasma is so much that it blows molten metal away from the work piece.

The purpose of our study is to identify certain factors, find out their emphasis and improve the production value of CNC Plasma Arc Cutting Machine.

Each component in a industry plays its own role in its own capacity and affects the final product even though inspection is a refining procedure and it helps to sort the quality of products, recurring errors or even a minor change in quality statistics can haywire the closely controlled systems.

Thus factor analysis and improvement is an important step towards securing and maintaining the momentum in production. The company has conducted breakdown maintenance on the machinery and thus requires setting up of new working standards for it. Our work consists of studying the machine working and deducing the rate change in productivity it is indicating.

Parameters

1. Minimum diameter

The current value is somewhere between 12-15 mm, this value is to be identified with accuracy and precision.

2. Smoke entrapment

Smoke generated during process is currently just spread away from the machine bed by using fans; a proposal has been applied for using smoke entrapping devices. Our study would involve identifying the best option from the available ones.

3. Taper

The angle of taper of the bed decides the quality of cutting taking place. A flat bed is the best surface.

4. Burr

The amount of Burr generated increases production time because of the additional grinding requirement, our study shall focus on finding best parameter to avoid its formation.

5. Running meter

The productivity can be directly linked with running meter which basically helps calculate the amount of output generated by the machine.

6. Min./Max. Voltage

The value of voltage the machine performs up to.

7. Min./Max. Ampere

The value of current the machine performs up to.

8. Continuous working hours

Maximum time which the machine works without generating noise and unnecessary disturbances.

9. Water level

The water level to be maintained during and after operation.

10. Taper in sheet

The capability of the machine to work with sheets having tapers.

11. Distance between nozzle tip and workpiece

The distance between nozzle tip and workpiece setup as per workpiece thickness setup by the operator.

II. TECHNIQUES AND PLANS

First phase

Literature Review

A literature survey is carried out to identify the entities affecting our machine and get directions related to our focal area. The aim is to establish a relationship with

everyone participating with the machine. Factor analysis is done in the period of machine usage and a paper survey is conducted amongst the employees.

Second phase
Factor analysis

The methods of time study are employed extensively here. The study would consist of time calculation and assessment of production value. The analysis will be based on the methods of observation and previous data sampled from earlier observations. Factors deemed useful will be used for further procedure in establishing effect in productivity

Third phase

The collected data will be analyzed and the required factors will be compared with the variations. Thus establishing the rate of productivity and the change it shows.

Machine Details

Messer Comcut 3100

Length (4.5 m) X Breadth (2.5 m) X Height (0.7 m)

Table- I:

Type	Comcut 3100
Company	Messer
Voltage	230v
Frequency	50Hz
Power	2.5KVA
Refrigerant	R134a, 125g
Cooling output	L35,150,210W/200W
Diesel Pressure	6 Bar/27 Bar
Noise level	62dbca
Running	30Amp
Rated Current	1.8A
Starting Current	2.8A

III. RESULTS AND DISCUSSION

The result generated is on the basis of comparative graphs generated between multiple factors and their association with the standard graph.

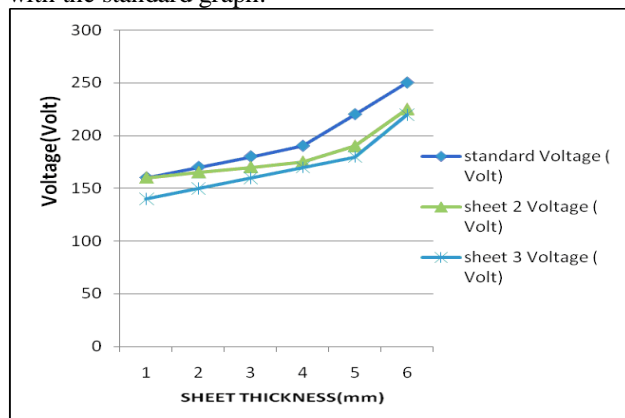


Fig.1.Comparison of Voltage change with Messer Comcut

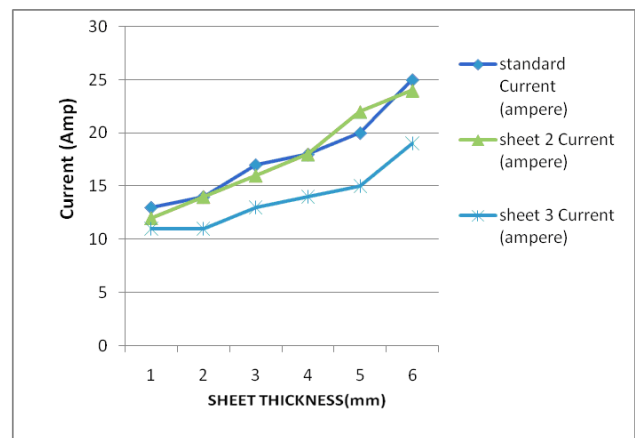


Fig ;1. Comparison of Current change with Messer Comcut.

These curves were generated on the basis of tables present in the appendix. The graph indicates that Voltage generation is lesser compared to standard. This is the resultant of Continuous Breakdowns and irregular servicing of the machinery. The analysis yields an introduction to the setup of a new Power supply unit which shall monitor all 3 parameters namely Air Pressure, Current and Voltage. The current power supply is developing faults and thus is incapable of handling the load on machinery.

These curve deviations are observed because the air pressure is not regulated properly for the Plasma machine. Furthermore the current power supply when serviced was found obsolete and old.

Also the unit requires the Power supply to be compatible and at least near equivalent to its own generation of machines.

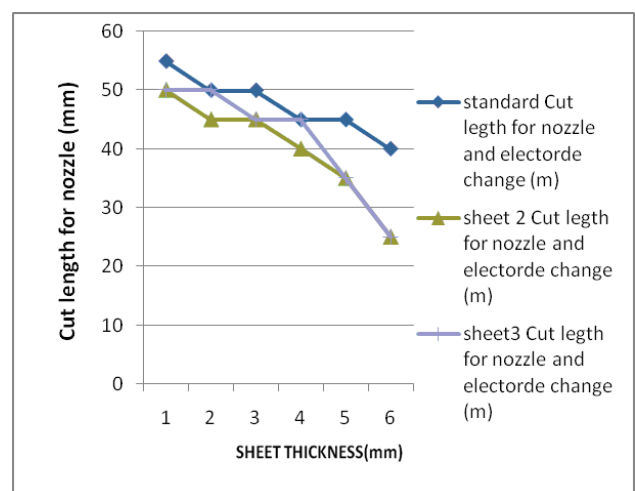


Fig .3. Comparison of Cut length for nozzle change with Messer Comcut

The Cut length indicates that the nozzle and electrode suffer quicker wear as compared to previous data. This can be attributed to the fact that the current housing of the machine nozzle and electrode is faulty. The Sensor which calculates the Standoff distance from the sheet seldom underperforms and thus the wear is evident.

The solution would be to change the Plasma assembly itself since the sensor is of a outdated generation and has been repaired multiple times.

Portable CNC machine SH-2012AH-QG

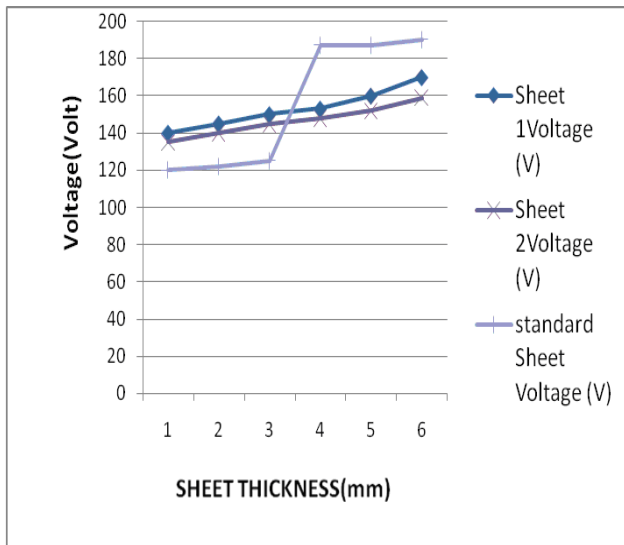


Fig. 4. Comparison of Voltage change with portable CNC machine

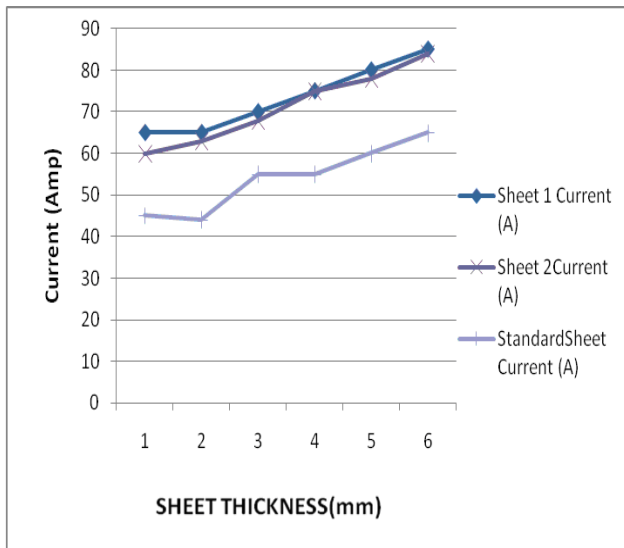


Fig. 4. Comparison of Current change with portable CNC machine

The graph indicates that the voltage generated is lesser than standard, this can be acceptable since Machine standards are not indicative of production standards. The Solution would be ideally conducting a maintenance record during the monthly maintenance cycle so that the Production standard is maintained.

The same applies for current.

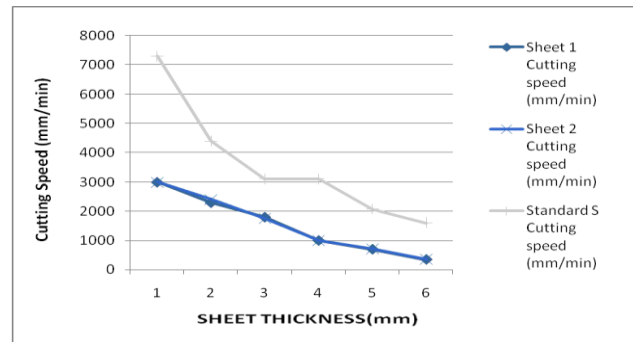


Fig. 4. Comparison of cutting speed change with portable CNC machine

The cutting speed is consistent in most readings, thus it is established that the precision of maintaining cutting speed is excellent. As far as Accuracy is concerned the cutting speeds are kept at low because of the recent acquisition of the machine. So that, the motors and drives can accustom better to each other. The new power supply is a bit efficient due to company maintenance being conducted regularly.

The factors were analyzed and the conclusions derived in the next section.

Target factors

1. Taper on bed

Taper on bed causes improper plasma generation and decreased usable area. Besides the gap between bed rods are very wide due to which work piece always falls into the water below. Currently the taper on bed is manually corrected as per sheet size. Operator puts weights in and around the sheets to ensure that it is flat. This causes time delay and moreover it is a tedious job as it causes hindrances during cutting too.

2. Taper on sheet

The Taper on sheet is measured daily by the operator, and thus the best fit sheet is selected while the other sheets are sent back to inventory. This again increases time taken by operator to work and causes delay.

3. Water level in tanks

The water level maintained is usually varying from 25-30mm. The change of water occurs at random intervals and water is not cleansed. Unclean water causes scaling and a stench in the nearby environment.

4. Minimum Diameter

Old machine: - 13mm, New machine:- 10mm

It is the minimum diameter which the machine is capable of cutting. The lower this number the higher the performance capability of the machine. Minimum diameter increases as the usage of the machine increases because the sensory coils which help in positioning accumulate dust and error soon enough.

5. Guide ways

Guide ways are the path upon which the nozzle assembly travels. It is very important for the guide ways to be free of any hindrances and obstructions. The new machine has grinded guide ways; the old machine has hardened guide ways.

6. Provision of alleys

The distance between the machines is maintained at 5 feet. It causes operator and man power movement problem, besides everyone has to stand on the sheets themselves because of improper handling.

7. Smoke entrapment

The smoke generated in a Plasma operation is its most dangerous aspect. It is a highly poisonous gas and immediately affects nearby surrounding. Currently the machines use giant fans which blow away the smoke but in reality they spread it wide around the area.

IV. CONCLUSION

1. The Taper on bed can be maintained by weld joining the bed with small pieces of metal, this helps in maintaining positional accuracy. Preferably L shaped weld joints would help holding the bed as well as control falling of work piece into the water.
2. Pre-treat the sheets to avoid Taper. Since there are only 2 machines serving the industry and the inventory for both of these machines is commonly delivered. The material to be sent in advance can be pre-treated and taper in them reduced so that delay due to incompatibility of sheet is avoided.
3. Fix a water level cleanliness chart and maintain changing of water levels at consistent pace. Also chemically purify the water so that rust is not developed on the work pieces.
4. Conduct daily maintenance activities on the nozzle assembly and motor drives to maintain longevity of precision and accuracy during performance
5. Replace the new machine guide ways with hardened guide ways since the grinded guide ways are prone to damage very quickly.
6. Increase the distance to at least 10 feet since the trolleys can move between the machines. Also the raw material are kept in the way of the alleys so one has to walk over them to go anywhere near machines. So a proper area must be painted and maintained for the sheets.
7. Penalties are imposed accordingly by the State government for air pollution thus a suggestion for smoke control is required.

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