

# REVIEW OF OPTIMIZATION IN PROCESS PARAMETER AND MATERIAL REMOVAL ON CNC FLAME CUTTING MACHINE

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**Abstract:** The Last forty years there is tremendous research in machining and development in technology. With increase in competition in market and to attain high accuracy now a days the non-conventional machining are become lifeline of any industry. One of the most important non-conventional machining methods is CNC flame Machining. It has high accuracy, finishing, ability of machining any hard materials and to produce intricate shape increases its demand in market.

In thesis work literature has been studied in context to parametric optimization of CNC flame Machining. In order to attain target and optimum results, Taguchi method employed. The appropriate orthogonal array has been selected as per number of factors and there levels to perform minimum experimentation.

The work pieces of mild Steel materials will be use for experiment purpose. The optimum value will have been determined with the help of main effect plot and ANOVA table. The Regression equation for MRR and Surface Roughness (Ra), Confirmation test will be doing to confirm the value estimated through the observation.

**Key words:** Flame cutting machine, Cutting torch, Taguchi method, O<sub>2</sub> & LPG gas, etc.

## 1. INTRODUCTION

The topic for the thesis writing is the Analysis of Process Parameters of CNC Flame Cutting Using Design of Experiment Techniques. The focus on this project is to obtain an optimum condition (setting) to obtain mini MRR and minimum the surface roughness (SR).

A person doesn't need to be a physicist or chemist to understand the CNC Flame Cutting (PAC) and Gouging process. There are fourth states in which physical matter may be found solid, liquid, gas. Changes from one physical state to another occur, by either supplying the energy & subtracting energy, in the form of heat.

The fourth state of matter, gas, looks and behaves like a high temperature gas, but with an important difference; it conducts electricity. The CNC flame is the result of the electrical arcs heating of any gas to a very high temperature so that its atoms are ionized and enabling it to conduct

electricity. The main difference between a neutral gas and plasma cutting is that the particles in plasma cutting can exert electromagnetic forces on each other.

If you happen to be reading this by the light emitted by a fluorescent lamp you see flame in action. Within the glowing tube of the lamp is flame consisting of low pressure mercury or sodium vapor. It is ionized by a high voltage across electrodes at the ends of the tube and conducts an electric current which causes the flame to radiate which in turn causes the phosphor coating on the inner surface of the tube to glow.

For many years, oxy-acetylene cutting was often the process of choice for quickly cutting through steel plate. From the past few years plasma arc cutting has used much more over, of or some very good reasons to perhaps most importantly. A plasma cutter will cut through any metal that is electrically conductive. That means that one unit will cut steel, stainless steel, aluminum, copper, bronze, and brass etc.

The flame jet that does the cutting is hotter and narrower than an oxy-acetylene flame, so the kerfs width is smaller, and can get cleaner cuts. This makes flame cutting particularly well-suited for cutting sheet metal; the task oxy-acetylene cutting torch is not well-suited so it leaves a lot of slag on the edges of parts.

### 1.1 PROBLEM DEFINITION

Advanced materials exhibit very excellent technical properties. However, the high cost of both raw materials and processing reduce their uses. Alternatively advanced machining process such as CNC flame Cutting is normally used. Advanced material such as MS nickel-base alloys, titanium alloys and stainless steel can be used as the work piece in this type of cutting.

A torch in which temperatures as high as 30,000°C are achieved by injecting a flame gas tangentially into an electric arc formed between electrodes in a chamber; the resulting vortex of hot gases is emerges at a very high speed through a hole in the negative electrode, to form a jet for welding, spraying of molten metal, and cutting of hard rock or hard metals.

The plasma arc cuts various materials like ferrous metals and non-ferrous metal faster than Oxy-Fuel torch, with nearly no heat affected zone, especially on a clean cut with little means less time and money is required to finish the work piece. Parts are virtually weld-ready.

With CNC flame cutting, less preparation work is required. A flame arc is hot enough to burn through most surface coatings such as paint and rust and still provides excellent cutting results. With flame cutting, there is minimal heat input and distortion of the metal as there is with jigsaws or cutting shears. For applications of cutting difficult shapes, such as ventilation ductwork, Air conditioning, vessels, plasma cutting has various advantages than other process for that fixture is not required.

The feasibility and effectiveness needs to be proven by experiment and by using Taguchi Method of the processing parameter to obtain the best factors combination (MRR and Surface Roughness).

### 1.2 WHAT IS FLAME CUTTING



Fig-1.2 Fuel Cutting

Oxy-fuel welding and oxy-fuel cutting are the processes that uses gases as a fuel and oxygen for welding and cutting the metals, respectively. French engineers Edmond Fouche and Charles Picard became the first to develop oxygen-acetylene welding in 1903. Pure oxygen is used than that of air to increase the flame temperature that allow melting of the work piece material e.g. steel in a room environment. A common propane/air flame burns at about 1,980 °C, a propane/oxygen flame burns at about 2,253 °C and an acetylene/oxygen flame burns at about 3,500 °C. Oxy-fuel is the oldest welding processes than the forge welding. Still used in industry, in recent decades it has been less widely utilized in industrial applications as other specifically devised technologies have been adopted. Today's it is widely used for welding pipes and tubes and much more applications, as well as repair work. It is also frequently well-suited, and favoured, for fabricating some types of metal-based artwork. Also oxy-fuel has an advantage over electric arc welding process and cutting processes in various condition where accessing electricity would present difficulties; it is more self-contained, and, hence, often more portable. In the oxy-fuel welding, a welding torch is used to weld various metals. Welding metal result when two or

more piece are heated to a high temperature that produces a shared pool of molten metal. The molten pool is generally supplied with additional metal called filler. Filler material depends upon the metals to be welded. In oxy-fuel cutting process a torch is used to heat metal to its kindling temperature. A stream of oxygen is then strike on the metal, burning it into a metal oxide that flows out of the kerf as slag.

### 2 METHODOLOGY

Proposed work started with the problem identification in industrial process cutting and manufacturing of different type of plates and making various sections like I,C,etc. By collecting available information and specification further solution finding approached. It is found that Quality and productivity play important role in today's manufacturing market. Manufacturing of various sections are playing a very important role in construction of industries & it is the cheapest and most efficient way to improve the productivity.

#### FLOW DIAGRAM OF METHODOLOGY

Methodology used for whole processing Design And manufacturing of different plate section is given below; this methodology gives way about how work is to be carried out in systematic way. It is standard process of describing process, how it is done in simplest manner.

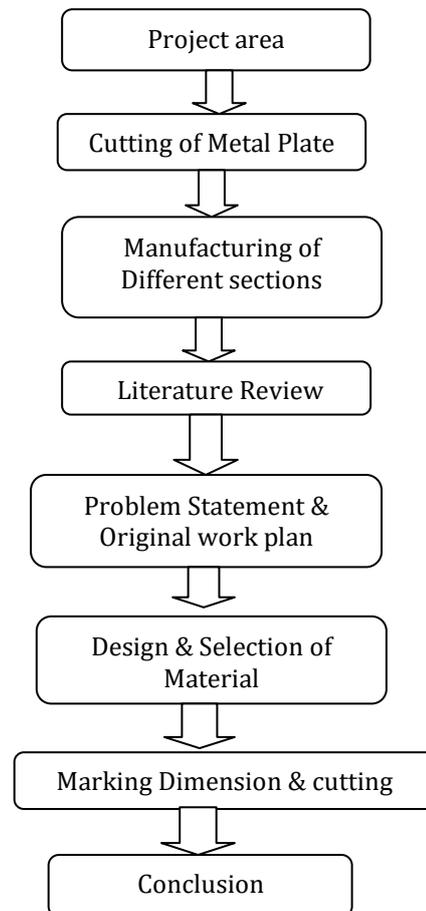


Fig.1.2. Methodology flow diagram

## CONCLUSION

In This project we have presented an application Taguchi method to the optimization of the machining parameters of Plasma Arc Cutting Machine. As shown in this study, the Taguchi method provides a systematic & efficient methodology for determining optimal parameters with far less work than would be required for most optimization techniques.

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## BIOGRAPHIES



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