

# AUTOMATIC GAS PROFILE CUTTING MACHINE

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## ABSTRACT

Profile gas cutting machine is a precision, quality constructed, hard-working gas shape cutter build for high production. Compact and simple operate; this machine excels at repetitive work, continuously producing accurate flame cuts by following a steel template. A powerful magnetic roller smoothly guides the cutting torch around any shape, cutting steel plate up to 4 inches thick. This machine offers all the convenient features of more expensive models with all the dependability and efficiency needed for our applications. Profile gas cutting machine is small profile radial arm oxygen cutting machine. Being small in size and light weight, the machine can be easily carried to the worksite and placed directly on the plate to be cut.

**Keywords:** profile gas cutting, high production, efficiency, compact, lightweight.

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## 1. INTRODUCTION

Gas cutting machines have become a necessity in the world of metal fabrication. Hence, there are constant improvements and developments that take place in this field. In the last couple of decades itself consumers have shifted drastically from the traditional cutting methods that used to be quite inaccurate, time consuming, and lead to high amount of wastage, to efficient and effective cutting methods like laser, oxyfuel, etc. With the use of such cutting solutions, businesses and companies have found a way to increase profitability, while reducing cost, time and wastage. Gas cutting machines have some advantages on its side as compared to laser cutting machines. The machine is mostly portable and does not take up too much space. As compared to laser cutting machines, gas cutting machines can cut thicker sheets of steel or brass and other electrically-conductive metals like aluminium with fair accuracy.

### 1.1 SPECIAL FEATURES

Automatic Profile gas cutting machine have some features they are explained below

1. Profile gas cutting machine is a lightweight, portable yet robust shape cutting machine, which can be used on field job as well as in factories.
2. The machine is designed with pantograph type arms, which keeps the hinge points of all the arms parallel to the line of
3. The tracing roller and the torch, thus providing a direct line guiding system.

4. This is simplest and one of the most accurate magnetic tracing systems, which help in maintaining repeatability of the flame, cut parts.
5. Profile gas cutting machine can cut shapes like stars, hexagons, squares, rectangles, triangles, straight lines etc. and bevels up to 45 Degrees.
6. The basic system of the machine enables the torch to duplicate any intricate shape provided on a template on the machine.
7. The carriage arm consisting of a motor driven Electro Magnetic Tracing Head and a cutting torch travels round the template.
8. The tracing head can be moved in clockwise or anticlockwise direction by a selector switch.
9. Accurate & easy to operate.

### 1.2 PROBLEM STATEMENT

Problem related to conventional cutting process in industrial operations are Inability to process complex shapes. It was difficult to apply consistent flow of gas torch in cycle manually. It lacks in case of precision accuracy and due to repetition of the work, the process caused boredom and fatigue to the worker.

So the main aim of our project is to rectify the above limitations.

### 1.3 OBJECTIVE

1. To study design and fabrication of profile gas cutting machine.
2. To study the testing and analysis of profile gas cutting machine.
3. To reduce time required to generate the profile.

### 1.4 SCOPE

The project work is carried out for the following purpose:-

1. For cutting the sheets in steel industry and other workshops and selling places.
2. Cutting metals that are in intricate form and requires a good finish and accuracy.

### 1.5 METHODOLOGY

1. Market survey of different cutting machines.
2. Selection of different components (motor, bearing ,nozzle and variac speed controller).
3. Design of mechanical components.
4. Calculation and estimation of different parameter i.e. diameter and thickness.
5. Fabrication and assembly.

### 1.6 PROFILE CUTTING

It is a process that is used to cut steel and other metals of different thickness using a torch. In this process, a gas is blown at high speed out of a nozzle and at the same time an electrical arc is formed through that gas from the nozzle to the surface being cut, turning some of that gas to profile. The profile is hot enough to melt the metal being cut and moves fast enough to blow molten metal away from the cut.

A. Basic components of cutting machine:

Profile gas cutting machine consist of following basic components which are required for its construction. These are as follows

1. Oxy Fuel Pattern Cutter
2. Arms
3. Magnetic Roller
4. Base
5. Main Column(Rod)
6. Template Base

Oxy Fuel Pattern Cutter:

An oxygas cutting outfit usually consists of a cylinder of acetylene or MAPP gas, a cylinder of oxygen, two regulators, two lengths of hose with fittings, cutting torch and nozzle. Pressure regulators are used to regulating and controlling the pressure, it having three knobs. Out of two knob which are connected to oxygen cylinder one is used to Supplying initial pressure which is required for cutting material and other is to adjust the pressure. To conduct the cutting process, cutting equipment must be set up and required adjustment should be done to perform the cutting operation.

Arms

Basically two arms used in profile gas cutting machine. Two arms are connected by using rod and two ball bearings, these gives support as well as provide smooth movement and rotation about rod with minimum friction. Front arm supports the nozzle torch and motor. The other arm is connected to the main or centre pipe and front arm through bearings and rod. Arms are the moving element in the machine and guides around the profile and gives cutting of any required shape or as per the shape of template. The height of the arm from the ground level can be adjusted on the centre pipe.

Magnetic Roller:

Magnetic roller is placed on the roller or shaft. This shaft is connected to the motor shaft through gear arrangements. Roller follows the shape of steel template fixed to template holder and accurately guides the torch. Due to the magnetic roller there is magnetic attraction and roller attracted towards the template.

Base:

Base is a square plate on which whole assembly is fixed. Base balances all the weight of whole structure. It has levelling arrangement and with the help it machine can be levelled on any rough surface and it needs not levelled surface for its operation

Main Column (Rod):

Centre pipe provides the base for the bush on which arm is fixed and bush on which template is fixed. In between two centres pipe there is thrust bearing for rolling of pipes.

Template:

The template to be used on this machine is recommended to be made from sheet iron or steel not less than 3mm thick. For efficient drive of magnetic tracing roller, the working edge of the template should have file finish (not too smooth). The edge must be square with the surface of the template. The machine is provided with mounting for fitting external template as well as internal template an external template is one which lies inside the path described by tracing roller, whereas an internal template lies outside the path described by the tracing roller. Straight cuts can be produced by using a flat bar.

## 2. MATERIAL AND METHODS

List of standard components:

Sr No.	Name	Quantity	Material
1.	Thrust Bearing	2	Mild Steel
2.	Ball Bearing	2	Mild Steel
3.	Bolt(M20,M16,M10,M6,M4)	11	Mild Steel
4.	Nut(M6,M10,M16,M8,M20)	14	Mild Steel
5.	Nozzle	1	Bronze
6.	Electric Motor With Gear Box	1	Mild Steel
7.	Magnetic Coil	1	Copper
8.	Magnetic Coil Holder	1	Mild Steel

Manufacturing methods:

Sr No.	Components	Manufacturing methods
1.	C-shape frame	Bending, Cutting, Drilling, Welding
2.	Arm	Cutting, Drilling, Welding
3.	Hollow Pipe	Cutting, Turning, facing
4.	Counter Weight	Drilling
5.	Template	Gas Cutting
6.	Main Column(rod)	Cutting, Facing, Turning, Threading
7.	Center shaft	Cutting

### 2.1 WORKING PRINCIPLE

In gas cutting, the metal is first preheated with the oxy fuel flame to the ignition temperature. When the required temperature is reached, the cutting oxygen is turned on, and the stream of pure oxygen is directed against the heated metal. This ignites the iron or steel and starts the cut. When iron or steel is heated to a temperature of 1600° F, it will burn if brought into contact with oxygen. If the oxygen comes only from the surrounding air, combustion occurs only on the surface of the metal.

However, if a jet of pure oxygen is directed at the hot metal, the metal will burn through a narrow zone, called a kerf. By moving the flame and oxygen jet (torch tip) progressively forward, fresh metal and oxygen are brought together forming iron oxide or slag in molten form and expelling it from the bottom of the kerf. A balance must be achieved among speed of movement, oxygen jet size, and intensity of flame to achieve a continuous operation.

The preheat oxygen and fuel are first mixed, and the mixture ignites as it issues from the outer ring of orifices as preheating flames. The flow of fuel is controlled by the torch fuel valve and the flow of preheat oxygen is governed by the valve on the side of the cutting attachment.

The cutting-oxygen jet is controlled by pressure on the lever mounted on top of the attachment. Oxygen to both the preheat oxygen valve and the cutting oxygen lever valve is supplied through the torch oxygen valve which is opened wide during cutting operations.

### III. RESULT AND DISCUSSION

Upon development of profile cutting machine work has been carried out on different template shape and material thickness.

When the thickness of sheet to be cut is increasing, its cutting speed decreases. It is found that thickness of sheet to be cut increases, pressure of oxygen gas increases almost linearly, while the pressure of LPG gas remains the same. It is also found that surface finish of manufactured profile is achieved.

Time required for different shapes

Sr.No	Profile Shape	Time	Thickness of Material
1	Circular	80sec	10mm
2	Square	70 sec	10mm
3	Square	45 sec	6mm

### IV. CONCLUSION AND FUTURE SCOPE

#### A. Conclusion

In past decades man is constantly trying to gain more and more comfortness. Man attempt has been made to develop more and more modified technique with increasing the aesthetic and economic concern Hence there is always more and more scope towards whatever he might have created of course after having the experience of the presently manufactured things. But being the Engineers and having the ability to think and plan. But due to some time constraints, and also due to lack of funds, we only have thought and put in the report the following future modifications.

1. Thickness increases time required for machining also increases.
2. Surface finish obtained is good.
3. After manufacturing no need of surface finish.
4. Time required is less than manual gas cutting.

#### B. Future Scope

In the future use of profile gas cutting machine would be fast and comfortable by using PLC with microcontroller. Profile templates could be loaded and unloaded automatically where various profile templates to be machined. We can use electromagnet or different sensors at place of magnetic roller, machine can be made more

comfortable to user also by using new technology machine can work at any environmental conditions.

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