

# SHEET METAL CUTTING MACHINE BY USING SOLENOID VALVE

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**Abstract:** *The sheet metal cutting process has a vital role in all kind of industries. Generally in medium and small scale industries this machine is manually hand operated. In our project is “SHEET METAL CUTTING MACHINE BY USING SOLENOID VALVE”. Automation in the modern world is inevitable. Any automatic machine is designed for the economical use of man, machine, and material worth the most. In our project solenoid valve is key for the automation. The working principle of pneumatic double acting cylinder is mainly involved in the sheet metal cutting machine. The piston is associated to the moving cutting tool and thus sheet metal is cut into the small sizes. As the machine is portable in size it’s easy to transport.*

**Key words:** *Sheet Metal, Pneumatic Cylinder, Double Acting Cylinder, Solenoid Valve.*

## 1. INTRODUCTION

**1.1. SHEET METAL:** Sheet metal is simply a metal piece, shaped in thin and flat. It is one of the fundamental forms used in metal working and can be cut and bent into a variety of different shapes. In industries, it has wide range of utilisations. Thicknesses can vary significantly. Although extremely thin thicknesses are treated as foil or leaf and pieces thicker than 6 mm (0.25”) are treated as plate. The steel sheet metals which are commonly used vary from 30 gauges to about 8 gauges. When the gauge number is increases, the sheet metal gets thinner. Gauge is measured in ferrous (iron based) metals while nonferrous metals such as aluminium or copper are designated differently; i.e., Copper is measured in thickness by Ounce. So many different metals can be converted into sheet metal, like aluminium, brass, copper, steel, tin, nickel and titanium. Important sheet metals include silver, gold and platinum (platinum sheet metal is also utilized as a catalyst.) in decorative purposes. Sheet metal also has applications in airplane wings, roofs for buildings (Architectural), car bodies, medical tables and many other things. Sheet metal of iron and other materials with high magnetic permeability, also known as

laminated steel cores, has applications in transformers and electric machines. In history, a vital use of sheet metal was in plate armor worn by cavalry, and sheet metal continues to have many decorative uses, including in horse tack. Sheet metal workers are also known as "Tin Bashers", ("Tin Knockers") which is derived from the hammering of panel seams when installing tin roofs. There are three primary procedures in Layout.

**1.2. SHEET METAL CUTTING:** In cutting processes a piece of sheet metal is separated by applying a great sufficient force to cause the material to fail. The most familiar cutting processes are performed by applying a shear force, and are therefore sometimes referred to as shearing processes [1]. When a great shearing force is applied, the shear stress in the material will exceed the ultimate shear strength. Then the material will fail and separate at the cut location. For this shearing force, two tools are used, one above and the other below the sheet. These tools may be a punch and die or upper and lower blades. The tool above the sheet delivers a quick downward force to the sheet metal that rests over the lower tool. A small gap is present between the edges of the upper and lower tools, which facilitates the crack of the material. The size of this clearance is typically 2-10% of the material thickness and depends upon other factors, such as the specific shearing process, material, and sheet thickness [2]. The effects of shearing on the material change as the cut progresses and are visible on the edge of the sheared material. When the punch or blade impacts the sheet, the clearance between the tools allows the sheet to plastically deform and "roll over" the edge. As the tool penetrates the sheet further, the shearing results in a vertical burnished zone of material [3]. Finally, the shear stress is too great and the material fractures at an angle with a small burr formed at the edge. The height of these portions of the cut depends on several factors, including the sharpness of the tools and the clearance between the tools.

## 2. PROPOSED DESIGN

**1. PNEUMATIC CYLINDER:** Pneumatic cylinders (sometimes known as air cylinders) are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion [4]. Like hydraulic cylinders, pneumatic cylinders utilize the stored potential energy of a fluid, here compressed air, and convert it into kinetic energy as the air expands in an attempt to reach atmospheric pressure. This air expansion forces a piston to move in the required direction. The piston is a disc or cylinder, and the piston rod transfers the force, it develops to the object to be moved [5]. Engineers prefer to use pneumatics sometime because they are quieter,

cleaner, and do not require large space for fluid storage. Because the operating fluid is a gas, leakage from a pneumatic cylinder will not leak out and contaminate the environment, making pneumatics more desirable where cleanliness is a constraint [6].

For example, in the mechanical puppets of the Disney Tiki Room, pneumatics are used to prevent fluid from dripping onto people below the puppet.

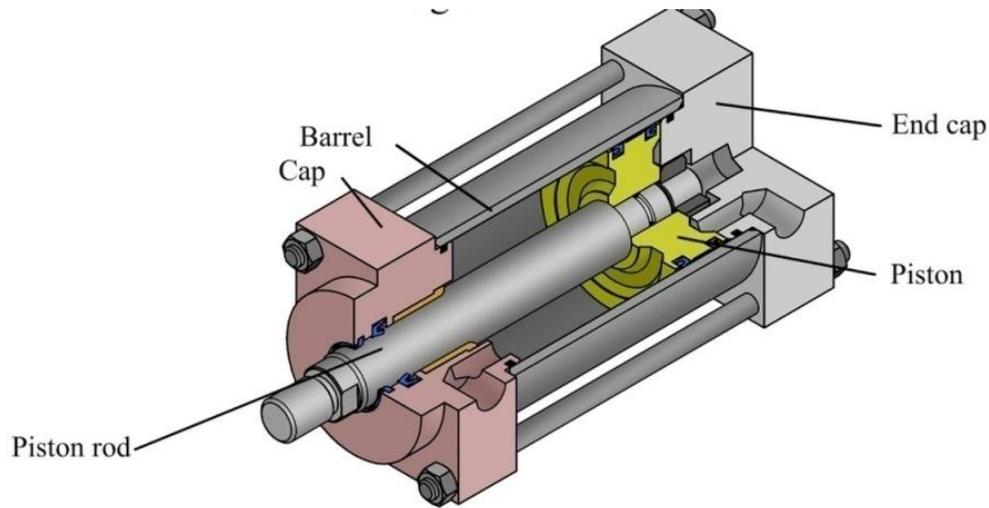


Figure 1

**2. DOUBLE-ACTING CYLINDER:** Double-acting cylinders (DAC) use the force of air to move in both extends and retract strokes. They have two ports to allow air in, one for outstroke and one for in-stroke. Stroke length for this design is not limited; however, the piston rod is more vulnerable to buckling and bending. Addition calculations should be performed as well by using design data hand book using some relations between cylinder and pressure we can accurately find out bending and buckling of tie rod.

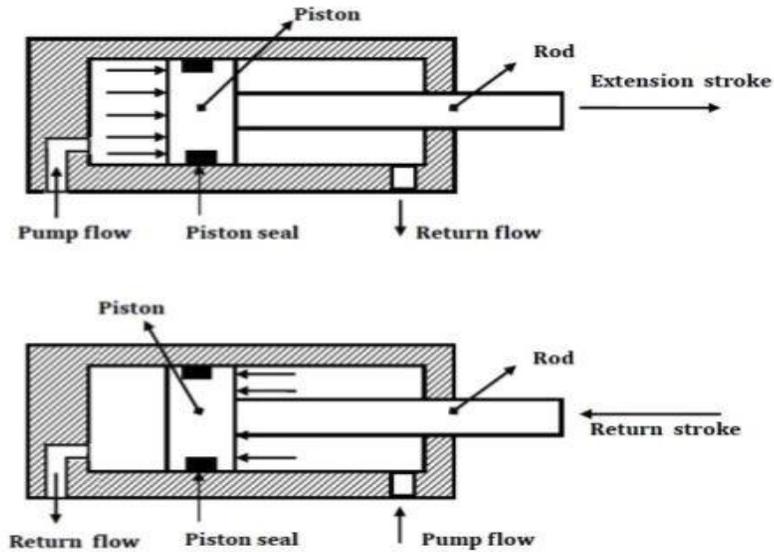


Figure 2

### 3. COST ANALYSIS

SL.NO	COMPONENTS	COST IN RUPEES
1.	SHEET CUTTER	1500
2.	PNEUMATIC CYLINDER	2000
3.	SHEET METAL ANGLE FRAME	500
4.	PNEUMATIC VALVE + HOSE NIPPLE CONNECTOR	350
TOTAL COST		4450

### 4. RESULT & DISCUSSION

Human’s normal behavior is to gain more and more luxurious. That’s why they always try to create more and more customized technique with increasing the aesthetic look and cost-effective thought. Hence there is always better scope. Being the graduate Engineers and having the ability to think we try to do impressive different. But due to some time constraints, and also due to not having enough funds, we only have thought and put in the report the following future modifications:-

- i) It can be used as bottle cap sealing machine. The immobile platform can be made auto swiveling type by installing the timer and heat sensor arrangement on the platform. It can be done in such way that the bottle mouth is sealed up to the desired temperature and then the electrical heater circuit gets cut off. At that similar time the motor installed on the reduction gear

box starts operating the bevel gearing and the platform starts rotating thus it can be made auto rotating type.

ii) It can be prepared hydraulic operated type by replacing the hand lever by hydraulic cylinder and along with the ratchet and Paul arrangement.

iii) It can be prepared hydraulically power operated by installing the gear oil pump at the place of air compressor and pneumatic cylinder arrangement.

## 5. CONCLUSION AND FUTURE SCOPE

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical facts regarding, planning, designing drawing, purchasing, computing and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institution industries. We are proud that we have concluded the work with the limited time successfully. The machine is working with satisfactory conditions. We are able to realize the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work, let us add a few more lines about our impression project work. The chief advantage of our system is that, it cutting speed is varied. The fast operation is done by the timer unit. This project is a low cost automation project.

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