

Computer aided design and manufacturing of low-cost profile cutting tool for cylindrical pipes

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Abstract - The Profile cutting is an in-depth process that takes out piece of chips and transforms it into a particular shape/profile. Cutting is typically carried out on a lathe table using a designed profile tool that is suitable for the product. Profile tool types vary as there are a number of different kinds of shapes may be available in various thickness and grades, so not all can be cut the same way from intricate designs to heavy bulk orders in profile cutting. In this paper we designed and manufactured a profile cutting tool for cylindrical pipe as per our design and shape and tested on Lathe machine. Initially it is modelled by CATIA as per dimensions. The manufactured tool is used for profile cutting of various pipes. It is found that profile cut is very cost effective with less time and accuracy.

Index terms - Profile Cutting, CAD, CATIA, tool design

I. INTRODUCTION

There are many factors involved in choosing a particular method or technology for cutting pipe of different profiles. The various factors that affect the profile cut consists, the tube or pipe material [1] wall thickness, squareness of ends, end-conditioning requirements, and other secondary process requirements. The other factors include the volume of production, efficiency of cutting, overhead costs and special tube or tube material used.

The manufacture of profile consists of a complex outline of a form that must be made into a sheet of material [3], such as laminated plastic, aluminum alloy or steel plating. In recent practice a drawing office determines the form and dimension to fit the sheet in a bigger work and provides guidance to a computer-controlled cutter for the profile. Due

to advancement in CAD/CAM the tools initially are designed and drawn using CAD software and then are fabricated and tested.

There are several oxy cutting machines; high definition plasma cutting and laser cutting machines [10] are dedicatedly available to specific plate sizes. The largest profile [6] cutting machine has a table length of 96m and can cut exactly with proper tolerances on the steel thicknesses of 0.5mm-300mm. Some of newly designed machines that drill, mill, countersink, bevel on each steel pipe using same profiling table to reduce handling and processing time accurately.

A. Steps in Design

First, we designed the vice which has 1 inch of slot. The vice is fastened to the tool post of the lathe machine. The pipe is inserted into the vice's slot, and an HSS tool is fitted to the spindle side inside the chuck's jaws. In this procedure, the tool rotates while the object to be machined remains motionless. The tool used should be the same diameter as the pipe to be joined to the machined pipe [5]. We can also give the rod an angle in this procedure, so profile cutting [7] can be done at different angles.

Research Article – Peer Reviewed
Published online – 20 Aug 2020

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Cite this article – Rachayya.R. Arakerimath, "Computer aided design and manufacturing of low-cost profile cutting tool for cylindrical pipes", *Journal of Production and Industrial Engineering*, RAME Publishers, vol. 1, issue 1, pp. 45-48, 2020.
<https://doi.org/10.26706/jpie.1.1.20200705>

B. Use of tool for profile Cutting

The lathe spindle is designed to cut round tubes, pipes and solid bar stocks in high-volume production. The operator transmits the workpiece to a stop, measuring the size of the cut. The workpiece is stowed and rotated by instruments mounted on a slide. The workpiece is rotated. The temperature control and wear of tools are controlled by a coolant liquid throughout the cut. The cutting of the tiles is ideal for square cutting of thin-walled material and ends with minimum burr. During the cutting process several cross slides allow the external diameter to be deburred or chamfered at both ends.

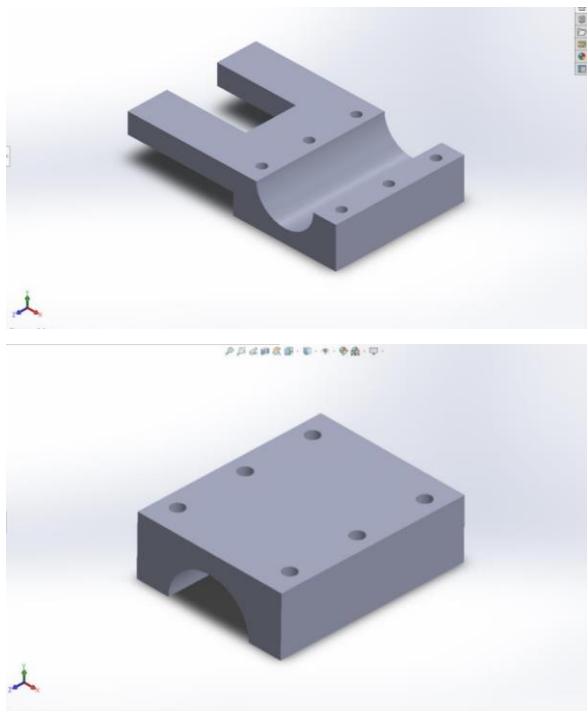


Figure 1. CAD model of tool holder

C. Design specifications and parts used

- a) Machine Vice, b) Base frame
- c) Profile cutting tool

The tool is manufactured of HSS, has a 1-inch OD, and cutting edges around its circumference.

- d) Lathe machine with a jaw chuck.
- e) Lathe Machine

II. PROFILE CUTTER

High-Speed Steel cutting tools are subjected to tremendous friction, high heat, and excessive wear, and to

address these issues, they must have high wear resistance, hardness, and red hardness [2]. High Speed Steel (HSS) cutting tools are produced of M-1, M-2, M-4, M-48, and T-15 high speed steels. They are also employed in the cutting and shaping of tool steel and high-speed steel into tooling components.

HSS cutting tools are available in a variety of shapes and sizes for a wide range of cutting and forming activities. The HSS cutting instruments are made by shaping a blank high-speed steel into a cutting profile, then hardening and testing to HRC 62-68. The cutting instruments are usually fixed to the machine with a collet, chuck or tool holder which gives the machine a strong connection.

From cutting a raw material block to drilling a hole for shaping a profile [9] to finishing a close dimension of tolerance, the cutting tools carry many functions. High-speed steel cutting tools are employed in the majority of machining processes.

A. Finished profiled Product

These two-pipe couplings are manufactured with a profile cutting tool and are utilised for various joints in chassis and appropriate alignment triangulations.



Figure.2. Profile cutting tool fitted

This work is carried out for the following purpose:

1. For cutting the pipes in steel industry and other workshops.

2. Cutting metals that are in intricate form and requires a good finish and accuracy.

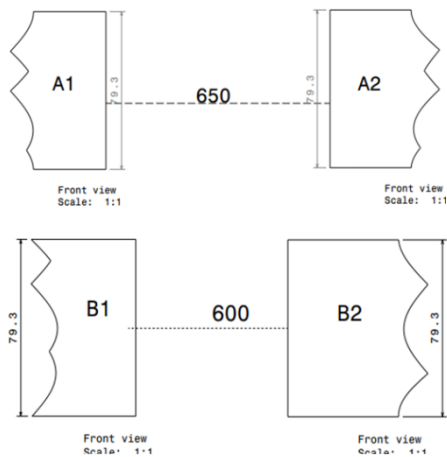


Figure 3. Profile cut section of job

B. Methodology

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

TABLE 1
SPECIFICATION

Material Used	Aluminum
Small Holes	M6
Nut & Bolts	Grade 6

III. APPLICATIONS AND ADVANTAGES

This profile cutting device is used for lathe machine to cut specified profile for making structure members from various pipe sizes and profiles.

Machining hollow rod or pipe of any shape and size is possible with low cost and less skills.

The advantages of profile cutting device are as follows.

- a) Portable tool
- b) Faster to cut
- c) Precision cuts can be made
- d) Versatility

- e) Lower machining cost
- f) Ease of use during machining.
- g) Wide cutting ability
- h) Perfect for round bars
- i) Super performance in 30mm thickness
- j) User friendly profile tool
- k) Safer to use in all cutting conditions.

IV. CONCLUSIONS

This paper explains the design and development of profile cutting tool for cylindrical pipes on Lathe machine. Here the tool is designed and manufactured for profile cutting as shown above for effective cutting with less time. This helps for machining various cylindrical pipes can be profiled for specific application with lower machining cost and time.

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