



DESIGN AND FABRICATION OF FIXTURE OF EDM WIRE CUTTING MACHINE

N.Manikandan¹, D.Manikandan², M.Sanjaykumar², K.Logesh², K.Selvaraj²,
1-Associate professor - Department of Mechanical Engineering,

P.A College of Engineering and Technology, Pollachi,

Tamil Nadu, India - 642002

2- Students - Department of Mechanical Engineering,

P.A College of Engineering and Technology, Pollachi,

Tamil Nadu, India - 642002

ABSTRACT

We have known as workpiece-holding component is called a fixture, and we designed it using an Edm wire-cutting machine. This leaves a small lead time for auxiliary manufacturing needs, such as fixtures and tooling. Fixtures are used as the so many Conventional and non conventional machines, it will be play the important role in machining operation. Fixtures are different in the based on some machining process. then different materials are used and fabricate the fixture on the conventional and non conventional machines, We have selected the OHNS steel, also known as Oil Hardened Non-Shrinkable steel, can be suitable for EDM (Electrical Discharge Machining) machine fixtures due to its good machinability, wear resistance, and hardness properties.. A machine fixture in manufacturing refers to a device or tool that holds a workpiece securely in place during machining or manufacturing processes.

Keywords:

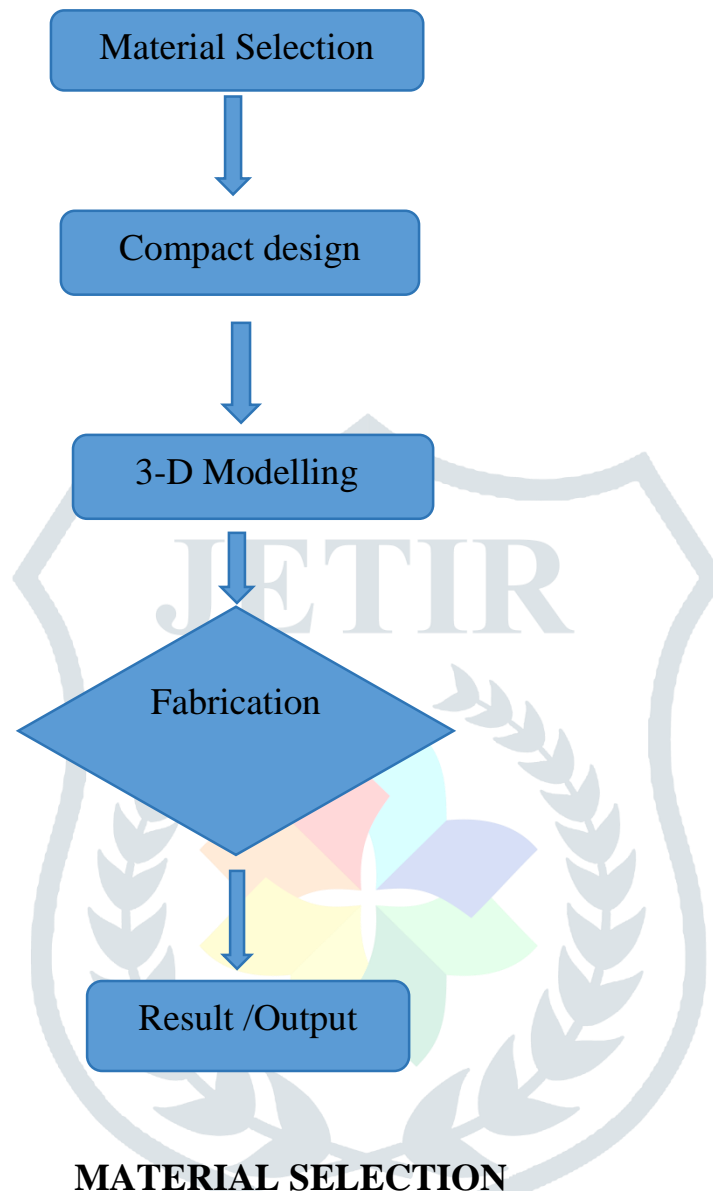
Edm Machine Fixture,

Solidworks 2020

INTRODUCTION

The wire that cuts through Electrical Discharge Machining (EDM) is a well-known non-conventional machine more complicated shapes and very hard materials have cutting in the machining process. Material removal is made possible by a series of electrical discharges that occur between the workpiece and the wire electrode (tool) in this thermoelectric process. A dielectric fluid, usually deionized water, is poured over the part and the wire to act as a coolant and wash out the dirt. Electrical conductivity is a requirement for the material that will be machined. Only when repeatability and high productivity can be integrated into mass manufacturing processes can this accuracy of WEDM be fully utilised. Fixtures are used in activities that require a lot of tools, which means that their utilisation affects production quality, cycle time, and cost. Fixtures can and have been used in WEDM, much like in traditional machining techniques, to locate and clamp workpieces to prevent repetitive job setting and to lower the need for a highly skilled staff. Despite the fact that WEDM itself does not require as much force as the use of fixtures is still crucial in operations like milling because of the exact nature of the work done in the edm machine. It also aims to offer an affordable fixture required design solution for edm machine by utilising widely accepted then easily accessible industry standards. Because of its superior mechanical qualities such as its high strength, hardness, and resistance to wear and deformation Tool steel is frequently used to build fixtures. These characteristics make alloy steel ideal for making strong fixtures that can tolerate the strains and pressures that come with different manufacturing methods. Next, as this material has a high degree of hardness and strength, we have used OHNS grade steel in the fixture's manufacturing. Plasma gas cutting has also been used in this cutting procedure. and moreover employing the Arc welding procedure to join two materials that are identical. Finally, we have the L-Section Fixture to create some supports and holes to prevent workpiece slippage during milling. as well as grasping the workpiece to prepare it for the die and cutting the specified form.

FLOW CHART



Fixture material properties depend on the specific application and requirements. Common properties considered include strength, hardness, stiffness, thermal conductivity, and corrosion resistance. Different materials like steel, aluminum, or polymers may be chosen based on factors such as the intended load, environment, and cost constraints. When selecting materials for fixtures, it's important to consider various properties to ensure optimal performance. Above the materials are using the process of made a fixture . so we have preferred the tool steel material (OHNS) Oil hardened Non-shrinking Steel . it has OHNS Die Steel is a widely popular grade of steel used for manufacturing various tools and dies. It is well known for its excellent toughness, wear resistance, and heat resistance, high strength ,hardness,and also stiffness material .so have using the this material for maufacturing the fixture of Edm machine.

TOOL STEEL (OHNS) MATERIAL

OHNS (Oil Hardened Non-Shrinking) steel is a type of tool steel known for its high hardness, wear resistance, and dimensional stability. It's typically used in applications where the tool is subjected to high stress and repeated use, such as in making dies, punches, and forming tools. OHNS steel is oil quenched and tempered to achieve its desired properties, and it's known for its ability to maintain its size and shape during heat treatment. This makes it particularly suitable for precision tools where dimensional accuracy is crucial.



FIXTURE DESIGN

SolidWorks is a powerful computer-aided design (CAD) software developed by Dassault Systèmes. It's widely used in various industries, including mechanical engineering, aerospace, automotive, and consumer products. SolidWorks uses parametric modeling techniques, allowing users to create 3D models by defining parameters and relationships between geometric features. This enables easy modification and updating of designs. We then use Solidworks software to create the "L" section fixture. Moreover, the clamp will move in a linear manner, holding the workpiece in place while it is cut.

DESIGN CALCULATION

Maximum length of horizontal plate = 250mm

Maximum length of vertical plate = 220mm

Hole Size = ϕ 10

Thickness of Square bar = 25mm

Width of Square bar = 50mm

Sol ;

$$1. \text{ Slot Size} = 250 - 100 = 150\text{mm}$$

$$2. \text{ Area of Rectangular plat} = \text{length} \times \text{Breadth}$$

$$= 0.25 \times 0.05$$

$$A = 0.0125 \text{ m}^2$$

3. Approximate Size of Workpiece = 0-100 mm workpiece hold only

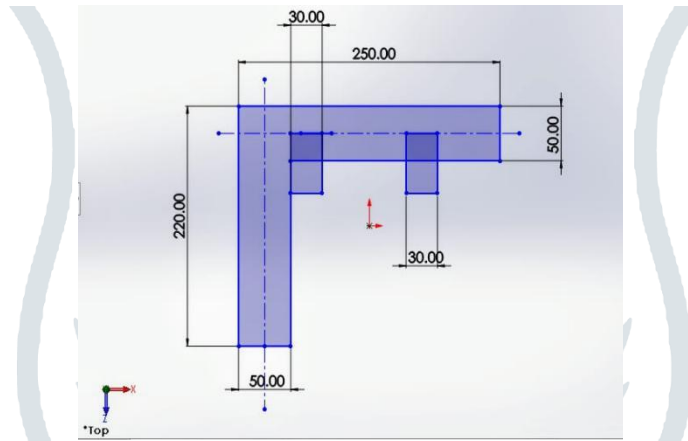


Fig : 2-D diagram

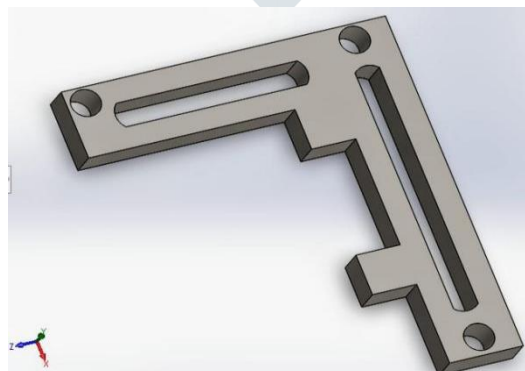


Fig : 3-D Modelling

FABRICATION PROCESS

PLASMA GAS CUTTING

Thermal cutting techniques such as plasma gas cutting are used to cut through electrically conductive materials such as copper, brass, aluminium, and steel. It entails melting and removing the material using a high-velocity jet of an ionised gas, usually nitrogen or oxygen. Because of its reputation for accuracy and speed, plasma cutting is widely used in the automotive, building, and industrial sectors. One very effective way to cut through electrically conductive materials is via plasma gas cutting. By passing an ionised gas jet at a high speed through a narrow nozzle, it produces a plasma arc that can reach temperatures of up to 30,000 degrees Fahrenheit. A high-pressure gas stream blasts the molten metal away, leaving a clean, accurate cut behind as the material is melted by the tremendous heat. Because of its speed, accuracy, and capacity to cut a broad variety of materials and thicknesses, plasma cutting is extensively utilised in many different industries. When electricity is detected flowing from the electrode to the work, the control system cuts off the electrical connection to the nozzle. After then, as current flows from the electrode to the work, an arc forms outside the nozzle. Cutting can resume after that without running the risk of nozzle burnout. Nozzle life is not limited by cutting time, but rather by the number of arc starts. Subsequently, OHNS steel and fixture material are slotted for the fabrication process using plasma cutting.



Fig : Plasma gas Cutting

WELDING

welding is a method of joining metal to metal by melting the metal with the use of electricity. The melted metal then forms a bond with the other metal when it cools, Arc welding is a joining process that uses electricity to create an electric arc between an electrode and the base material, melting the metals at the welding point. as stick welding, SMAW uses a consumable electrode coated in flux to create a protective gas shield and slag to protect the weld from contamination. Arc welding is widely used in various industries for its versatility, portability, and ability to create strong and durable welds on a wide range of materials and thicknesses.



Fig : Arc Welding

DRILLING

The Using specialised equipment, the drilling process makes holes in a variety of materials, including concrete, metal, and wood. To make the hole, a drill bit is usually rotated against the material and pressure is applied. The material being drilled and the intended hole size determine the kind of drill bit to use as well as the rotational speed. Drilling is the process of utilising a revolving drill bit to make holes in materials. When the drill bit is pressed up against the material, it cuts through and leaves a hole as it turns. Depending on the material being drilled, different drill bit types are utilised, such as masonry bits and twist bits for wood and metal. for concrete, and hole saws to create holes with a big diameter. The material, hole size, and level of precision needed can all affect how difficult the drilling procedure is known as drilling.



Fig : Drilling

EDM MACHINE

INTRODUCTION

The method known as wire electrical discharge machining, or wire EDM, involves feeding a wire electrode under tension on a vertical axis constantly. After passing through the wire and across a dielectric liquid, the discharge voltage reaches the grounded workpiece. An X-Y plane is used to move the workpiece in order to draw a cut pattern through the material. Either drilling a hole initially or starting erosion from the workpiece's outside edges are two possible starting points. EDM can erode a hole through the billet to serve as the contained cut path's beginning point. The precise pattern that needs to be cut and the requirement to remove degraded material from the surface can occasionally make the either deionized water or paraffin. This bath serves as a convenient means of clearing debris in addition to its primary functions as a coolant and semiconductor that permit precisely regulated arcing. Originally designed as an arc bandsaw or EDM cutter, wire EDM devices were intended to cut intricate 2D patterns. Nonetheless, they have developed steadily to the point that contemporary 5-axis wire EDM machines are capable of extraordinarily intricate tasks.

PRINCIPLE AND WORKING

Simple theory underlies EDM. Between an electrode and the workpiece, an electric spark is produced. The method of separating metal materials by melting them after the heat produced by an electric spark discharge hits their melting point is the basis for wire EDM machining. According to varying technologies, wire EDM machining is classified as slow WEDM, rapid WEDM, and medium WEDM. It was created by the former Soviet Union in the previous century. Since there isn't much physical mechanical cutting force used during the cutting process, the difficulty of the workpiece material processed during online cutting has little to do with the metal hardness of the processed material. This technology is applicable to the processing of any conductive materials, including highly hard alloys. But there is a limit to the workpiece's minimum corner radius that can be machined. That that is, the electrode wire's radius plus the distance between the processing plate and the console constitute the minimal radius in WEDM processing. The workpiece's contour figure is the only thing that this can process; the remaining excess materials can still be put to use. A type of technological process called wire EDM machining uses a spark discharge to cut and shape a workpiece made of damaged metal electrode wire. The impact of electrode loss on machining accuracy is circumvented by this type of moveable electrode wire. Currently, wire EDM technology is limited to cutting edges and through holes, and is able to cut and punch a variety of intricate pieces.



Fig : Edm Machine

RESULT

The material being processed, the needed surface smoothness, and the desired precision all affect the wire thickness utilised in Electrical Discharge Machining (EDM). Typically, wires are between 0.1 and 0.3 mm thick; thinner wires are utilised for more complex tasks and thicker wires for quicker material removal. It's critical to choose the right wire thickness depending on the particular needs of your machining project.

The entire strategy is predicated on machine shop instruments used in the fabrication process and widely accessible commercial SOLIDWORKS software products. Additionally, we have Prepare it for the die, which will cut the wire electrode metal tool (EDM) used to cut brass or copper materials, regardless of how simple or complex the shape is. The electronic data cable is Stronger materials can be cut with greater strength in the wire Edm and at higher thicknesses.



Fig : Fabrication Fixture

ADVANTAGES

Precision:

Even for complex geometries, fixtures ensure accurate and repeatable machining results by firmly holding the workpiece in position.

Stability:

During the EDM process, fixtures stabilise the workpiece, minimising vibrations and lowering the possibility of dimensional errors.

Efficiency:

By enabling the simultaneous machining of several workpieces, a well-designed fixture can boost output and cut down on setup time.

Flexibility:

Fixtures can be made to fit a range of workpiece forms and sizes, which promotes application flexibility in machining.

Safety:

Fixtures improve worker safety by preventing mishaps such as workpiece displacement or tool breakage by firmly retaining the workpiece.

Consistency:

Fixtures aid in maintaining uniform machining conditions, which minimises the need for rework or corrections and produces finished products that are more uniform. In general, employing a fixture in wire cutting machines for EDM enhances the machining process's safety, precision, and efficiency.

COMPARISION

PREVIOUS FIXTURE	NEW FIXTURE
Particular Shape Workpiece only holded ,	Different Shape workpiece will be hold .
No Long Life	Long Life can be possible

CONCLUSION

The "edm machine" refers to the electric discharge machine. We are fabricating the fixture for this machine, which will be machined to have a difficult shape. The workpiece was then placed in the fixture, where it was held while the Edm wire cutting machine was adjusted and the component was cut to the desired shape. That sums up our endeavour involving design and fabrication. We can produce highly accurate cuts for any conductive material thanks to our technique. The workpiece was then placed in the fixture, where it was held while the Edm wire cutting machine was adjusted and the component was cut to the desired shape. That concludes our project on design and fabrication. The procedure will be swift in contrast to jig ,Afterwards, we employed fixtures to boost the production rate. Fixtures are used throughout the machining process to increase accuracy and mass production. There will be a time-saving procedure. We are finishing more work in less time. So a long life is conceivable.

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