Safety Precautions

Personal Safety

- Wear tight clothes; beware of hanging hair, ties, clothing, scarves or belts getting caught.
- Never enter the workshop without safety shoes. Do not use rings, watches etc. while working.
- Keep the workshop clean and tidy. The floor should be free from oil and grease; the slippery floor is always dangerous.
- Wear goggles whenever there is danger of flying matter.
- Never attempt to measure the job in running.
- Always stand in respectful distance from moving and hanging parts.
- Practice cleanliness and orderliness in the shop.
- Do not run or play on the shop floor.
- Keep your body behind the sharp edges of cutting tools.
- Do not attempt to lift heavy articles without assistance.
- Never handle chips or shavings with bare hands; use special hooks, brushes etc.
- Never place sharp tools on the floor or at the edges of the workbench; keep them in the proper place assigned for them.
- Be aware of the cause of electrical hazards such as bare wires, poor earthing, return connections, wet floors etc.

Machine Safety

- Never operate the machine unless you have been properly instructed.
- Never work on the machine having unguarded moving parts.
- Stop the machine immediately, if it produces any unusual sounds.
- Before starting an operation, always check whether the work and cutting tools are secured fast.
- Never leave a machine when it is running.
- Never mount or remove the work, replace tools, clean or lubricate the machine, or remove the cover while the machine is running.
- Do not run the machine at an incorrect speed.
- Do not talk or disturb others while they are operating a machine.

Job Safety

- Use the right tools for the right job.
- Use metal strips to hold work pieces like brass or aluminum, to avoid gripping marks on the finished surface.
- Put oil lightly on finished jobs to avoid rust.
- Tools with loose fitting or broken handles shall not be used.
- To save time and material, frequent checking has to be made.
- Do not mix the precision measuring instruments with other tools and equipment.
- Store inflammable materials like kerosene, turpentine etc. away from the shop.

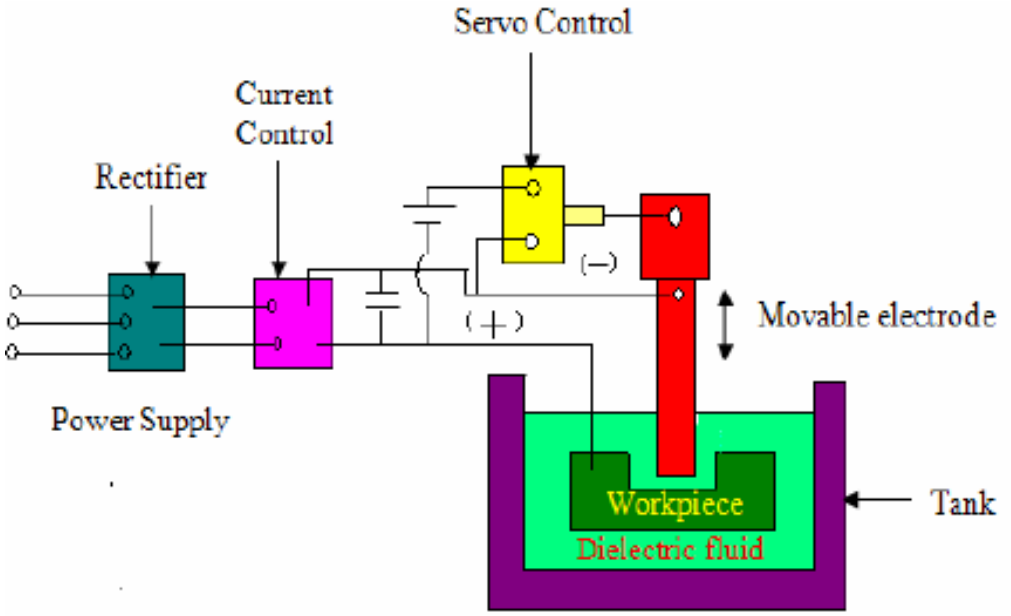
- ❖ Be aware of the details and location of fire fighting devices like fire buckets, fire extinguishers etc. and first aid box in the workshop.

Introduction to EDM

In conventional machines the cutting tool is in direct contact with the work and material is removed in the form of chips. It is impossible to machine certain materials like carbide, stainless steel and many other high strength temperature resistant alloys, etc. By using conventional machining, machining of these materials is difficult, time consuming and sometimes impossible due to high strength to weight ratio, hardness, heat resisting qualities, etc.

Considering the seriousness of the problem, machines in the 1960's emphasized the need for the development of the nerves concept in the metal machining process to overcome these difficulties. These processes are non-traditional tools for the metal removal instead of directly utilizing some form of energy of metal machining.

Electric discharge machining



Electric discharge machine is a controlled metal removal process that is used to remove metal by means of electric Park erosion. In this process an electric spark is Used Honda cutting tool one piece to produce finished part to decide shape. The metal removal process is performed by applying a pulsating (On / OFF) electric charge of high frequency current through the electrode to the workpiece.

This removes very thin pieces of metal from the workplace at a controlled rate.

The EDM process can be used in two different ways;

1. A push rod or formed electrodes (tool) usually made from graphite or copper shaped into the form of cavity is to be reproduced. The formed electrode is fed vertically down and reverse the shape of the electrode is burned into a solid workpiece.
2. A continuous traveling vertical wire electrode that has the diameter of a few micrometers which is controlled by the computer to follow programmed path to electrode or cut a narrow through the workpiece to produce the required shape.

Type of EDM

Conventional EDM

In the EDM process an electrode spark is used on all the workpiece, which takes the shape opposite to that of the cutting tool or electrode. The electrode and the workpiece are both submerged in the dielectric field, which is generally lubricating oil. A servo mechanism maintains a space of about the thickness of a human hair between the electrode and the work is prevented from contacting each other on EDM or similar machining. A relatively soft graphite or metallic electrode can be used to cut hard and steel or even carbide. The EDM process produces a cavity slightly longer than electrode because of the over-cut.

Wire cut EDM

The wire cut EDM is the discharge machine that uses CNC movement to produce the desired shape. It does not require a special shaped electrode instead it uses a continuous traveling vertical wire under tension. Electrode in wire cut EDM is about 0.2mm thick on a small diameter needle where the path is controlled by the machine to produce the shape required.

Dielectric fluids EDM

During the EDM process the workpiece and the electrode are submerged in the dielectric oil which is an electric insulator that helps to control the arc charge. The dielectric oil that provides a means of fleshing is pumped through the arc gap. This removes suspended particles of workpiece material and electrode from the work cavity.

Flushing ram type EDM

Flushing is the most important in any electrical discharge machining operation. Flushing is the process of introducing clean filtered dielectric fluid into the spark gap. There are a number of flushing methods used to remove the metal particles efficiently while assigning in the machining process too much fluid pressure while removing the chips before they can assist in cutting action, resulting in slower metal removal to a little pressure will not removing the chips quickly enough and may result in short circulating the erosion process.

Servo mechanism

Both wire and vertical EDM machines are equipped with a servo controlled mechanism that automatically maintains a constant gap about the thickness of human hair between the electrode and work. Otherwise arcing could damage the workpiece and break the wire.

Advantages of EDM

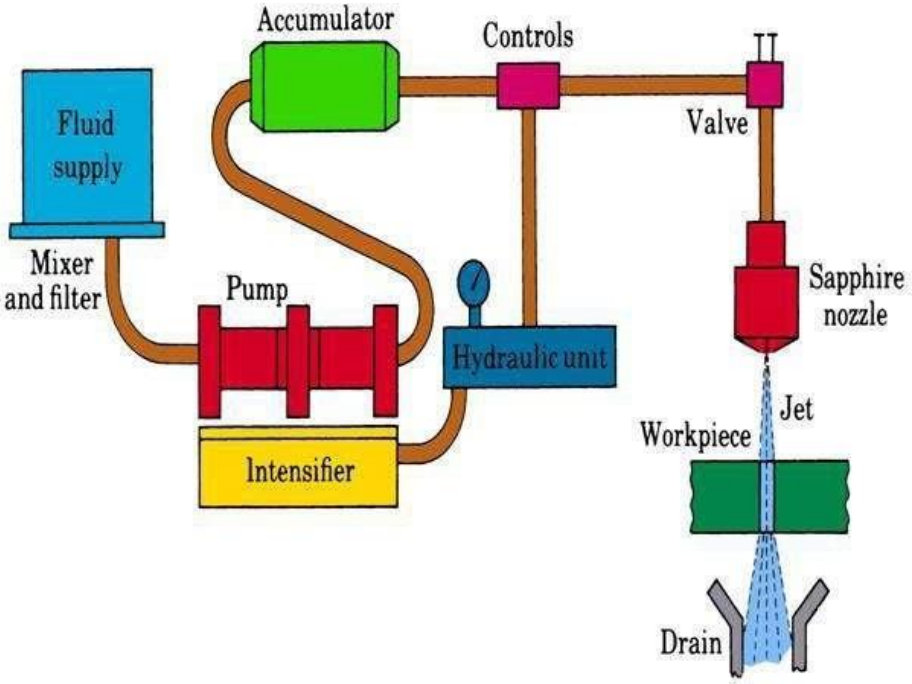
- Conventional EDM machine can be programmed for vertical machining, orbital, helical, conical, rotational, spin, etc
- Any material that is electrically conductive can be cut using the EDM process.
- Hardened workpiece can be machined eliminating the deformation caused by heat treatment.

- X, Y and Z axis movements allow for the programming of complex profiles using simple electrodes.
- Complex sections and mold can be produced relatively faster and at lower cost.
- The EDM process is burr free.

Water jet machining

Introduction

It is one of the most famous non-traditional machining processes because it is environment friendly. It uses a water jet working as a tool to cut the metal. It is the same as abrasive jet machining except the working medium is water. In this machining process a high speed stream of water jet impinge on the workpiece which removes metal from contact surface by erosion. It is mostly used for machining soft materials. For machining hard materials like carbide, ceramic, etc. abrasive particles added in the water stream which increases its machining quality. This process is known as abrasive water jet machining. It is mostly used in mining industries, aerospace industries for cutting required shape.



Principle

This process works on the basic principle of water erosion. In this process, a high speed well concentrated water jet is used to cut the metal. It uses the kinetic energy of water particles to erode metal at contact surface. The jet speed is almost 600 m/s. It does not generate any environmental hazards. For cutting hard materials, abrasive particles are used in water jets. These abrasive particles erode metal from the contact surface.

Components of water jet machining

Pump

In the water jet machining process a hydraulic pump is used to pump the water from the storage tank for the machining process. It is connected by an electric motor.

Intensifier

As the name implies, it is used to increase the water pressure for further process. Hydraulic intensifiers accept water from the pump at a small pressure of about 4 bar. The water pressure at the outlet of the intensifier is about 3000-4000 bars.

Accumulator

Hydraulic accumulator is used when a large amount of pressure energy is required for an instant. It used to eliminate pressure fluctuation. It supplies fluid at high pressure when required.

Tubing System

Tubes are used to supply high pressure water to the nozzle for further cutting. It increases the kinetic energy of fluid. Its diameter is about 10-14 mm. It provides flexible movement and does not allow any significant losses.

Flow regulator

Flow regulators are used to regulate the flow according to cutting requirements. For high cutting load, high pressurized water is supplied at a high rate.

Abrasive

Abrasive particles are used in abrasive water jet machining for machine hard material. Generally Aluminium oxide, Silicon carbide etc. used as abrasive particles.

Nozzle

As we know, nozzles are used to convert pressure energy into kinetic energy. This nozzle converts the high pressure of water into a high velocity jet. This high speed water jet strikes at the work surface which is used for machining. There is possibility of erosion at orifice of the nozzle due to high pressure water jet. Therefore high wear resistance material is used for nozzles. The size of the nozzle is about 0.2 – 0.4 mm. If abrasive water jet machining is used, abrasive particles mixed in the water stream before entering into the nozzle.

Drain and Catcher

The drain and catcher system is used to remove debris and other machined particles from water. It separates metal particles from water and this water is further sent to the reservoir. It is also used to reduce noise associated with WJM.

Working

The working of water jet machining can be summarized as follows.

- First water is filled in the water reservoir. It provides water for cutting operations.
- A pump sucks water from a water reservoir and sends it to an intensifier.
- Intensifier increases the water pressure from 4 bars to 4000 bars. It sends water to an accumulator which stores some pressurized water.
- This high pressure water now sends through the tubing system to nozzle. The water passes through a flow regulator valve which regulates the flow.
- Now this high pressure water enters into the nozzle. Nozzle converts some pressure energy of water into kinetic energy.
- A high speed high pressurized water jet is available at nozzle exit.
- This water jet is sent to strike at the work surface. It erodes metal from the contact surface. Thus metal removal takes place.

Application

- It is used in aerospace industries.
- Abrasive jet machining is used to cut hard metal like stainless steel, titanium, Inconel etc.
- It is used for machining or cutting reinforced plastic.
- It is used to cut stone which reduces dust in the environment.
- Used to machining PCB.

Advantages

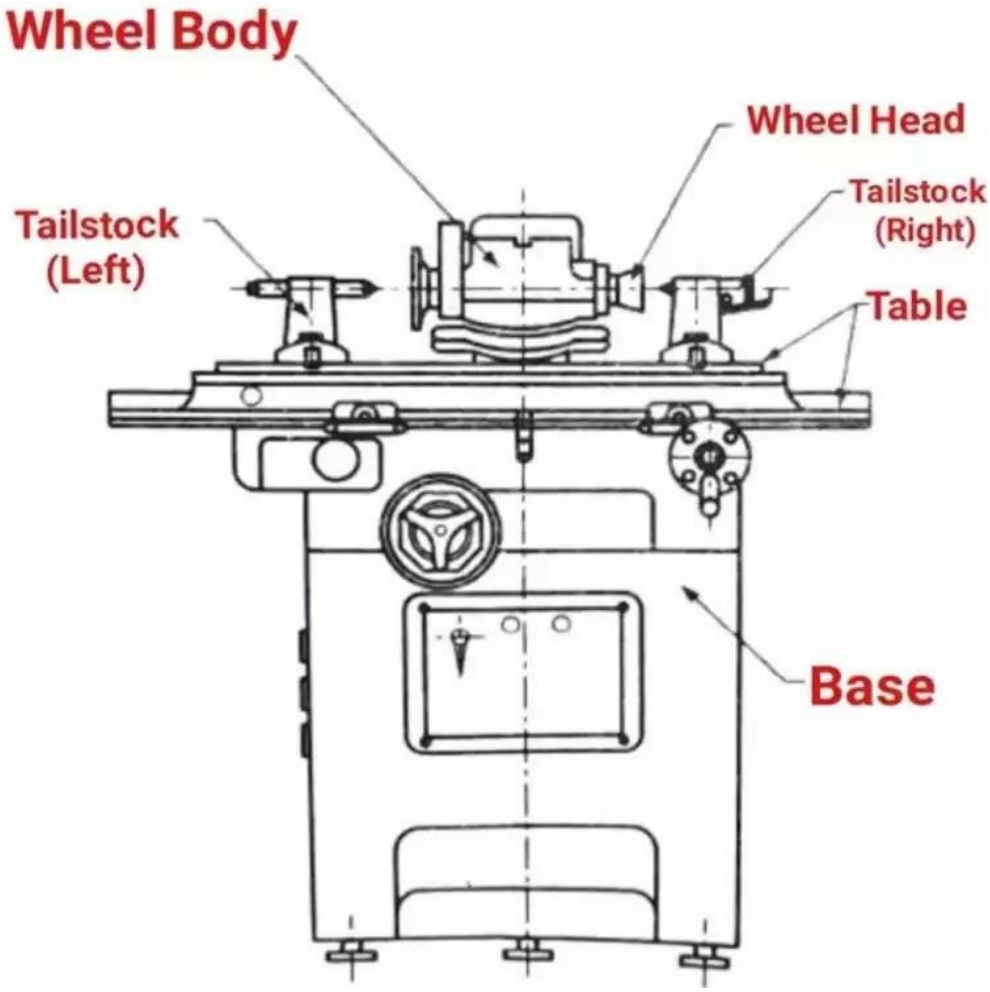
- It does not change the mechanical properties of the workpiece. It is useful for machining heat sensitive material.
- It is environment friendly because it does not form any dust particles and uses water as cutting fluid.
- Good surface finish.
- No physical tool is required.
- It can cut both soft and hard material. For machining soft materials, water jet machining is used and for machining hard materials, abrasive water jet machining is used.
- It is an ideal process for laser reflective materials where laser beam machining cannot be used.
- Lower cost of machining.

Disadvantages

- It cannot be used for machining material which degrades in presence of water.
- Low metal removal rate.
- High initial cost.
- Thick material cannot be machined easily.

Tool and cutter grinder
Introduction

In the machine shop, most of the machining operations are performed by a single-point cutting tool or a multipoint cutting tool.
Continuous use causes the cutting tool to become blunt and needs to be resharpened for continuous production.



Tool and cutter grinders are used mainly to sharpen and recondition multipoint tools like drills, reamers, milling cutters, taps, hobs, broaches, etc, and for accurate grinding of angles of single-point tools.

With suitable attachment these grinders can also be used for light cylindrical surface, internal grinding operation on items like jigs and fixtures, gauge elements, etc.

But nowadays CNC type grinding is most widely used in the industry because this type of grinding is fully automatic.

Parts of Tool and Cutter Grinder

The following parts are used in the tool and cutter grinding machine.

- Base
- Saddle
- Table
- Column
- Wheel Head
- Tailstocks

Base

It is strong, heavy and box-type construction that supports all the other parts of the machine.

Saddle

It is mounted directly on the top of the base which carries the table raised and traverses the table movement crosswise.

Table

It rests or moves on the top base mounted on the saddle which reciprocates. It can be swiveled from a certain angle.

Column

It is fixed on the back of the machine. It has a wheel head that moves up and down depending on the depth of the cut.

Wheel Head

It is mounted on a column on the back of the machine which can be swiveled at a certain angle. It has two grinding wheels which are fitted on both ends of the spindle.

Tailstock

Right, and left tailstocks are placed between the centers to support the mandrel.

Types of Tool and Cutter Grinder

There are the following two types of tools and cutter grinders are used.

- Universal Tool and Cutter Grinders
- Single-Purpose Tool and Cutter Grinders

Universal Tool and Cutter Grinders

Universal tool and cutter grinder can be used for sharpening a variety of tools and milling cutters. Universal tool and cutter grinders are often used for sharpening reamers, taps, single-point tools, dies, punches and milling cutters, etc

Single-Purpose Tool and Cutter Grinders

Single-purpose tools and cutter grinders are used for grinding tools such as drills, tool bits, etc. in a large production plant where the volume of production is a high and large number of similar tools need to be grind frequently.

Characteristic Of Tool & Cutter Grinder

There is the following characteristic of the tool & cutter grinding machine.
It can hold the maximum diameter of the wheel.

It can grind the maximum height of the job or workpiece.

It can grind the maximum length of the job or workpiece.

It can grind the maximum breadth of the job or workpiece.