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Assignment 8: Demonstration on wire EDM.

- wire EDM machine can machine anything that is electrically conductive regardless of the hardness, from relative common materials such as steel, aluminium, copper & graphite.
- The wire does not touch the system (workpiece) so there is no physical pressure imparted on the workpiece compared to grinding wheels & milling cutters.
- The accuracy of surface finish & time required to finish the job is extremely predictable.
- The EDM process leaves no residual burrs on the workpiece, which reduces or eliminates the need for subsequent finishing operations.
- Most workpieces come off the machine as a finished part, without the need of secondary operation. It's a one-step process.

Substantial increase in productivity is achieved since the machine is intended.

### Principle of wire Electrical discharge Machining

The Spark theory of wire EDM is basically the same as that of the vertical EDM process. In wire EDM, the conductive materials are machined with a series of electrical discharges (sparks) that are produced between an accurately positioned moving wire (the electrode) & the workpiece.

Many sparks can be observed at one time. This is because actual discharges can occur more than one hundred actual thousand times per second with discharge sparks lasting in the range of  $1/1,000,000$  of a second or less. The range of volume of material removed during this short period of spark discharge depends on the desired cutting speed & the surface finish required.

The heat of electrical spark, estimated at around  $15000^{\circ}\text{F}$  to  $21000^{\circ}\text{F}$ , erodes away a tiny

- CO<sub>2</sub> abatement & reduction of green-house gases emission through the development of renewable technology.
- Reducing natural resources including land, forest, minerals water & ecosystems.

### Details of physical location

The wind farm is located at Brahmaneri village at Dhule district in the state of Maharashtra. The location has been chosen based on Average wind speed, maximum wind speed & wind gust. The average speed is 20.4 kmph, Maximum wind speed is 29.1 kmph & wind gust is 25.9 kmph. Dhule is located in the North-western part of Maharashtra state. The geographical location of Dhule is 20° 58' 57" N, 74° 46' 11" E.

The salient feature of the project are as follows:

- Higher efficiency is Designed to achieve increased efficiency & coefficient of power (cp).
- Minimum stress & load : well balanced weight distribution



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The system is very easy to use, allowing the operator to quickly become familiar with it.

- Besides evolving NC data for positioning movement of the axes, the control amends their movements when using offsets, tapering, scaling, rotation, mirror image or axis.

- The control also compensates for any pitch errors compensation for backlash error in the axes drives, to ensure high accuracy positioning. The machine has multiple co-ordinate systems. & jobs can be programmed in absolute or incremental modes saving valuable programming time.

- Multiple jobs can be set-up on the worktable, while storing the separate reference points or locations of these jobs in specific co-ordinate registers. The numerical control offers the capabilities of scaling, mirror imaging, rotation, axis exchange & assist programs.

## 2. Power Supply.

- Most machines have power supply rated to cut over twenty square inches per hour & faster.

- Faster or slower speeds are obtained depending on the workpiece material, part thickness, wire, diameter, type of wire, nozzle position, flushing condition & required part accuracy.
- Adaptive control is yet another improvement where high speed circuitry has improved the speed gap. Sensitivity, reaction time of servo motors & changes to the power.
- With these improved capability, wire breakage is reduced to a minimum, making today's machine far more better to use.

### 3. Mechanical Section

#### Table Movement

- Machine movement is accomplished with precision lead screws with recirculating ball bearings on all axes that are driven by AC motors. The machine's position is checked & any errors or backlash are corrected by pitch error compensation that is permanently stored in the computer's memory.

### Wire path.

- when wire EDM was first introduced copper wire was used on the machine machines because it conducted electricity the best.
- There is a vast array of wire to choose from with brass wire normally being used however, molybdenum, graphitized, & thick & thin layered composite wires are available for different applications.
- wire diameter range from 0.004 through 0.14 with 0.10 being the most commonly used end. wire originates from a supply spool, then passes through a tension device. It then comes in contact with power feed contacts where the electric current is applied. The wire then passes through a set of precision, round diameter guides, & is then transported into a waste bin. The wire can only be used once, due to being eroded from the EDM process.

### 4. Dielectric System :

- wire EDM uses deionized water as the dielectric compared to



vertical EDM's that use oil

- The dielectrical System includes the water reservoir filtration system, deionization system & water chiller unit.
- During cutting, the dirty water is drained into the unfiltered side of the dielectric reservoir where the water is then pumped & filtered through a paper filter, & returned to the clean side of the dielectric tank.
- Following Filtration, the clean water is measured for conductivity & if required passes through a vessel that contains a mixed bed of Orion & contains beads. this mixed bed resin (the ion exchange unit) control the resistivity of the water to set values automatically.
- The clean water fills the clean side of the dielectric reservoir & proceed to the cutting area. Used water is drained & returned by to the unfiltered side of the dielectric reservoir to complete the cycle -

- A water chiller is provided as standard requirement to keep the dielectric, workpieces thermally stable. During the cutting process the chips from the material that is being eroded, gradually changes the water conductivity level.
- Resistivity levels of the water are set according to the cutting requirements of the workpiece material being machined.

### Conclusion :

wire EDM has a broad range of applications that are continuing to grow.