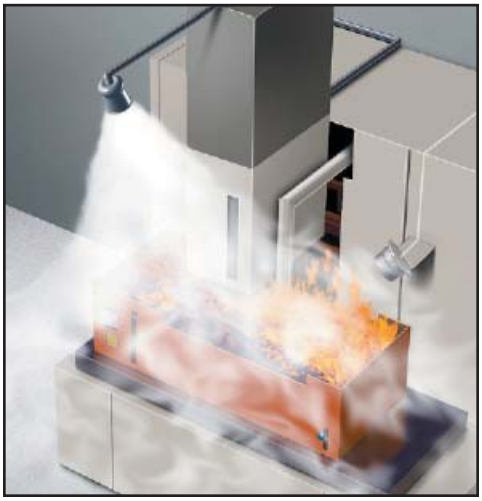
ELECTRIC DISCHARGE MACHINING (EDM)

Application Profile

TYPICAL INDUSTRIES SERVED

- Manufacturing
- Mold Production
- Exotic Metal Machining
- Conductive Material Machining
- Tool and Die Production

INTRODUCTION



What is Electronic Discharge Machining? Electronic Discharge Machining (EDM) is a machining process that uses an electrode to remove metal, or any other conductive material, from a workpiece by generating sparks between conducting surfaces. The electrode is the cutting tool for the EDM process and cuts the workpiece with the shape of the electrode. This material removal technique uses electricity to remove metal by means of spark erosion. During this process, sparks are created between the electrode and the workpiece. The energy from the electrode dissipates the workpiece and the desired shape is formed.

Parts made with he EDM process are used in various fields and industries. Some of these industries include, but are not limited to: medicine, chemical, electronics, oil and gas, die and mold, fabrication, construction, automotive, aeronautics and space, EDM processing is virtually found any place metals are machined.

The purpose of this application guide is to provide an understanding of the possible hazards associated with Electronic Discharge Machining and protection solutions utilizing Fike Carbon Dioxide Extinguishing Systems. This document is intended to be a guideline and is not applicable to all situations. Fike's Carbon Dioxide Design, Installation, and Maintenance Manual and NFPA 12 shall be referred to when designing CO_2 systems. If you have any questions, please contact the Fike Protection Systems group, or our regional sales manager in your area.

THE PROBLEM: DIELECTRIC FLUID IGNITION

There are several different types of EDM processes. Die-Sinking EDM, Wire EDM, Submersible EDM, and Small Hole EDM. Wire Cutting and Small Hole EDM do not pose near the fire hazard as Die-Sinking and Submersible EDM. Die-Sinking and Submersible machining is done submerged in large tanks of dielectric fluid. The dielectric fluid, stored in capacities up to 1,000 gallons (3,780 liters), serves several purposes. it helps create and control the spark, provides a shield between the electrode and the workpiece, assists with keeping the workpiece cool, and removes the eroded particles from the cutting area. The dielectric oil serves several valuable roles, but is the leading contributor to EDM fires.

Oil will ignite at certain temperatures. The flash point of the dielectric oil ranges from 200°F (93°C) to 260°F (127°C). Fires can and have often occurred in EDM processing. Most fires occur when heavy cutting is taking place, because the oil may get so hot that it reaches the fluid flash point.

Another cause of EDM fires is related to th level of the dielectric fluid dropping below the point at which the EDM processing is taking place. Die-Sinking EDM processing occurs on 3 axes (x, y, and z), which means fire may initiate at a higher level than first realized.

The dielectric fluid, located in the EDM bath, serves as the main fire hazard with an EDM application. The remainder of interior controls located inside the cabinet are not considered to be a fire hazard, and therefore are not protected.

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THE SOLUTION: LOCAL APPLICATION/RATE-BY-AREA

The CO_2 Rate-By-Area design method is used to protect two-dimensional, horizontal surfaces and low-level objects. For EDM applications, the Rate-By-Area design method is applied because the potential fire is two-dimensional. A "liquid surface" is any pool of liquid 0.25" (6mm) or more in depth. Electric Discharge Machine baths will exceed a minimum depth of .25" (6mm), therefore the application fits the description for a Liquid Surface design.

EDM oil tank surfaces are generally small in size; therefore the discharge rate will be moderate. The total quantity of CO_2 can be supplied in a single cylinder.

In addition to installing a carbon dioxide fire suppression system, additional EDM safeguards should be considered if not implemented. These safeguards include installing a coolant system to maintain a proper oil temperature, a low oil level switch on the recirculating oil tank, and a means to shut down the oil system and EDM unit in the event of a fire.

NOZZLE SELECTION

Nozzle quantity and location is a key factor when applying CO_2 protection to a Liquid Surface. The Rate-By-Area method for CO_2 fire protection utilizes the "S" Type Nozzle, which directs the Carbon Dioxide agent discharge in a specific pattern toward the protected surface. This method of agent application is effective only when the proper agent flow rate and nozzle height are applied to a specific coverage area. The height of the nozzle above the surface being protected and the total number of nozzles must be determined to calculate the appropriate nozzle flow rate. Placement of the CO_2 nozzle must not interfere with the operation or maintenance of the machine. The nozzle must also be installed at a location that will enable an extinguishing "envelop" to be developed around the entire protected area. Any obstructions that could interfere with the flow of CO_2 from the nozzle to the protected surface must be avoided to provide proper system performance. Input from the EDM owner or operator is important at the time of system design.

DETECTION AND CONTROLS

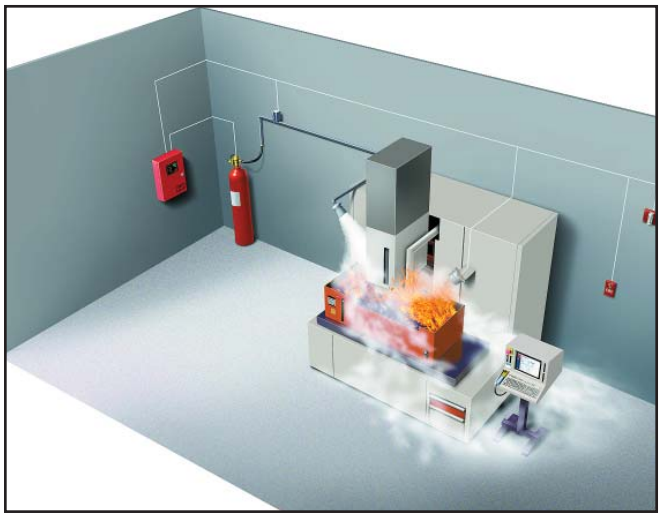
Automatic fire protection is implemented when protecting EDM applications. Quite often, machines are programmed to operate without machinist present. A flame detector or linear heat detector is installed to detect a fire and activate the CO_2 system. The detector should be installed in a position to view and detect any fire. The detector must be carefully installed and not interfere with the operation, but must still serve its purpose.

For this application, Fike's Single Hazard Panel (SHP) is the best-suited releasing control panel. A pressure switch is also recommended to provide a positive pneumatic confirmation to the SHP that the CO_2 system has discharged. The pressure switch provides the input to the SHP needed to shut down oil pumps and the machine to confine the fire and prevent the oil from re-igniting.

Audible and visual devices are installed to warn nearby personnel of the CO_2 discharge. A manual release station is conveniently located to allow electrical manual CO_2 operation. The SHP panel relay contacts can be tied into he facility fire alarm system notifying personnel of a trouble or alarm condition. This will provide proper response into the event of a fire.

A Fike CO_2 system protecting an EDM process is shown in the illustration below.

References:
Sommer, Carl. (2000). Non-Traditional Machining Handbook. Houston, TX: Advance Publishing, Inc.



"Electronic Discharge Machine" Protected by a Fike Carbon Dioxide Suppression System

Form No. CDAP003 May, 2008 Specifications are subject to change without notice.