CHEMETRON™ Fire Systems

CARDOX

CO_2 Application Bulletin

CARBON DIOXIDE FIRE SUPPRESSION —

Machining Centers

Part 3: Electric Discharge Machining (EDM)

The machining of intricate metal shapes is done by a process called Electric Discharge Machining (EDM). In this process the piece to be machined is submerged in a tank of electrolyte and an intermittent electric arc removes unwanted material to create the shape desired. There are two EDM methods – "Wire" and "Sinker."

While the Wire method presents a minimal hazard, the Sinker method involves relatively large tanks of oil, which is the electrolyte. The flash point of the oil can range from under 200°F (93°C) to over 250°F (121 °C).

As the electric discharge causes sparking, which takes place under the oil surface, the oil is continuously circulated in the arcing area to cool it, flush out residue and provide fresh electrolyte to the machining point.

The oil in the machine tank, which can have a capacity of a 1,000 gallons (3,780 L) or more depending on the number of units served, is recirculated and continuously filtered and cooled.

In some large, multiple machine installations, there is a central oil storage processing facility that requires protection. Local application of CO_2, using traditional protection methods, has been used to protect same.

On occasion, the machining is programmed to be performed over an extended time period and the operation is often unattended during portions of that time. Thus, proper fire protection dictates the use of an automatic suppression system.

CHEMETRON™ Fire Systems
A World of Protection

4801 Southwick Drive
Third Floor
Matteson, IL 60443
Telephone: 708/748-1503
Fax: 708/748-2847
email: info@chemetron.com

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Serious fires have occurred when the oil level is allowed to drop below the point at which the machining is taking place. Since machines operate on 3 axes, this may be at a higher level than first realized. The electric arcing is the ignition source for almost all fires.

Fire Protection

Special hazard fire protection is provided for EDM machines where continuity of production is vital or where values are high. In addition to normal protection measures in any machine shop, the following should be provided:

- A low oil level switch on the recirculating oil tank.
- A means to de-energize the unit electrically in the event of a fire.
- A means to shut off the central oil system.

For fire extinguishment, the "local application" of carbon dioxide (CO_2) to a fire on the surface of the oil in the tank offers quick, effective fire extinguishment with no mess or need for cleanup of the fire extinguishant. It is also safe to use around the sensitive control electronics.

Some small dry chemical modular units have been marketed for this protection. However, they only offer short term agent application that may not be adequate. In addition, they will create serious problems if the fine chemical particles get into any of the electronics.

The CO_2 system design is based on the "rate by area method" of NFPA Standard No. 12. Splash guards, or in some cases a partial enclosure, help confine the oil – and hence the fire – to the EDM oil tank surface, ensuring coverage by the CO_2 discharge.

Obviously, the placement of the CO_2 nozzle is critical. It cannot interfere with the operation or maintenance of the machine and it must be placed so it can cover the oil surface completely. Therefore, input from the machine manufacturer or the plant operator at the time of system design is invaluable. Manufacturers have been known to provide for mounting a nozzle on the machine for future connection of a system. Special methods of application have been used to ensure coverage.

In the "rate by area method," CO_2 nozzles – that have been fire tested and rated as to their extinguishing ability – are used. This rating is based on the design of the nozzle, the rate of CO_2 application and the projection distance from the face of the nozzle to the surface being protected. The rating published is based on a square area of coverage with the size of that square based on the greatest dimension of the square. For example, to protect a 5 ft. by 3 ft. area with one nozzle, the nozzle would have to be rated 5 ft. x 5 ft.; or two nozzles, each rated 3 ft. x 3 ft., could be used. CO_2 quantities are based on whether the coverage is of a liquid surface or a coated surface. In this case the protected surface is liquid. As a result, the system designer almost always has a choice of nozzles to accommodate a nozzle location(s) that ensures surface coverage, but yet does not interfere with machine operation and maintenance.

Both the system control panel and a CO_2 pressure switch are interconnected to de-energize oil pumps and the machine. This helps contain the fire and eliminates an obvious reignition source.

Machines are often programmed to run without operators present. In such cases, provision should be made to send a signal to an attended location or tie-in to the building fire alarm system to ensure a follow-up response is made in case of fire.

Since overheating of the oil has been shown to have contributed to many fires in the past, the CO_2 discharge must not only provide complete coverage of the oil surface, but also must assist in cooling the oil after the open burning is extinguished. Therefore, a 3 minute discharge is recommended.

Printed: 06/2023 20230601SM

As the exposed oil surface area is not too large, the CO_2 discharge rate will be modest and the total quantity required can often be supplied by one cylinder.

Automatic protection is necessary and the mounting of a linear detector or a rate compensated, heat actuated spot-type fire detector – again out of the way but in a position to be fully exposed to any fire – is required.

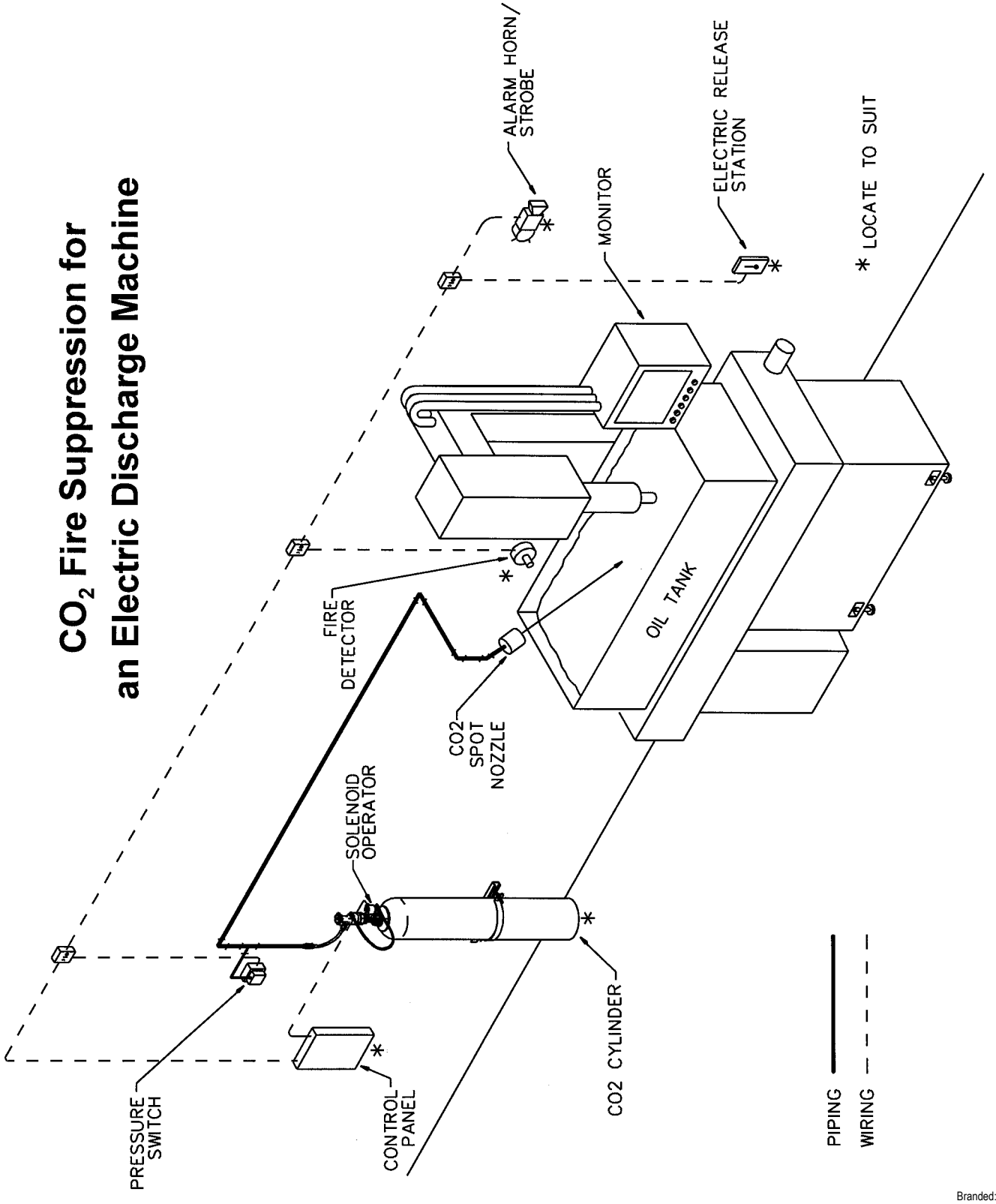
A manual release station, convenient to the operator but not located where it will be inaccessible during a fire, is also required. All systems require both an audible and visual alarm to warn of an impending system discharge.

A factory fabricated system skid, including agent supply and controls, has been used to minimize field installation.

A schematic drawing is included herein to illustrate the protection described above.

References

- Factory Mutual Loss Prevention Data Sheet 7-37: Para 3.6 (EDM)
- EDM Today, March/April, 1999, "How To Start a One Spark Fire."



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