CHEMETRON™ Fire Systems

CARDOX

CO_2 Application Bulletin

Carbon Dioxide Fire Suppression —

High Speed Machine Tools

The occurrence of fires in high speed machine tools is not common, but nor is it rare. A fire occurs just often enough to warrant that plant operators must be sure to plan for such a contingency.

Broken tools, abnormal abrasion from dull tools, higher than normal coolant temperatures, and the failure to have Murphy's Law repealed can cause a fire to occur without warning in the machining enclosure and/or the associated oil hydraulic system.

In the event of a fire, prompt operator action in shutdown and extinguisher use can mitigate the loss. However, many of these tools are performing critical tasks, often in an unattended environment. Automatic fire suppression is, thus, needed. In addition, specialized machining, such as that done with magnesium for industries such as automotive and aerospace, has become widespread. Fires involving this type material present a much larger risk, not only to the tool, but to the facility itself.

The installation of an automatic fire suppression system is an appropriate means to mitigate this risk. Selection of the type of fire suppression system needed requires some evaluation on the part of the operator as well as the fire system designer. This bulletin is written to assist in this evaluation.

The selection of the proper fire extinguishing agent is one of the first things that needs to be considered. The possibilities are water (in this case "water mist"), dry chemicals, and several different gaseous agents (CO_2 and other inert gases.) All of these have been used for machine tool fire protection at one time or another.

But what are the factors that an operator should consider in selecting the best fire extinguishant and type of system needed? Cost vs Benefits? Of course. A clean, non-contaminating agent? You bet! Relative effectiveness? Certainly. Facility compatibility? Yes.

Over the years the evaluation of these factors has identified gaseous agents as being the overwhelming preference. They can extinguish quickly and cleanly and are cost effective. In addition, gas systems have been developed that are more compatible with the facility than ever before (see below).

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A World of Protection

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 Issued: (8/2002)

Branded: 06/2023 20230601SM

If the cutting oils or hydraulic fluids are the combustibles with which you are concerned, the fire extinguishing processes with gas systems are pretty simple:

- Envelop the combustibles in a non-fire supporting atmosphere
- Shut down equipment (operation of the e-stop)
- Maintain the extinguishment for a period of cooling while alerting the plant and operators that the system has discharged.

We mentioned the machining of magnesium above, so let's take this as an example. Fires almost always start with the ignition of cutting oil vapors and need to be extinguished quickly before the chips are involved. Once it has started burning, magnesium cannot be extinguished by any of the common extinguishants, so the objective is to extinguish the fire before that occurs. The use of CO_2 has worked well in this regard. However, if the magnesium is being machined dry, there is a possibility that it can be ignited. For this we recommend the use of "Argonite" (argon/nitrogen) to confine the fire so it can be dealt with using Class D fire extinguishers. (Class D extinguishers are specifically approved for metals fires.)

⚠ NOTE

MAGNESIUM AND SIMILAR METALS BURN AT A HIGH ENOUGH TEMPERATURE TO BREAKDOWN A COMPOUND LIKE CARBON DIOXIDE. WHILE ARGON AND NITROGEN OBVIOUSLY CANNOT BE BROKEN DOWN, THEY WOULD BE INEFFECTIVE IN EXTINGUISHING THE FIRE. HOWEVER, THESE INERT GASES CAN CONFINE THE FIRE UNTIL EXTINGUISHMENT BY HAND USING THE CLASS D EXTINGUISHERS IS ACCOMPLISHED.

Over all, by far and away the most popular fire extinguishant used to automatically protect Automated High Speed Machine Tools is carbon dioxide (CO_2). A typical system for a Spindle Machine is illustrated on page 3. Systems for other types of Tools or Grinders would be somewhat similar, but each would be specifically designed for that particular tool or family of tools.

A concern in protecting these tools is the need to consider worst case conditions in the design of the suppression system. CO_2 has a significant advantage in this regard over other gaseous agents.

Gaseous agents are most commonly applied by what is known as "total flooding." When the fire is detected, the protected enclosure is 'flooded' throughout with a fire extinguishing concentration of the agent used. Some relatively small openings can be accommodated by added gas. However, if there are significant potential gas leakage points at the time of a fire, a door open for example, the effectiveness of the total flood protection would be compromised. Luckily, with CO_2 there is an approved method of protection system design called "local application," wherein an effective system can be provided for non-enclosed, partially enclosed, or enclosed configurations. When analyzing a machine configuration, we assume the worst case. This is illustrated in the drawing on page 3. Notice in the inset drawing we show the use of 'spot' type nozzles for both flooding and local application, which creates total CO_2 envelopment of the hazard, even with a door (or doors) open.

⚠ NOTE

CO_2 IS THE ONLY GASEOUS AGENT WITH A PROVEN LOCAL APPLICATION EXTINGUISHING SYSTEM HISTORY (OVER 60 YEARS AT CHEMETRON/CARDOX.)

Early in this presentation we mentioned the desirability of having "facility compatible" systems. An example of the need for such comes from the propensity of operators to move equipment around - this side of the plant today, the other side tomorrow. As you can see from the drawing, all the system components except those actually on the machine are 'packaged' on a skid, which allows the system to be moved with the machine. And as long as there is no drastic change in the distance between the skid and the machine in the new location, no recalculation of piping and nozzles will be required, just a re-hookup.

The Chemetron organization and its worldwide distributors are available to help evaluate the requirements of any specific tool.

Other associated Chemetron Applications Bulletins:

- Bulletin #0755 - Production Line Machining
- Bulletin #0770 - Machine Tool 'Snuffer Systems'
- Bulletin #0800 - Electric Discharge Machining

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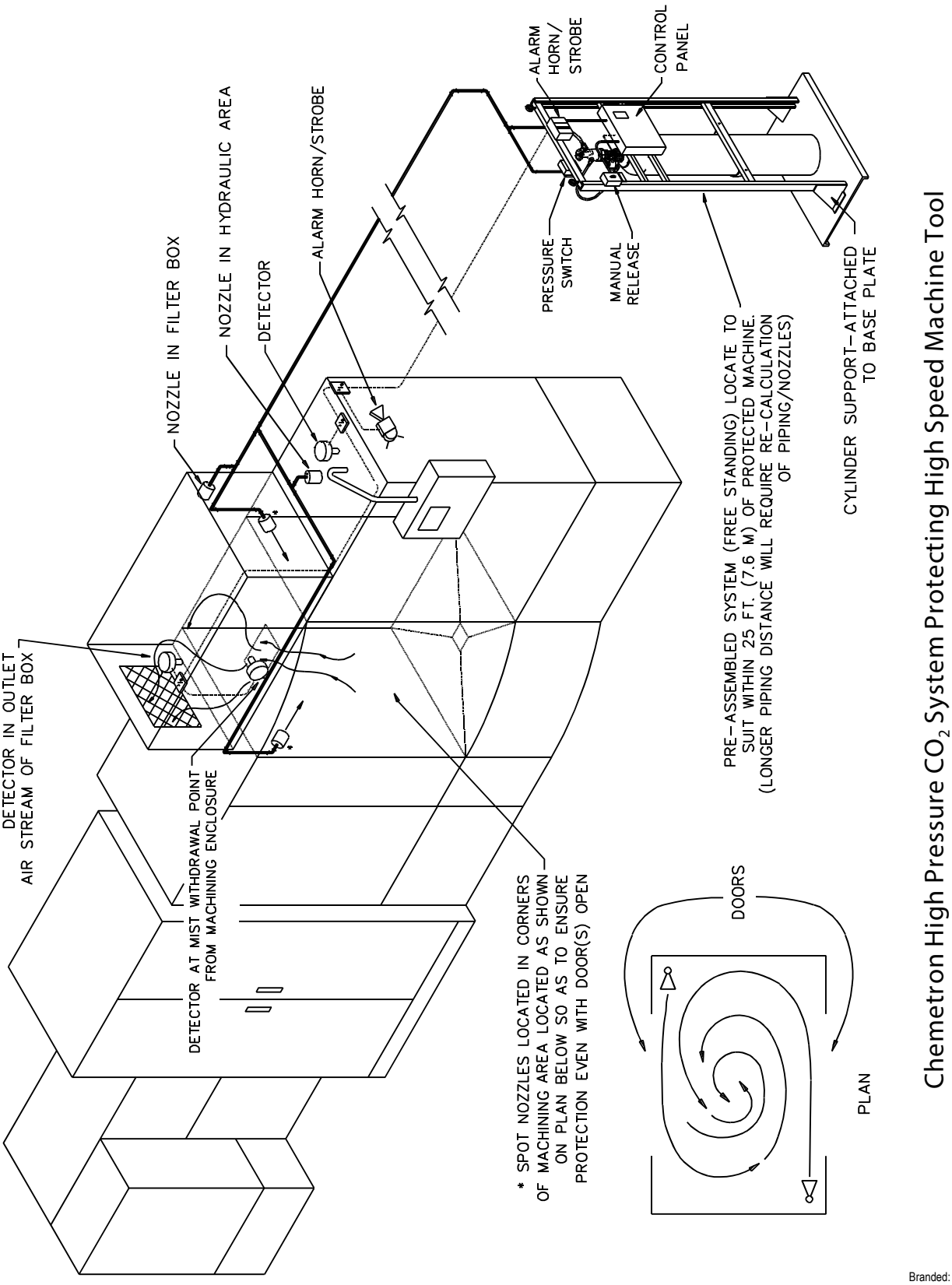

Chemetron High Pressure CO_2 System Protecting High Speed Machine Tool

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