CHEMETRON™ Fire Systems

CARDOX

CO_2 Application Bulletin

Carbon Dioxide Fire Suppression —

Metals Rolling Mills

The protection of an aluminum foil rolling mill by a low pressure carbon dioxide system is shown on the accompanying drawing.

Many such systems have been installed to protect a variety of metal processing facilities where metal is reduced in thickness, its metallurgical properties are changed, its bright surface enhanced or otherwise processed. This is done in such a way that combustibles are used in the processing. When metal is squeezed to reduce its thickness, heat is generated. When a bright surface is needed, as with aluminum foil, a mineral oil is used to remove this heat while keeping the foil shiny. A portion of this heated oil vaporizes and the resultant vapors must be captured and removed. The oil that is not vaporized drains to catch pans from which it is cleaned, cooled and pumped back on the mill. The fire potential of this oil/oil vapor hazard is obvious. The use of carbon dioxide, with its ability to extinguish, while not contaminating the oil, is universal.

Even for rolling mills on which the roll coolant used is in itself not combustible, CO_2 fire protection has found a place. See Bulletin #0305, Multi-Stand Mills/Mills With Water Based Coolant.

It should be noted that the coolant is not the only combustible on the mill. The bearings are usually oil lubricated and much of the equipment is oil-hydraulic operated. Proper protection includes protecting this equipment as well.

Protection afforded by the CO_2 system is a combination of local application and total flooding.

Local Application Coverage

Local application coverage includes the following:

Roll Stack: The work rolls, together with the mill coolant hoses and applicators, are usually treated as rate by volume (per NFPA Standard No. 12), with the mill frames treated as walls to limit the hazard on the ends. Nozzles cover both the unwind and rewind sides. See drawing.

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Bearing Journals and Oil Hose Connections: The bearings, with their lubricating oil system connections, are usually treated by local application calculated rate by area. On the accompanying drawing, note that a removable enclosure is shown around the bearings. Instead of an enclosure, sometimes a shutter-like barrier is dropped to enclose this area while the mill is operating. The purpose of these is to prevent oil vapors from escaping into the mill area through the ends of the mill. Nozzles providing the coverage must be inside the enclosure so it will not interfere with the discharge. Total flooding is not practical because the enclosure is removable. If the enclosure is so close to the mill as to prevent installation of local application nozzles inside, total flood nozzles for coverage when the enclosure is in place, and local application nozzles for when it is not, are both used.

Screw Down Area: Some mills are equipped with hydraulic equipment mounted on a platform on top of the mill that provides the downward force to squeeze the rolls together. (The foil mill on the drawing does not have same. This design is required for mills rolling heavier gauges). This platform, in addition to having some oil equipment, tends to accumulate oil which, if ignited, would be difficult to reach due to its relative inaccessibility. It is protected using rate by area local application.

Hoods: In order to ensure maximum VOC (volatile organic compounds) control, modern mills have very sophisticated fume control systems. These include air curtains, double hoods, etc. For simple sheet metal hoods (as shown on drawing), the underside of the hoods are covered using rate by area local application. Nozzles, which are pointed up, should be provided with caps to prevent oil accumulation in the nozzles.

Coils and Handling Equipment: Some coils are prepared for rolling by being covered with roll coolant as they unwind. This equipment is protected rate by volume. If it is located under the hood and the hood height is not too high, it could be better to treat the bottom of the hood as well as everything under it down to the mill floor as local application rate by volume.

Open Pits: Uncovered pits, in which oil may accumulate, that are less than 4' deep are treated by local application rate by area. When the open pit is 4' or more deep, local application at a rate of 4 lbs. per minute per square foot is used as described in NFPA Standard No. 12.

Total Flooding Coverage

In addition to the above, other parts of the total rolling mill hazard can be treated as total flooding. These include:

Closed (Covered) Pits: CO_2 is calculated for the pits using the flooding factors of Standard No. 12 depending on the volume of each pit. It should be noted that pits on the mill consist of open sections adjacent to covered sections. Each is treated in its own way, but the ends of a covered pit are not considered open when they open into a protected open pit, and hence, no compensating CO_2 for loss is needed in the CO_2 calculations for flooding these spaces.

Fume Exhaust System: CO_2 is calculated at a 65% flooding concentration as per Standard No. 12. In most modern mill exhaust systems, an oil collection system prevents the discharge of oil vapor into the atmosphere. This system is also flooded with CO_2. Fire dampers in the fume exhaust system, actuated by the CO_2 discharge, are needed. Upon system actuation, all fans are shut down. CO_2 is discharged on both sides of dampers.

IMPORTANT

UPON SYSTEM OPERATION, ALL COMPONENTS OF THE SYSTEM ARE DISCHARGED SIMULTANEOUSLY AND COVERAGE MUST BE COMPLETE PER PARA. 3-2.1 OF NFPA NO. 12. SINCE THE PRIMARY CO_2 REQUIREMENT IS LOCAL APPLICATION, A 30 SECOND LIQUID CO_2 DISCHARGE IS USED PER STANDARD NO. 12. THEREFORE, WHEN DOING THE CO_2 HAZARD CALCULATION, YOU MUST REMEMBER THAT YOU WILL HAVE ONLY ½ MINUTE TO PROVIDE FLOODING CO_2 FOR THE TOTAL FLOOD SECTIONS.

IF THE EXHAUST SYSTEM IS MADE OF RELATIVELY LIGHT GAUGE METAL WHICH COULD BE QUICKLY HEATED IN A FIRE, CONCERN MUST BE GIVEN TO ENSURE HEATED METAL SURFACES CANNOT REIGNITE THE FIRE.

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For a more detailed description of fire protection for fume control systems, see Bulletin #0765, Fume Control Systems.

Directly associated with the operation of the mill is the equipment which filters, cools, and pumps the oil to the mills. Most of this equipment is in a room or cellar away from the mill where it can be protected by total flooding, usually as a separate hazard from the mill protection system.

However, there are times when some of this equipment is out on the mill floor — usually the filters, to facilitate service; in that case, it is treated as a separate hazard covered by local application. If the hazards interexpose one another, they must be capable of simultaneous protection.

Controls: The systems are automatic using rate compensated heat detectors, with manual release stations for the system on both the operator's console and away from the mill. A feature sometimes used is called a spurt. Conditions which have been shown to precede a fire can be identified by the mill PLC and a signal given to initiate a localized CO_2 discharge on the mill bite area.

Experience has shown that fires on mills can develop to be very large very fast. "A ball of flame all the way to the roof" is how some have been described. Therefore, the desirability of applying the full CO_2 discharge as quickly as possible exists, in which case you want to minimize the vapor time of the discharge. The liquid CO_2 in the storage tank picks up heat from pipe and fittings as it is discharged and becomes vapor. Only when the pipe is fully cooled and full of liquid CO_2 do you get the fully effective discharge needed Quick liquid discharges can be obtained by keeping the tank close to the mill or using an insulated discharge header that is constantly full of liquid CO_2. The heat input to this header vaporizes some CO_2 that is recondensed to vapor by the storage unit or by a separate refrigerator unit. A circulation pump may be needed.

Other hazards associated with the rolling mill operation such as electric drive motors, switchgear and controls, cable tunnels, etc., can be protected from the same system. They are treated in other CO_2 application bulletins.

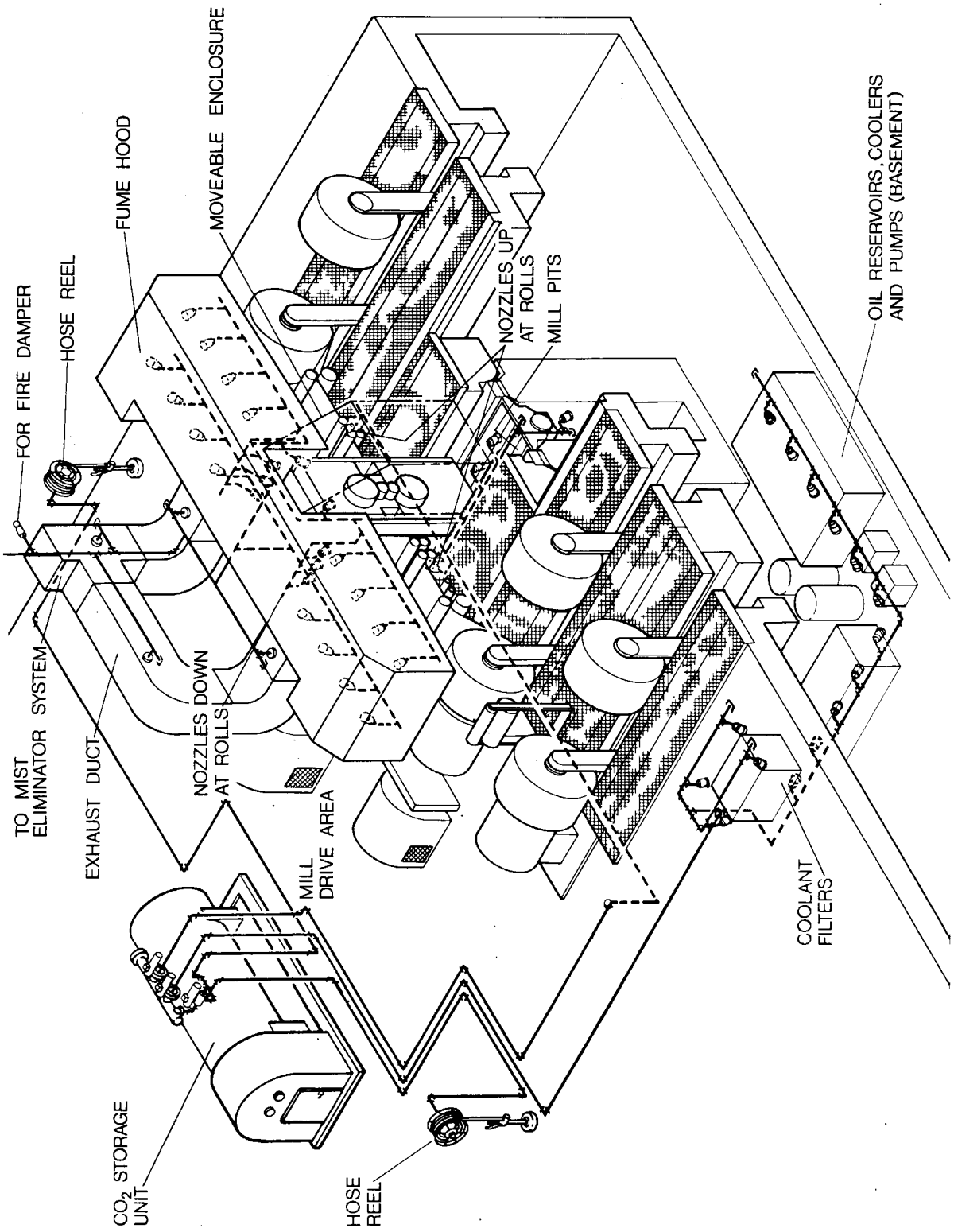
When the low pressure CO_2 system is used, the highly effective CO_2 hand hose lines provide very valuable back-up protection. See Bulletin #0760, High Capacity Portable Protection with CO_2 Hand Hose Lines.

Safety Considerations

When the carbon dioxide system is designed, the provision for personnel safety must be considered as strongly as the fire protection. A safe system includes provision for:

- Alarms that absolutely, positively indicate the system is about to discharge.
- Analysis of the CO_2 gas flow to identify where the CO_2 will be after a discharge.
- Provision for a proper lock-out system during periods of maintenance to prevent an accidental discharge endangering personnel.
- Adequate instructions and training, including warning and instructional signs.

NFPA Standard No. 12 provides good information in this regard.



LPCO_2 Fire Extinguishing System Protecting a Cold Rolling Mill

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