CHEMETRON™ Fire Systems

CARDOX

CO_2 Application Bulletin

Carbon Dioxide Fire Suppression —

Metals Rolling Mills

Part 2: *Multi-Stand Mills & Mills With Water Based Coolant*

In Metals Industry Bulletin #0300, an aluminum foil mill was illustrated and the protection described. In that write-up, references were made to mills rolling heavier strip gauges and to mills using water soluble oils as roll coolants. This bulletin is written to expand on these subjects, as well as to illustrate and describe the protection utilized on a typical mill of this type.

The mill illustrated is based on the CO_2 protection system provided for a 2 stand tandem mill rolling thin strip for tin plate at a major USA steel mill. On this mill there are some significant differences from the mill described in Bulletin #0300. Besides having two mill stands installed in tandem, the mill contains a screw-down platform containing the equipment needed to exert the force required to push the rolls together. It is also equipped with a down-draft ventilation system in which coolant fumes are drawn down through the pits to a fog tunnel, then to an outside wall where they are exhausted after processing through a mist eliminator (not shown). To contain the fumes at the mill, hoods are installed over each end and ducted down to the exhaust tunnel. The sides of the mill around the rolls are covered by rolling doors that are dropped while the mill is in operation. The area between the two mill stands is also enclosed (with access doors available).

NOTE

REFERRING BACK TO BULLETIN #0300, YOU WILL NOTE THE MILL HOODS ARE SHOWN AS OPEN HOODS WITH CO_2 NOZZLES AIMED UP TO COVER SAME. HOWEVER, SINCE THAT BULLETIN WAS WRITTEN, NEWER MILLS OF THIS TYPE HAVE BEEN PROVIDED WITH DOUBLE WALLED HOODS. ON THESE THERE IS AN AIR SUPPLY SECTION OF THE HOOD WHICH FEEDS AN AIR CURTAIN AROUND THE HOOD DISCHARGING AIR DOWN TO BLOCK FUME FLOW AWAY FROM THE MILL. TECHNOLOGY IN FUME CONTROL IS RAPIDLY DEVELOPING TO MEET ENVIRONMENTAL NEEDS AND FIRE PROTECTION SYSTEM DESIGN MUST BE MODIFIED ACCORDINGLY.

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A World of Protection

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Mills of the type illustrated herein are now equipped with sophisticated controls for controlling gauge and strip shape, and are automated for increased production speeds. They allow quick change-over and offer flexibility of operation. They are also more susceptible to fire damage if the fire is not extinguished quickly.

A history of several of fires within a month or so in midyear 1988 illustrate the protection problem.

A maintenance worker was cutting out a 1" bolt on a 6-stand tandem cold mill in a steel mill and ignited condensed residue that remained from mill operations. It took over 7 weeks to get the mill back in operation after an extremely serious fire.

At an aluminum plant, a 6-stand tandem cold mill using water based coolant had finished a production run and a platform was being installed when "...sparks from the torch ignited oily dirt and sludge that had accumulated underneath the mill. Within minutes, fire engulfed three of the six stands on the ...mill. The fire burned for about 40 minutes before it was finally extinguished. ...You could only see 10 to 15 feet in front of you in the building the smoke was so thick...flames shot up in the air twenty to thirty foot."

These fires were, of course, on mills where, because of the use of water based coolant, no fire hazard was thought to exist. The need for protecting these mills is well established by these incidents, plus numerous others at both steel and aluminum mills operating similarly. While the installation of a properly designed water spray system could provide fire control, the use of CO_2 is considered primary protection for the following reasons:

- The CO_2 affords faster protection - a matter of seconds.

  Modern mill protection CO_2 system design targets a full extinguishing discharge within 10 seconds of the start of operation. Because of the introduction of sophisticated and sensitive mill controls, as mentioned above, quick extinguishment is imperative.

- CO_2 is three dimensional and will extinguish a three dimensional fire, while water will not.

  The CO_2 gas will penetrate all parts of the mill, pits, etc., whereas water would have to be discharged directly on each protected area.

- Since it is imperative that the entire hazard be covered, the back of the mill, which may be close to the electric drives, is especially important. CO_2 can be discharged in this area without concern for shielding the electrics or disconnecting power before a discharge.

- The same CO_2 system can provide protection for fume exhaust, lube oil, and electrical drive systems; the Chemetron $LPCO_2$ hand hose line offers superior first aid protection during cutting and welding (obviously needed in the previously mentioned 2 incidents).

- CO_2 requires no provision for drainage or retention of the extinguishing agent discharge.

Arrangement of Protection: In the arrangement of protection of the mill shown on the accompanying drawing, we would like to point out the following features.

1. The fume exhaust system is protected as a separate hazard (zone) with its own valve and controls. In the case of a mill fire, the exhaust system is automatically flooded along with the mill. But the exhaust system can also be discharged separately, providing for a longer sustained discharge.

2. A set of nozzles (hidden from view) discharge down across the back of the mill, covering the entire area. These are in addition to the CO_2 nozzles directed in to cover other mill equipment. This coverage is usually calculated rate-by-area.

3. The screw-down area is covered by a local application discharge calculated on a rate-by-area method. Some operators have also valved the screw-down protection separately so it can be independently discharged.

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4 Reduction of fire incidents can be accomplished by using the computer to monitor strip tension. It has been found that when the strip breaks, conditions for fire ignition occur. When tension is released by a strip break, inerting the work area of the mill with CO_2 will prevent fire ignition. This localized spurt is not shown on the accompanying drawing.

Comparing the earlier rolling mills bulletin, you will note the protection of the following mill segments is similar.

Roll Stacks: Local application, calculated rate-by-volume.

Bearing Journals and Oil Connections: Local application using rate-by-area with concern given to coverage with fume containment doors in either the up or down position.

Open Pits: Local application using rate-by-area for pits less than 4' deep and the NFPA Standard No. 12 recommended approach for pits 4' or more deep.

Closed (Covered Pits): Covered by total flooding.

Safety Lockout and Reliability: We discussed above the advantages of using CO_2 as primary fire protection, but this use is not without risk. As pointed out before, in fire extinguishing concentrations, CO_2 is suffocating. Therefore, it is imperative that all areas where CO_2 can be discharged or where it can drift to after a discharge be kept free of personnel while CO_2 is present. When necessary for personnel to work in these areas, supervised lock out of the CO_2 discharge is necessary. Chemetron would be pleased to help design such an arrangement. Under these conditions, a fire watch is mandatory in the same manner as when sprinklers are impaired. In the lockout mode, detection remains in service while interlocks prevent equipment operation while the CO_2 discharge is shut down.

Since the CO_2 system is so critical to maintaining mill operations, it is very important that all possible steps be taken to ensure system reliability. Gigantic strides in providing for this have taken place in recent years. These include:

- control panels that aid in locating and solving problems.
- systems that are fully electrically supervised.
- battery back-up power.
- key pilot piping and tubing supervision.
- alarms that allow much more extensive and positive personnel warning.

Certification of system designers by the National Institute of Engineering Technologies (N.I.C.E.T.) helps ensure proper systems design. This certification is established by testing and experience, and involves substantial training.

Once this type protection has been installed, proper inspection and maintenance by qualified personnel is mandatory. This includes updating protection as mills are modified and modernization of protection as new technology evolves.

Those concerned with reliable CO_2 fire protection should take comfort in recent studies by some large users of CO_2 fire protection showing that it is statistically at least as reliable as water protection.

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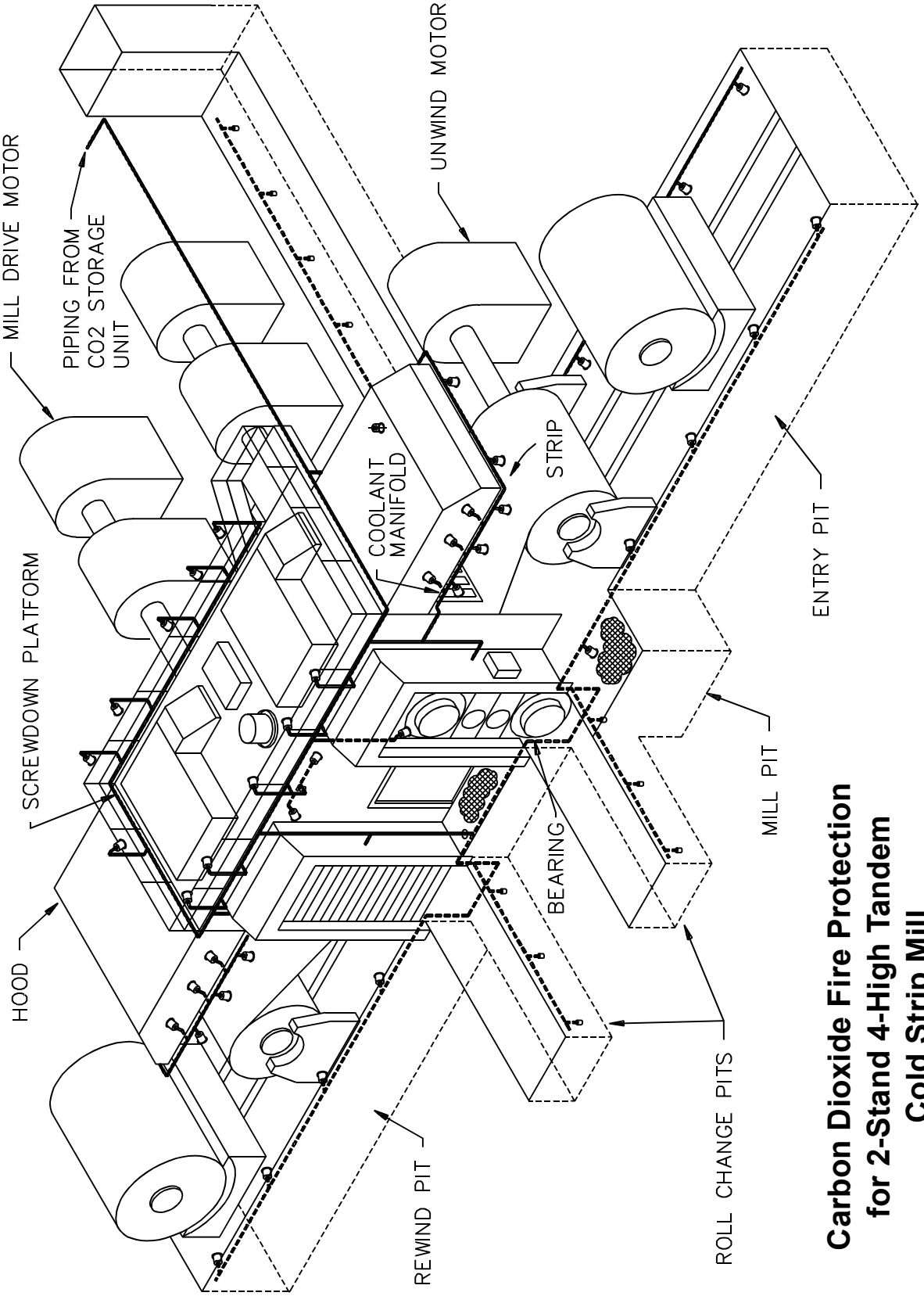

Carbon Dioxide Fire Protection for 2-Stand 4-High Tandem Cold Strip Mill

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