CHEMETRON Fire Systems™

CARDOX

CO_2 Application Bulletin

Metals Industry Bulletin #0310

Carbon Dioxide Fire Suppression —

Continuous Coil Coating Lines

Continuous coil coating lines are process lines where aluminum or steel strip is continuously coated (painted). Coatings can be applied to protect against corrosion or weathering, for wear or scuff resistance, or to give a decorative appearance.

The drawing on page 4 shows only a part of a typical coil processing facility. The entire facility consists of coil handling at the entry end with unwinders and a joiner to create a continuous strip, strip cleaning and preparation stages, prime coating and an associated curing oven, finish coater(s) with curing oven, cooling equipment, a coil looping stage and tension equipment to facilitate smooth material flow, an exit shear, and a coil rewind with a belt wrapper. The drawing shows that portion of the line consisting of the two coaters (prime and finish), curing ovens and the associated exhaust system. It is this portion of the line where CO_2 is often used for fire protection. Both water based and solvent based coating materials are used on continuous coil coaters — sometimes both on the same line at different times. The CO_2 is, of course, for protection when solvent based coatings are used.

The coating lines can be set up for variations involving heavy coatings, intermediate coatings, or the lightweight coatings that can be processed at high speeds. Therefore, these facilities can process metal strip for a great many applications, such as building materials, foil packaging, toys, can tops, etc. Interestingly, one design of our low pressure CO_2 storage vessels has painted aluminum strip from a coil coater as the outside metal housing.

Coating lines can be set up to produce metal with wood grains or other designs, as well as bright finishes. Sometimes stripable film is applied at the end of the line for protection of the finished material. The coating materials are such that the metal can be formed after painting without leaving blemishes. This even includes embossing.

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A World of Protection

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 Issued: (9/96)

Branded: 06/2023 20230601SM

Industry has found that for many, many products, they can avoid the cost and problems associated with installing an in-plant painting facility by buying prepainted metal. Therefore, the coil coating industry has enjoyed a steady market for many years.

Chemetron has been installing low pressure CO_2 systems for these facilities for over 25 years. An article in the October, 1966 issue of Iron and Steel Engineer, entitled Organic Coatings for Steel Sheets -Continuous Painting Line, has a photo of the line with a CARDOX Low Pressure CO_2 tank in the foreground along side the bake ovens. Technology has, of course, improved with such advances as computerized control of paint thickness, higher speeds (1500 feet per minute), and widths to 80 inches. But the basics of CO_2 fire protection still apply.

Coating line configurations are designed to meet product needs and plant layout. Some lines double back to use less floor space. Some have the coaters above one another rather than in line horizontally. Ovens are usually horizontal, but we have several customers with vertical units. One set of ovens can be mounted above the other when the line is doubled back.

The principal fire hazards of the coating line that lend themselves to CO_2 protection consist of the coaters themselves, freshly painted metal, the ovens, fume exhaust, and paint piping trenches.

Coaters

The coaters are usually out in the open, requiring that the CO_2 protection be local application. Because of the difficulty in identifying areas of spillage, leakage, etc., the rate-by-volume method of calculation usually works best. In our illustration there is a hood over the coater; spot nozzles are mounted in the hood, directed down at the coater. This performs very well because the hood, itself, ends up being a large, low velocity nozzle directing a CO_2 discharge down to envelop the coater. If there is no hood, nozzles are mounted from stanchions around the coater unit.

Sometimes the coaters are arranged so they can be moved in and out of a set position. When moved laterally, out of the line, they are in a position to be cleaned. In this configuration, two sets of nozzles are required; one set to cover each of the two positions of the coater. They are, however, piped so that the CO_2 discharges in both positions simultaneously. The CO_2 requirement is calculated accordingly.

In some installations the coater is installed in a coating room, which simplifies the CO_2 system design by allowing the entire coating room to be totally flooded.

When the coaters are installed in the open, it is very important that the paint spillage be confined by dikes or drains to limit the extent of the hazard so we can define the extent of the required CO_2 coverage.

Detection of a fire triggers the automatic shut down of the line and paint pumps.

Freshly Painted Strip

National Fire Protection Association (NFPA) Standard No. 12, Carbon Dioxide Extinguishing Systems, in Para. 3-2.1, Extent of Hazard, warns that freshly coated stock constitutes part of the hazard. Therefore, it is necessary to use the rate-by-area method of CO_2 local application to cover the freshly painted strip between the coater and the oven.

Remember that if CO_2 is discharged just from nozzles mounted above, the strip itself masks part of the hazard. Therefore, nozzles are needed below the strip as well. Protection of the strip is an extension of the coverage on the coater station, all being covered by the CO_2 discharge simultaneously.

Some of our customers, after their fire risk analysis, have chosen to protect just the coater and strip, while others, based on their own fire experience, also protect the curing ovens.

Ovens

There are ovens in which the strip is supported (flotation type), or where it hangs in a catenary. Heating can be infrared, indirect, or direct (the most dangerous). The size and design of the curing/drying ovens is based on the material being coated, the speed of the line, and environmental concerns. Hence, there are many variations. Ovens can be set in line as shown in our illustration, or as mentioned before, they can be set one on top of the other if the line doubles back to save space.

Modern computerized controls can monitor the solvent content of the atmosphere in the oven at ±1% and, therefore, can operate safely at somewhat higher solvent levels. Without these controls, it is usual practice to keep the solvent level below 25% of the lower explosive limit.

The CO_2 protection of the oven is, of course, total flood to the design level of the solvent used (usually 34%), with an additional 1% CO_2 added for each 5°F of operating temperature over 200°F (2.8°C of operating temperature over 93.3°C).

Over the years, probably more difficulty has been experienced with false trips of CO_2 systems in ovens than from any other source. The usual detection is rate compensated thermal detectors. The temperature rating of these detectors is set about 100°F above the operating temperature. If temperature spikes occur or there are rapid changes in temperature on start up or fan shutdown, false trips can occur. On new installations, we recommend that a break-in period be considered. During this period, the detection system is arranged to give alarm only so that any temperature variations inherent to the operation that might trip the detectors are recognized. Then, whatever changes needed in the CO_2 system and/or the operating procedure can be made without concern for dumping CO_2. Once this is established, the system is put on fully automatic control.

Fume Exhaust

A number of different duct configurations are possible. The exhaust system illustrated is that used on one of our more recent installations.

Upon system actuation, the CO_2 system floods the exhaust ducts to a 65% CO_2 concentration, operates a fire damper (with the CO_2 discharged on both sides of the damper), and shuts down the fans.

If there is a solvent recovery system, it is flooded with CO_2 as well.

Paint Piping Trenches

In some installations, the paint piping is run in trenches in the floor between the paint supply and the coaters. These trenches should be flooded with CO_2 to cover any possible accumulation of combustible from past and present leaks, and to act as a fire stop to ensure that any burning liquid from the coater that could reach the trench would be extinguished.

System Arrangement

In the system arrangement shown, the prime coater and its oven are protected as one hazard, and the finish coater and its oven as a second. We have also designed systems where the coater (plus the freshly painted strip and paint trench) was protected separately from the oven (and the fume exhaust). This potentially reduces CO_2 use, but adds to system control costs.

The protection is arranged so that any adjacent hazards can be discharged simultaneously, if this should ever be necessary. The CO_2 storage is sized for this eventuality.

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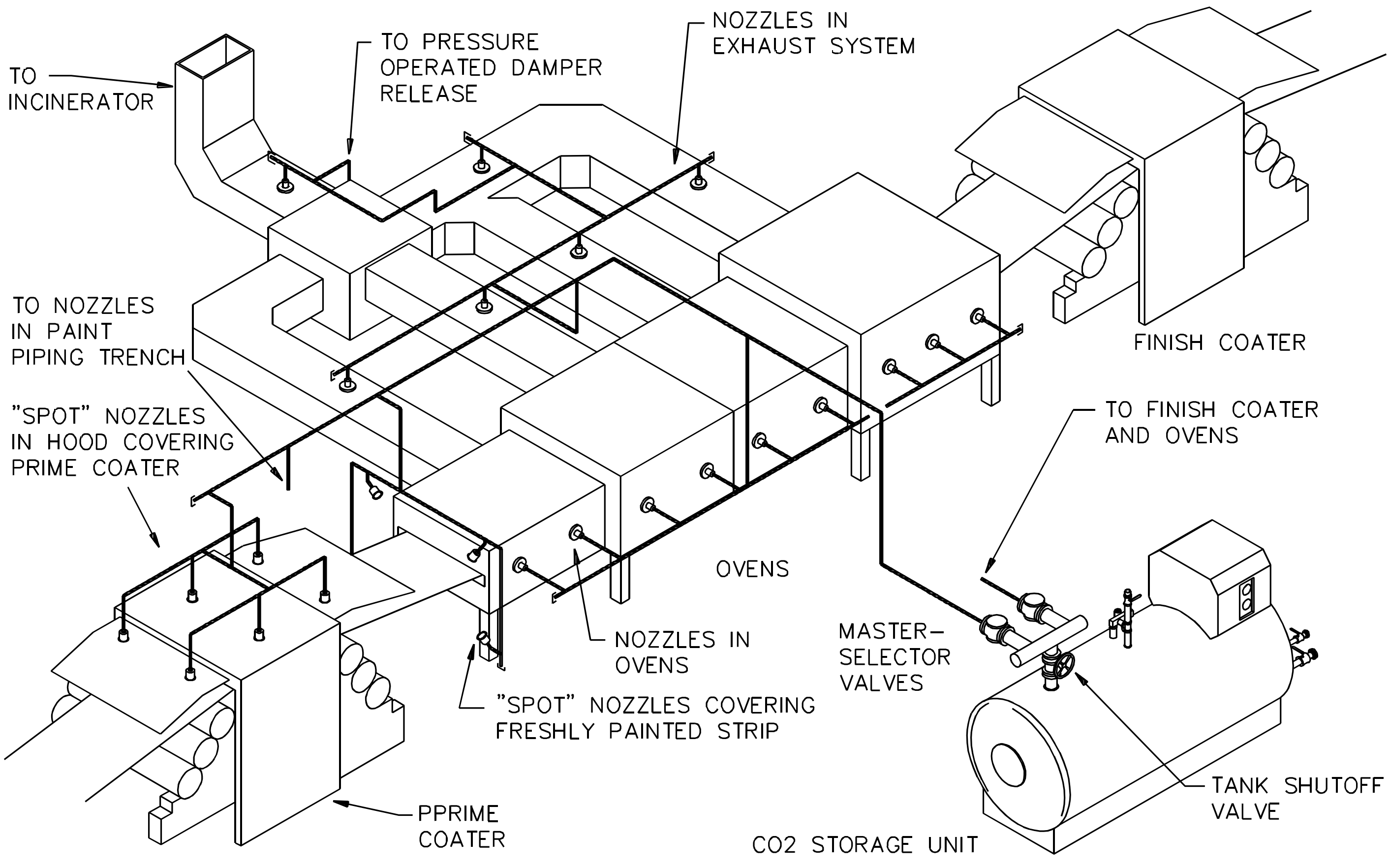
Other Hazards

Some other areas which may need protection and could be protected from this same system include coil handling hydraulics and lube; electrical control rooms; computer rooms and/or underfloors; and paint rooms.

Information on fire protection of these hazards is contained in the following bulletins:

- Computer Operations Bulletin #0600 - Protection of Spaces Beneath Raised Floors
- Computer Operations Bulletin #0610 - Computer Room Fire Protection for the 1990's
- Computer Operations Bulletin #0615 - Critical Computer and Electrical Control Cabinets
- Industrial Facilities Bulletin #0750 - Paint Mixing and Storage Facilities



Carbon Dioxide Fire Protection for a Continuous Coil Coater