Sheet HANDLING with VACUUM

By Daniel Pascoe

ALL THE PRODUCT TYPES THAT ARE DIFFICULT TO PICK UP, thin sheet handling is one of trickiest to undertake for the vacuum user. Sheet handling is very common and found throughout industry in sheet metal fabrication, paper printing, wood panel production, etc.

The reason it is difficult is not because of heavy weights, cycle rates, or dirty environments. The difficulty is preventing sheets sticking together in a vertical lift. Multiple sheet lifting is at least an irritation for a printing press operation and at worse, catastrophic in a steel stamping facility where multiple sheets are placed in an automated press production line.

This article offers some basic solutions to this problem. As is often the case in good vacuum practice, it is not the component choice but their application that makes for a successful solution.

Depending on the product being handled, various methods are employed. As in most industrial applications, what works for one industry often is not suitable for another. Here I offer an obvious starting point for particular industries with the three previous industry examples being used for comparison.

PAPER HANDLING

With printing presses, at one end you have a stack of plain white paper sheet on a pallet, and on the other end, you have a stack of very colorful printed paper on a pallet. There are four fundamental things that happen to this paper in its transformation: it is picked up from the first pallet using vacuum, transferred mechanically through the press, ink is applied, and then using vacuum once again, it is placed on the second pallet.

This happens very quickly, with sheets being transported though the printing press at incredible speeds. Therefore, the accurate pick up and release of the sheets with vacuum cups must be reliable and repetitive.

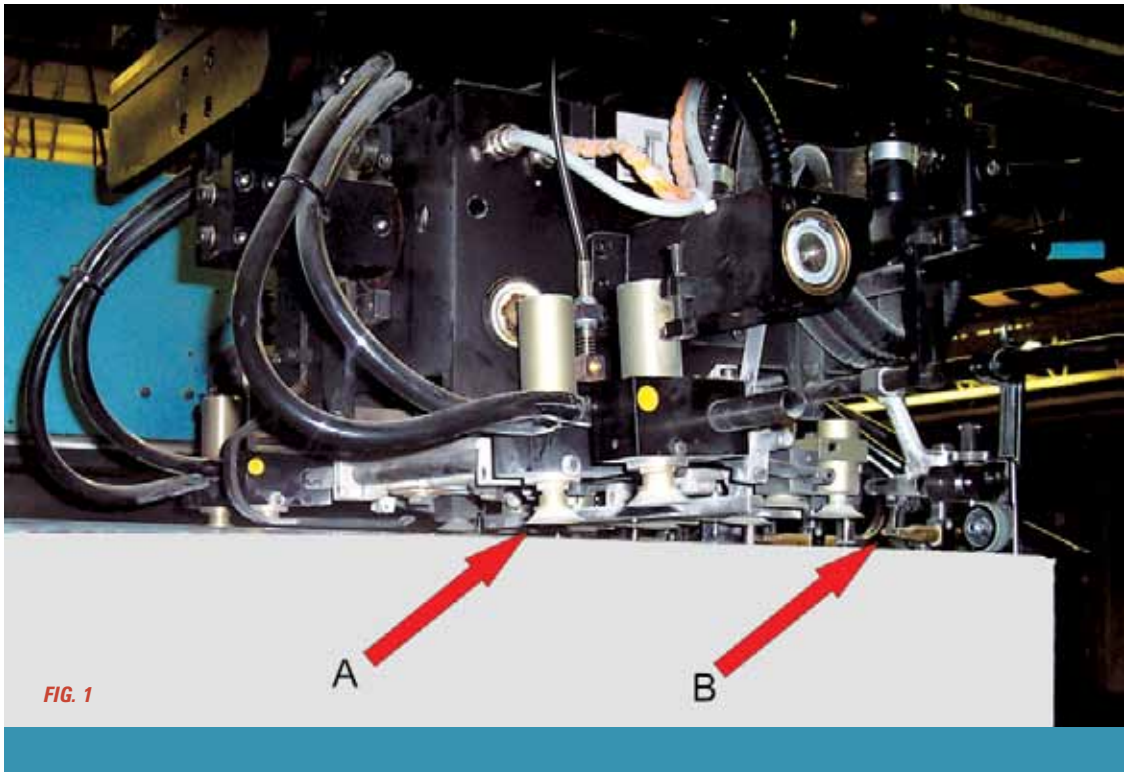


FIG. 1

Vacuum on a web offset press is often generated by what is referred to as a "pressure/vacuum pump." This electrical vacuum pump generates BOTH vacuum and pressure where the exhaust port of the pump is used for the pressure generation. Vacuum is for vacuum pick up, and pressure is used for separating the thin sheets of paper to enable a single sheet lift. In *Fig. 1,* the vacuum cups are highlighted by arrow "A" and as highlighted by arrow "B," air nozzles are positioned just below the top layer of paper, which creates separation. The vacuum cups grip the top sheet, and lift and drag the leading edge into the printing press. At the same time, a bristled brush head is sometimes used to keep other sheets down. Not very technical, but effective nonetheless.

Vacuum cup selection in this scenario is not crucial except that the cups selected must have a flat, wide diameter location surface to prevent deformation of the paper. This is in contrast to the next application.

WOOD PANEL AND SHEET METAL HANDLING

Unlike paper handling as described previously, wood panels are normally very heavy. They are also very flat. Finished panels also have a very smooth surface. These three characteristics create enormous problems, but the fourth and normally the most problematic to the user is that they are porous—a whole host of characteristics that offer difficulty lifting only the top sheet.

The actual application will determine which of the following methods are the most efficient. However, the following methods used either by themselves or together, offer a good single panel handling solution. Bellows vacuum cups offer an individual lift feature independent of the actual machinery movement. Therefore, when vacuum is applied, the bellows cup will pull the panel upwards. If you use two separate systems, as shown in *Fig. 2,* one side of the panel is lifted just before the other. This creates a "peeling" effect, which breaks the seal on one side of the panel. When circuit two is activated, the panel is drawn vertical with the cups in circuit one.

One of the simplest methods of avoiding vacuum from being drawn through to the second sheet due to the porosity of the wood panel is to use the correct size vacuum cups. Quite often, particularly on wooden panels, vacuum cups in the region of 150-mm diameter (6-in.) are used. Each of these cups offer in excess of 200 lbs per cup at 20"Hg. The smaller the diameter the vacuum cup, the less surface area and consequently the less air "drawn" through the top layer. For example, a 2-in. diameter vacuum cup at 20"Hg offers 30 lbs at 20"Hg. Ten of these, of course, will handle 300 lbs, more than enough for a 8 ft x 4 ft wood panel.

There are certain vacuum cups that offer a pressure ring within the vacuum cup itself. *Fig. 3* shows a cut-away view of a cup that uses two O rings as the vacuum seal. Compressed air is blown through the central area at the same time vacuum is applied to the outer ring, "pushing" the panel underneath, away from the top sheet. However, this method requires more control equipment, and less choice of manufacturers are available to the vacuum user.

Handling metal sheets has the same issues experienced in handling wooden panels. Porosity is not a characteristic when handling steel, however, but an oil film often is. The oil used to in steel storage or production creates a large problem when vacuum cups are used for handling the sheets from a pallet. In most applications, a dual circuit (circuit A + B) as described above is very effective. Users often use a mechanical separator, such as a sprung steel "finger," that traps the second sheet when the top sheet is lifted. The correct vacuum cups are crucial in this application. Ones that are flat offer the best solution, as large bellows cups (often found in the stamping industry) create a deformation just underneath the first steel sheet, which itself creates a "vacuum cup" as it is pulled into the center of the large bellows cup. Bellows cups are popular in steel stamping as they are good at deforming to curved surfaces. However in de-stacking operations, flat cups should be used.

Consideration should be made to vacuum level, flow rate, and in particular, machine movement when handling thin sheet products. This article offers basic fundamentals, but of course each application is different offering its own set of unique problems. The methods described here offer a good starting point for handling one sheet at a time….every time.

This article is intended as a general guide and as with any industrial application involving machinery choice, independent professional advice should be sought to ensure correct selection and installation.

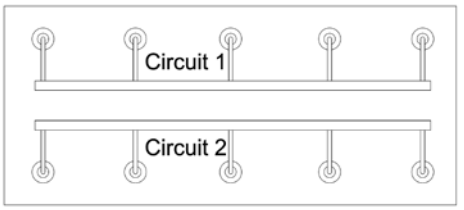
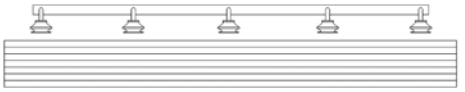


FIG. 2



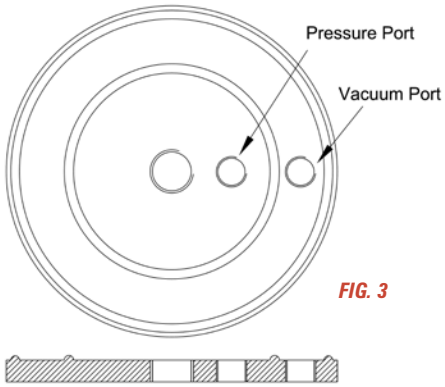


FIG. 3

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