

Contact versus Non-Contact Gluing a Corrugated Box's Manufacturer's Joint

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The Dilemma

Prior to the 1970's most manufacturer's joints in corrugated box were either stapled or glued with a "pot and wheel" system. Since the advent of resin-based adhesives and closed, extrusion application systems, the possibility of running higher speeds with more accurate glue pattern placement became a reality. During the last 30 years, most of the systems installed were based on low-pressure adhesive system and a simple head that contacted that board, usually at an angle. The advent of faster direct-electric valves and further advances in adhesive technology have made jetting the glue from a distance away from the board a valid method for applying adhesives. Non-contact manufacturer's joint glue application can offer advantages for corrugated converters, but also come with some downsides.

Consideration should be given to the adhesives that will be used for either contact or non-contact gluing before switching a machine from one to the other. Further, pattern flexibility and the glue station should be weighed before settling on the best application method for glue joints.

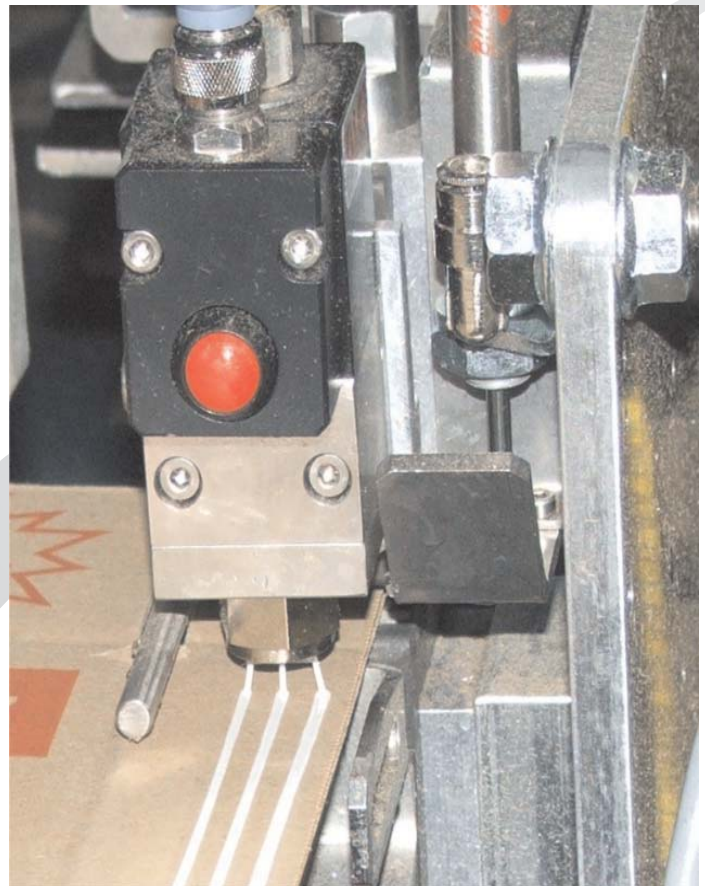
Adhesive Issues

By far the most central player in the question of contact vs. non-contact gluing is the adhesive. In fact, only advances in resin-based liquid adhesive technologies have allowed non-contact gluing to become a possibility. Early on, extrusion adhesives were loosely based on glue-pot adhesives and would not have stood up to the pressures and ejection velocities of a high-speed non-contact system.

Viscosity

Contact extrusion systems typically use adhesive viscosities between 1000-3000 Cps with solids contents between 50 and 65%. The question of viscosity is important to the extent that sufficient volume must be extruded from the head, but the orifices in the head are between 1mm and 1.5mm in diameter. Due to the large openings, sufficient quantity at these viscosities is available to flow directly from the orifice to the board while part of the orifice is touching the board.

In contrast, non-contact applications require the adhesive to be much thinner in order for it to attain the velocity required to jet cleanly and cut off cleanly from the orifice. Typically, non-contact adhesives are between 200 and 800 Cps, with solids content of approximately 50%. Because the orifice sizes are generally less than 1mm, the lower viscosity is even more important.



Typical non-contact adhesive application

Pressure

In addition to using thinner adhesive, higher pressures are required to jet adhesives non-contact. With contact applications, the contact with the board helps draw the adhesive out of the valve and onto the board. Because the adhesive must be ejected as far as 10mm to the board, sufficient pressure is required to develop enough velocity for the stream to reliably apply the glue in the correct position. If the glue pressure is too low, the stream will not be straight and buildup will occur on the nozzle tip.

Trailing

Trailing is the presence of glue on the flap or fourth panel after the pattern is supposed to end and occurs after the valve has shut off. Trailing can occur in both contact and non-contact applications. In a contact scenario, trailing occurs because the applicator head is not at the right angle for angled heads and for straight heads, the cause is usually that the board is not making good contact with the head. However, trailing can occur in non-contact applications due to quality adhesive, a sluggish or plugged valve or the valve adjusted too high off the board.

Pattern Width Limitations

Non-contact glue stations are typically constructed using one large valve and a multi-orifice (2-4) nozzle or 2-4 individual single-orifice valves in a row. As a result, pattern widths are generally limited to 2-4 beads on 1/4" centers or a total bead width of approximately 1 inch. While this is often satisfactory for smaller machines running boxes with smaller tabs, larger tab sizes will not have sufficient coverage. Contact systems offer the advantage of using interchangeable applicator heads that can cover tabs up to 4 inches wide on standard glue stations or 6 inches wide on jumbo glue stations.



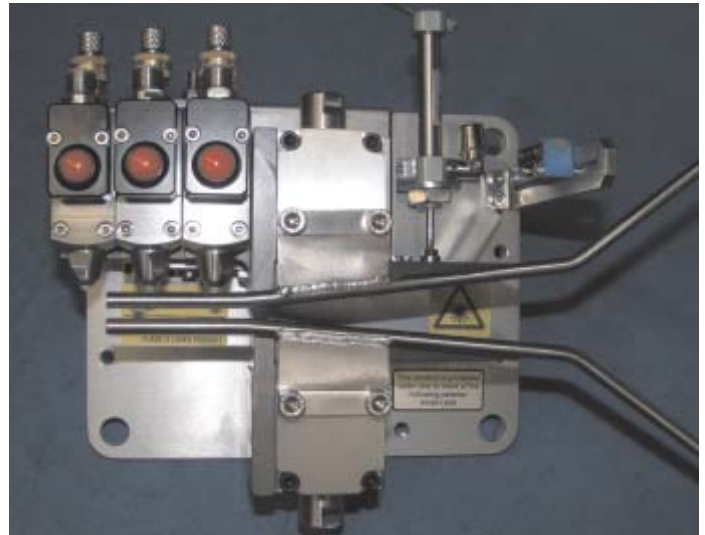
Contact glue station



Typical replaceable contact glue head with quick-change connector

Different bead lengths

By contrast, the non-contact glue station with multiple valves can actually apply beads of different lengths on one manufacturer's joint. This would be useful, for example, if a glue pattern was needed that was tapered at each end to match the tab angle.



Non-Contact, multi-valve glue station

Central Pumping Systems

Many plants operate with a glue tote located in a convenient place on the floor and are plumbed with PVC pipe to each Flexo-Folder-Gluer or Specialty Folder Gluer where the glue pressure is regulated down. In this case, switching one machine to non-contact adhesive will, in most cases, require a different adhesive product entirely, or at least a thinner formulation of the plant's existing manufacturer's joint adhesive. This means individual drums need to be brought to that machine and a pumping system needs to be installed.

Cost

In many cases, a higher quality adhesive is needed to accurately glue using non-contact. This will often lead to a higher price per pound for the new adhesive. The plant should weigh the process improvements expected from non-contact application with the additional glue cost.

Pattern Flexibility

Non-contact and contact methods of glue application both apply good quality beads to the manufacturer's joint. However, there are limitations to each method that need to be considered before dedicating a particular machine to one method.



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Glue Station Considerations

As the mechanical application point of the glue, the glue station can mean the difference between large numbers of defects or consistent production on any machine. Both contact and non-contact stations have special requirements that need to be considered when selecting or upgrading equipment.

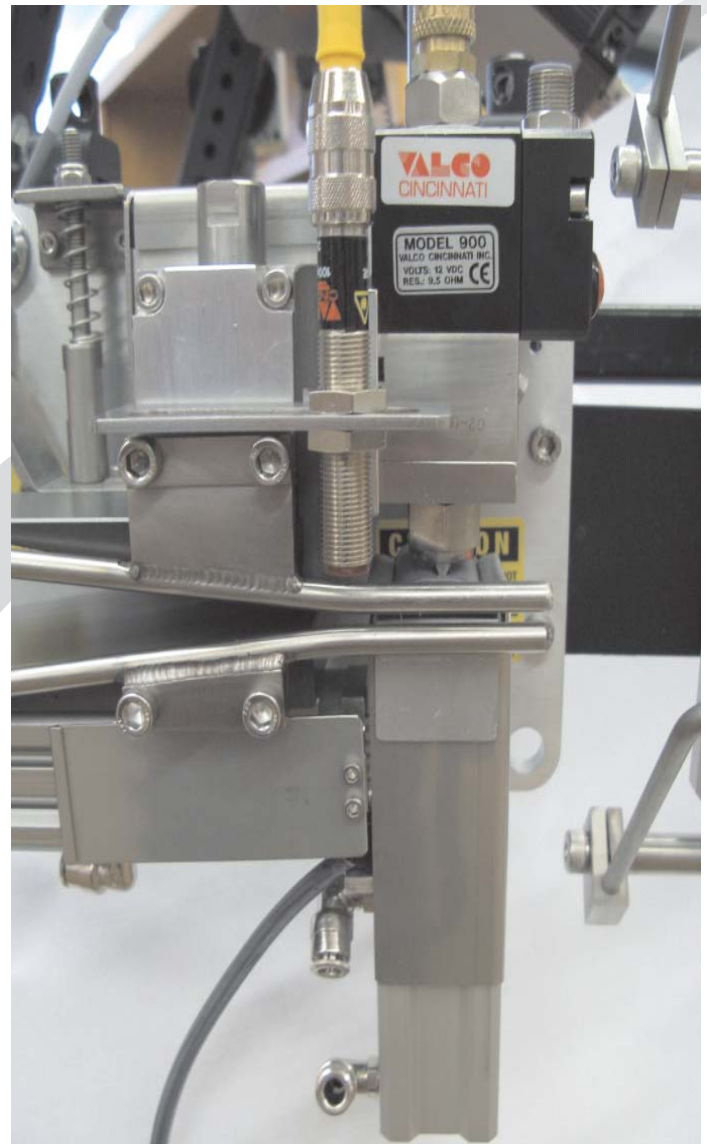
Tip Sealing

Because of its smaller orifice size and longer restriction length (the length of the small hole in the nozzle through which the adhesive is dispensed) non-contact orifices plug faster due to glue drying. This effect is made worse with fast-drying aggressive glues used for special board types. If the machine is not running boxes for even a few minutes, enough glue may dry in the tip to improperly glue the first box through the station.



Typical non-contact adhesive nozzle

For this reason, tip sealers are often required that cover the nozzle tips while no board is being fed. As soon as board is fed, the tip-sealer uncovers the nozzle and the adhesive in the nozzle is fresh and the first box is perfectly glued. Without this additional feature, the "first boxes" should be sorted out of the stacks. Worse yet, partially clogged nozzle tips cause adhesive to drip onto other areas of the box, especially on fourth panel installations, causing potential "stickers," or boxes that either stick closed to stick to each other.



Tip-sealer mechanism in sealing mode

Bottom-up

Typically, machines that require bottom-up application are not suitable for using non-contact gluing. Although it is sometimes done, the end result is usually glue residue that eventually builds up on the nozzle and valve which requires periodic purging and operator attention.

Board Guiding

Similarly, contact glue applications require that the board makes good contact with the glue head. When the board does not make good contact, the adhesive does not always adhere to the board but splashes out of the glue station in the direction of travel of the board resulting in contamination of the machine and the floor downstream from the glue station. It is especially important that springs or guides that constrain the box create a level, smooth flow through the glue station to apply a perfect glue joint. Any guiding issues are amplified by higher-speed

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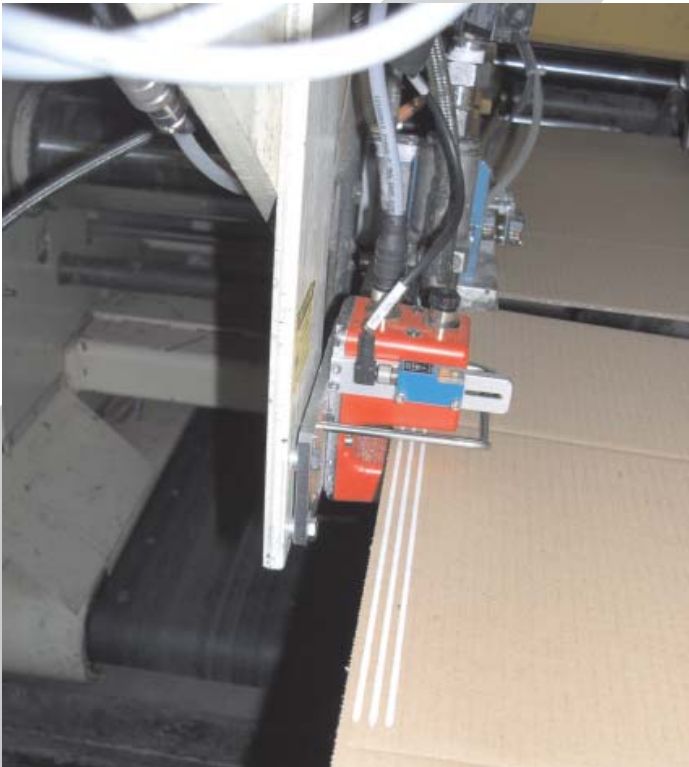
machines that run in excess of 20,000 boxes per hour.

Setting Up a Non-Contact System

If the plant is 100 percent contact gluing, it may be worthwhile to run a non-contact trial on a particular machine to see if the customer reject rate is lower and if operators and maintenance staff can support the new method.

When installing and setting up the system, care should be taken to keep the nozzle tips approximately 1/4" away from the board. This keeps the tips close enough to get good pattern results, but far enough away that the board cannot accidentally touch the tip and disturb the glue application.

Depending on adhesive viscosity and nozzle orifice size, glue pressures will have to be at least 80psi at full speed and often as high as 150psi. The plant's adhesive supplier should be consulted to supply a high-quality extrusion adhesive suitable for non-contact valves. Electric valves should be exclusively used because of their fast opening and closing times and their repeatability. These valves typically require special settings in the glue control.



High-quality, high-speed fourth panel glue joint application

Either Contact or Non-Contact gluing can produce a defect-free manufacturer's joint if consideration is given to the equipment and adhesive selection, as well as the product mix, to be run on the machine.

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