VALCO MELTON™

GLUING & QUALITY ASSURANCE SYSTEMS.

White Paper on Corrugated Gluing with Valco Cincinnati

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Valco History of Summary of Technology

1. History of Valco Cincinnati.

a. Company Formation:

B.L. Thomas founded Valco Cincinnati in 1952. Valco Cincinnati was derived from the original name “The Valve Company”. Mr. Thomas had a PhD in chemistry and was employed at the Proctor and Gamble Company as the technical expert for edible fats and oils. Initially Valco sold on a part-time basis a special safety shutoff valve for gas lines in commercial buildings.

b. Industries were first served by Valco:

In the early 1960's the business expanded to include a distributorship from Vansco Products in Los Angeles for a simple line of cold adhesive hand gluers and specialty valves and brackets for sealing boxes and cartons in the packaging industry. By 1967 Mr. Thomas' love for glue valves and packaging machinery made it a full-time business. Soon Valco had its own identity with a proprietary line of cold adhesive application equipment still directed at packaging.

Box-maker's know that end users seal RSC boxes with a case sealer that applies hot or cold adhesive or pressure sensitive tape. In the late 60's and 70's as case sealers were converted from the old mechanical pot and roll applicators Valco was very successful in retrofitting these antique machines with cold glue extrusion or spray systems.

These systems allowed the new PVA adhesives to be used in an enclosed environment providing better seals, at lower cost with less compression time. We were also quite successful in eliminating the old paste belt systems on roll through labelers with a specially designed cold glue extrusion system.

By1973 the product line which consisted of some basic components had proven so reliable that they formed the basis for new product expansion and entry into other industries. One of these special components the 362 valve (later the 366 valve) formed our foundation in corrugated and the paper converting industry.

c. First product introduced in corrugated:

In 1976 Valco revolutionized glue lap application in the corrugated industry with the introduction of Flexoseal®. It was developed, tested, and proven at CCA in Dolton, Illinois on an S&S 701 flexo folder-gluer. Valco then followed up with three major innovations for corrugated manufacturers: The Jam Preventer System, the cold glue and hot melt extrusion system for General and Universal tapers and the multiple head extrusion system for specialty folder gluers. Since 1977 Valco Cincinnati has averaged as many as 300 Flexoseal® systems per year for folder-gluers and flexo folder-gluers. Most plant machine operators today don't recognize or even remember the glue wheel as the standard gluing system.

Mr. Thomas sold the business in 1983 to three long time senior employees of which two remain as co-owners.

2. Summary of the development of detection systems:

In the early 1980's, Spraymation pioneered non-contact gluing for high-speed gluing in the folding carton industry. Without a marketing organization they launched their technology through Mactron. Mactron was extremely successful and owned about 80% of the folding carton market worldwide but refused to invest in new development and bring their products up to date. Shortly, they were eclipsed by Pafra, Valco, hhs, Dynatec, Vansco all of whom had developed non-contact gluing technology. Pafra became the industry leader with a small valve and an early microprocessor-based control. Since that time, there have been mergers, acquisitions and bankruptcies but Valco Cincinnati continues to be the leader in water-based application systems. Non-contact technology migrated into other industries such as printing, envelope, graphics and other specialty paper-converting applications.

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Quality assurance products in the folding carton industry evolved along different paths from the corrugated industry. Sensors were designed with single beads in mind. Control/inspection platforms were multi-channel to accommodate the number of glue valves on a typical box. Early on, UV and microwave sensors dominated the industry. These were less effective than the optical and laser sensors currently in use. During the 1990's, methods were also developed to check for skew, bar-code, color-code, print density, window detection, etc. Further, a great deal of technology was developed to eject cartons from the stream. The pharmaceutical industry as well as initial investments surrounding ISO-9000 drove a great deal of the demand for folding carton quality assurance products. Unfortunately, many of them are no longer in use. Because of the speeds (over 600 mtrs/min) and complexity of these machines, systems are more complex and costly.

Valco's roots are in corrugated. Our strategy was to listen to customers in the corrugated industry. Reliability and simplicity are paramount in order for an inspection system to be accepted by operators and successful on the floor.

Although widely recognized in the corrugated industry, Valco also has the most widely recognized color-code reading system in the world primarily used for folding carton machines. Unmatched for speed, ejection performance and ease-of-use, Valco's system solutions in folding carton are also growing in popularity because of the multitude of personal contacts available to customers for troubleshooting, installation and service.

3. Development of Valco's experience in the corrugated industry:

After Valco developed the Flexoseal lap gluing system in the 1970's, corrugated plants have continued to run these reliable, easy-to-operate systems literally for decades. Our direct sales/service group has been calling on corrugated facilities for more than 25 years. Our survey of purchasing patterns by major plants over the last 18 months shows that most of the equipment in these plants is older and still running.

Innovations since the introduction of Flexoseal have focused on improving the accuracy, maintainability and speed of contact applications. From the 362-valve to the 366-valve (1983), maintenance intervals grew, cycle rates increased and glue pattern cutoff improved. During this period, the adhesive companies devoted development to improving adhesives for pressurized systems. Early adhesives were pot-glues that had fillers, were very viscous and poor viscosity consistency. Modern resins are resistant to shear, setup quickly and have better bond strength. More recently, Valco switched the industry to electric valve technology. Electric valves surpass pneumatically-activated valves in longer maintenance intervals, more accurate pattern placement and easier rebuild.

The primary difference between traditional folding carton and corrugated is that corrugated continues to be successful with contact gluing. Contact gluing is proven for top-down and bottom-up on both the tab sides and the fourth-panel sides. Clearly, non-contact gluing in bottom-up applications is not a desirable alternative. In non-contact gluing, nozzle clogs or problems with dried glue result in bad boxes. In contact applications pattern quality is much more robust. Advancements in glue station design (Valco's Boardrunner) ensure better contact gluing accuracy.

Early efforts in quality assurance in corrugated began with jam prevention. As possibly the least expensive way to avoid costly downtime and product waste, Jam Preventors provide up to six locations of jam detection on each machine.

During the 1990's, customer demand and other quality systems drove the need for detection systems in corrugated. Valco developed sensors unique to the demands of corrugated applications. Early industry sensors included UV and unsophisticated capacitive technologies. Over ten years of experience later, Valco installs a special two-sided capacitive sensor with industry leading switching frequency. This has proven to be a robust sensor that is easy to clean and maintain. Valco's sensors are waterproof and mount downstream from the glue station. In particular, Valco uses analog sensors whose signals are analyzed by the software. Typical digital sensors must be calibrated and tuned on each machine to match the board conditions. Valco's sensors require no user-adjustments. The biggest challenges in glue inspection for the corrugated industry are acceptance and training of operators.

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4. Challenges faced with high-speed converting machines:

The biggest challenge during the last two decades has been designing and installing gluing equipment in a huge variety of machines of different vintages. As house supplier for the Bobst-Martin group, Valco regularly installs systems in brand-new Martin machines that are smoothly integrated into the machine. However, the vast majority of US installations are older machines that were never designed with gluing systems in mind. In many cases, the folding section begins immediately after the slotter leaving little room for a glue station. In other machines, lugs make the conveyance of the board through the glue station poorly controlled. Belt slippage, board skew all result in poor quality glue patterns that are attributable to the machine.

Machine manufacturers have still not developed equipment to remove faulty boxes from the stream. Manufacturers of folding carton and specialty folder-gluer equipment such as Bobst and Alliance (J&L) both have high-speed ejection systems that remove cartons from the machine if the quality assurance system has labeled them as defective.

Flying tabs from slotter section plague tab-side installations. The tabs can become lodged in the glue station, cause false triggers of glue or get folded into the box all of which contribute to defective product. Installations on the 4th panel run more cleanly, but the applicator head is difficult to access on the 4th panel side.

5. Persistence of gluing issues:

Most corrugated plants have consistently invested in spare parts to keep their equipment in running order, but has not spent to rebuild systems to “like new” or upgrade to newer technology from Valco. Valco sales/service contacts report that they are unable to help plant managers reduce issues because Valco is not a qualified vendor for new systems. Purchases of competitive equipment have been found turned off, adding to the frustration. Some plants are still using valves that were designed in the 1970's. Although Valco is proud that the equipment is still performing satisfactorily, there is probably room for improvement 30 years later.

6. Opportunities for improvement:

Within the Valco organization, there is a combined experience in the corrugated industry that is unparalleled by any other supplier of gluing equipment.

Various levels of upgrades to existing equipment would offer improvements like Autoglue (automatic glue length computation – no set-up time), glue volume regulation with machine speed, simple touchscreen control interfaces and glue balancing regulators. Replacement of control units would allow adhesive inspection to be integrated with gluing equipment. During upgrade installations, sales and service personnel can advise plant management of process issues that inhibit optimum production.

7. R&D investments:

Valco maintains a staff of over 30 engineers devoted to development of more robust gluing and quality assurance products. Instead of using new technology for new technology's sake, engineers combine field experience to create tailored solutions to problems that are universal among corrugated plants. While Valco also leverages technology among its many industries, we are unique in our installed base and experience in the corrugated market. Corrugated equipment is sold exclusively to the industry and is designed and built with the users in mind.

New development includes: software for analysis of machine performance/defect data, improvements in sensing technology, networking of Valco equipment with plant systems. Newer, more sophisticated sensing techniques are also under development. Ultimately, end-users and OEMs drive demand for new features and new equipment.

8. Role of adhesives in the corrugated plant:

There are basically three valve types offered to the corrugated industry from Valco Cincinnati. The most common are the 366 contact extrusion valve, the model 900 contact/non contact all electric valve, and the model 300/400 high speed non contact valve for specialty folder gluers. All of the valves perform well using industry standard water based adhesive from a multitude of suppliers. Normal adhesive criteria include a limited amount of fillers or preferably 55% solids (+/- 5%) and the appropriate viscosity rating for the valve.

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It is just as important to consider that quality adhesive performance depends on the control of the substrate at the point of application. Failure to recognize this important fact will severely impact the performance of equipment and adhesive. Another important point is that the operator knows how to program the pattern controller so that the pattern starts and stops are positioned accurately on the board and not firing prematurely or trailing causing blocking, jams, downtime and damaged product.

Basically the operator must understand how an electronic gluing system functions and operates. They should be able to notify maintenance that the system requires attention when it is beyond their means.

No matter which system you use from Valco or other, it must be neatly installed, in the correct location with the proper parent machine interface (encoder) and a control that fits the application need. This includes the glue inspection system which sometimes is seen as a need but not a necessity.

Our recommendation to improve the reliability of the glue application process in plants would be to make sure that management's vision and knowledge of a faultless gluing operation extends through each plant and the entire organization. Proper care and use on a day to day basis of the proven Valco Cincinnati Flexoseal® lap gluing systems are our recommendation to improve the reliability of the glue application process in plants.

The most important aspect of gluing is having a reliable system that operates day-after-day, year-after-year. Valco Cincinnati has consistently proven it for 30 years.

9. Industry survey

In the corrugated industry Valco sells to OEM's and end-users approximately 300 Flexoseal® lap gluing systems annually worldwide. With over 8,000 systems sold, Valco Cincinnati products have taken their rightful place in the corrugated industry. We take pride in the fact that our systems are used every day and are not turned off.

Valco offers three basic Flexoseal® lap gluing systems for folder-gluers and flexo folder-gluers each with different features/benefits and costs to meet the plant's requirements. The middle range system (VC350AG) and the upper range system (OT12 with glue inspection) are most popular. Customers strongly prefer the all electric glue valve for maximum performance. In most cases, the customer investigates the most desirable system and then buys based on budget restrictions. If glue inspection is required then the high performance and higher cost package will be required.

Valco recommends the Flexoseal PRO touchscreen control system and electric valve for maximum flexibility and performance.

Quality in corrugated gluing:

1. Valco in-house quality system:

Valco Cincinnati is registered to the ISO-9000:2000 quality management system. Valco maintains the quality system at every level of the organization including sales, engineering and manufacturing. Our quality handbook is available upon request.

2. How detection works:

The Valco inspection system is triggered by a photocell. The box trigger needs to look at the same portion of the box (tab or fourth panel) that the sensor does. The trigger can be downstream from the sensor. The box passing through the gate sensor generates an analog signal which is analyzed by the software. The glue pattern start and end points are located and any gaps or volume errors are analyzed. If the box is faulty, a marking valve sprays the bad box downstream in the machine. This box must be manually removed, generally after the stacker. Detection with other sensors such as skew, bar-code detection, RFID detection etc. works in the same way.

For the purposes of determining a bad box, sensor readings can be compared to the distances entered in the control or with a sample reading.

3. Possible causes of misreads or good boxes being rejected as bad:

If inspection tolerances are set so that normal pattern variation falls outside the tolerance bands, false alarms will be triggered. Normal tolerance ranges for corrugated customers are between 0.25” and 1.5”.

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If the sample readings for length and/or volume are done under poor conditions, not only will there be false alarms when normal conditions are reached, but boxes that match the bad sample reading can also be passed. For this reason, Valco systems will also inspect directly from glue pattern data input from the user or from the AutoGlue system.

Excessive buildup of wet adhesive on the sensor can cause the sensor to false trigger. Glue buildup pushes the output of the sensor up so that the total signal deflection is not captured.

Tabs can be a major source of false alarms. Tabs that trigger the glue sensor when there is no box will trigger a misread. Although this will not cause waste or pass a bad box, it does cause nuisance alarms.

4. Expectations of inspection system:

The tightest tolerances that can be entered into the system are +/- 1mm or +/- 0.01 inch. For a machine that is either new or has been painstakingly rebuilt, tolerances of +/- 0.25" or 5mm can be achieved without unreasonable waste. Improving the processes on a machine includes rebuilding/maintaining the machine in excellent condition and understanding machine capability, including the glue station. Valco adhesive detection systems monitor glue pattern start/end as well as gaps and glue volume. Tolerances are set individually for each condition.

Other Topics:

1. Upgrading older equipment:

Valco's customers have historically experienced a high quality of service and support from Valco Cincinnati through their local sales/service people. Valco is the only vendor that offers both contact and non-contact systems with a proven track record in the industry, including significant commitments from machinery manufacturers.

If you have an older Valco System such as VC-350I or VC350M with dated 1970's pumps, valves and regulators that have proven to be costly to maintain, they should be replaced by the current Flexoseal-Pro technology from Valco.

Various levels of upgrades to existing equipment would offer improvements like Autoglue (automatic glue length computation – no set-up time), glue volume regulation with machine speed, simple touchscreen control interfaces and glue balancing regulators. Replacement of control units would allow adhesive inspection to be integrated with gluing equipment at very low cost. During upgrade installations, sales and service personnel can advise plant management of process issues that inhibit optimum production.

2. Training during installation

Systems are professional installed by Valco service technicians, Valco sales/service personnel, or we provide supervision for plant personnel to install. Following the installation and startup of the equipment, we utilize our local, direct sales/service person to provide training during the initial phases of startup until plant personnel are comfortable. If desired, we conduct training seminars at the plant given by our local sales/service personnel. Maintenance training is included with operator training during the installation and startup.

3. Recommended spares:

Recommended spare parts lists are either included with the system quotation or available in the operator manual. Spares requirements vary with each type of system. In addition, local sales/service personnel make periodic visits to review spares stocks.

4. Systems in Kit form:

Gluing system components all have repair kits (pumps, regulators, valves, etc.). They all contain strategic parts to put the equipment back in "like new" operating conditions.

5. Variations from desired gluing results:

Variations from the entered values for glue start, end and volume can come from a number of sources (incorrect cell-gun dimension, poorly installed photocells, incorrect encoder ratio, poorly set pressure curves, adhesive variations). In sampling mode, whatever the glue pattern looks like at the time of the sampling is used as the standard. In this case, the target becomes the current pattern. If the data in the integrated control is used as the standard, the target is the entered data. This mode forces operators to maintain consistency between entered data and pattern outcome.

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6. Applicator head recommendations:

Most customers use 0.060" holes on standard applicator heads and 1.5mm holes on Boardrunner applicator heads. Three and four hole heads continue to be the most commonly used. Center distances are usually 1/4". Some customers, though, have standardized on 1/8" centers and 0.40" holes. The Boardrunner patterns are unique in that they are flatter and more controlled than the extrusion beads on older systems. Glue consumption is usually reduced.

7. Housekeeping recommendations:

- Excessive buildup of wet adhesive on the sensor can cause the sensor to false trigger. Glue buildup pushes the output of the sensor up so that the total signal deflection is not captured.
- Tabs can be a major source of false alarms. Tabs that trigger the glue sensor when there is no box will trigger a misread. Although this will not cause waste or pass a bad box, it does cause nuisance alarms.
- Flying tabs from slotter section plague tab-side installations. The tabs can become lodged in the glue station, cause false triggers of glue or get folded into the box all of which contribute to defective product. Installations on the 4th panel run more cleanly, but the applicator head is more difficult to access on the 4th panel side.
- Applicator heads and nozzles must be kept clean. Buildup over long periods and lack of cleaning after the machine is down cause additional downtime. Valco offers an optional tip/head cleaning kit.
- Machine/belt slippage contributes to misapplication of glue and skewed boxes, which increases the defect rate.
- Clean electrical power is critical to good performance.
- Valco-supervised installations ensure consistent quality throughout the Weyerhaeuser organization.
- Photo eyes must be kept free of dust and adhesive.

8. Preventetive maintenance recommendations:

- Glue Filter system plugging causing lack of glue volume or pressure to the system is the # 1 issue that Valco's field service people deal with in our plants.
- Valco's older 1970- and 1983-designed pneumatic valves are also a frequent cause of failures. These should be upgraded to the more reliable, 900 series, all-electric style valve.
- Older-style pneumatic regulators with Viton® diaphragms are also found to be defective by Valco Service Technicians and should be rebuilt every 6 months or replaced with the new style balancing regulator.
- See chart below for Valco recommended PM:

VALCO GLUE SYSTEM - MAINTENANCE PLAN	beginning of shift	end of shift	before break of more than 14 days	after break of more than 14 days	Weekly	Monthly	3-Month	6-Month	Yearly	as required
check glue source	x			x						x
flush system w/10:1 water/vinegar solution			x					x	x	
purge system w/glue				x						
clean or replace filter screen					x					x
check for proper air/ glue pressure setting	x									x
clean glue inspection sensor (optional)	x									x
check water separator (air regulator)					x					
purge glue valves	x									x
Lubricate disconnect fittings with grease					x					x
rebuild or replace quick disconnect fittings								x		x
rebuild model 366 glue valves w/seal kit							x	x	x	x
clean and rebulid glue valves/glue regulator									x	x
check scanner sensitivity						x	x	x	x	x
clean exterior of glue valves/ glue head	x									x
leave system under pressure (water filled)			x							x
clean and inspect 900 valve						x	x	x	x	x
coat nozzle tips with grease		x	x							x
check encoder for proper operation						x	x	x	x	x

The discipline of the PM schedule will save downtime in the future.

9. Adhesive selection:

There are basically three valve types offered to the corrugated industry from Valco Cincinnati. The most common are the 366 contact extrusion valve, the Model 900 contact/non contact all electric valve, and the Model 300/400 high speed non contact valve for specialty folder gluers. All of the valves perform well using industry standard water based adhesive from a multitude of suppliers.

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Normal adhesive criteria include a limited amount of fillers or preferably 55% solids (+/- 5%) and the appropriate viscosity rating for the valve. 366 valves should only be purchased for maintaining older systems. This is no longer the state of the art for Valco Cincinnati.

It is just as important to consider that quality adhesive performance depends on the control of the substrate at the point of application. Failure to recognize this important fact will severely impact the performance of equipment and adhesive.

Non-contact Boardrunner glue stations typically use up to 3 hole nozzles of 0.025" diameter. Non-contact patterns are limited to 4-bead applications.

Most customers use 0.060" (1.5mm) holes on standard applicator heads and 0.040" (1.0mm) on contact Boardrunner applicator heads. Three- and four-hole heads continue to be the most commonly used. Center distances are usually 1/4". Some customers, though, have standardized on 1/8" centers and 0.040" (1.0mm) holes. Some plants also use larger heads (up to 3.5" wide) for wide tabs and jumbo boxes. These pattern sizes require contact application. The Boardrunner patterns are unique in that they are flatter and more controlled than the extrusion beads on older systems. Glue consumption is usually reduced.

Adhesives used for Flexoseal systems should fall into the specification ranges below:

Contact Adhesives:
1500 – 2000 centipoise. Viscosity tested @ 72° F
Solids: 50 - 53 % solids
No abrasive filler

Non-contact Ahdesives:
300 – 1500 centipoise. Viscosity tested @72° F
Rheology – non-tailing, quick cut-off
Solids: 50 - 60% solids
No abrasive filler

Controlling adhesive consistency and quality will ensure good results from the gluing system.

Safety

1. Valco internal safety record:

Valco's TCIR (total case incident rate - # accidents*200,000/# hrs. worked) has been:

2001: 1.07
2002: 1.59
2003: 1.12
2004: 3.2

2. Safety concerns with Flexoseal equipment:

There are no significant safety concerns with cold gluing equipment. In working with hot melt, safety from burns is paramount. Safety instructions are included with operator manuals for the equipment.

The only additional safety concerns would be safety around machine parts that are near the gluing system (folding belts, scrap conveyers, etc.). Plants should be responsible for e-stops, lockouts and other machinery safety considerations.

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