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Fact Sheet

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Adhesive Systems for Textile Screen Printing

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Most textile screen printing requires some type of adhesive system to hold the substrate stationary on the press platen during the printing process. Because of their flexibility, textiles cannot be removed from the print platen between the different screen colors, as it would be impossible to reregister the image area.

The traditional and still most common method of applying adhesive is through the use of aerosol cans. They are convenient, easy to use and have a relatively low unit cost. There are alternatives available, including solvent and waterbase bulk adhesive systems.

How Textile Adhesives Work

Textile adhesives, either aerosol or bulk, are composed of three main parts: an adhesive solid, an evaporative solvent that acts as a carrier, and a propellant. The propellant, usually a compressed petroleum gas (propane, LPG, etc.) in spray cans, and compressed air in bulk systems; pushes the adhesive and carrier solvent through a nozzle onto the work surface. The solvent, usually a petroleum distillate or water, evaporates leaving the solid portion of the adhesive. The surface of the platen thus becomes tacky so that the textile substrate will adhere to it and remain stationary through the print process.

Aerosol Spray Adhesive Overview

Aerosol adhesives come in a variety of types, solids contents, spray types, and sizes. The most common type is a solvent base mist adhesive that sprays in a pattern similar to aerosol spray paint. These "mist adhesives" are quick drying, and very easy to use. On the downside, "mist adhesives" do not last through very many print cycles. Depending upon the particular fabric being printed, the adhesive may need to be reapplied as frequently as every cycle or it may last for several cycles. And, the mist overspray creates a considerable mess in the work area. Overspray lands on machines, floors, and people creating a housekeeping nightmare.

This overspray can also create an inhalation hazard due to the adhesive and solvent propellant. While significant effort has been made to reduce the hazardous chemicals in these sprays, there are still some chemicals that should be avoided. The biggest change in recent years has been the removal of Methylene Chloride due to the lowering of the permissible exposure limit by the Occupational Safety and Health Administration. Most MSDS's for aerosol spray adhesives still recommend the use of a NIOSH approved respirator, chemical resistant gloves, safety glasses, and mechanical ventilation by anyone exposed to these products if proper ventilation is not used.

The other major type of aerosol spray adhesive is web adhesive. Web adhesives have the advantage over mist adhesives in the reduction of overspray leading to considerable reduction in the inhalation risk of the adhesive itself. The web adhesive exits the can in a stream rather than a mist. Where it lands, it adheres like a mass of spider webbing. It still can be messy if the operator oversprays and does not aim well. The risk of propellant and solvent inhalation is still present.

Bulk Adhesive Systems Overview

Bulk adhesives come in two main types: petroleum based solvent and waterbased solvent. Bulk systems work either through an operator-controlled spray gun or an automatic full platen sprayer that is actually installed on the press. The gun systems work in a manner similar to a spray can. An operator sprays each platen as needed. However, with the bulk system, the gun does not empty out as quickly as a spray can and the propellant is usually compressed air rather than a petroleum gas. In addition, the precise aim of the spray nozzles significantly reduces overspray.

The automatic systems use a series of overlapping nozzles that coat the platens with adhesive. These systems are controlled in several ways. The two most common types involve a foot pedal controlled by the operator or a counter that can be set to apply adhesive over a set number of press cycles.

Advantages of Bulk System

The biggest single advantage of using a bulk adhesive system is the reduction in operating costs. Even with the cost of the equipment factored in, a bulk system can pay for itself in most applications. Only very small one and two manual press shops will have difficulty justifying such systems. Typical ROI's (return on investment) for bulk systems range from three months to one year depending upon shop size and volume.

A second significant advantage to bulk systems is the reduction of airborne hazardous contaminants in the workplace. Even the petroleum solvent bulk systems have a lower level of airborne contaminants. Due to the larger droplet size more of the adhesive ends up on the platen rather than airborne where it can be inhaled.

Advantage of Waterbased Bulk Systems

Waterbased bulk systems have the same advantages of the solvent bulk systems with one added bonus. They also offer a significant reduction in VOC (volatile organic compounds) emissions. Since the evaporative portion of the product is predominantly water, VOC emissions are drastically reduced.

The typical aerosol spray can of adhesive has approximately 0.3 pounds of VOC's. If a shop uses 6 cans of adhesive per day, 250 days per year, that amounts to 450 pounds of VOC's released per year just through the use of aerosol adhesives.

A busy shop with two automatic presses and two manual presses may use as many as 30 cans of adhesive per day. The VOC release for this shop would be as high as 2,250 pounds per year, just for adhesives.

The biggest drawback to the original bulk waterbase systems was that they were slow drying. The speed issue was a handicap in high production operations. The newer waterbased adhesive products combined with advances in spray technology have largely overcome this handicap. The newest waterbased applicators and adhesives dry quickly enough to be applied inline with no degradation in press speeds.

Flammability

Any product containing a significant VOC content as well as petroleum-based propellants has the potential for a high level of flammability (flash point lower than 140 degrees F.). Aerosol adhesives are no exception. Over 50 different adhesives were reviewed for this fact sheet. Every one of the aerosol products was listed as having a high level of flammability (level 3 and 4 on NFPA rating system). The solvent based bulk systems were also considered highly flammable.

The waterbased systems were all listed as combustible (level 2 on the NFPA rating system). A combustible product will not burn unless exposed to an open flame. Whereas a flammable product will ignite in the presence of sufficient heat only. Combustible products do not require special storage cabinets for extra inventory whereas flammable products do.

Explosion Hazard

An additional hazard with aerosol spray cans in a textile screen printing operation is the risk of exploding cans. Most textile screen printing utilizes heat to cure the ink. The heat is usually supplied by conveyor dryers with heat settings as high as 750 degrees F. There are very few screen printing operations that have not had the experience of an aerosol can of adhesive being bumped onto the conveyor and going through the dryer. The lucky shops had the can come out the other end. The unlucky shops had the can explode inside the dryer, usually causing significant damage to the dryer. There is also the risk, although low, that the explosion of an aerosol can that goes through a dryer could injure employees.

Alternative Application Methods

Bulk adhesives do not have to be applied with a sophisticated spray system. They can also be applied with a brush or roller. The advantage of this method is the reduction in the cost of equipment. The disadvantage is the slower drying time that could cause a delay in production. However, if application coincides with the normal break periods, delays can be greatly reduced.

Certain textile substrates do not work well with the manual application method. The printing of fleece products usually requires significantly more adhesive, and more frequent applications than do thinner substrates such as jersey or interlocks. The roller method would not be practical for fleece applications. However, a facility may opt to apply bulk adhesives manually, and supplement with aerosol adhesives when printing fleece.

One shop that was polled for this fact sheet did adopt this practice. By mixing applications, they went from using 6,250 aerosol cans per year to approximately 36 cans per year. Aerosol use was limited to supplemental spraying during fleece printing and sample printing on a manual press.

Adhesive Features Table

Type	Ease of Use	Product Cost	Explosive?	Flam. Storage	NFPA Flammability	NFPA Hazard
Aerosol Mist	Easy	High	Yes	Special	3-4	1-2
Aerosol Web	Easy	High	Yes	Special	3-4	1-2
Bulk Solvent	Easy	Low	No	Special	3	1-2
Bulk Waterbased	Fair	Low	No	None	0-2	1
Bulk Waterbased (rolled)	Fair	Low	No	None	0-2	1

Summary

The biggest hurdle to switching to bulk adhesives is the startup cost. The equipment may range in price from as low as \$250/press for spray gun systems to as high of \$2,500 per press for sophisticated automatic systems. However, the payback on bulk adhesive systems ranges from 3 months to 16 months based upon system type and usage. One of the best ROI's in the survey was from a company that bought 3 of the most expensive systems available for their automatic presses. They had a return of less than four months based upon both a reduction in adhesive cost and a significant increase in productivity.

The productivity factor cannot be overlooked. When press operators have to apply adhesive manually from a can, they cannot operate as quickly as when an automated system is applying the adhesive. The increase in productivity in the above example went from an overall plant average of 37 dozen printed an hour to 41 dozen printed per hour. This increase resulted in an increased productivity of 15,000 dozen impressions annually. This number is the equivalent of 400 hours of production on one machine with labor savings of over \$14,000 annually.

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