

Demystifying Adhesive Dispensing within the High-End Appliance Industry

By Jason Smith, Sebastian Wagner, and Robert Muscat, Sales Engineers at Scheugenpflug Inc.

Appliance designers are constantly evolving to satisfy the ever changing wants and needs of their consumer base. These changes filter down and include not only the materials but also the equipment used to dispense the material in the manufacturing processes. Moreover, the latest evolution of appliances also seeks to add luxury controls and eye-catching applications. This challenge then, of new applications and material dispensing, often means the application and execution of these increasingly complex materials present multiple challenges up and down the appliance supply chain. Successfully meeting the material dispensing challenge has the potential to spur growth significantly in the higher-end appliance industry as the manufacturing adhesion processes evolve to meet market demand.

According to a new report from Transparency Market Research the global adhesive market is likely to be worth \$55.8 billion by 2025 from \$34.3 billion in 2016. The global adhesive market is rising steadily due to several factors and demand for adhesives across industrial sectors is primarily driving the market. At present, adhesives are extensively used in the manufacturing of automobiles and aircraft due to their weight reduction and fuel efficiency benefits. As the demand for fuel efficiency and lighter structure becomes imperative, the need for adhesives is predicted to grow.

Applications - New innovative chemistries from material manufacturers allow thicker beads to cure in absence of atmospheric moisture from the air during the curing process. No fumes and no odor (as the common acetic acid “vinegary smelling” byproduct) is consumed back in the material during cure - instead of being emitted as in most RTVs and adhesives.

Typical common applications across the appliance industry found similarly to suit the aerospace and marine industries include:

- Panel and display adhesion
- Door and port-hole glass sealing/bonding
- Gasket-in-place dispensing
- Encapsulation of electronics

Manufacturers are dedicated to overcoming all obstacles to the dispensing challenge. With over 25 years of experience, Scheugenpflug is one of the leading manufacturers of innovative adhesive bonding, dispensing, and potting technology - including vacuum potting. By aligning key dispensing principles to high-speed automation systems, even difficult to serve applications can be addressed. The key items are the effectiveness and repeatability needs from high volume applications. This is exemplified in the basic framework in four key areas:

Quality Improvements – Require a high degree of accuracy and complete

elimination for deviation often observed from human fatigue. Automated systems must also be able to react to inputs from sensors.

Cost Effectiveness – Depend on the process design and a focus on outcomes. While delivery and functionality are often important, many applications are cost-constrained as well and if it cannot meet the market financial goals, it often makes little sense.

Work Environment – Demands that automation eliminate heavy and repetitive movements. There are many factors that play into the work environment that often go unnoticed. Automated systems allow for work environments which would be harmful or unsafe for humans.

Flexibility – Manual handheld applicators possess the ability to easily switch programs and allow for intricate dispense patterns not readily achieved by automated dispense programs. Yet automation allows for offline programming and easy transfer. All of these things must be taken into consideration when selecting the proper system or a combination of all. For instance, the pictured handheld applicator coupled with the A220 material pail feed replaces cartridges in the manual operation where more flexibility and increased throughput is needed for hard to reach.



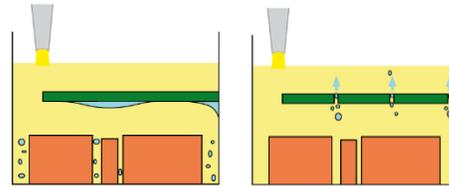
Dispensing Design Considerations and workpiece geometries pose new challenges to optimize dispensing. Working closely together with material manufacturers and dispensing companies (in a stage as early as the design and development phase) can be crucial to ease the manufacturing process in high volume production and eliminate problems in the potting process before they occur.

To protect electrical components from environmental influences or aggressive liquids, designers and engineers often choose to pot or encapsulate the component with a material specifically formulated for that application and environment. It is critical that the potting material reaches every corner of the part and does not leave air gaps in the finished parts which, when expanding and contracting due to temperature changes, can cause failure of the component.

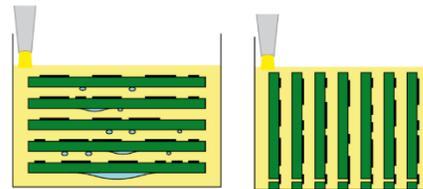
The right material selection as well as the choice for the right material preparation and dispensing equipment play a big role, but so does the design of the workpiece. Issues with entrapped air can be avoided before they even occur if the geometry of the component is considered and optimized for the potting process.

The more complex the workpiece geometry, the more complex the dispensing application will be to ensure the material covers all components without voids, but some simple considerations in the workpiece design can facilitate the potting process and positively affect equipment cost and cycle time.

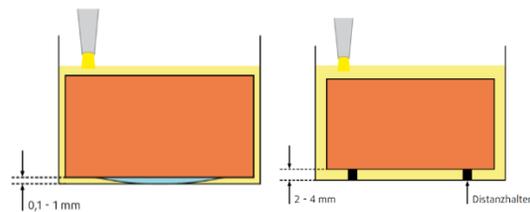
Small venting holes to allow air to escape:



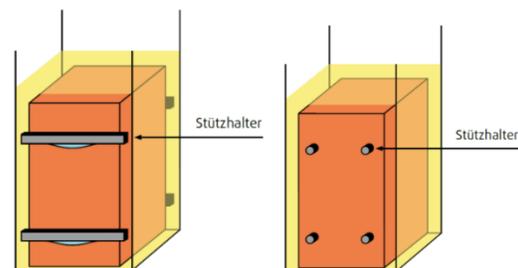
Components orientated vertically instead of horizontally:



Spacers to allow enough room for material to flow freely:



Selection of right type of spacer:



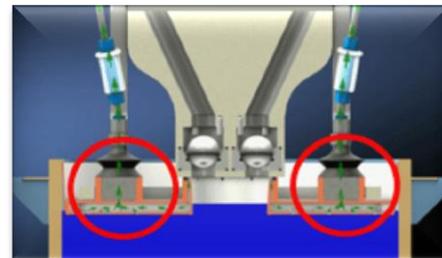
The importance of Waste Reduction

It has been mentioned that material dispensing plays a key role in in a manufacturing facility's waste reduction efforts. To illustrate this importance, a study various systems against the Scheugenpflug system was conducted and analyzed. The experimental approach at a major automotive manufacturer was to find the amount of waste that could be reduced, and the return on investment for the best and most suitable system that would continuously dispense formed-in-place gaskets. Waste from Form-In-Place Gasket (FIPG) processes can be found to vary from 3 to 20 pounds per 5 gal pail. In high volume applications, more than 5,000 pails per year can be used in a single plant's operation. With the cost of these engineered materials rising and ranging from \$200 to \$600 USD per pail, the savings potential adds up.

Scheugenpflug's ergonomic and visually aesthetically pleasing A220 and A280 systems, incorporating its patented follower plate design, brought residual remaining material wastes down to 0.33 pounds per bucket. A complete order of magnitude less than the competitor's equipment. The system further eliminates purging and gets to all of the material in the pail leaving less than 3% residual material in the pail. No need to call the hazardous material disposal team in. The advanced control system of those machines counts pump strokes and is able to help predict and monitor maintenance preventative schedules.

In summary, Scheugenpflug system offers a 3 year ROI and 20% Rate of Return. The

savings began paying back in year 1 and amounted to a quarter of a million dollars per year!



The Equipment Matters - Not all equipment is created equal. Scheugenpflug systems are scalable and designed to eliminate air bubbles and any damage to the materials. The company's core capabilities puts itself in alignment to be one of the industry leaders in the areas of potting, adhesive and thermal management, seal and gasket formation, and onsite support.

Potting systems are reviewed to meet the original designed intent and longevity. All builds are thoroughly tested for maximum output with a variety of incorporated functions to meet application and material demands:

- Vacuum - for a void and moisture free dispensing atmosphere that prevents air bubbles from being trapped, which otherwise would be causing subsequent damage.
- Heating – for assisting material flow.
- Bubble-Free Degassed Material – eliminates entrapped air infused into the material.
- Mixing – most accurate mixing through volumetric design.
- Recirculation – ensures material homogeneity at the point of dispense.

The Adhesive and Thermal Management Material Dispensing piston pump design allows for continuous material supply and high flow rates. The equipment is suited for highly abrasive and highly filled thermally conductive media. Users benefit from long service life and simple, fast maintenance.

- Waste reduction to drive improved ROI

- High dispensing speeds for high volume applications
- Rugged designs that can handle engineered materials
- Operation at low pressures prevents material damage

Seal and Gasket Formation technology focuses on being robust and stable operational solutions. Scheugenpflug dispatches simple solutions to handle the most difficult challenges. Deliverables include a variation of a wide range of equipment offerings:

- Handheld Systems from mobile bulk containers (see above)
- Modular standard equipment
- Highly integrated dispensing systems for high volume applications

Finding ways to minimize downtime is often overlooked. Highly filled materials and pastes cause excessive wear and tear of the production equipment on the production floor.

Improvement to Quality

While waste reduction and equipment selection are critical factors, perhaps the most critical to consider is the cost of poor quality. Many formulations of reactive adhesives require mixing components in an accurate ratio. To select a machine, several questions must be answered:

1. What material is to be dispensed (epoxy, polyurethane, silicone, etc.)?
2. What are the characteristics of that material which will affect metering (viscosity, component ratio, filled or unfilled, abrasive or non-abrasive, pot life)?
3. Application, production rate, volume requirement, continuous or intermittent dispensing?

The reality is that the basic methods to dispense materials is available to all manufacturers of meter, mix and dispensing equipment. It is the degree of sophistication governing the driving and monitoring of these devices which varies from manufacturer to manufacturer, as does the cost.

To put this in financial perspective, the cost of poor quality is often the dominant expense factor on a per part basis. Of the four major cost-drivers - equipment, material, labor, and yield - yield costs can represent sixty percent or more of the finished part cost.

What is driving the yield costs in these applications? The main drivers of yield consist of the production rate of good parts, the number of defective parts produced and the costs of the defective parts.

Good engineering practice is to consider the effects of poor dispensing on the defective material rates. These factors include an inaccurate mix ratio, excessive system operating pressure, lack of effective feedback and control, damage to fillers and materials, and finally, the creation and presence of voids in the potted material.

In summary, in a high-volume production environment like appliances, it is essential that high levels of throughput be maintained while at the same time producing only good parts. This way, cost competitive products can be manufactured and delivered to consumers.

To do so, efficient manufacturers ensure that the dispensing systems specified are of high reliability to minimize downtime. At the same time, use of effective feedback and control systems reduce the cost of poor quality. Together, this approach helps appliance manufacturing engineers achieve the lowest cost per good part produced.

**Future Development:
High Speed Dispensing**

This equipment setup is being released today to the automotive industry, but has potential for the appliance industry. During the dispensing process, robots are used to do the difficult tasks to toting the high speed dispense head filled with engineered material. The automation is independent of the dispensing process challenges, yet they both work hand-in-hand to improve efficiency and throughput. More experimental trials need to be done to determine durability and feasibility for this industry including process capabilities in a full production setting.

performance hasn't been heard of. This technology can also be transferred to appliance manufacturing and assembly operations.

**Summary**

Several manufacturers' equipment offerings are available to dispense materials used in appliances. Today, all equipment is designed to meet the demands of the manufacturing process. More and more demands are put on the material which has to improve its performance driven by enhancements to the formulation. These engineered materials are becoming increasingly difficult to dispense. The goal is to master the unique challenges and significantly enhance dispensing within the appliance industry from lesson learned from other demanding industries as the processes continually evolve to meet market demand.

This high speed dispensing system designed for automotive batteries provide superior performance. The specifically designed piston pumps allow a continuous material supply and high flow rates of up to 80 ml/s for materials with viscosities of up to 1,000,000 cPs. Until now this kind of

Contact a dispensing specialist to review and trial which potential solution will work best for your application.

For more information, call +1 770 218 0835, email sales.us@scheugenpflug-usa.com or visit www.scheugenpflug-usa.com.