appliance DESIGN

Appliances with a View

How to design washing machines with transparent lids.

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Routine chores around the house come with a lot of questions. What's cooking in the microwave or oven? Is the bread burning? Is the wash on its final spin cycle yet? People want to see what's going on inside their appliances, and they want to see it quickly and easily. Opening washing machine doors and lids during the wash cycle to check on the progress wastes time and energy, causes unnecessary hassle, and can even be unsafe. For these reasons and more, manufacturers are creating washing machines with see-through doors, lids, and enclosures.

This transparency trend is growing stronger among consumers. Beyond the desire to see, aesthetics continue to rival functionality in the appliance purchase decision. Appliances such as washing machines, dryers and ovens appear far less bulky if you can easily see

the space that is available to you directly through the glass window or door. Washing machine suppliers compete to provide larger capacity, and the transparent lid easily showcases the large interior, as the consumer can look directly inside to see how much space is available. Consumers that are looking for an appliance that makes a statement in their home are attracted to the mix of materials, rather than the solid appearance of a painted or metal door panel. Additionally, many consumers value consistency in the design of all their major appliances, featuring a mix of transparent and opaque materials.

To keep these designs truly seamless in their appearance, appliance designers and manufacturers rely on a variety of adhesives. Adhesives are a preferred attachment alternative when working with transparent materials such glass and polycarbonate. This is because mechanical fasteners can create visual disruption in the design, and drilling holes risks cracking and scratching the glass surface. This can lead to potential follow-up repairs to restore the perfect showroom finish.

With adhesives, designers can create a beautifully smooth surface, uninterrupted by bolts or screws while also simplifying steps in assembly. Additionally, the bond line of the adhesive or tape provides a moisture seal along the whole length. Sheet metal screws and bolts will not provide the same moisture seal.

But even a task as simple as hinging a transparent lid to a washing machine requires selecting the right adhesives. The adhesives need to work well with each material—from glass and steel to ABS—providing durability to withstand the constant impact of the heavy-duty, daily use of high performance appliances.

The right adhesives handle lids with ease and won't come unhinged

Because attaching a transparent lid to a washing machine is a multi-step process, you'll get the best results by selecting different adhesives of varying strengths. It's important to consider the different sizes and shapes of the bonds, the surfaces that are being bonded, and the range of stresses on each adhesive joint.

Listed below are four adhesive applications that one should consider when attaching a transparent piece to an appliance.

1. The parts of the washing machine assembly that endure the most force of the lid being opened and closed are the hinges, so a very strong structural adhesive application is a good choice. Attaching a hinge to the main body of the appliance is typically a metal-to-metal bond. Because the surface area on this type of hinge is limited, a small amount of adhesive must be able to provide superior durability.

2. The other side of this hinge is attached to the transparent side of the lid. There is more surface area available for bonding on this side, and there is less force when opening and closing in this area than right at the hinge. Maximizing adhesive strength is not the only goal for this part of the assembly; the critical design issues here are bonding glass to metal and absorbing the impact of opening and closing the lid. Therefore, a more flexible and impact-resistant adhesive can be used in this joint.

3. The plastic strip that's typically applied to the front of the lid functions as the handle, and can be attached by an adhesive with less strength than the previous two applications. This is because it is not a high load bearing joint and it is not taking nearly as much mechanical force as the joints closer to the hinge. For this application, a double-sided, high strength foam tape is a great choice.

4. The transparency trend is not limited to lids on top-load washing machines. On front-load machines, transparent doors are being designed larger than before. Manufacturing a front-load washing machine with a large transparent piece requires robust gaskets, which presents a need for stronger gasket adhesives. This is because larger doors have bigger and tougher gaskets, so the attachment of the gasket must be stronger to hold it in place and prevent leaks.

All of these adhesive applications are fairly straightforward in manufacturing. But they can all be automated as well, through use of an automated dispensing system for adhesives and a robot arm to guide application of the proper amount of adhesive to the exact locations needed.

Tips From an Expert

- Look for a toughened epoxy. A toughened epoxy can be used to form a stronger, more impact-resistant bond than a rigid epoxy adhesive.
- Ask your supplier whether or not it's best to prime your polycarbonate or glass, in order to improve the long-term life of the adhesive bond.
- Remember to consider the long-term strength of a bond when it is exposed to moisture. Moisture can make the adhesive material soft, or change its thickness, so it's important to select an adhesive that is moisture-resistant. Moisture can also penetrate the bond line between the adhesive and the substrate it is attached to. For this concern, it's imperative to select an adhesive that is compatible with the substrate surface, and to properly prepare the surface for bonding. Common preparation steps include cleaning, abrading, and priming.
- Talk to your supplier about the size and weight of each surface being bonded. This will help them understand the bond area and forces involved. Also talk to your supplier about constraints in manufacturing for surface preparation and automation, special requirements, and test procedures for the unit. This allows the supplier to make recommendations that will ensure success in manufacturing the appliance.