

CONVECTION vs CONDUCTION

Almost all vaporizers depend primarily on one of two principles:

- *Convection* vaporizers rely on passing hot air around and through the material.
- *Conduction* vaporizers work by contact with a heated surface.

We say “primarily” because virtually every vaporizer benefits from a combination of both, with the contribution of the secondary principle varying depending on the design.

Conduction: The BC Vaporizer

In the mid-90s, the first mass-market commercial vaporizer appeared. It was called the BC Vaporizer, since it was developed in Canada. It used conduction heating without temperature control, relying instead on limiting the maximum heat to avoid reaching combustion temperatures. You placed your material on a metal heating plate. The vapor was captured in a glass dome and delivered by drawing through some tubing. At the time, vaporizing was not widely known and was poorly understood. Users of this early design had mixed success. The heat regulation was erratic. The material was unevenly heated, often resulting in combustion of some parts while other parts were not heated at all. Although the BC Vaporizer was cheap, it was too tricky for most users to master. Failure was common, and vaporizing acquired a bad reputation.

Convection: The Volcano Vaporizer

The new millennium brought a revolution in vaporizing with the introduction of the first successful convection vaporizer. The Volcano Vaporizer, developed in Germany in the late 90s, hit the market in 2000. This was the first successful convection design, with a major advance: an accurate temperature control dial. A fan pushed heated air through the material and into a food grade plastic bag, which was a much simpler and reliable design. The load was heated evenly and thoroughly. Like the BC Vaporizer, the original Volcano relied on limiting the heat available to avoid combustion. Unlike the BC Vaporizer, the Volcano’s system worked.

Also unlike the BC Vaporizer, the Volcano was expensive. Potential users who were aware of the shortcomings of the BC Vaporizer did not want to risk a lot of money on a system they were unsure of. Nevertheless, because it actually worked, the Volcano acquired a devoted following and eventually revolutionized vaporizing.

Box convection vaporizers

Designers realized that there was a market for a cheap convection vaporizer. A type popularly called a box vaporizer began to appear. These were basically a box (hence the name) built around a heat source, often with a dial to regulate the heat. Some even featured a digital temperature display. To use them you loaded material into a glass tube called a wand, which you then attached to the heat source. The connection did not bring the material into contact with the heater. Instead, you drew through PVC or silicone tubing, providing airflow through the load and causing vaporization through convection heating.

Since the box vaporizer is simple and cheap to build, many variations quickly appeared. Like the Volcano, these were much easier to use successfully than the BC Vaporizer. Consumer confidence in vaporizing was restored, and the vaporizer market took off.

Convection reigns

For a time, almost all new designs utilized convection heating. Variations on heat systems, delivery systems, and temperature control appeared. Designers cited the advantages of convection, mainly easier and more precise temperature control, and more even and thorough heating of the material. Most reviewers concluded convection was superior, and most vendors recommended them over conduction. Many pundits predicted that conduction vaporizers were dead and would disappear from the market. They were wrong.

Conduction revival

Until recently the only new conduction designs tended to flame heated pipe-style vaporizers, which required careful technique but had the advantage of being small and portable, as well as cheap. Then in 2009, the Magic-Flight Launch Box appeared, putting conduction back in the game. Magic-Flight had thought through the shortcomings of previous conduction vaporizers and developed a design to overcome them while retaining their advantages.

Conduction vaporizers were mostly small, portable, and inexpensive. Existing conduction vaporizers typically required an external flame-based heat source. This was usually a butane torch lighter, which the user had to hold carefully at the right distance and position. Avoiding combustion was tricky.

When the Launch Box was introduced, it was arguably the smallest vaporizer available. It avoided the disadvantages of a flame heat source with a simple design that used a AA NiMH battery to heat up a fine screen, allowing nearly instantaneous warm-up and cool-down times. By keeping the cost low and offering a lifetime warranty that even replaced Boxes damaged through user error, Magic-Flight rapidly became one of the most popular vaporizers available. Conduction was back.

The grind and technique: the keys

To get around the uneven heating problem, Magic-Flight instructed users to grind their material to salt-grain size, and shake the Box after each use. Since conduction works through contact, this advice brings more of the load into contact with the heated screen, resulting in more even and thorough vaporization.

Another thing Magic-Flight did was study carefully how vaporization and vaporizers work. They realized that technique was critical for conduction vaporizing. The Volcano and similar fan assisted designs had eliminated the need for technique. Anyone could fill a balloon and draw from it. When box vaporizers arrived, technique re-entered the picture, but only on a small scale. The speed of your draw influenced the temperature: faster draws cooled things down, sometimes overwhelming the heater so that users needed to wait between draws for it to come back to operating temperature. Many later convection designs included heat exchangers to minimize this problem and improve heat retention, and some devices included programmed controllers that tried to maintain a constant temperature.

Magic-Flight recognized that drawing too quickly would cool conduction vaporizers down and prevent them from working effectively. Instead of creating a complicated design to try to maintain heat no matter what the user did, Magic-Flight took a different approach: education. They instructed their customers to control their draw. The approach worked. Launch Box users learned that breath control combined with the duration of the battery contact allowed them to control the temperature of the Box.

As a result, different techniques evolved for using the Launch Box. Some users have found success by alternating small puffs with intervening pauses. Another technique, useful for creating thick cloudy vapor, involves drawing only through the nose, allowing the partial vacuum inside the mouth to pull in the vapor.

The success of the Launch Box has inspired other designers to create new vaporizers that rely primarily on conduction. (Remember, there is a secondary convection effect at work as well in these designs.) To exploit the advantages of conduction, these are small portable devices, powered by batteries. This class of vaporizer is probably the fastest growing sector of the market. Two of the new designs, the Pax by Ploom and the Inhalater INH004, are available here at Vape World, along with the venerable Magic-Flight Launch Box. If you are looking for a portable solution, consider one these devices. Finally, if you choose one of them, keep in mind the keys for best results: fine grind, slow draw, and shake or stir.