To understand how and why MeltFlipper® works, it is imperative to understand the fundamentals of plastic flow. Plastic is a laminar flowing material, therefore, no “mixing” or “turbulence” occurs in the plastics during its injection phase because it is scientifically impossible.

As plastic flows through a runner system, each of the layers throughout the cross-section of the runner experiences a different shear and temperatures condition. The highest shear is around the perimeter of the runner channel and lowest –or zero- at the center. (Fig. 1: Red=high sheared material; Blue=lowest sheared material).

This high sheared area creates significant frictional heating because of the layers of plastic being forced to move along the outer wall. Imagine this force of movement similar to quickly rubbing your hands together. The faster and longer you rub your hands together, the hotter they get. The same happens to plastic - the faster and longer the outer most layers of plastic are being forced through a runner system, the hotter, less viscous and easier-flowing it will become. This will lead to an annular ring of higher-sheared, hotter, less viscous material to form around the perimeter of the flow channel as shown in Figure 2 in red.
Understanding Filling Imbalances and Fundamentals of Plastics Flow

Now picture what will happen to this annular ring of high sheared material as it reaches an intersection of a runner system. It will split and now one side of the next runner branch will have a higher sheared, less viscous material than the other side (Figure 3).

![Figure 3](image)

This is typically where the imbalance begins. In an eight cavity, H-pattern mold, (Figure 4) the flow will split again, with most of the high-shear, hotter, less viscous material flowing to one cavity on each tertiary runner section, which fills first because of a hotter temperature melt.

![Figure 4](image)

We refer to these first filling cavities as flow group 1. These cavities will often flash while other cavities are still filling. Parts formed from these cavities will normally be heavier and larger than those from other cavities. Additionally, they will shrink and warp differently from the other cavities, and will have different mechanical properties as well because of the different temperatures and pressures they were formed under.

Predicting which cavities will receive flow group 1 in a multi-cavity mold is as simple as following the outside edges of the runner system from sprue to cavity. Place a pencil against the side of the primary runner in a mold and drag the pencil along, continuing through all of the runner branches, until it gets to a cavity.
In a normal eight-cavity mold, two flow groups will result: flow group 1 develops from the high-sheared material and flow group 2 develops from the low-shear material. In a 16-cavity mold there will normally be four flow groups; 32 cavities will result in eight flow groups; 64 will result in 16 flow groups, and so on. Each of these flow groups produces parts that are formed under different conditions.

In 4-cavity molds (and sometimes 2-cavity) you will experience what we call an “intra-cavity” imbalance. A shrinkage difference from side-to-side is caused because one side of the part is filling with a higher sheared, hotter material than the other side. In layouts similar to Figure 5, two cavities will fill with the hotter material on one side of the part versus the other 2 cavities receiving this hotter material on the complete opposite side, leading to shrinkage differences.

**How is this issue solved?**

To solve the side-to-side imbalance that occurs at a runner branch, it isn’t necessary to eliminate it, but instead, they can be repositioned. Picture a runner that branches horizontally from side to side: the melt divides along a vertical axis at the runner branch. If the melt in each branch could somehow be rotated or flipped so that its symmetry is no longer top to bottom, but side-to-side, the next split the flow fed to each cavity would be of equal temperature, pressure, and viscosity.

The method to reorient the melt uses an elevation change within the runner that causes the melt to literally “flip”, hence the name MeltFlipper®. The MeltFlipper® runner geometry is located at each runner branch repositioning the side-to-side flow variations by rotating the melt circumferentially by 90 degrees (Fig 5), thus ensuring that each mold cavity receives an equal portion of the varied melt condition. In turn, all cavities will now fill at the same time under the same temperatures and pressures. This technique is a simple and cost-effective solution to designing a runner-system that fill properly every time.

The biggest advantage of implementing MeltFlipper® technology is that right from the start, drastically reducing mold commissioning, time and money. It allows molders to potentially double or quadruple production by being able to run higher and higher cavitation molds comfortably. MeltFlipper® can be adapted to nearly any runner profile and can be applied to both new and existing molds.
Will MeltFlipper® work in single-cavity molds?

The same concepts that apply to Meltflipper® in multi-cavity molds to correct any imbalance between cavities can also be applied to single-cavity molds to correct cosmetic defects such as gas traps, weld-lines, sinks, voids, warpage, etc. These issues are fixed by rotating that highersheared, less viscous material that developed around the perimeter of the flow channel to the center of the flow channel. The MeltFlipper® runner design actually splits the melt and transitions it through a level change between mold plates. This causes a 180 degree rotation of the melt, leading to the higher-sheared, less viscous material to now be in the center of your flow channel (Fig 1). This continues through the center of the gate and the center of the part.

This is a big advantage when molding parts that have intricate geometry up the middle of the part because now there is hotter, less viscous, easier flowing material flowing through the geometry.

MeltFlipper® can also be used to fix or improve weldline strength and visibility. Since MeltFlipper® allows for hotter material, the plastic that comes together to form the weldline is stronger and less visible because there is more time for the molecular chains to entangle as it cools.

For more information please visit our website at www.Beaumontinc.com.