

# Baffled by BAFFLES?

*"Why do I have swirling in my tank?"*

*"What are my options if I don't have baffles?"*

*Baffles... they can be baffling.*

*It's a topic we hear questions about frequently. But, like many questions when it comes to tank and mixer configuration, the answer isn't simple: It depends on the application and desired result.*

If you are mixing a medium to high viscosity fluid, there may be enough resistance for the mixer to impose all of its torque on the fluid, so baffles would not be required. But if your mixer is center-mounted vertically, and you are mixing a low viscosity fluid, you will likely need baffles to achieve an optimal axial flow pattern.

Baffle configuration and mixer mounting play a critical role in optimizing an application. In this article, we dive into how optimal mixer mounting and the use of baffles can prevent the undesirable flow pattern of swirling.

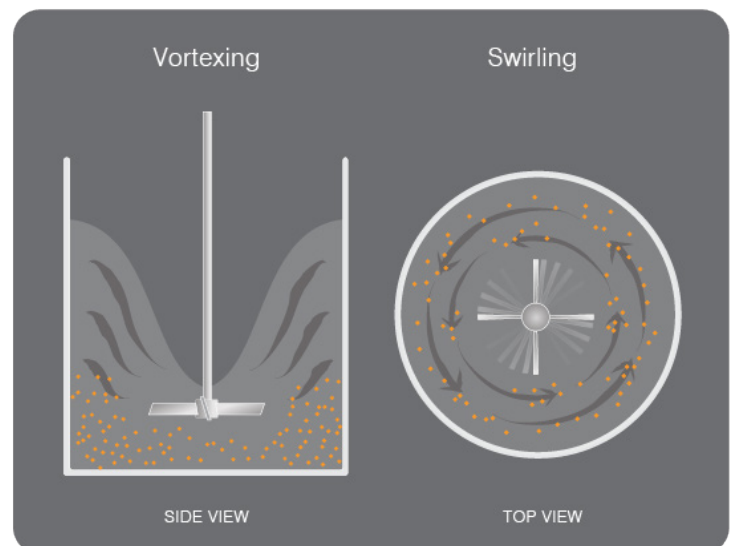
## UN-BAFFLED TANKS

First, let's take a look at what happens when we don't use baffles in one of the most common tank configurations:

### *Vertical Cylindrical Tanks*

If a mixer is center-mounted in this type of tank, what we see is a very inefficient flow pattern. Tangential velocities produced by the impeller can create turbulence on the surface of a fluid, eventually causing a vortex. This creates the undesirable swirling motion that will cause fluid spin as one big mass within the vessel.

In applications where the suspension of solids is critical, a swirling flow pattern will cause solid particles to chase each other around on the bottom of the tank and collect in corners and dead spots. A center-mounted mixer will not create the top-to-bottom axial flow required to lift solids up of the bottom of a tank and suspend them in the fluid.



As evidenced by the illustration, the entire application (fluid and solids) will swirl like a merry-go-round, with the application failing to reach uniformity.

### *The Prevention of Swirling*

Excessive swirling in a fluid creates an unbalanced load and places undue stress and wear on mixer components. Left unchecked, this added stress can shorten the life of a mixer and could lead to expensive equipment damage.

There are three ways swirling can be prevented (by preference):

1. Installing baffles in tanks
2. Offset angle mounting of mixers
3. Offset vertical mounting of mixers

Using offset mounting techniques will generate unbalanced loads that will act on the mixer shaft. When these unbalanced loads become significant, a heavier-duty agitator gearbox and bearing are needed. As a result, the mixer can become more expensive.

Baffles are our first choice because the loads generated are much lower than those generated by offset angle or vertical mounting techniques.

For smaller tanks less than 10' in diameter, offset mounting will be sufficient, and the extra cost associated with compensating for unbalanced load is minimal.

For larger tanks, however, it becomes expensive to go with a heavier-duty mixer, and installing baffles is more cost effective.

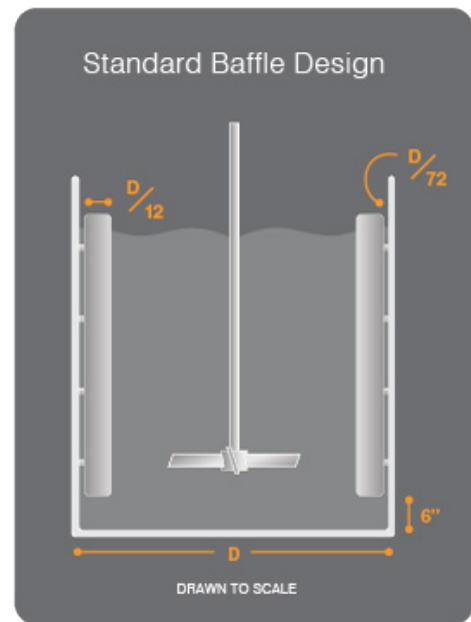
## BAFFLE DESIGN

Baffles are long, flat plates that attach to the side of a mixing vessel to prevent swirling and promote top to bottom fluid movement. They are most commonly used for blending and solids suspension because these applications often use vertical, cylindrical tanks that tend to create swirling patterns, regardless of the type of impeller being used.

## BAFFLE CONFIGURATION

Baffles should be designed using the following guidelines:

- **Number of Baffles** – 3 to 4 (4 is ideal, but 3 will result in sufficient mixing). Adding any more than 4 baffles will not result in any significant mixing improvement.
- **Baffle Width** –  $1/12$  of the tank diameter (i.e. for a 12' diameter tank, the baffle width will be 1')\*
- **Baffle Length** – Starts approximately 6 inches from the bottom and ends just above the maximum liquid level
- **Baffle Mount Position** –  $1/6$  of the baffle width off the tank wall\*\*. (i.e. a 1' wide baffle will be mounted 2" off the tank wall)



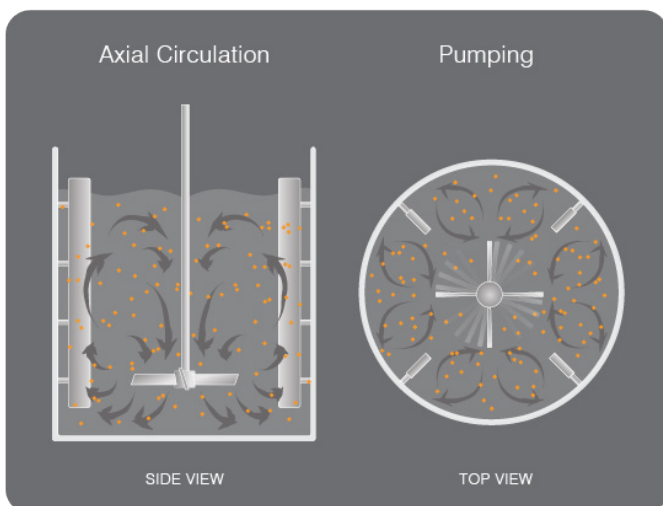
\* For medium viscosity mixing (i.e. viscosities over 3,000 cps or Reynolds Numbers from 10 to 10,000), we often reduce the width of the baffle to  $1/2$  of standard width

\*\* When agitating slurries, baffles are often located up to  $1/2$  of their width from the vessel wall to minimize accumulation of solids on or behind them.

## GOING BAFFLE-LESS

As previously mentioned, there are instances where the use of baffles is not required:

- **Square or Rectangular Tanks:** Most blending applications that use square or rectangular tanks don't need baffles because these tanks are self-baffling. However, these tanks are less suitable for solids suspension because "dead spots" are frequently formed in the corners.



The flow patterns in the illustration show that the use of baffles in a cylindrical tank results in full tank involvement and excellent top-to-bottom axial flow circulation.

# 3 Ways to Prevent Swirling...

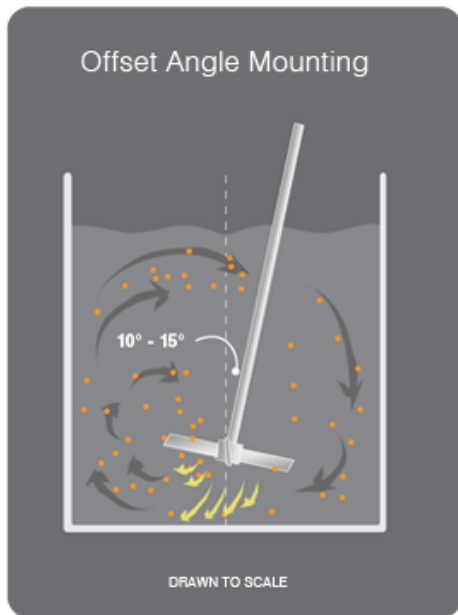
1. Install Baffles
2. Angled Offset Mixer Mounting
3. Vertical Offset Mixer Mounting

- **High Viscosity Mixing:** For high viscosity mixing (viscosities over 5,000 cps or Reynolds numbers  $< 10$ ), the same power is consumed by the impeller, with or without baffles, so they are seldom used.

## MIXER MOUNTING

### Offset Angle Mounting

With axial-flow impellers, an angular off-center position where the impeller is mounted approximately  $10-15^\circ$  from the vertical, can be used.



It's worth noting that the angular off-center position used with axial impeller units is usually limited to those delivering 3 HP or less. The unbalanced fluid forces generated by this mounting can become severe with higher power.

### Offset Vertical Mounting

If an angle mount is not available, the mixer can be offset while being placed vertically in the tank. The rule of thumb for this is to offset the mixer on the x-axis,  $1/6$ th of the total tank diameter.

For example, in a 60" diameter tank the mixer would be offset 10" from center, or  $(60"/6 = 10")$ .



As you can see, baffle configuration and correct mixer mounting have a significant impact on the mixing process. When engineered correctly, the right application of these techniques can decrease costs and increase equipment life while optimizing the mixing process.

If you have questions or are interested in learning more about using baffles and how it affects your mixer configuration, email us at [info@dynamixinc.com](mailto:info@dynamixinc.com)



## Our Solution Assurance is a Process Guarantee

Our approach to your mixer design not only guarantees your **Product Uniformity**, but also your **Process Time**.

